

The Architectural Review

SPECIAL

TIMBER

ISSUE

February 1936 2/6



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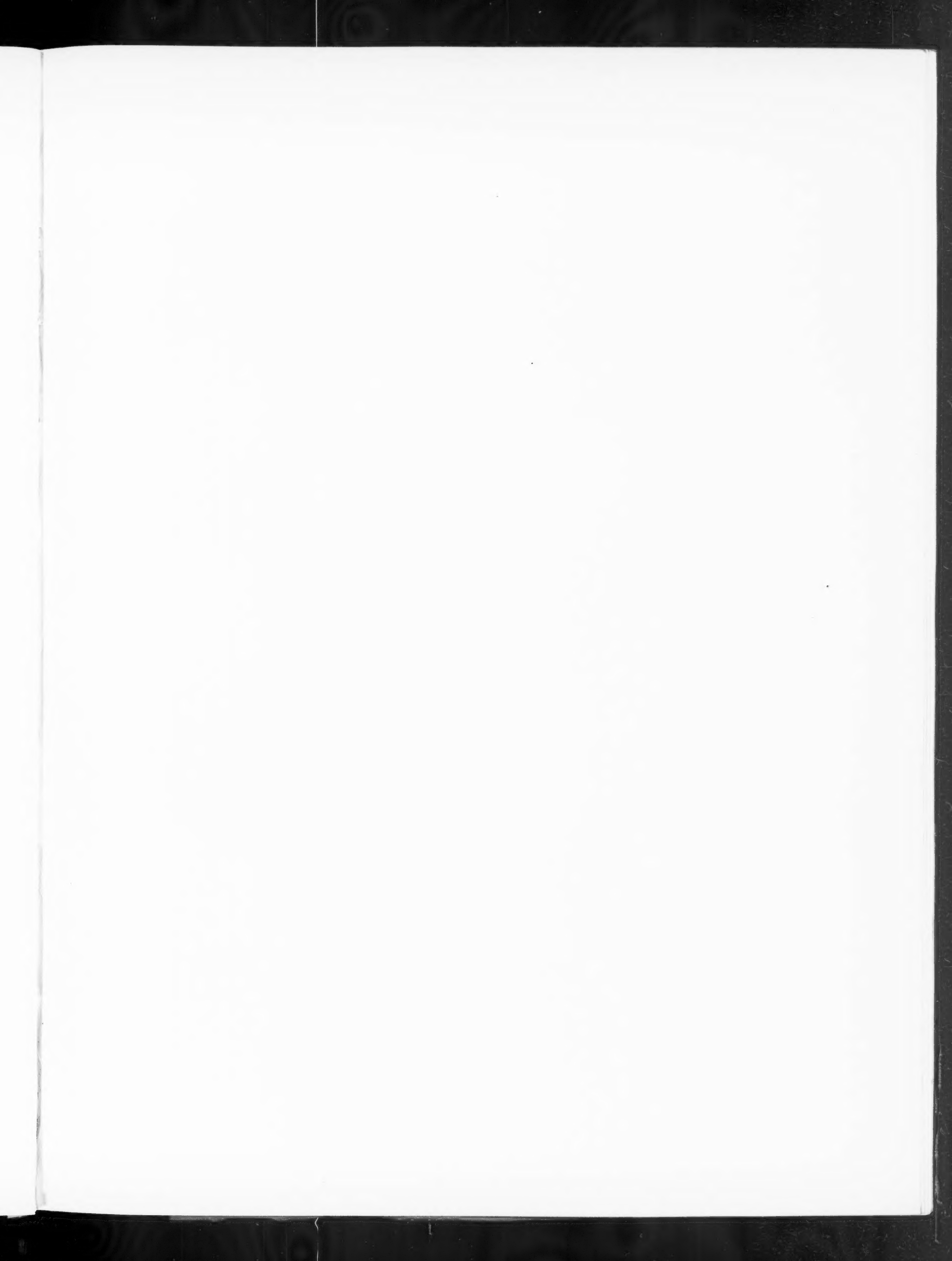
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Timber slide at "Les Chats," upper Canada, from an early nineteenth-century print, signed W. H. Bartlett; R. Wallis. The virgin forest, then being newly drawn upon, is seen in the background; across the river are the wooden huts of the lumber settlement, and in the foreground the rafts of timber being guided down the slide by the intrepid lumber-men.

PLATE I

February 1936

Timber as a C R O P

By E. H. B. Boulton

THE natural resources of the earth have in all ages and in all countries, for a time at least, been squandered by man with a wanton disregard of the future, and are still being squandered wherever absolute necessity has not yet forced a more careful utilization.

The soil is a valuable resource as far as it is fertile and capable of agricultural production; the fertility, while liable to deterioration, can, with few exceptions, be said to be restorable, and it certainly yields increased returns to intelligent increased labour.

It may be stated without fear of contradiction, that outside of food products, no material is so universally used and so indispensable in human economy as wood. Indeed, civilization is inconceivable without an abundance of timber. So general and far-reaching has its use become, that a wood famine, however improbable its occurrence, would be almost as serious as a bread famine.

We are rocked in wooden cradles, play with wooden toys, sit on wooden chairs and benches, eat from wooden tables, use wooden desks, chests, trunks, are entertained by music from wood instruments, enlightened by information printed on wooden paper with black ink made from wood, and even eat our salads seasoned with vinegar made from wood.

Other materials have displaced wood in some uses, but other uses have arisen for wood, and often the substitutes have again been displaced by wood, when its superiority or peculiar qualities have been more fully recognized. Even in such nicely balanced structures as the bicycle, for which metal seemed the only proper material, wood has proved itself superior, at least in certain parts.

The temperate zones are the favoured ones in that they abound not only in a variety of woods which are most readily turned to use in all the various directions in which wood is required in our civilization, but the most useful ones occur more or less gregariously, so that their exploitation can be

most readily and cheaply accomplished. This is especially the case with the conifers, spruces, firs, redwoods, and above all, the pines, which cover large areas exclusively or nearly so, and excel in the combination of desirable qualities all other materials, so that without them our civilization would be badly crippled.

The vast virgin forests of North Europe consist of species which produce the chief building construction timbers; these are the Scots pine (*Pinus sylvestris*), European whitewood, spruce (*Picea excelsa*), larch (*Larix decidua*), silver fir (*Abies alba*). These are trees which, in natural forests, are found rarely to exceed 250 years in age. Whilst they are frequently found in pure stands, they may also be found in mixtures.

The quality of the timber is dependent upon many factors, chief of which is the fertility of the soil, the rainfall, temperature, aspect and elevation. As these coniferous trees make varying demands on light so the spacing will alter the quality of the timber. Trees grown with very little side light on their foliage will be of slow growth. The branches of the trees will be suppressed owing to lack of light at an earlier stage in the growth of the tree than in the case where trees are wide apart and receive any amount of overhead and side light. Therefore, many grades of timber, each grade varying in its quality, according to the situation in which the trees are grown, are produced in Northern Europe.

The forest trees of North America are of larger dimensions usually than those of Northern Europe, for many of these trees have been growing for periods ranging from four to six hundred years. Therefore, from these natural forests larger dimensioned timber, free from defects, is obtainable.

Forest Management

With the advancement in forest research, and especially silviculture, all the important countries of the world produce timber under some form of forest management. The forester's business is based upon the con-

ception of what is technically called the "sustained yield," a continued systematic use of the same property for wood-crops, the best and largest possible; this is secured by proper attention to silviculture, reproducing systematically the harvested crop. Finally, when the industry is fully established, he is annually to derive this "sustained yield" as far as practicable in equal or nearly equal amounts forever, under an "annual sustained yield management."

The ideal conduct of the management "for annual sustained yield" is possible only under the ideal condition, which the forester recognizes in the "normal forest," the standard by which he measures his actual forest, and to which he desires, as nearly and as quickly as circumstances permit, to bring his actual forest. The latter will usually be found abnormal in some one direction, or in several directions, and hence make the ideal conduct impossible. The object of forest regulation, then, is to prepare for the change of an abnormal forest into a normal forest.

The simplest method is to divide the forest into as many areas as there are years or periods in the rotation, and cut one, or the equivalent in volume, every year, or during every period, when after one rotation, the age classes are established. If proper attention has been given to the reproduction and to keeping the reproduced areas fully stocked, the normal conditions are attained after the forest has been once cut over, i.e., during the first rotation. This would burden the present generation with the entire cost of securing the normality: at the same time, necessitating not only unequal felling budgets, as better or poorer stands are cut, but also requiring that the harvest of timber past its prime be deferred, if the forest is largely composed of old age classes, or that immature timber be cut prematurely, if young age classes predominate—in either case, a financial loss. Indeed, the greatest practical difficulty which confronts the forest regulator is found in gauging the sacrifices which the present must make for the sake of the future.

By a forest survey, the number and contents of trees of different diameters near felling size found on the average acre is ascertained; by a series of measurements (stem analyses) the rate at which one diameter class grows into the next higher is determined, and upon this basis a yield table is constructed which shows the amount of material obtainable from decade to decade, according to the difference of felling size. That diameter limit then is chosen which, in the long run, appears most profitable.

Forest crops are grown on rotations of from four years to 240 years. The crop which produces, when manufactured, walking sticks and barrel hoops is one of the shortest rotations in forestry. Grown from coppice; the stool shoots must reach their height growth in one year, and the required girth is reached in the fourth year. Sweet chestnut is the commonest wood grown for this purpose, although ash and hazel are sometimes used. The stool shoots not good enough for making walking sticks are made into barrel hoops.

Fencing is grown on rotations varying from nine to 14 years, and is still one of the chief rural industries of Sussex and Surrey. Oak fencing, however, is made from mature oak trees of the finest quality. The large butts are cleft with wedges and split into quarters, each pale following the grain of the wood; both edges of the oak fence pale are then trimmed on a saw and afterwards trued up with a drawing knife. This type of fencing is not only extremely durable, but very attractive.

Other crops of timber are divided out under many headings, such as coppice with standards, which is the commonest type of English woodland. In this type of woodland two types of crops are grown, a system which originated with the first forest protection laws of this country, which stated that so many standard oak trees to the acre were to be left to produce knees and bends for the Navy in the days when our battleships were built of oak, hence our common form of woodland of an over-crop of standard trees with a coppice under-wood, which is such an excellent form of forestry for general utility and cover for game.

Regeneration of Crops

The other forms of forest management come under two headings: artificial regeneration and natural regeneration of crops. Artificial regeneration is carried out by various methods of seeding and planting. Nurseries of rare young plants are formed, either in temporary situations adjacent to the area to be planted or as a permanent tree nursery, consisting of seed-beds and transplant beds. The seedlings are grown from one to two years in the seed beds, and afterwards transplanted to the transplant-bed. It is seldom advisable to keep these transplants in the nursery for more than two years, so that four-years-old transplants go out into the area to be planted.

Planting can be done by dibbling when young transplants are used. This is a very

rapid method of planting up suitable areas. Another method known as knotching is commonly employed where the vegetable matter on top of the soil is sufficient to hold it together, for a spade is used to make two incisions in the ground which are levered up and the transplant placed in the cutting; by simple firming up of a man's heel the planting process is completed. For transplants with good root development a pit is usually dug. It is advisable to allow this pit to weather before the planting season commences. Another somewhat costly and unique method of transplanting trees is known as the ball-planting method. Here a special spade, circular in shape, takes out a ball of earth around the roots. Holes are made with the same spade in the area to be planted, and the transplant, complete with its earth around the roots, dropped into the hole. This is a very useful method of transplanting small trees in areas where the distribution is uneven, for blanks can be beaten up in this way.

The planting distance of these trees is covered by the quality of the soil. It is necessary on poor soil to plant the trees close together, whilst on a more fertile soil the planting distance can be wide.

A certain amount of tending of the plants, beating up failures, pruning, keeping down weeds and undergrowth, may be necessary in the first few years of the life of new plantations.

After the crop has been established about eight years the side branches start to intermingle, and so, as the crop grows, a reduction in the amount of light on its side branches takes place, until they are gradually killed and fall off. As the trees grow in size they should be skilfully thinned, keeping the canopy of the trees sufficiently close together to get rid of two-thirds of the side branches as early as possible in the life of the tree, and yet, at the same time, keeping the trees sufficiently far apart for them to continue to manufacture their food and remain healthy. A crop started with approximately 4,840 trees to the acre, at the end of its rotation may only have 110 to 140 trees. The trees removed during the period of the rotation have gone out in the form of light poles, medium poles and poorer quality trees, leaving the finest selected trees to form the final crop.

It is often necessary, especially in the case of some hardwood plantations, to pay special care to pruning. This is particularly urgent in such crops as ash, sycamore, cricket bat willow and poplars, especially where these trees are being grown on a technical rotation for the manufacture of sports goods, for the quality of the timber is dependent on its rate of growth and its freedom from knots.

The cricket bat willow is a tree which is always reproduced by cuttings. The true cricket bat willow (*Salix caerulea*) is always a female tree, and as there is no male species known, it therefore has no fertile seeds. The pruning of this tree is commonly done with the thumb; as the buds appear on the lower portion of the stem they are simply pushed off before they can form

branches, which would develop into small knots, and would make the timber useless for the manufacture of cricket bats.

Many poplars are also planted as cuttings, and a plantation 6 ft. high can readily be established in a few hours.

The management of artificial woodlands is not nearly so difficult as when natural methods of regeneration are used. The simplest form of natural regeneration is known as the selection method. In a forest managed under this system the trees are all of unequal age. As selected or mature trees are felled and extracted, the gaps are re-stocked from the seeds which fall from the surrounding trees, so that a continuous rotation is carried out with this method. It is the nearest approach to the regeneration which takes place in a natural forest but it has the advantage of the aid of a skilled forester to eliminate the great struggle for existence which goes on amongst different species in a natural forest, for by selected fellings the trees can be kept sufficiently far apart to produce the largest volume of timber in the shortest possible time, whereas in a natural forest many of the young trees are unable to force their way through the dense portions of the crop which have not been aided by selective thinning.

Another method of natural regeneration is known as the uniform method, or natural regeneration under shade or parent trees. This method is commonly employed in Northern Europe, especially in the coniferous forests. Six, eight or ten trees are left to the acre, the rest of the crop is clear felled. The extraction of the logs is sufficient to disturb the soil to make the seed-bed and the young crop is established under the parent trees. The advantage of this method



1. Cleaving oak for cleft oak fencing. See the complete process illustrated on the facing page.



The process of cleaving oak for the manufacture of fencing palings is done by cleaving the oak along the radial section and afterwards dividing it up into small quarters. This is seen being done in 1, 2, 3 and 4. These quarters are then trued up on a saw and afterwards further cleft by hand, as shown in 5 and 6. The finishing and final truing up of the palings, 7, is done with a drawing knife. Such palings, 8, are extremely durable and are very easily erected. Timber stored for air-seasoning, as shown in 9, should be carefully stickered and care should be taken that each sticker is directly above the other one. The ends of the boards are closed with a cleat to prevent any shakes taking place during the seasoning process.

of regeneration is that a uniform crop is formed underneath, and the parent trees offer shelter to the young seedlings until such time as they are fully established and the parent trees are then cut out and removed.

A simple method of natural regeneration is called the strip method, where strips are cut in the forest against the prevailing wind. These strips are regenerated from the trees growing alongside, so that this forest gives

the appearance of a series of steps formed by the varying heights of the different aged strips throughout the forest.

A method which requires a large amount of skill is known as the group selection method. Here small groups of trees are cleared in the forest and the trees at the edge of these groups thinned, the re-stocking taking place in small patches. The fellings for the formation of these

groups are quite small and the circle is afterwards enlarged so that a series of small groups of young trees is gradually increased until the whole area is re-stocked. The great advantage of the group selection method is that it produces an undulating canopy in the forest and the removal of trees in no way disfigures the landscape, which cannot be said when the strip method is used. Any areas that have been felled

so as to produce hard lines are detrimental to the beauty of the countryside.

Official Measures

It is gratifying to know that many of the forests of the world have now passed under State control, and through the employment of these various methods of artificial and natural regeneration the possibility of a timber famine decreases with each decade. Forest management has been so successfully carried out that many of the State forests now only cut into their annual increment, and, therefore, the capital volume of timber never decreases. Had proper precautions been taken, many of the vast areas which were originally covered with trees, therefore, would not be the derelict waste land which now occurs throughout the world in the form of prairie land. Much of this land was originally covered with trees, but owing to ruthless felling, lack of fire protection and the forest not being considered by man as a crop to be grown on fixed rotations, these forests have gradually disappeared.

A great deal of good work has been done in Germany, France, Sweden and Finland to further the knowledge of growing trees in a systematic way. In 1919 the Forestry Commission was formed in this country and much valuable work has been done. The total area under the control of the Commissioners is approximately 909,000 acres of land, of which some 250,000 acres have been planted in Great Britain. Some of these forest areas, the largest of which is Thetford Chase, which comprises an area of 34,000 acres, will yield some of the finest home-grown building construction timbers that this country has ever possessed.

Whilst there has been some criticism about the vast areas which have been planted with softwoods, it has been a step in the right direction to establish in this country some sort of forest resources. The Forestry Commission, now having planted these areas of coniferous woods, are turning their attention to the planting and cultivation of hardwoods.

Tropical forests, from which so many of our beautiful ornamental timbers are derived, have received thorough surveys in recent years, and under the various methods of regeneration the more valuable species, such as teak and mahogany, have been encouraged and in many areas inferior species have been entirely eliminated.

The problem of treating tropical woods as a crop is far greater than in those forests which grow in the temperate regions, but, here again, much research work has been done and great strides have been made since the war.

The much-lamented absence of roads and railways in many of our colonies has proved to be a blessing in disguise, inasmuch as it has helped to preserve certain mahogany areas inaccessible without them. With the development of Forestry Departments these forest areas came under systematic management before the opening up of the country.

From the fact that various countries have been able to depend on the resources of their forests for long periods, many for over 200

years, and from the additional fact that after this long period of exploitation these forests still remain the main source of income of these countries, one might conclude that the wealth of these forests and their stock of good wood must be almost inexhaustible. That is, however, not the case. It was not the richness of the forest, but the relatively small volume of local timber trade, as compared with the area, that enabled the local forest industry to keep alive for such a long time. It is due to various retarding circumstances, such as the very small population and the absence of means of transport (roads and railways) that the extraction of mahogany and other woods has never assumed such dimensions as to strip the forests entirely of all exportable wood.

The great improvement in methods of extraction has now enabled many woods to be marketed which under the old methods could not be considered a commercial proposition.

Changes in Supply and Demand

Before the days of free intercourse between this and other countries practically all the timber used in these islands was of native origin and native hardwoods were used much more extensively in proportion to the total consumption than they are today. As trade with other European countries developed the softwoods of Central and Northern Europe gradually became known to British timber users and in the course of time began to displace the home-grown hardwoods for a number of purposes, for they were relatively easy to work and at the same time cheap. The rapid increase in the population since the Napoleonic wars and the equally rapid expansion of trade in manufactured goods rendered the supply of home-grown timber quite inadequate to meet the demand, for it must be remembered that for centuries previously the clearing of forests to make way for agricultural pursuits had steadily progressed, and supplies of native timber had similarly diminished. Even as far back as the sixteenth century it was realized that a serious shortage of certain hardwoods, more especially such as were in demand for shipbuilding, was threatened, and legislation was passed which it was hoped would avert such a possibility. For a time the development of the iron-smelting industry in Sussex resulted in the destruction of large areas of oak forest, the oak being used for fuel in the smelting process.

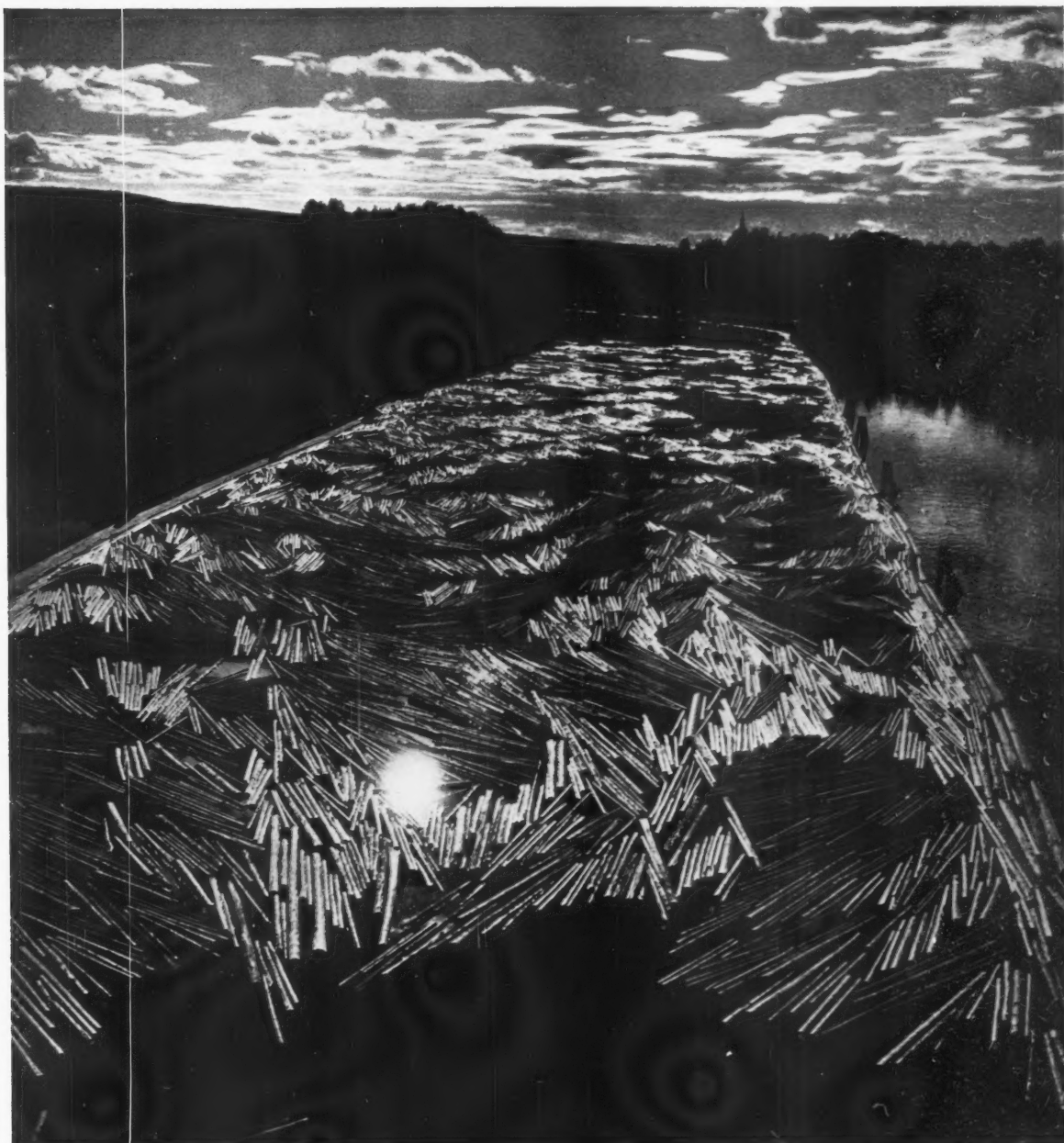
The forest areas of North Europe were capable of supplying soft woods in quantities sufficient to meet the increasing demands of the nineteenth century, however, and the introduction of iron and steel for the building of ships very quickly reduced the need for timber for that purpose. Although for a time the consumption of softwoods increased rapidly, it must not be supposed that there was a corresponding diminution in the use of hardwoods, but rather that the total consumption of timber was also increasing; for it must be remembered that practically every trade uses timber for some

purpose or other, even if only for packing cases, added to which new factories and workshops had to be built for the accommodation of the new trades.

From Elizabethan times overseas trade developed steadily. The countries of the East and those of the New World were many of them well wooded, and although for a time the goods brought from those new lands consisted largely of precious metals, precious stones, silks, spices and other high-priced commodities, it was not very long before some of the rarer and more beautiful timbers began to arrive, and slowly a trade was established in such decorative woods as amboyna, ebony, rosewood and satinwood from the East and mahogany from Central America.

The colonization of North America was marked in its early stages by the wholesale destruction of forest land to make way for farming, but later an extensive lumber industry was built up and markets had to be found. The softwood forests of the United States were cut out without replanting, nobody seeming to realize where such a policy was leading, until in recent years the remaining forests of the States proved inadequate to maintain the enormous trade which had been developed and to make up the deficiency large quantities of softwoods were drawn from Canada, mainly from British Columbia. Canada had, however, developed a very large lumber industry of her own, but having a much sparser population the forest destruction had been relatively insignificant, although, when considered in terms of acres of forest destroyed or of volume of timber wasted, sufficiently startling. With the advent of the post-war depression and the consequent reduction in the world's trade a tariff wall was built up which effectively shut off the American markets from Canada's softwood supplies. The Canadian lumbermen thereupon turned their eyes to the East in their search for fresh markets, and started a campaign in this country which had for its object the capture of a bigger share of the United Kingdom softwood trade, which for some years they had largely neglected. The campaign was vigorous enough to be attended with a considerable measure of success, and so in these days Canadian pines, spruces, cedar, hemlock and Douglas fir are to some extent supplanting the Continental redwood and whitewood.

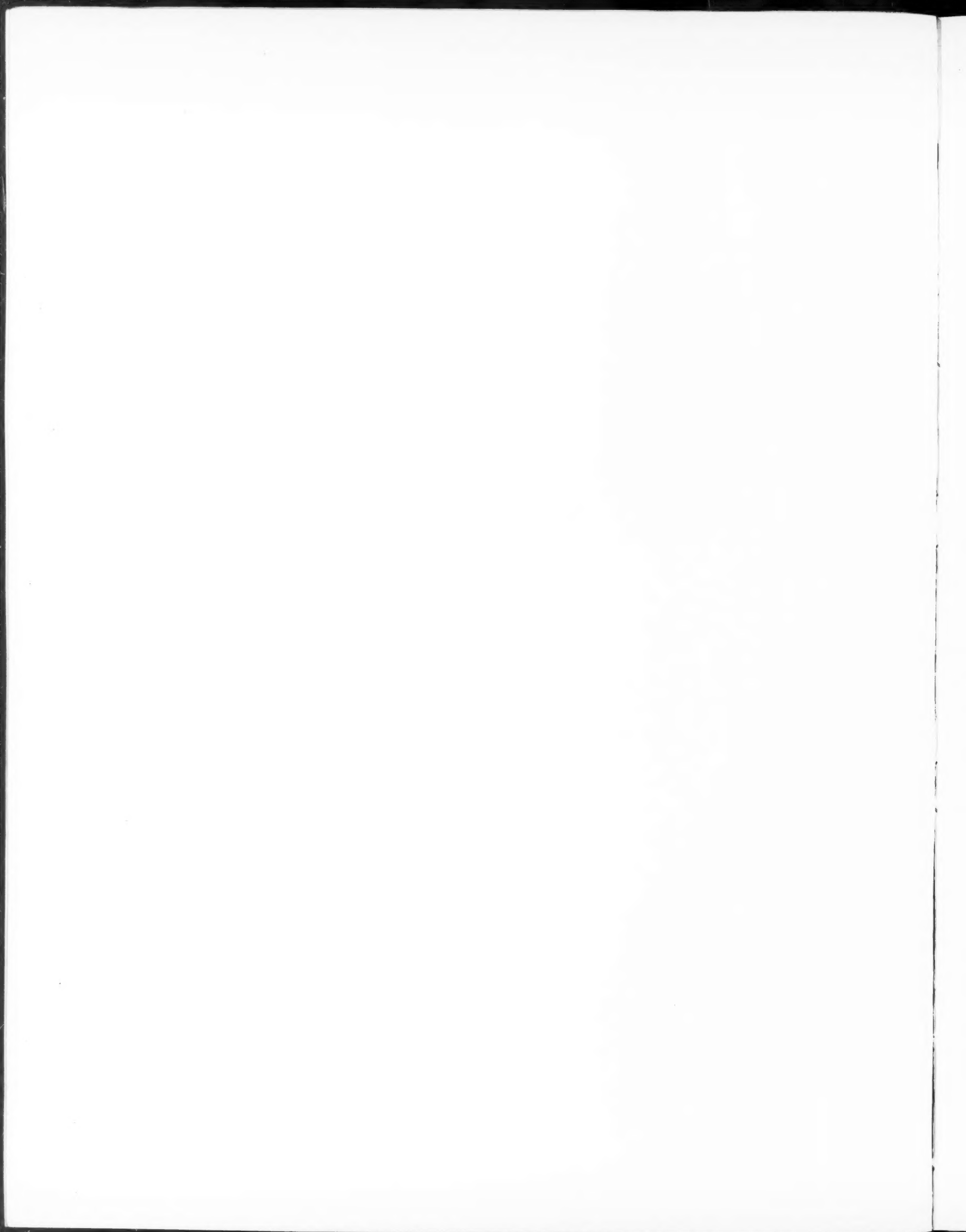
In the present century there has been a rapid development of the resources of our colonies in West and East Africa and in tropical America and of the Philippine Islands under American control. As a result large numbers of new hardwoods have become available, and the more promising have found their way into the world's markets and more especially those of Western Europe and the United States. The Japanese also have been exploiting the forest wealth not only of their own islands but also of Korea and, to a less extent, of Formosa. Hence there is today an unprecedented number of hardwoods available, suitable for every purpose to which wood can be applied and capable of satisfying even the most fastidious.



Softwood logs on a Swedish river, held in position by a log boom. The picture is taken at the point where the Dal River leaves the Siljan Lake. The Dal is one of the most important waterways for timber-floating in Sweden.

PLATE ii

February 1936



Timber as a PRODUCT

By R. Grueon

QUITE frequently when cargoes of timber are being inspected, and their merits (or, more often, their demerits) are being discussed with the receivers, the architect is trotted out as a sort of "bogey-man." For instance, if in the course of seasoning, some wood has become slightly discoloured, or superficially grey or weathered, the receiver will often admit quite readily that the wood is really not a scrap the worse for that: "but then, you see, the architect would not pass it." That usually leads to a mutual anathematizing of all architects, and points to the necessity of a clearer understanding amongst architects of the qualities desirable and attainable in timber.

In these remarks I propose to confine myself to the constructional woods, as it is in this province that questions of grading and specification most seriously arise, and it is in this province that questions of production and import most closely concern the architect. Among these, I shall treat almost exclusively the coniferous woods of Northern Europe, as they constitute the bulk of the constructional woods of today. In limiting my remarks to that part of the world supply I have no intention of slighting the important quantities of constructional wood which are shipped from the Eastern and Western Coasts of the Continent of America, these being in particular Spruce from the Eastern side and Douglas Fir (Oregon Pine) from the Western side, so perhaps I had better say something about those woods before passing on. To a Londoner it is hardly right to speak of Spruce as a constructional wood at all, as its principal use in the London area is as a material from which packing cases are made, although a considerable quantity is used for such purposes as "scaffold boards," for which purpose some of it is peculiarly suited, owing to the toughness of the fibres preventing the wood from breaking off short even under great strain. But in Ireland and in Lancashire, Spruce is a common constructional wood. Of late years there has been a very great increase in the import into this country of Douglas Fir, mainly from British Columbia, in a great variety of dimensions and qualities. Another wood shipped from the Pacific Coast which has found considerable favour here is the Western Red Cedar. This, whilst it is used for constructional purposes,

is regarded chiefly as a joiners' and carpenters' wood.

To turn now to Northern Europe, the area can conveniently be divided into four parts, each of which exports round about a million standards of wood each year. The largest exporter of the four is at the moment Finland, whose export will probably exceed the million in the coming season. Next comes Russia, then Sweden and Norway together, and fourthly, the Baltic States.

Qualities of Wood

Over the whole of Northern Europe the principal wood export consists of Redwood (Pine—*Pinus Sylvestris*) and Whitewood (Spruce—*Picea Excelsa*). It is not at all easy to identify a small piece of wood as having certainly come from any one of the four areas mentioned, but there are certain characteristics belonging to each group distinctively, or to certain parts of each group. For instance, Russia possesses large pine trees of slow growth from which is produced material of fine texture and close grain and a large proportion of high quality wood which is especially noticeable in the boards which are cut from the outer part of the log. These high quality boards have in the past been much sought after and have commanded a very high price, but owing to the fact that the general quality requirements for joinery are not so high as they used to be, there is no longer quite the same demand for expensive boards. The sapwood of the redwood is close-grained and of an attractive creamy colour. This well-grown wood is much less liable to warp or twist than sappy, open-grained wood, and it is therefore specially suitable for joinery purposes. The whitewood shipped from the White Sea ports is also of fine quality, but that shipped from the Leningrad area is more similar to South Finnish productions.

In Finland there is a great variety of growth, the product of the northern and eastern parts being close-grained, fine-textured wood, usually designated joinery wood even in unsorted quality, and by many makers of joinery it is even preferred to the Russian wood. The pine trees in the North of Finland are not on the average so large as the Russian, so the dimensions produced are not quite so wide, but the narrower boards are usually of very fine quality and the wood of a very pleasing

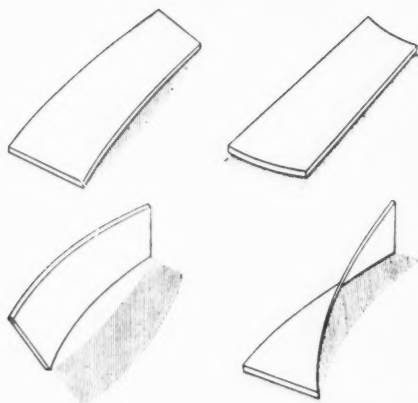
reddish colour. The whitewood is also close-grained and fine-textured, but usually contains rather many small black knots. In the East of Finland, in Carelia and along the Russian border the trees are somewhat larger and yield some very fine side boards from the butt logs, but the top logs which are cut into small scantling sizes are rather knotty. In other parts of Finland the wood is generally more quickly grown and consequently more sappy and open-grained. So-called second-grade stocks consist almost entirely of this poorer wood, whilst the first-class stocks, even from the South of Finland, contain a high percentage of close-grained wood quite suitable for joinery.

The Swedish product shipped from the middle and upper gulf ports is similar to that from the north and east of Finland, but for some reason or other the wood is more of a pinkish colour, somewhere between the darker colour of North Finland and the yellowish colour of the South Finland wood. Several of these Swedish productions are recognized joinery woods, but in the south of Sweden there is a considerable amount of wood which has grown in exposed situations and is very knotty. So much refers to the redwood: some whitewood from the Söderhamn district is the best obtainable from Northern Europe.

From Norway comparatively small quantities of sawn wood are now exported. The forests have in the past been cut down regardless of the future, and the Forest Laws which have come just in time to save Finland from a like fate came too late to save the forests of Norway. In face of that difficulty the Norwegians have held their lead as experts in machining wood and make the very most of their supplies by converting the greater part of them into matchings, floorings, caseboards, etc. They even import wood from neighbouring countries for this purpose.

The product of the Baltic States in redwood is generally more open-grained and more resinous than that from the more northerly areas. For general structural purposes this wood is sometimes even preferred to the more expensive and closer-textured wood from other countries. After all, the durability of any piece of wood used in building construction depends not so much upon the wood itself as upon the ventilation with which it is provided. A sound piece of wood will quickly decay

TIMBER AS A PRODUCT



TERM.	DEFINITION.
WARP. Ad. WARPING.	Distortion due to stresses causing departure from a plane or true form.
BOW. Ad. BOWING.	A curvature of a piece of timber in the direction of its length (camber). (see Fig. 6.)
CUP. Ad. CUPPING.	A curvature occurring in the transverse section of a board or plank. (see Fig. 7.)
SPRING. Ad. SPRINGING.	A curvature of a board or plank in its own plane (edge bend). (see Fig. 8.)
TWIST. Ad. TWISTING.	Spiral distortion (winding). (see Fig. 9.)

1. A sample of the efforts made by the Committee of the British Standards Institution to standardize the meaning of timber terms. Above is a diagram from one of their publications defining some common defects, and the verbal definitions that accompany it.

if it is enclosed in a damp, foul atmosphere, but in a dry well-ventilated situation it will last practically for ever.

Grading

The best quality of North European wood is produced in those areas which are served by the Russian White Sea ports of Archangel, Onega, etc., where most of the wood is sorted into qualities: Firsts (I), which are practically free of defects, at all events on one face; Seconds (II), which contain small sound knots and other slight defects; and Thirds (III), which contain a fair number of knots and a reasonable number of other defects; whilst the Fourths (IV) are defective or faulty in some way, such as excessively knotty, i.e., either too many or too large knots, or rotten, dead or loose knots, or log-blue, or slightly discoloured or weathered, or somewhat shaken or waney; in any case, not too many of these faults may exist in one piece, as the bracking is not according to the existence of any one particular fault, but according to the accumulation of faults, so any piece containing too many faults together is reduced to the next grade below.

In Finland it is the custom to ship unsorted quality, which is not the same as saw-falling, but is the full run of the log from I to IV inclusive, the Fifths and below having been bracked out. Here the rule of "Shippers' usual" applies, inasmuch as a contract is not necessarily satisfied by a shipment consisting, for example, of IVths only, unless it is "usual" for shippers to

ship the dimension in question in that quality. For instance, in boards of a high-class stock the percentage of high quality wood will be considerable, whilst in small sizes such as 2 ins. $\times$ 4 ins. there may not be much high quality wood, because the shipper usually cuts that size mainly from top logs. There is a considerable difference between the grading of the various shippers of high-grade productions putting the dividing line for Fifths very high. There has, in fact, been a steady raising of the dividing line between Unsorted and Fifths by producers of better grade wood in Finland and one result of that is that instead of the Fifths being considered a "cutting-up" grade, it is now used very largely for ordinary constructional purposes and there is really no reason why most of it should not be so used.

By way of comparison, the Fourths Russian are similar in grade to Fifths of high-class Finnish stocks.

As to planed boards, there are in Finland several different practices regarding grading; some shippers make Unsorted (I to III) and "Inferiors," some follow the sawnwood grading and ship Unsorted and Fifths, others ship Unsorted and III/IV, the latter being throw-outs from the planing mill, not necessarily for inherent defects in the wood, but possibly only for a slight planing fault.

Sweden still does a considerable amount of sorting into qualities in the central and northern parts of the country, both of sawn and planed wood, but the shipment of Unsorted quality in sawnwood predominates with a good market for Fifths, and also for Sixths, which last is definitely a "cutting-up" grade. In the south of Sweden are some lower-grade shipments, also some circular-sawn stocks which are rather good quality so far as grain and texture are concerned, but the sawing is somewhat irregular, since circular sawing, as practised there, cannot give the same precision as modern high-speed frame sawing.

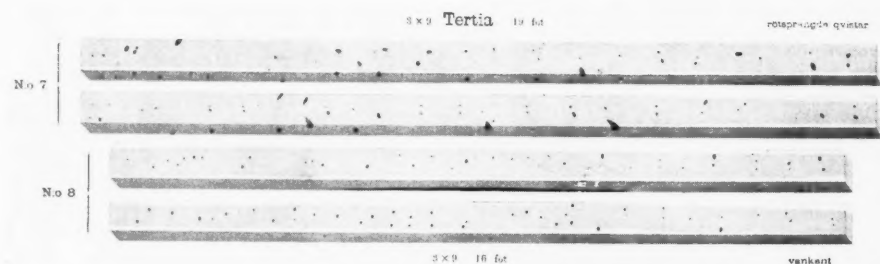
Norway planes very cleverly to make the most of the wood at her disposal. In planed boards, the Unsorted are Firsts to Thirds, the lower grade pieces being called "Inferiors."

In the Baltic States they follow generally the Russian system of grading, which makes the Unsorted I to III, and the Fourths a separate grade. Poland has, however,

broken away from this tradition and adopted the Swedish system of shipping I to IV as Unsorted and the Fifths separately. The line of separation between the Unsorted and the lower grade, whatever it may be called, is, however, approximately the same.

Rules

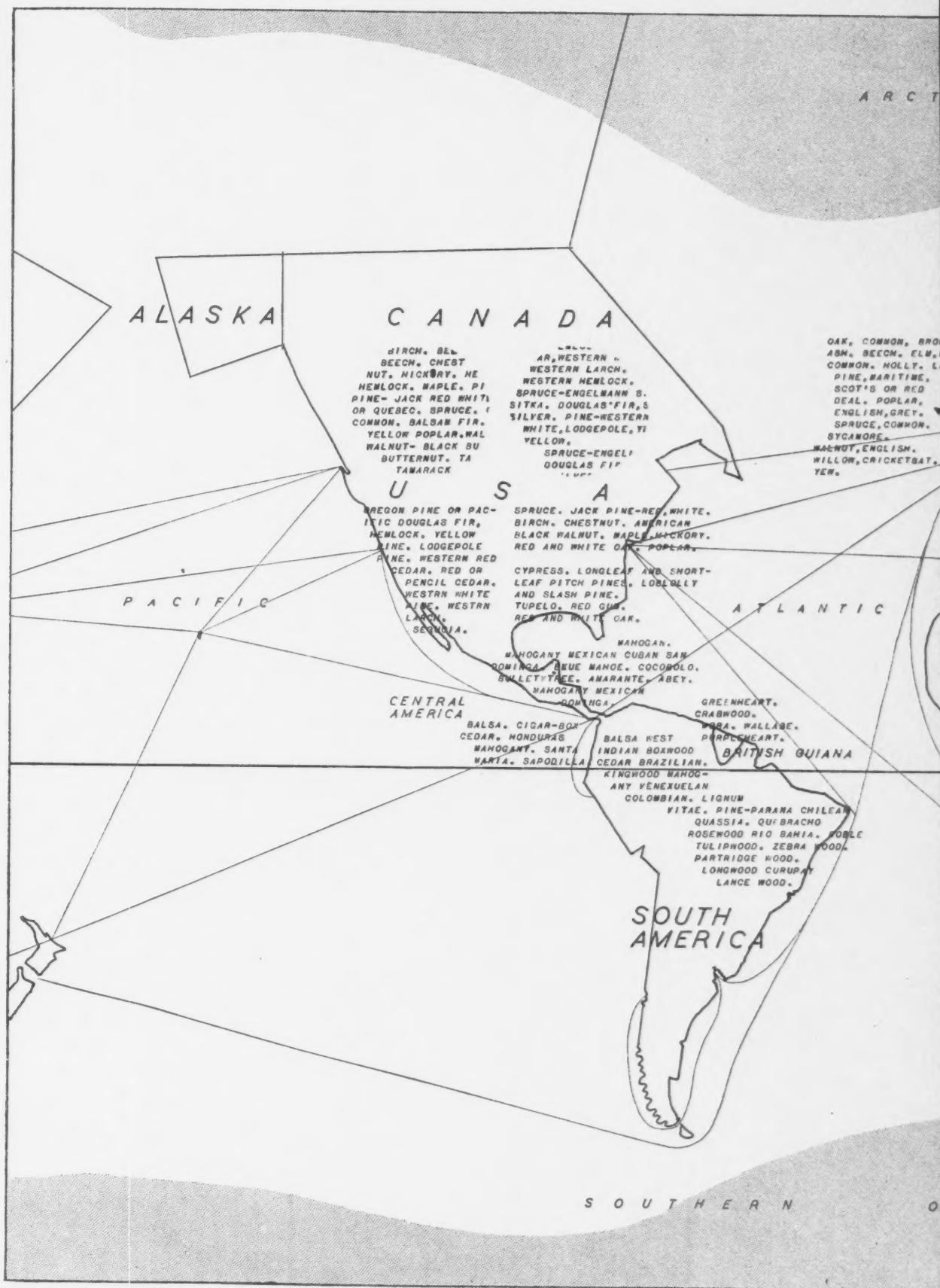
Attempts have been made on many occasions by different bodies in various countries, to formulate precise rules as to the kind and extent of the faults which may be allowed in each quality of timber, but the result has not so far been perfectly satisfactory, as the more important shippers have their own ideas as to quality, and their brackers have carried out the same system of sorting for so many years that the only possible description of the quality is that contained in the wholesale contract forms, namely "Shippers' usual." Fairly recently a reprint was made of some grading rules as applied in the Hernösand district since the year 1880, which set out quite definitely under the headings of various dimensions, what faults might be allowed in the different qualities, but these are over-ruled by notes, in the preface and introduction, to the effect that stricter sorting is now being applied, that the faults permitted are the maximum for the grade, and that if there is much of one fault, there must be less of another and so on. Still more recently, whilst lecturing at the Timber Exchange, a well-known arbitrator set out a summary of the methods of bracking used by leading shippers, in the course of which he said, "common sense plays a large part in bracking, coupled with a knowledge of values." So after all we are left to exercise our common sense in judging the quality, either of a single piece of wood or of a whole cargo, and we must always bear in mind that wood is a product of nature, and consequently subject to a good deal of variation. Some Swedish grading rules which were compiled in 1888 and published the following year at Stockholm, by F. and G. Beijer, are beautifully illustrated with pictures of both sides and edges of typical pieces, showing the utmost faults allowed to a particular size in the grade. A good example is the illustration, 2, of 3 in. by 9 in. Thirds, 19 feet, showing the number of unsound knots allowed where no other fault is



2. A specimen illustration from a book of grading rules for Swedish timber, published in Stockholm in 1889. Pictures are given of each grade of wood in various sizes (in this case, Thirds, 3 by 9), showing the number of defects permissible in that grade. The dark marks in the lower specimens indicate waney edges, the other marks unsound knots.



THE WORLD SHOWING THE DISTRIBUTION OF TIMBERS



Drawn by
T. Gordon Cullen





PLATE iii, February 1936

present, and, by comparison, the smallness of the knots where wane also occurs. This quality is nowadays called Fourths in Sweden. The following is the short description of the knots allowed in IV given at the lecture I have referred to:—

"IV quality 3 in. by 9 in. On the face four to five sound live knots $2\frac{1}{2}$ in. to 3 in. diameter and three to four, say $1\frac{1}{2}$ in. to 2 in. diameter at each 16 ft. length: also a normal quantity of smaller knots: if any are dead they must not be loose. Reverse: diameter and quantity about the same, with two or three small rotten knots: the larger knots may be slightly tainted," which pretty well exactly describes the old Thirds illustrated about fifty years ago. An important rule of very general application in bracking is that the larger the dimension, the more faults are allowed: to this rule there is an important exception, that short lengths known as "ends" may have comparatively more faults than the longer lengths of the same dimensions and quality. At the invitation of the British Standards Institution, the Finnish exporters are endeavouring to compile some more or less generally accepted grading rules, but at the time of writing I had not heard of their having yet been published.

Shipping Marks

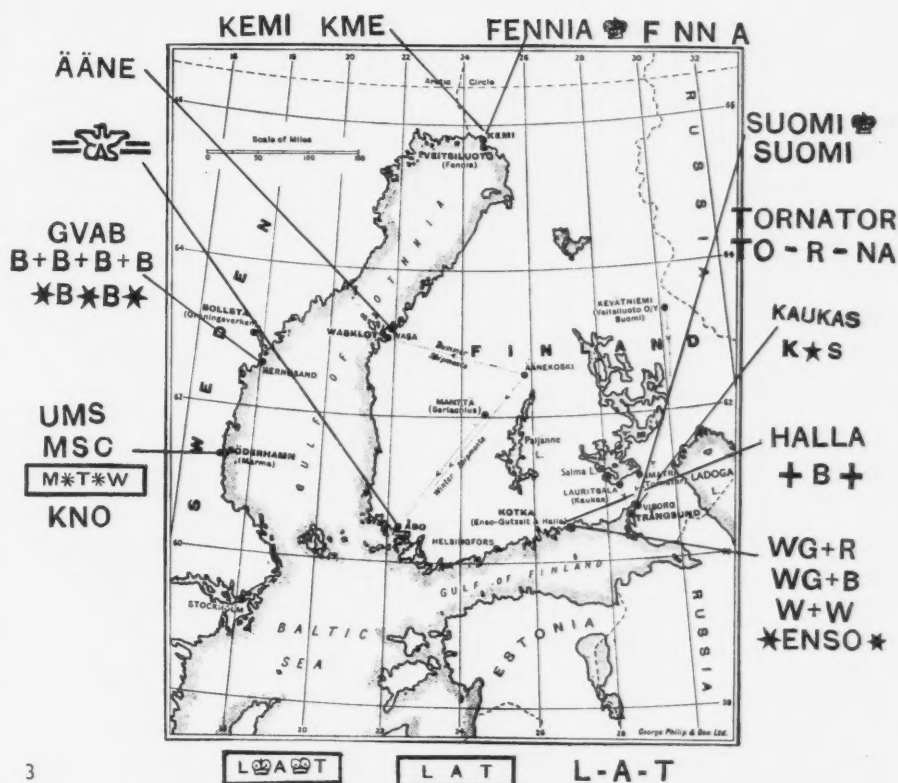
Russian wood can usually be recognized by its distinctive hammer-mark on the end, denoting the quality and the place or mill of origin. It is also marked on the edge or flat with quality marks in black or red pencil, one stroke for Firsts, two for Seconds, three for Thirds and a "4" for Fourth.

Finnish wood is usually paint-marked on the end with shippers' registered mark, the most usual colour being red, but whitewood is sometimes marked in black colour and discoloured goods sometimes in blue colour. First-class shippers are rather proud of their marks, and although in the hurry and bustle of shipping some few mistakes are inevitable, the mark is on the whole a good index to the quality. The mark for Fifth is always quite distinct from that for Unsorted, although in one of the best Finnish marks it is only the addition of a single crown which differentiates the Unsorted from the Fifths, but Sixth are usually unmarked. It is not unusual nowadays for shippers to be asked to ship Fifth quality wood on contract unmarked: in those cases the importers have some reason for supposing that they can sell the wood to better advantage without the shippers' mark.

Swedish wood carries some very old-established and well-known marks, and is seldom shipped unmarked; even the sixths have a distinctive mark.

In some Baltic States wood has recently come under Governmental control as regards marking the different grades so that marks and quality should be brought more into line.

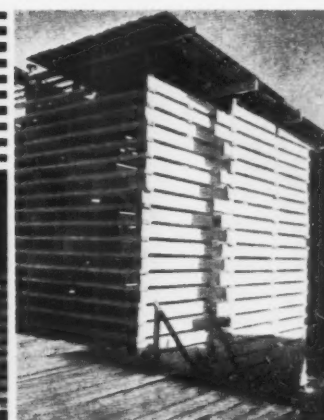
An important aid to a knowledge of these shipping marks is the publication entitled *Shipping Marks on Timber* (published by



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4



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The sketch-map, 3, shows the area of Northern Europe from which the greatest quantity of constructional timber is exported. Round the margins of the map are typical examples of Shippers' Marks, with which all but the very lowest grades of exported timber are branded. Lines are drawn joining the marks to the port of origin to which each refers. Below are typical photographs of North European timber yards, showing the varying methods of stacking timber preparatory to export. 4 is at Kotka, in Finland; 5 at Kevätmiemi, East Finland; 6 at Riga, Latvia, and 7 at Bollstabruk, in Sweden.

TIMBER AS A PRODUCT

EK-EW

INDEX TO EUROPEAN MARKS

MARK.	Page.	District or Port of Shipment.	Quality.	MARK.	Page.	District or Port of Shipment.	Quality.
EKMA	94	Gothenburg	Unsorted	E * N	94	Gothenburg	II
EKMA	108	Stockholm	Unsorted	E + N	94	Gothenburg	III
EKN	94	Gothenburg	Unsorted	E - N	94	Gothenburg	IV
EKN	94	Gothenburg	I Laths	E * N	94	Gothenburg	V
E - L	110	Sundsvall	V	EN C	95	Gothenburg	Unsorted
E * L	110	Sundsvall	VI	* ENSO *	60	Kotka planed	Unsorted

8

FINLAND.

EUROPEAN SHIPPERS AND THEIR MARKS

NAME OF SHIPPER.	Description.	Average Annual Production in Standards.	I	II	III	IV	Unsorted Non-class.
—KEMI (cont.)							
Rovaniemi Traföradlings Aktiebolag ... Rovaniemi	Sawn ...	1,000	RO VA	RO + VA	RO - VA	RO - MI	ROVA
Ditto ...	Sq. timber	...	...	...	...	...	RH (with axe)
Veitsiluoto Osakeyhtiö, Veitsiluoto and Helsinki Ship at Veitsiluoto; also at Uuras	Sawn ...	32,000	...	...	FNNA (in red)	FNNA (in blue)	FENNA (in blue), FENNA (in red)
—KOTKA							
Enso-Gutzeit Osakeyhtiö	Ditto ...	60,000	...	Waney Battens VAJAK	Discol. Red W + G	IV S + R	V Red W + W, Red WG + R, White WG + B
Ditto ...	Planed ...	...	...	...	III GTZ	...	* ENSO *

9

The publication "Shipping Marks on Timber" is an essential reference catalogue, giving the meaning of the letters and symbols that are stamped on nearly all timber imported from the Baltic region into this country. 8 is part of one of the index pages of this book, and 9 of one of the pages on which the various marks used are classified according to the shippers.

Benn), which is an essential book of reference on the subject. It is indexed so that any mark can readily be traced to the part of the book which will give the name of the shipper, the port of shipment and the quality designation. The grouping of the different shipments under countries and then ports is very useful, but it does not necessarily follow that shipments from the same port are similar to each other. To take an outstanding example, there is the port of Trångsund (Finnish—Uuras), from which a great variety of kinds and qualities of wood are shipped, including fine Karelian wood from the East, close-grained wood from the centre of Finland, and poorer quality wood from parts of the Saima Lake District. In addition to that there are shipments by first-class shippers, and also by second-grade shippers.

As has already been stated, the "Unsorted" marks cover all qualities from Firsts to Thirds (Russian, etc.) or Firsts to Fourths (Finnish and Swedish, etc.) respectively, which give a very wide range. When the importer is supplying to the builder, or joinery works, or carpenter, he usually sends the goods in bulk just as he receives them, or he may sort out the particular quality required for a certain purpose or series of purposes. I have noticed on large building schemes that the wood has been delivered practically direct from the ship to the site, but a considerable amount of selection goes on afterwards, the carpenter and joiner being allowed to pick what is suitable for their special requirements, and the remainder being used for carcassing and so on.

Standardization

The main difficulty in the way of standardization of qualities and marks of wood is the diversity of nature in contrast with the efforts of users to obtain an unvarying product for a definite use. Then again it is most remarkable how widely opinions of users differ. In some cases it is, of course, merely a question of price and getting the most reasonably suitable material in the circumstances.

The ideal way with wood is to provide a sufficient quantity from which each user, commencing with the most important or most expensive user, is permitted to select first what he requires for his particular job, and then the next user makes his selection, and so on. This is in fact done, as has been indicated, on large building schemes. Where this is not practicable one can always purchase, at a price, I quality Archangel or Onega for the highest quality joinery work, II quality for work in which some sound knots are no objection, and III quality for general high-class construction work. But there is not much difference in price between a III Archangel and a first-class Unsorted Finnish, the latter containing some very useful pickings of high quality wood which are not to be found in the dead level quality of the Russian III.

If an architect or contractor were to ask me which brand to specify for a particular purpose, I could tell him something about the comparative values of the different marks, but in the end he would have to go to the importers to ascertain what stocks are actually available of the quality required in the dimensions needed, sufficiently seasoned at the desired date.

The principal use of the *Shipping Marks* book is therefore to check up the importers' offers, rather than to provide a guide as to what marks to specify, when they may not be easily, or even at all, available at the right time. I know at least one importer who makes a speciality of selling goods subject to his customer's approval, thus backing his own judgment of his customer's requirements. Anyway, it is the importer's first concern, if only for his own sake, to import and sell only what the architect and contractor needs and to do so as reasonably as possible.

Another reference book, dealing with timber as a product, that also makes an attempt to introduce some necessary standardization, is the dictionary of terms and definitions commonly (though in the past, rather loosely) used in the timber trade, which has been produced by a Committee of the British Standards Institution. An example from this work, showing the definition of common defects, is reproduced in I.

Condition

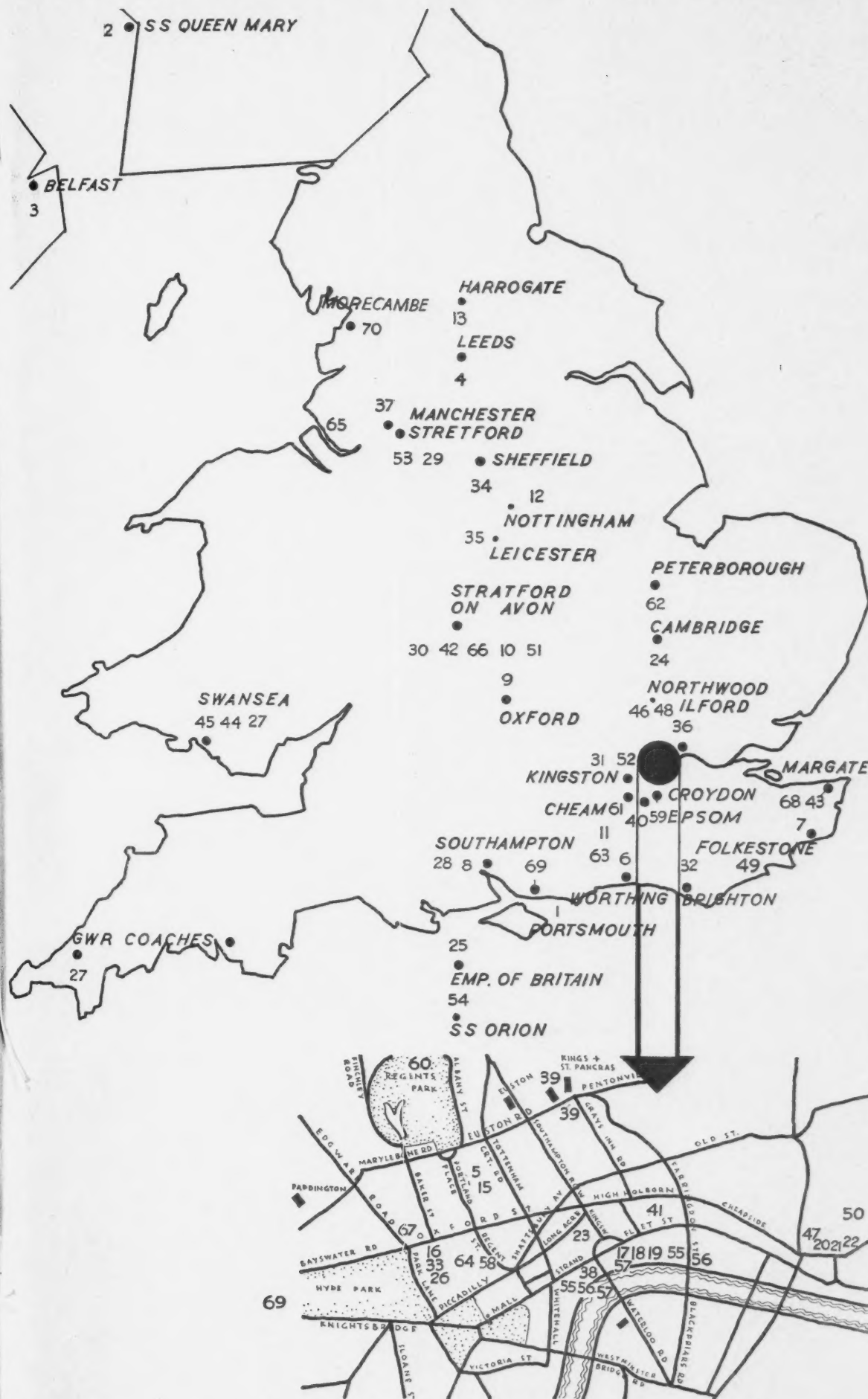
A matter to which much time and discussion has been given is the question of "seasoning." The usual contract forms in the timber trade merely require that the wood shall be "properly seasoned for shipment" to its known destination. This is usually interpreted to mean that the wood must have been so much seasoned that it will not "sweat" or "discolour" during the voyage. In this matter the shippers are very much at the mercy of the weather as they normally have to sell their wood before they have cut it (to ensure cutting the dimensions required by the market) and they have to calculate how long those dimensions will take to dry. Normally shippers reckon on fine weather and drying winds in the north of Europe as soon as the ice has melted, and then the wood which has been cut during the winter (the best time for cutting wood) and open-piled in the deal-yards, will dry out quite bright. But if it chances that the late winter has been snowy and stormy, it is probable that a lot of snow will have driven into the piles, and if that is followed by dull, windless weather it is practically certain that a considerable amount of discoloration will occur. On the other hand if drying spring winds are experienced after a mild winter, and that is followed by an early hot summer, it is probable that a great deal of the wood will be shaken and warped. The illustrations, 4, 5, 6 and 7, show normal open-air piling in typical deal-yards in South Finland, East Finland, Latvia and Sweden. Shippers may be relied upon, nowadays, to do all they can to ship their goods sufficiently dry and bright: if they are not drying quickly enough they may re-pile them to give them more exposure to the air: if they are drying too quickly they may close-pile them to retard the process, but it is no easy matter to catch up with all the vagaries of the weather even in the North of Europe where the weather is certainly somewhat more methodical than in Britain.

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TIMBER IN APPLICATION



1. Oak H.M.S. "Victory," Portsmouth.
2. Elm Burr Q.S.T.S. "Queen Mary," Corridors.
3. Oak Belfast. Law Courts. Fittings.
4. Oak Leeds. Town Hall. Assembly Hall.
5. English Walnut R.I.B.A. Council Chamber.
6. English Brown Oak Worthing. Town Hall. Police Court.
7. Sycamore Folkestone. "Astoria." Pay Box.
8. English Walnut Southampton. Municipal Officers' Conference Room.
9. Oak Oxford. Taylorian Institute. Joinery.
10. English Yew Stratford-on-Avon. Shakespeare Memorial Theatre. Tables and chairs in restaurant.
11. Red Cedar Chobham. Houses by Sir Edwin Lutyens.
12. English Walnut Nottingham. Civic Centre. Waiting Room.
13. Columbian Pine Harrogate. St. Wilfred's Church. Roof truss.
15. Quebec Pine R.I.B.A. Henry Florence Hall. Screen.
16. Spruce Oxford Street. British Industries House. Model House.
17. Black Bean Australia House. 1st Floor.
18. Tasmanian Oak Australia House. 1st Floor.
19. Blackwood Australia House. 4th Floor.
20. Jarrah Offices, Orient Line, Fenchurch Street.
21. Queensland Walnut Offices, Orient Line, Fenchurch Street.
22. Silky Oak Offices, Orient Line, Fenchurch Street. Lifts.
23. Australian Walnut Connaught Rooms, Great Queen Street, W.C.2.
24. Black Bean Cambridge. Fitzwilliam Museum.
25. Black Bean "Empress of Britain." 1st Class Lounge.
26. Queensland Walnut Coutts Bank, 108, Park Lane.
27. Australian Walnut Swansea. Civic Centre.
28. Karri Southampton Municipal Buildings. Flooring.
29. Jarrah Stratford. Town Hall. Flooring.
30. Queensland Maple Stratford-on-Avon. Shakespeare Memorial Theatre. Door panels.
31. Australian Silky Oak Kingston. Guildhall. Courts 1 and 2.
32. Karri Brighton. St. Wilfred's. Floor.
33. Maple Wood Park Lane. Curzon Cinema. Barrier in auditorium.
34. Walnut Sheffield. City Hall. Auditorium.
35. Black Bean Leicester. Martin's Bank.
36. Pyinkado Ilford. Town Hall. Flooring.
37. Pyinkado Manchester. Central Library. Flooring.
38. Indian Laurel Wood Shell Mex House. Board Room.
39. Indian Silver Grey Wood L.M.S. and Piccadilly Tubes. Coaches.
40. Indian Figured Ebony Epsom. Town Hall. Plinths and caps in Council Chamber.
41. Gaboon Ebony Fleet Street. "Daily Express" Building. Entrance Hall.
42. Indian Rosewood Stratford-on-Avon. Shakespeare Memorial Theatre. Pier sheathing in foyer.
43. Silky Oak Margate. "Dreamland." Auditorium Café.
44. Indian Teak Swansea. Civic Centre. Floors.
45. Indian Laurel Wood Swansea. Civic Centre. Mayor's Parlour.
46. Gurjun Northwood, Middlesex. Merchant Taylors' School. Assembly Hall floor.
47. Andaman Padauk Bank of England. New counter tops.
48. Andaman Padauk Merchant Taylors' School. Entrance doors, N. and S.
49. Austrian Oak Bognor Regis. Town Hall. Council Chamber.
50. Teak Lloyd's New Building. "The Room." Leadenhall Street.
51. Burmese Gurjun Stratford-on-Avon. Shakespeare Memorial Theatre. Flooring.
52. Macassar Ebony Kingston. Guildhall. Court 3.
53. Borneo White Mahogany Stratford. Town Hall. Screens.
54. Cherry Mahogany S.S. "Orion." Lounge.
55. Yellow Wood South Africa House. War Memorial Shrine.
56. Teak South Africa House. Doors, mouldings.
57. Stinkwood South Africa House. Furniture.
58. Cuban Mahogany Dickens and Jones, Regent Street. Entrance doors.
59. Birch Imperial Airways. Croydon. Airplane interiors.
60. Birch Regent's Park. Gorilla House, Zoo. Revolving screen.
61. Birch Cheam. St. Andrew's. Vaulting.
62. Austrian Oak Peterborough. Town Hall. Council Chamber.
63. Walnut Worthing. Municipal Assembly Hall. Joinery and panelling.
64. Pyinkado 9, Hanover Street. Showrooms.
65. Austrian Oak Liverpool. Anglican Cathedral. Choir stalls.
66. White Bombwe Stratford-on-Avon. Shakespeare Memorial Theatre. Flooring.
67. Blackwood Marble Arch. Cumberland House. Grill Room.
68. Lacewood Margate. "Dreamland." Auditorium Café.
69. Japanese Ash Kensington, Church Street. Rowley Galleries. Panelling.
70. Makoné Morecambe. Midland Hotel. Lounge.

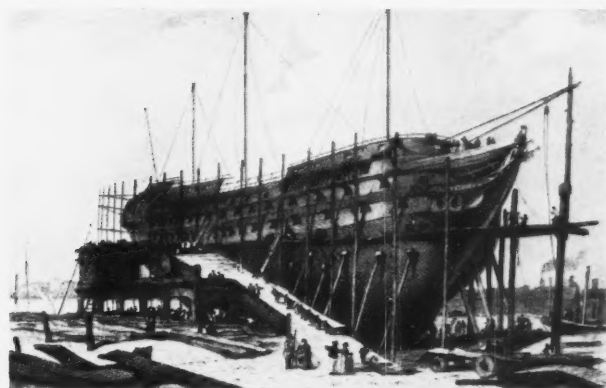
A map of England drawn to show where examples of the use of various timbers can be seen

TIMBER IN APPLICATION

A great deal of complacent nonsense is talked about what hack journalists and publicity copywriters call "our wonderful modern synthetic materials," which has become a convenient Fleet Street cliché to express anything and everything employed in present-day building. The examples usually cited are glass, steel, concrete and plywood. Glass is certainly a synthetic material, for it represents a complete fusion of its ingredients; but in spite of the immense technical progress recently made in its manufacture it is anything but a modern one. Steel being the product of refining and tempering iron ore is neither modern nor synthetic. Concrete and plywood are not chemical transformations, but simply structural re-formation of the two oldest building materials in the world: stone and timber. Both, however, depend on modern synthetic cements as their binding agency, though these differ radically in nature. Even the patent plastic substances materials made from pulped wood fibres are only semi-synthetic. To find a wholly synthetic modern material, such as bakelite, that is derived from wood we must turn to the cellulose from which the artificial silk of our shirts and stockings is woven. Any consideration of plywood immediately involves the second syllable of the word, since only one raw material is used in it: wood itself. Laminated wood (for plywood is only one of its varieties) is therefore simply wood presented in a form that enables it to be applied to new purposes on the one hand; and a form of wood that offers more economical or rational structural applications than ordinary sawn or adzed timber on the other. Though there are clearly cases in which the time and money or

weight and bulk saved has made, or is making, plywood supersede ordinary timber it would be a fundamental mistake to regard plywood as a competitive substitute for wood. Every fresh use of plywood calls for fresh auxiliary uses of solid wood, and more often than not fresh varieties of wood as well (some 40,000 exist). One has only to think of the hundreds of new decoratively-figured hardwoods which the rotary-cutter has called into being. Most of these are what used to be called "precious woods," and precious they were bound to remain as long as they were only available in straight-sawn panels. Anyone who has seen an elaborate plywood "set" built up in a film studio (such as that illustrated on pages 88-89 of this issue) will be familiar with the forest of timber battens that have to be employed as backing and shoring.

A new era in solid-timber construction is dawning which parallels that already opened up by plywood. It will be enough to quote such examples as Fritz Zollinger's "Lamella" roofing, joints for bent table-legs or deadwood acoustic roofs, with their imposing "Baroque" billows, introduced by Alvar Aalto. Wood is altogether too noble and human a material to be branded with that drab epithet "synthetic," even if the term could be correctly applied to it. Nor is anything like finality yet in sight in regard to the scope of its technique, which scientific research is continually extending and improving. That is why in this issue all forms of wood, natural as well as reconstructed, are considered as a single material that may be sub-divided into those two, traditional and untraditional, uses.



Timber as a NATURAL MATERIAL

By Bryan Westwood

THE particular aspect of timber with which I am mainly concerned is its use as a "modern" material. This is the explanation of the various gaps in both text and illustrations apart from those filled by specialist articles elsewhere in this issue. By a "modern" material I mean a material used in the modern way, scientifically and naturally rather than empirically; used in the right size for the job rather than in any size above the minimum.

Old methods may still be modern in this sense, but in the majority of uses the machine has stepped in to fashion the traditional

article more cheaply, or to form the basis of entirely new structural forms. The "Lamella" roof illustrated and described later is a striking example of the latter. Accurate knowledge of the material and principles involved, and mass production of the component "lamellas" ready drilled for erection, have made possible this amazingly light and strong roof.

Much has been said about the relative qualities of the hand-made and machine-made article, generally to the disadvantage of the latter. That criticisms should be levelled against the machine rather than the

method is borne out by the following example. It has often been stated that the machine cannot plane woods such as yew, which have peculiar kinds of grain. Actually the blade of the machine is set at an angle of 30°-32°, but for certain woods it is desirable to work at an angle as small as 10°. Because the ordinary machine is incapable of this adjustment, machinery as a whole is condemned as inferior for this type of work.

Such objections survive for years, in spite of the developments of machinery which have eliminated their cause.

TIMBER AS A NATURAL MATERIAL

Machinery has made it possible to produce framed and wrought work cheaply and with an accuracy of fit previously only attainable in metalwork, making possible interchangeability of parts in mass-produced articles.

The refined light steel or ferro-concrete structures which we see today are the result of scientific investigation and appreciation of the qualities of material. Such research applied to timber and the spreading of knowledge of its particular properties are bound to lead to its increased rational use. For instance, laboratory-tested wood can be used to a smaller factor of safety than non-tested material; steel gussets can replace bulky joints, and once more wooden trusses may rival steel because of cheapness, lightness and rapidity and ease of handling. Intense competition with other materials has been a factor speeding up research. Aircraft engineers have given a lead in refined timber technique, which lead is already reflected in other structural work (see illustrations of the radio mast at Datchet, 25 and 26, and the Dutch Pavillion at Paris, 33).

Foreign practice, particularly in Scandinavia, indicates the possibilities of timber as an economic solution of problems of housing in open developments; the very sphere where cheapness is paramount and repetition work makes the saving of shillings and pence on each house important, and where it is the duty of authorities to make experiments to ascertain the material which strikes the best balance between cheapness and real utility. The L.C.C. have recently made a small experiment on their estate at Becontree with imported Swedish pre-fabricated houses, but this is not sufficient as a test of timber for houses. Cheap transport has made the material available to all, why is it not more used? An answer to this question may be obtained by examining the factors that are retarding progress in the use of timber. The most important of these are the following:—

Bye-laws.—The dead weight of local authorities against new forms of construction goes much further than acting as a necessary brake on crazy experiments, and forms a serious obstacle to the advancement of timber technique. Even if it is possible to get consent for its use, the delay in so doing is such as to make any experiment impractical in most cases.

The Local Tradition.—Here, as in other countries possessing large deposits of suitable clays, brick has been the natural and economic material for building work, either as an infilling for hardwood framing or for the whole of the walls. As a result of its almost universal use for this purpose over a long period a very strong brick tradition has grown up with an accompanying reserve of inherent skill.

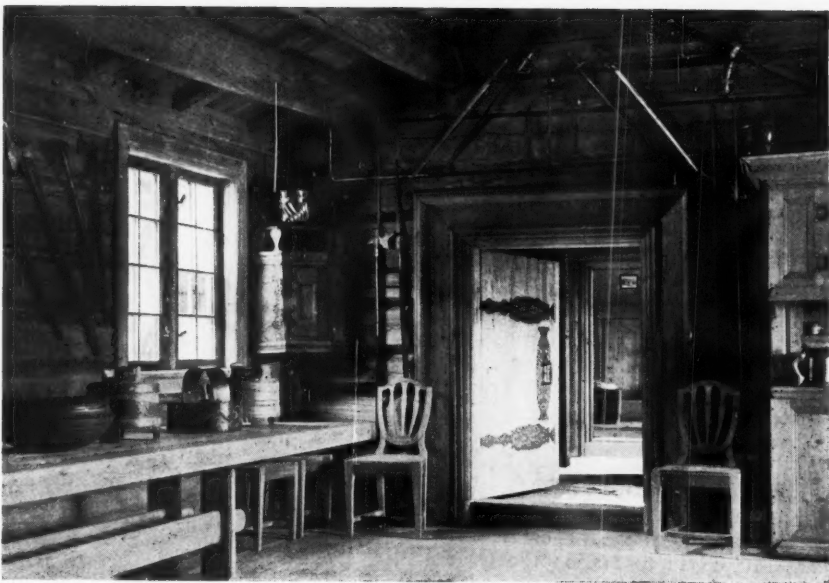
In contrast there has never been a strong softwood tradition here, and native skill in handling the material as walling has not developed.



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Different countries evolved different characteristic traditions of timber architecture, according to varying climatic and other conditions and according to the extent to which timber was the dominating material. 2, mediæval England; a house at Goudhurst, Kent (late sixteenth or early seventeenth century). 3, the exterior and 4, the interior of an old farm in Sandbu, Sweden, typical

of that country's timber tradition. 5, a detail of another Swedish farm, showing the massive construction. 6, an English equivalent; a weather-boarded mill at Bures, Suffolk. 7, eighteenth-century warehouses at Oslo. 8 and 9, Scandinavian timber architecture of the more monumental sort; the Folk Museum at Oslo and a doorway in a very old church at Vågåmo, Sweden.

There is also the understandable objection to the use of an imported material, the pros and cons of which are beyond the scope of this article, but for cottage housing at any rate such objection should not be allowed to prove overriding.

Fire.—A clear appreciation on the part of the public of the nature of risks from this source is essential if use of wood is to increase to a great extent.

The mediæval town with its tightly-packed dwellings constituted a fire hazard which has not been forgotten to this day. The year 1666 must surely be the timber merchants' greatest bugbear.

Misuse.—Misuse of timber in cheap bungalows and other buildings has led to wholesale condemnation of timber houses in the minds of many and their relegation to a general category known as "Wooden

Huts." Even a cursory examination of the "Colonial" type of house in the eastern states of the U.S.A. or of the old weather-boarded mills in Essex, forces one to the immediate realization of the permanence and dignity attainable by proper use of the material. With timber perhaps more than with other materials "proper" use is essential in order to combat the forces of decay.

The properties of timber as a structural material, determining the structural uses to

TIMBER AS A NATURAL MATERIAL



10

More examples of characteristic timber architecture. 10, an English windmill: Cranbrook Mill, Kent: built in 1814. 11 and 12, the American Colonial style: a timber tradition that reached a particularly high standard of refinement, the English style from which it sprang having been sensitively adapted to the change of material. 11, the St. George Tucker House, Williamsburg, Virginia, built in 1788. 12, a typical American Colonial interior: in the Market Square Tavern in the same town. (Reproduced by courtesy of the "Architectural Record.") 13, English domestic timber architecture: a row of weatherboarded houses of the Georgian period.



11



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13

which it may suitably be put, may be tabulated as follows:—

Cost.—It is difficult to obtain comparable data as to the cost of the ordinary house in this country built of timber, as compared with its brick or other counterpart. Circumstances vary greatly in every case, but, in general, cost compares very favourably. In cases within the writer's own experience a substantial saving has been effected even when the upper storey of a brick house has been constructed in studding, felt and weatherboards. In the case of a pre-fabricated house, a saving of 15 per cent. to 25 per cent. has been made, although the timber work only represented 50 per cent. of the total cost.

Durability and Low Upkeep Cost.—The idea that timber is only a temporary material is contradicted forcibly even in England, not a timber country. There are many examples of old timber buildings, but the weatherboarded Essex mills,⁶ and the Saxon log church at Greenstead are outstanding examples. Post Office telegraph poles over 60 years old are a common feature of the landscape; they have not rotted appreciably although standing in the ground.

The ninth-century Viking ship in the museum at Oslo, ¹⁴, is a famous example of durability, and the Scandinavian countries are full of examples of wooden buildings of all kinds which have stood for centuries. Improvements in creosoting and other methods of treatment for preservation and knowledge of anti-dry rot measures and the gradual elimination of insect infestations all increase the "expectation of life" of timber even when wrongly used.

Insulation.—(a) *Thermal*: Wooden houses are noticeably warm in winter and cool in summer, and the reason is strikingly borne out in scientific tests. It has been shown that a wooden wall 4 ins. thick is equivalent in this respect to a brick wall 1 ft. 10½ ins. in thickness. Red cedar shingles are claimed to have the greatest insulation value of any roofing material in general use.

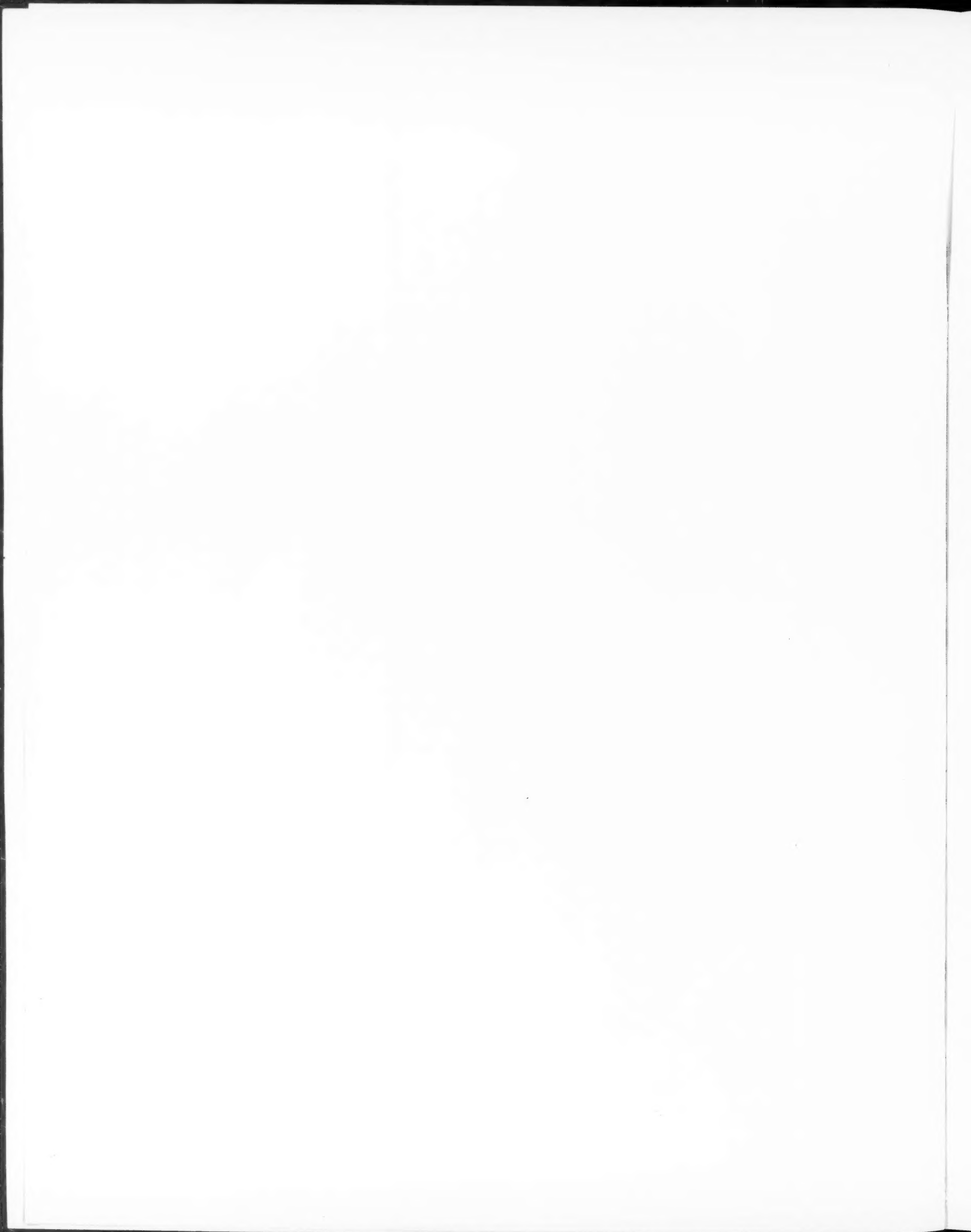
The insulation of Swedish timber houses, even of the cheapest kind, is such that a small domestic boiler of the kind in general use here is sufficient to maintain the internal temperature in the neighbourhood of 65° F. with the external temperature at 30° frost for prolonged periods. (b) *Sound*: Wall-

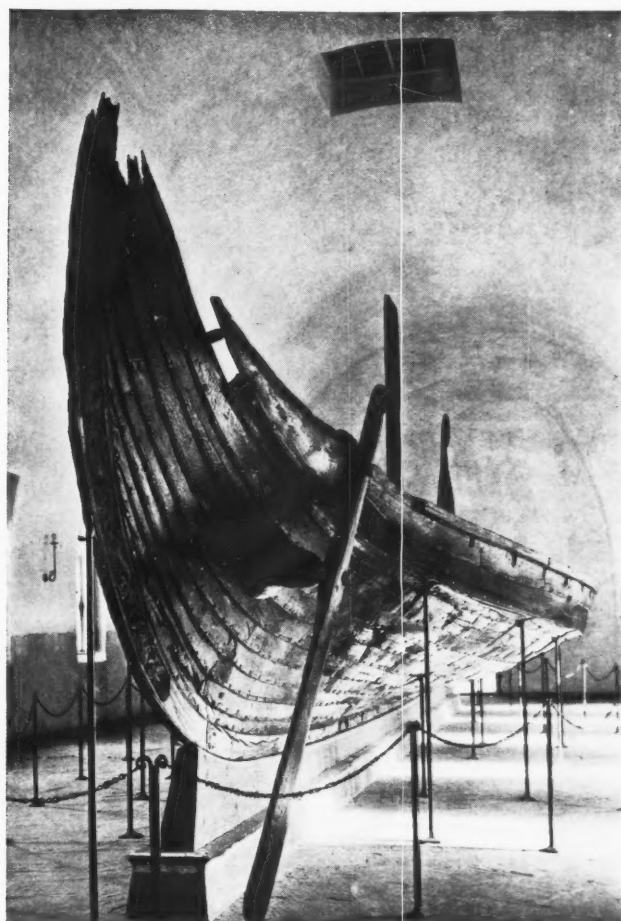


Old Walton Bridge, an ambitious structure in timber. From the painting by Canaletto, made in 1754, now in the Dulwich Gallery. [By courtesy of *The Connoisseur*.]

PLATE v

February 1936



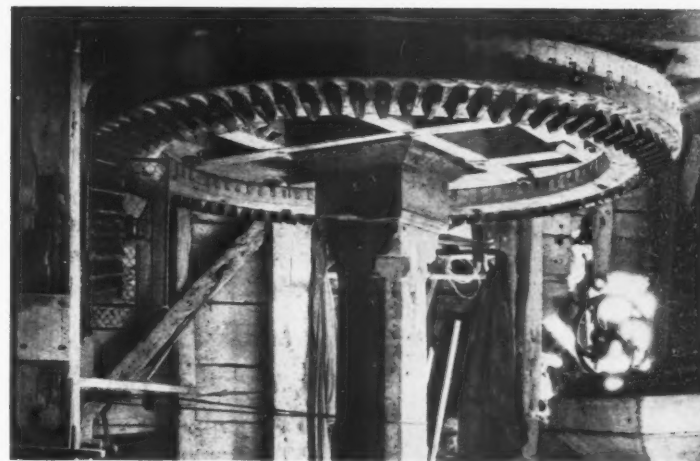


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Qualities shown in timber that are not usually associated with it as a material: 14, a ninth-century Viking Ship, now in Oslo Museum; it has the modern quality of lightness but is an outstanding example of durability. 15, remains after a severe fire. The timber framework in the foreground is badly charred but still intact and not distorted. 16, This wooden gear wheel, made of chestnut, has been taking the main drive from the waterwheel of Overshot Mill, Essex, for more than a century. Except for occasional renewals of wooden teeth it has required little attention although in continuous use.



16

boards are playing a growing part in the insulation of modern building, while paneling is being used extensively as a reflector in acoustically designed buildings.

Erection.—The material is easy to handle and fitting can be carried out on the site without the use of special plant. The entire structure except chimney stacks can be in the one material, thus eliminating multi-

plicity of "trades" and consequent delays. Erection is rapid even when all work is done on the site and the house can be lived in at once without inconvenience caused by the usual "drying out."

Methods of timber house construction vary accordingly to the value of material and labour. The log cabin is the logical forest form where material is cheap, whereas on sites far from the source of supply in-

genuity in jointing and construction has to take the place of mere bulk of material to accomplish the same end.

House construction being such an important use of timber, it is perhaps permissible to go into it in detail to a certain extent, even in a general article such as this. The Scandinavian house generally consists of roughly squared or oval shaped logs fitted together and caulked with moss or rope



17



18

made of twisted shavings. On the outside these are covered with vertical boarding and cover fillets. On the inside a variety of finishes is used, but thick building paper stretched over the logs as a basis for wallpaper is a cheap and practical method.

In the case of pre-fabricated houses the wall units are built up in layers of boarding and insulating material rather than the solid logs. The labour is done by machinery balanced by economy of material. An example is the "Stadens" system: 2 in. boarding forms the basis; 1 in. boarding separated from this by 1½ in. studs forms the outer skin. Sawdust fills the spaces between the studs and the usual fillets cover the joints.

In this country we do not need to take such elaborate precautions against extreme cold, hence the use of rebated weather boarding laid on felt on 4 in. by 2 in. studs, plastered or covered with wallboard inside. Studs can be reduced in size by using two skins of boarding, the inner one laid diagonally, giving a strutting effect. Vertical boarding can be used, but without the foundation of solid wood, special rails have to be introduced for fixing.

In this country door and window frames and interior furniture and finishes still provide the commonest examples of the use of wood.

With the assistance of machinery cheap and durable wooden window frames are being produced which are not subject to the defects common to cheap hand-made ones, and as far as doors, fittings and furniture are concerned, machinery performs the bulk of the work and has made sound articles of this type low enough in price to be generally used.

The general tendency towards simplification of detail in design is manifest in modern joinery work. The omission of mouldings and enrichment makes greater demands on finish and workmanship and has led to use of a greater variety of timbers in order to get diverse decorative effects from the wood itself.

Not being liable to shrinkage and other defects to the same degree as solid wood, veneers have enabled the designer confidently to take advantage of all kinds of

little-known woods. Further, the introduction of plywood has furnished a convenient backing for veneer—but a further source of abuse.

Generally speaking, wood has its advantages over other materials in some respects, even apart from cost: it is suitable from the start and does not need modifying for strength, or insulation, or appearance, to anything like the same extent.

On the pages of illustrations that follow, typical examples of the application of timber to modern architectural problems are shown. Owing to limitations of space the examples have had to be made representative rather than comprehensive, but it has been attempted to show, in all the different uses, the common quality: of using timber scientifically, exploiting the qualities that timber alone possesses.

17, an eighteenth-century wooden house at Stavsjobruk, Sweden: solid log walls and the same type of finishing as is still in use today. 18, a pre-fabricated house at Angby, near Stockholm. An example of the smallest type of working-class mass-produced dwelling. The walls are built up of layers of planking and studding. The spaces between the studs are filled with sawdust and insulating building paper is interleaved between the layers of planking. 19 and 20, misuse of timber in suburban England. Battens are spiked to the surface of a plaster finish, as decoration—no appreciation whatever of the qualities of the material. Compare this mistaken use of wood with its logical modern use in the design for a timber house illustrated in Fig. 64, page 73.



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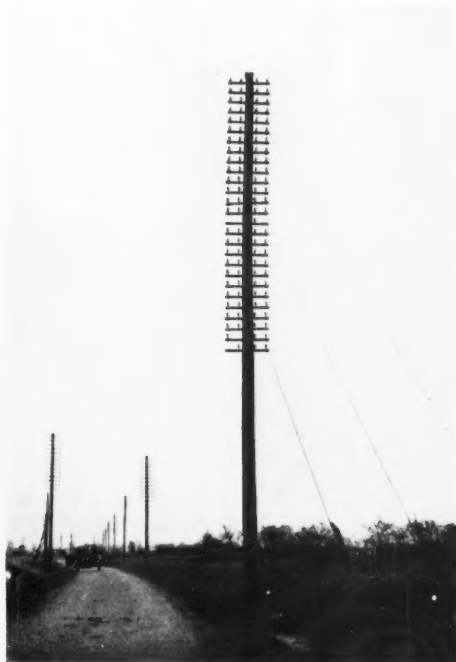


21

BRITISH COLUMBIA TIMBER COMMISSIONER



23



22

G.P.O. ENGINEERS' DEPARTMENT

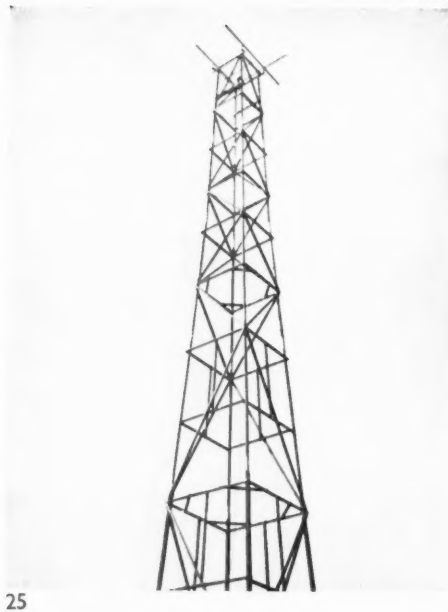


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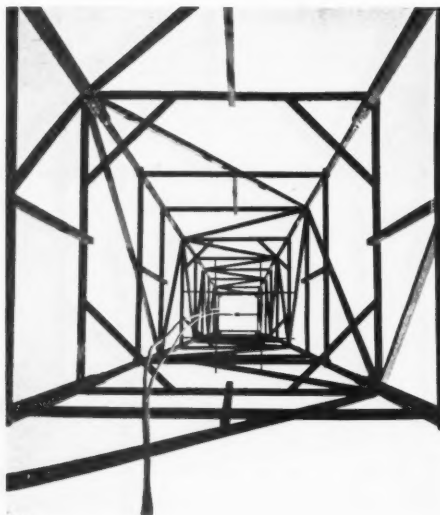
ENGINEERING

The examples on this page show timber used in simple ways. First of all its use as mere mass (23, baulks of timber which are lowered into grooves to close Polperro Harbour in rough weather), as a contrast to the uses on the following two pages which mostly show timber as a "modern" material, in examples where for certain reasons it has been worth while to use wood in a scientifically refined form. Even in the simpler forms such as the telegraph pole, 22, and the sea defence works, 21, its use is logical because it has properties which make it particularly suitable for its purpose. For instance, steel, concrete and even glass have been the subject of experiment by the G.P.O. as materials for telegraph poles. Timber, however, is the only one which possesses, to the right degree,

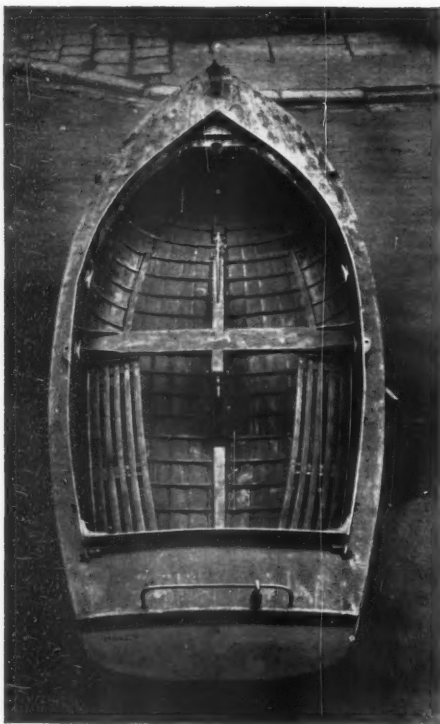
the principal qualities required; namely, durability and flexibility under severe wind pressure, without undue weight. Many of the first poles erected over 60 years ago are still perfectly sound. The largest poles in use are 60 ft. in total height, of which 10 ft. is below ground. 21 shows Douglas Fir used for sea defence works extending for $3\frac{1}{2}$ miles between Rye and Winchelsea: E. Latham, engineer. Screens formed of piles and waling are used to break up the waves before they reach the barrier made of two rows of piling sheeted with 9 in. $\times$ 3 in. timber. 24 is a massive timber bridge at Nigrande, built in 1935. Timber structures based on scientific calculations tend to take forms similar to those of other materials which react in a like manner under forces of tension and compression.



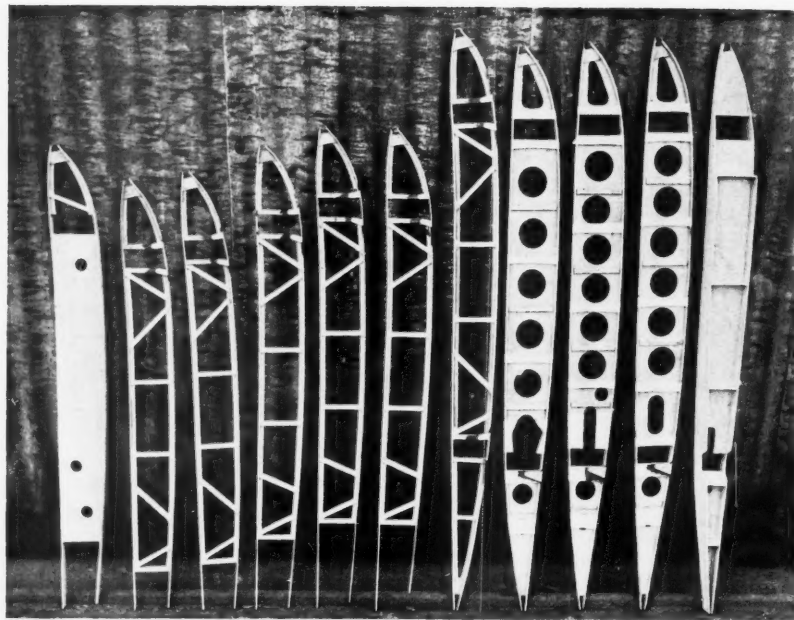
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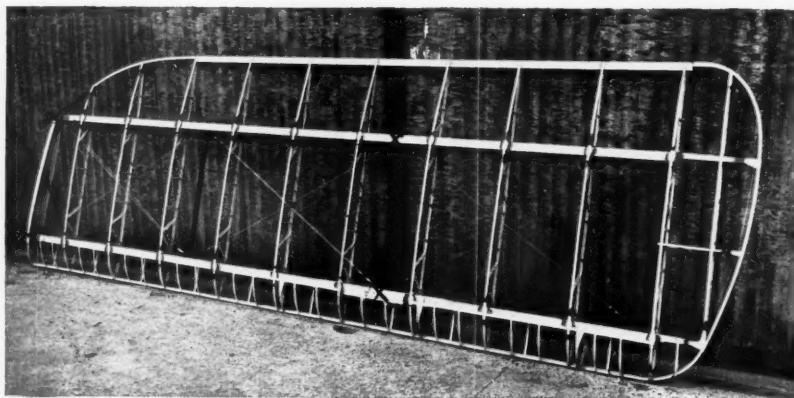
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30

DE HAVILLAND AIRCRAFT CO.

REFINEMENT OF STRUCTURE

Accurate, scientific use of timber leads to a refined structure contrasting with the mass uses shown on the previous page. 25 and 26 show masts at the Radio Research Station, Datchet; height, 72 ft.; 9 ft. $\times$ 9 ft. at the base and 3 ft. $\times$ 3 ft. at the top. The material is Oregon Pine, creosoted under pressure. The size of the members is only 3 ins. $\times$ 3 ins. at the base and 2 ins. $\times$ 2 ins. at the top. This mast was built of wood primarily because of its non-conducting properties, but has been found to be so light and strong that further masts of this kind may be built in wood instead of in steel. The "life" of the mast is not intended to exceed 20 years. 27 is the interior of a typical clinker-built boat. Small ribs and thin riveted planking are used with full appreciation of the strength and quality of the material. A traditional constructional method which is truly "modern." 28 is a photograph of a number of built-up aeroplane spars, showing really amazing strength with the minimum weight. For example, the fifth rib from the right weighs less than $\frac{1}{2}$ lb. and can hold a weight of 400 lbs.



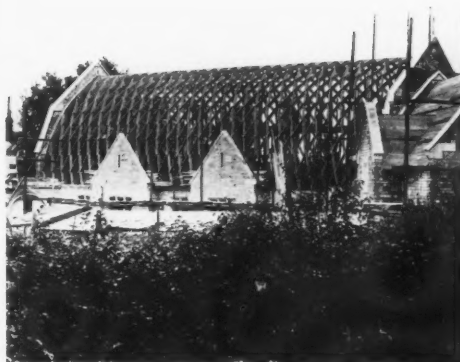
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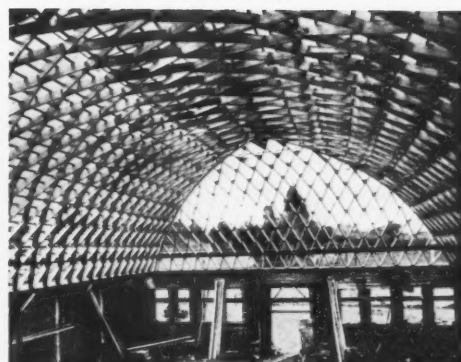
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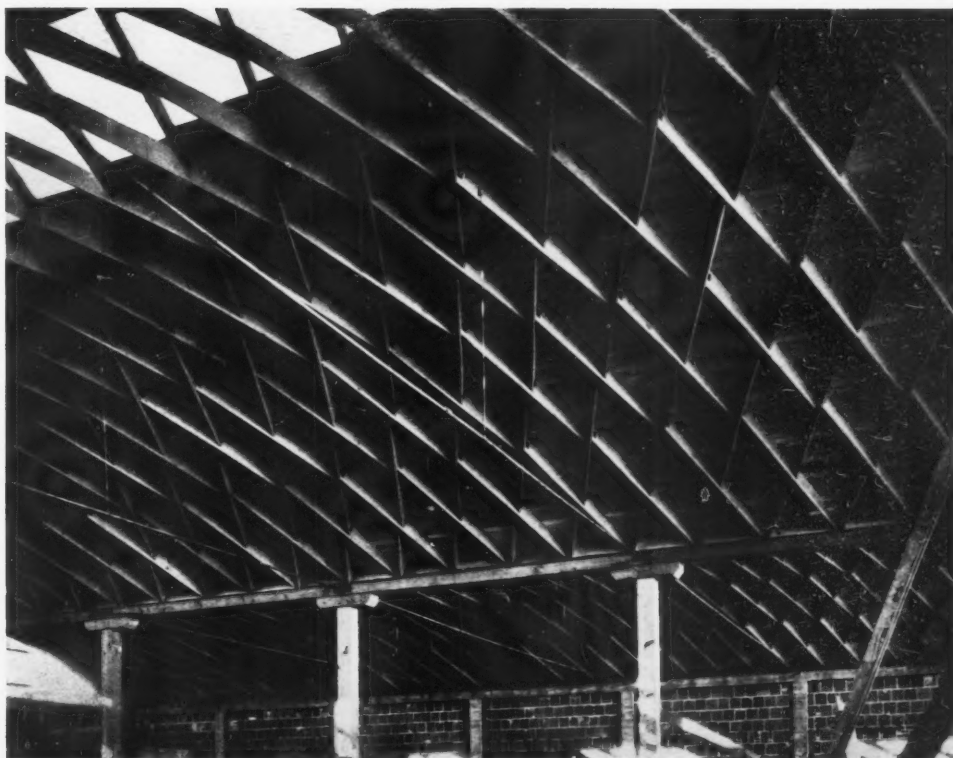
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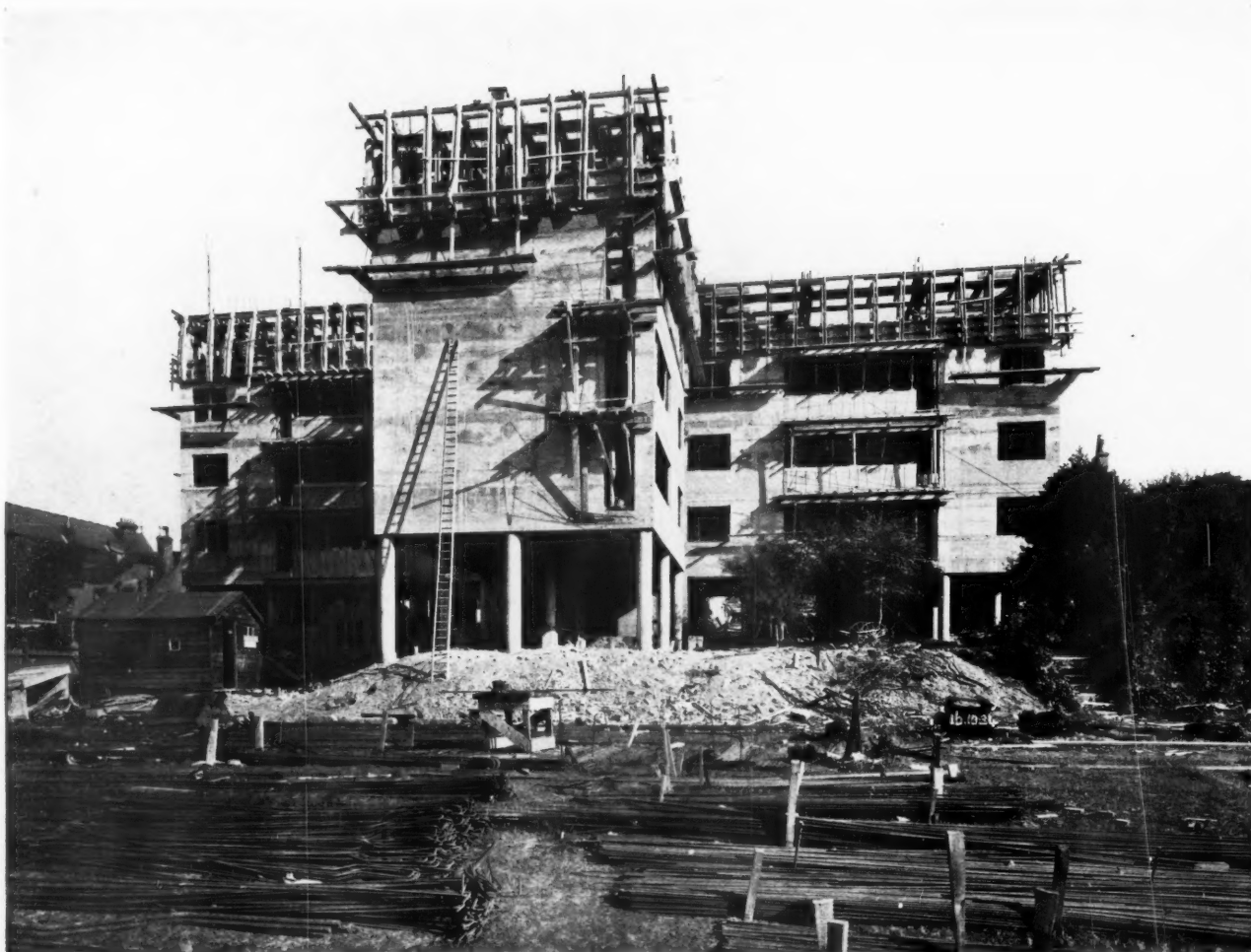
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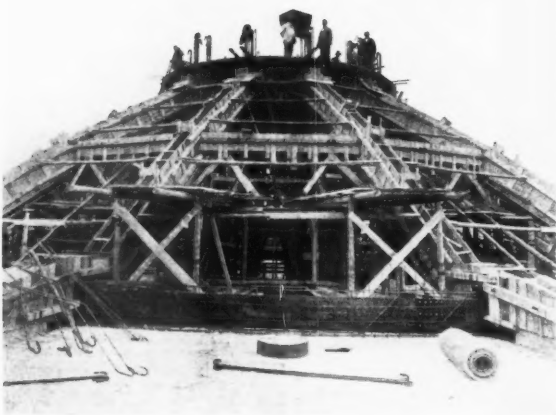
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when supported by spars passing through points marked "X." 29 is a "Tiger Moth" wing, weighing 78 lbs. complete. When supported at points marked "X" it will support 1½ tons. 30 shows a built-up wooden wing under a test load of 3 tons. The wood is silver spruce and birch ply glued and screwed, and the load is transmitted to the spars by built-up ribs similar to those above. The complete structure, which weighs only 116 lbs., is attached to the fuselage by two root end fittings and by a steel lift strut at a point half-way along the wing. The refinement of structure seen in these engineering and aeronautical uses of timber has its influence on architectural uses. 31, 32, 33 are past, present and future orthodox roof structures; 31, heavy chestnut trusses in the roof of the Abbott's Barn at Glastonbury; 32, normal domestic rafters, easily adapted to roof curved bays; 33, the roof of the Dutch Pavillion at the Paris *Exposition Coloniale*; P. A. Moojen, architect; I. C. Wegerif, engineer. The main hall,

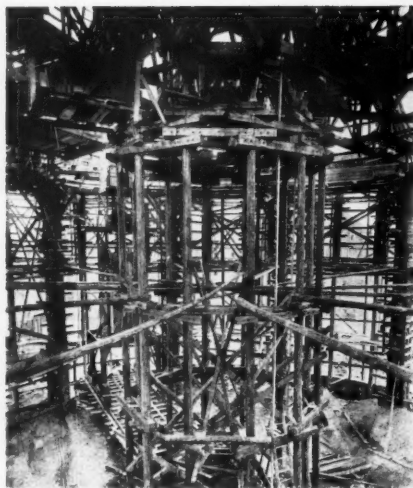
65 ft. wide, is spanned by trusses, at 14 ft. 6 in. centres, composed of 5 in. x 3 in. timbers, two to each member. The stress allowed was 1,500 lbs. per sq. in. The remarkable lightness is partly explained by the temporary character of the building, but it pre-supposes a thorough knowledge of all the factors involved. An important example of this latter quality is the "Lamella" roof, the invention of the German designer, Zollinger. Combining the principles of the arch and the network this new development of timber has been used on spans up to 165 ft. over a bay 363 ft. long (in the arena at St. Louis, U.S.A.). It dispenses with trusses and gives an unobstructed highly economical roof, especially in spans of 60-100 ft. It is built of easily handled short timbers called "lamellas" delivered ready to bolt together. 34, St. Wilfrid's Parish Hall, Harrogate ("Lamella" roof under construction); Leslie Moore, architect. 35, Church Hall at Romford: interior of "Lamella" roof under construction; E. Meredith, architect. 36, a closer view of 35,



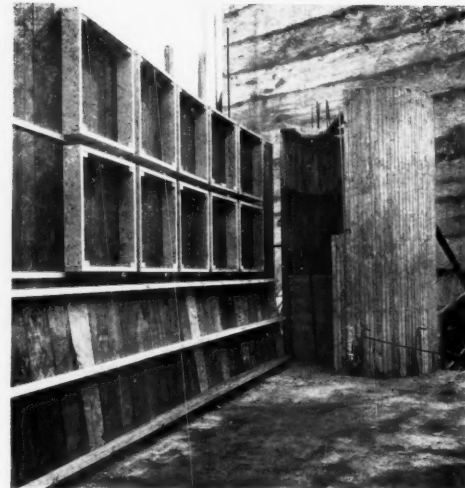
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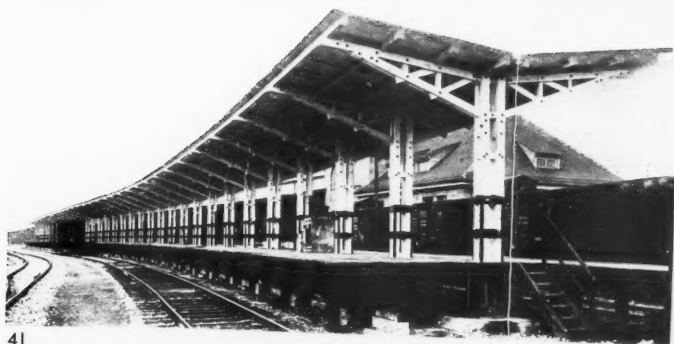
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J. L. KIER AND CO.

TEMPORARY WORK: LIGHT STRUCTURES

The increased use of reinforced concrete has introduced a new, important use of timber—for shuttering and formwork. In standardized work shuttering is re-used, and movable shuttering can be used where buildings are specially designed to avoid its limitations. 37, Highpoint Flats, Highgate. Lubetkin and Tecton, architects; Ove Arup, engineer. These are shown in course of erection under a system of movable shuttering. 38, formwork for the saucer dome, 35 metres in diameter, of a church at Ludwigshafen-am-Rhein; Karl Latteyer and Hans Schneider, architects. 39, the complicated internal centering for the same dome. In cases of this kind the support of the temporary woodwork is an engineering problem in itself; apparently a more lavish use of timber than a complete all-timber roof. 40, forms in position for construction of concrete window transomes

and mullions; also centering for a curved wall. Examples showing the lightness of timber construction, made possible by careful design. 41, a timber cantilevered roof to a goods station at Stuttgart. For this kind of work timber has the advantage of rapidity of erection and ease of handling, and alterations can easily be made to suit changing traffic conditions. 42, a timber roof over the arrival platform, Hütteldorf Station, Austria. 43, the Swiss Pavillion at the Brussels Exhibition. This is a fine example of the timber idiom. Again lightness is evident, but there is also a general character peculiar to timber-work alone. 44, the interior of a timber church at Frankfurt-on-Main; Martin Weber, architect. An illustration of a complete permanent structure in timber, the natural appearance of the wood serving as decoration. 45, the switchback at the Brussels Exhibition.



41



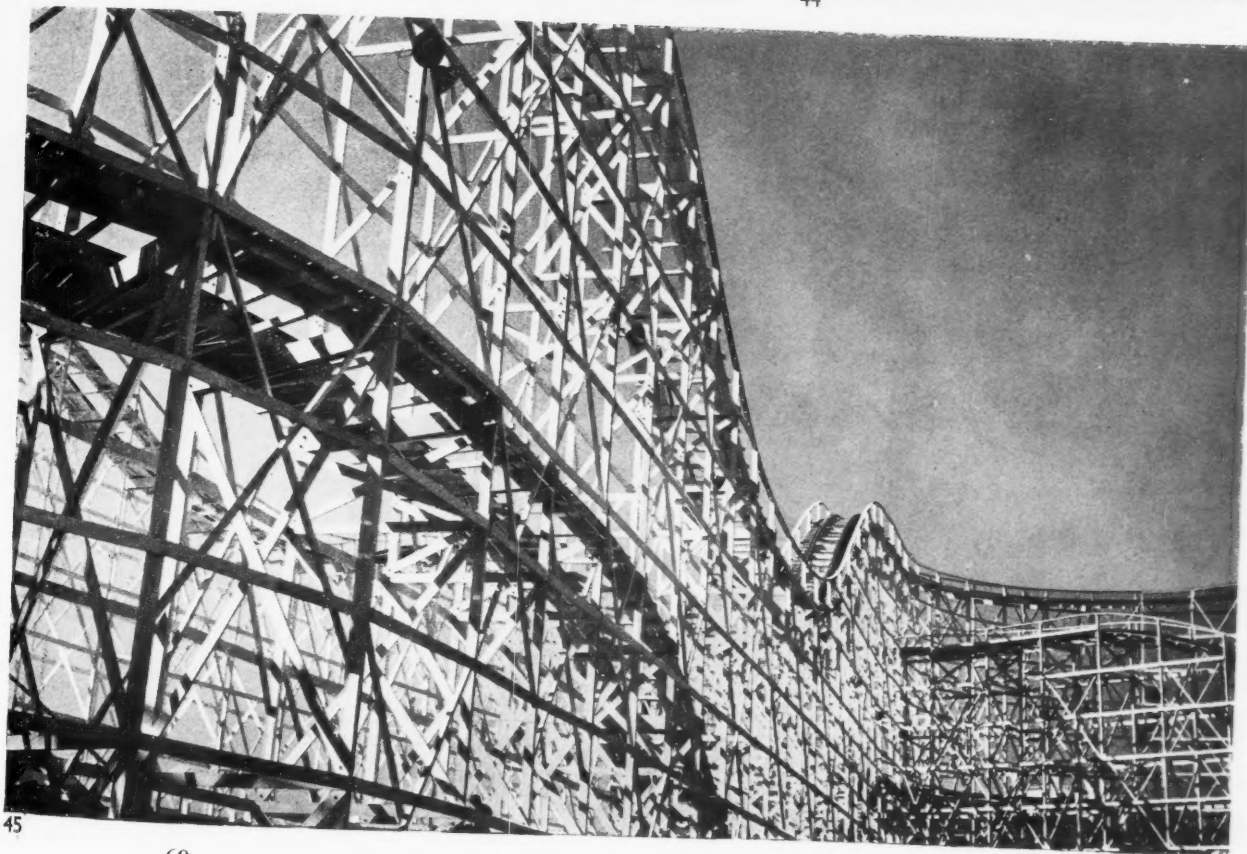
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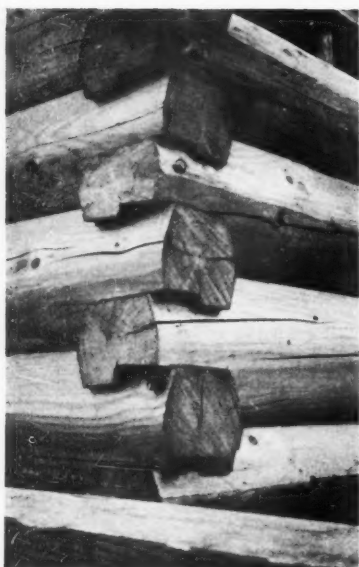
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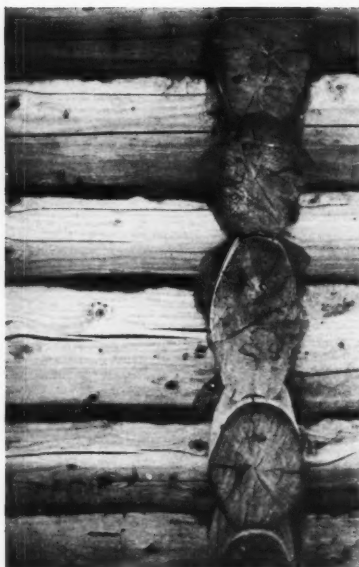
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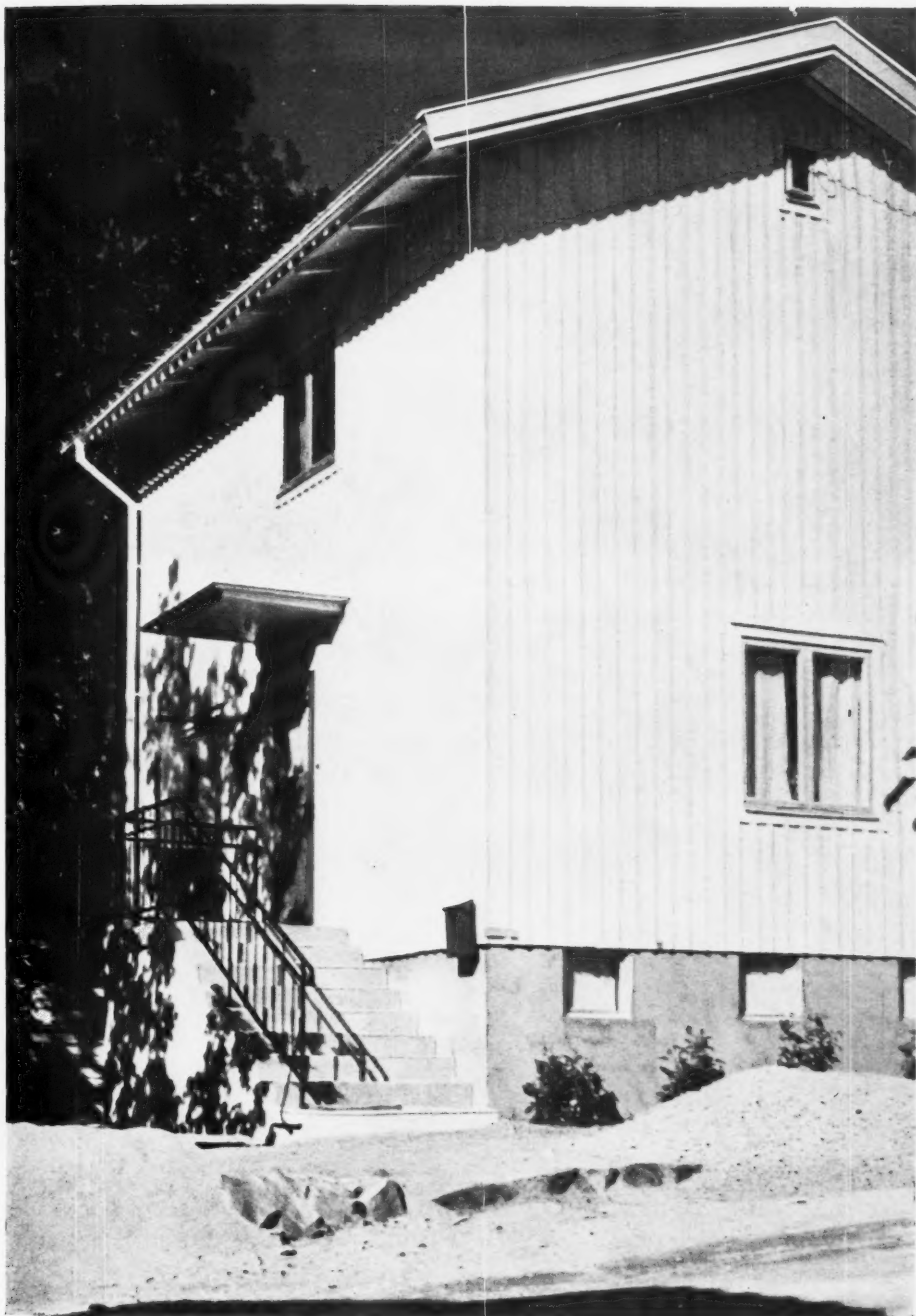


51

WOOD FOR SOLID WALLS

Solid wood for walls is still used to a great extent in timber-producing countries. Where the material is sufficiently cheap it is the most economical method for purpose-made, as opposed to mass-produced, work, and such a wall 4 ins. thick is equal in insulation to a 1 ft. 10½ in. brick wall. 46, 47, 48 and 49 show typical Norwegian log construction. The original round log has four oblique slices sawn off for use as fencing, leaving the rough oval-shaped log. The lower edge is then made concave to fit over the natural convex upper surface of the log below and the joint is caulked with moss. 48 shows grooves cut with an axe to receive the window frame shown on 49. Elaborate joints are used to keep the logs together in preference to any form of bolting or spiking. 50, a house at Inga, Finland: Ole Gripenberg, architect. The basic walls of this house are of roughly squared logs shaped approximately to fit together and caulked with rope made from shavings. The exterior is covered with the usual vertical boarding and cover-slips. Note that the timber walls are raised well above the ground on granite base walls. 51, the front door of the same house: decorative use of natural wood

for the door itself, relieved with light painted surround. On this elevation the outer covering boards are omitted and the log walls are left exposed. The interior of the house is reminiscent of American Colonial interiors. The same materials in widely separated locations, under the same conditions, produce similar solutions. The exterior one would not expect to be the same, because the climatic conditions are far more extreme in Finland. In contrast to this solid-built construction, places where timber is comparatively expensive have naturally evolved a standard form of wood construction consisting of walls built up of planking and studding, but for repetition work even in timber-producing countries the machine is employed to produce built-up units instead of the solid logs, making a substantial saving of material. 53, 54 and 55 show prefabricated houses in course of erection at Angby, near Stockholm. 53, laying floor joists on the concrete base; 54, erecting internal partitions; 55, painting. This type of house is intended for working-class men to build themselves. It was found that they were not capable of erecting shuttering and pouring concrete foundations themselves

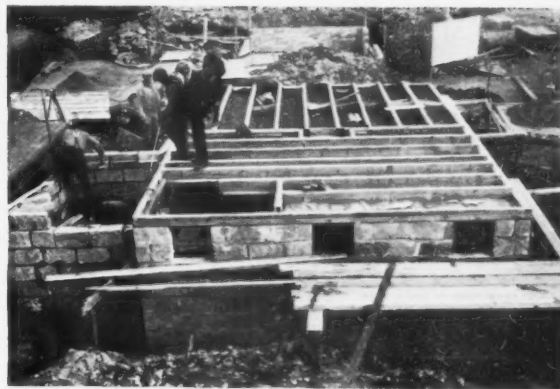


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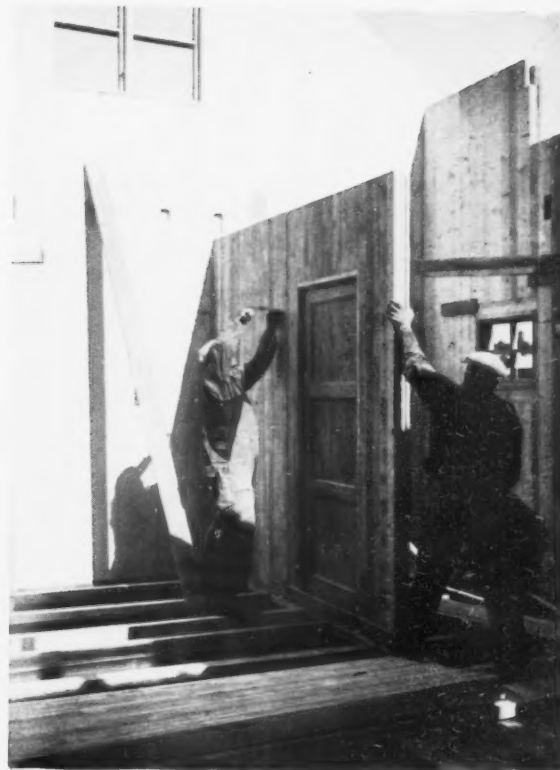
WOOD AS FRAMEWORK

(pre-cast blocks are now used instead), but they could erect the entire wooden structure with but little supervision and make a really fine job. The Swedes standardize *units*, not complete *houses*, so that a great variety of buildings can be evolved from these basic parts. For simplicity, however, the working-class housing estates contain only three or four separate types. Units consist of sections of wall either plain or containing windows, doors, etc., and special sections provided for joining these together. All wooden and other units are supplied in sizes which can be handled by two or three men. The walls are built up of layers of planking and insulating material in various arrangements, but all having the same external appearance of vertical boarding and narrow cover strips. 52 shows one of the houses completed. A carefully designed prototype is mass-produced, as compared with the poorly designed sectional sheds, etc., usually met with in this country. The same qualities which make the Swiss Pavillion, 43, so distinctive are apparent here. Note the wide eaves to the house and the concrete base, both to give protection to the timber walls.

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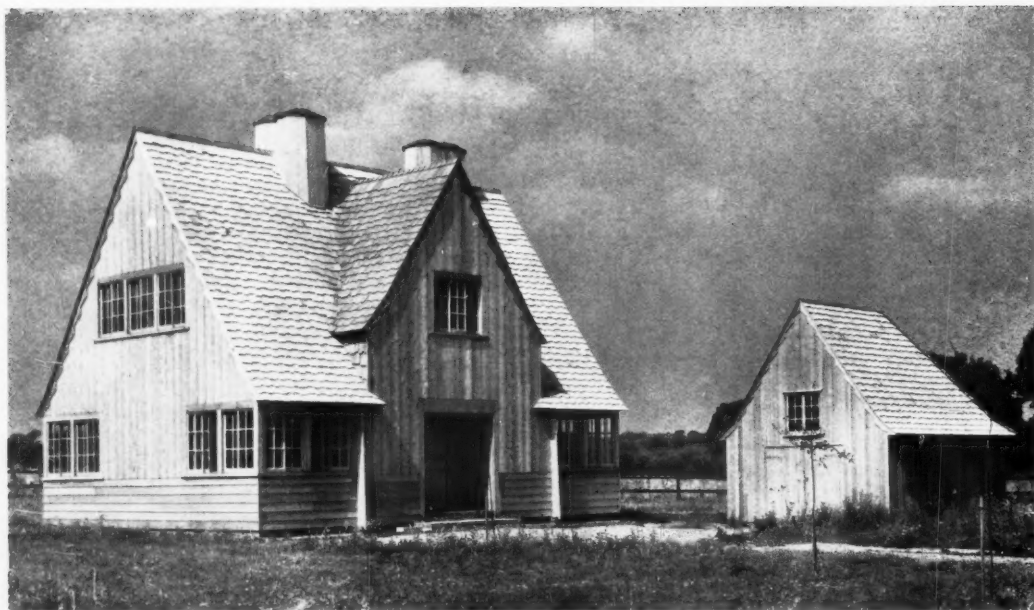
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56

COUNTRY LIFE



58



57



59



60

MODERN VERSIONS OF LOCAL TRADITION

In many countries modern timber houses have been built which, while showing appropriate use of the material, retain also the special architectural characteristics of the locality. Of the five countries exemplified in the illustrations only England, 56, is not a country where timber is the dominating material. 56 is a house at Chobham, Surrey; Sir Edwin Lutyens, architect. The material throughout, including the roof shingles, is red cedar, a wood which is very durable and does not need painting. This explains the omission of some of the usual features ensuring preservation; but at the same time as a general rule it would appear *desirable*, even with red cedar, to incorporate features such as wide eaves which are *essential* when working with less durable woods. The house is a striking contradiction of the idea that timber is a flimsy material only suitable for "shacks."

It harmonizes naturally with the countryside. 57, a summer house near Mount Asama, Japan; Antonin Raymond, architect. The house was built for the architect's own occupation. The base of the building is of lava concrete on which is placed the framing composed of roughly dressed chestnut covered with cedar weather boarding. The roof is thatched with grass, bound with straw-rope and reeds. 58, a school at Wengen, Bernese Oberland, Switzerland; Friedrich Graf, architect. The upper storeys are of pine logs, roughly stripped and finished with stain and a hard varnish. 59, a typical modern timber house in Gothenburg. In spite of the fact that the walls have been covered in stucco (basis, wire netting fixed to the timber) it still has the characteristic timber appearance. 60, a modern Norwegian house at Bergen; architect: Bang, of Oslo.



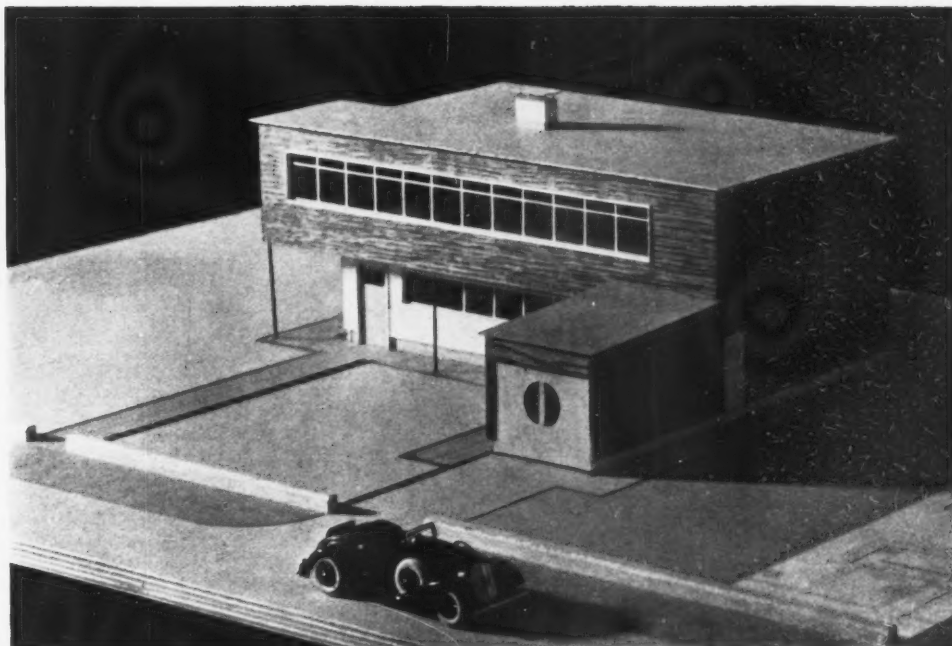
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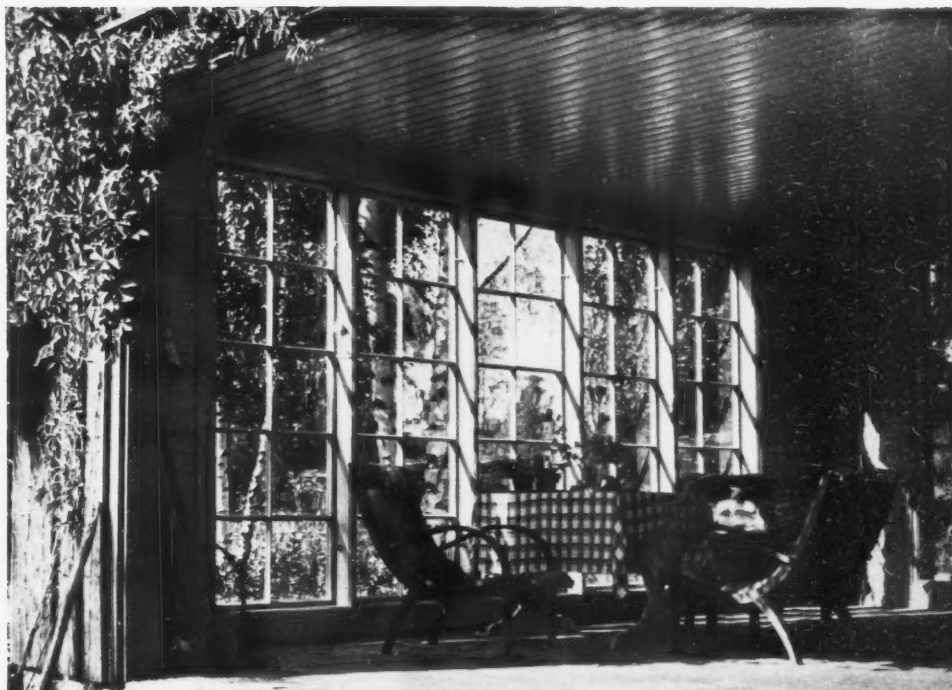
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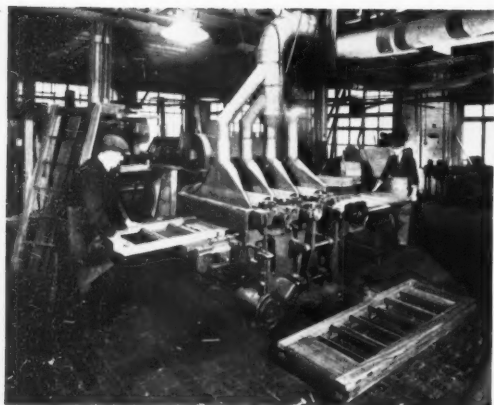


65

NEW DOMESTIC USES

In modern interior work generally advantage is being taken of the decorative qualities of *wood itself* in order to get the effects required, instead of applying mouldings and enrichment. This places greater demands on finish, but it has led to a new appreciation of such features as the staircase of the ordinary house, which, thus simplified, can be appreciated as form. Its structure is left exposed instead of being covered with plaster, as in 61, the standardized staircase in the Reinickendorf Siedlung, Berlin: Erwin Gutkind, architect. 62, another example, is in the house in Oslo built for himself by Herman Munthe-Kase, architect. 63 shows another modern form of interior timber, the mosaic floor. The method is standardized, but the pattern is left to the designer. 64, experiments with timber in a typical modern idiom: a model of the first prize design (a house for

a small family, costing £800), by R. A. Kirby, in the Timber Development Association Competition, 1935. This is an interesting example, showing that timber can be used to get the same freedom in both plan and elevation as is generally taken as being the special perquisite of ferro-concrete construction. There is nothing essentially new about this excellent design except the general appreciation of the ways of using timber as a means to produce a house in the contemporary idiom. 65, an all-timber interior: the loggia of a house in Finland: Ole Gripenberg, architect. Gripenberg uses a burnt finish to his timber furniture and ceilings. The surface of the wood is slightly burnt with a blow-lamp and then wirebrushed and polished, leaving a very hard, dark and durable surface; bringing out the grain of the wood, not showing marks and needing very little attention.

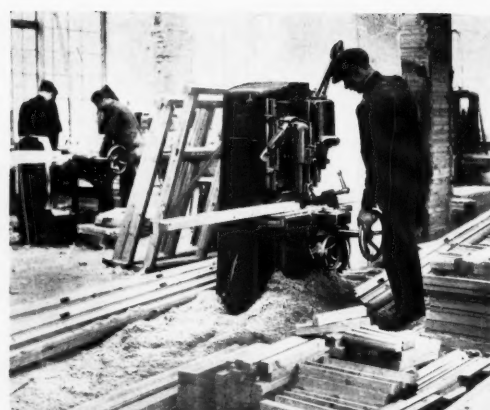


66

HARRIS & SHELDON



67



68

WADKIN



69



70



71

ADAPTATION TO SCIENTIFIC PRODUCTION

In the province of joinery and furniture the most important modern innovation is the application of the scientific method to production as well as design. Machinery is being improved continually so that the last strongholds of hand-made work are being attacked. 66, 67 and 68 are three interiors in modern joinery works: 66, a modern sanding machine; 67, a dovetailing machine—complete dovetailed angles are produced in two movements. It is machines such as this which enable good work to be produced cheaply. Without machinery the only alternative at the same price is the unsatisfactory article spiked together rather than jointed at all: 68, chain and chisel mortiser. Sometimes the old hand-made forms of simple articles, free from elaborations, are so fundamentally sound that mass-production technique does not necessitate major alterations to the design. This may well apply to the High Wycombe chairs, 70. Also to 71, a chair from a set of furniture designed by a group of Polish architects for standardization in a working-class housing scheme. 69 is one of the chairs designed by Alvar Aalto, produced in Finland. It is designed specially for machine production; the back, for instance, is moulded from the start: it is not a piece of plywood which has been bent afterwards. The method of jointing the frame is a machine method rather than a hand method adapted to machine production.



Timber as a RECONSTRUCTED MATERIAL

By P. Morton Shand

THE new forms and by-products of wood that interest the architect fall into two groups:—

(a) The various proprietary building-boards and wall-boards made out of wood-pulp or ligneous fibres (not to be confused with plaster-boards, which are manufactured from mineral substances such as gypsum, asbestos, etc.); and

(b) The different types of laminated wood.

FIBROUS BOARDS

The fibres generally employed are root or cane. These are well soaked, and then broken down into a homogenous blanket of pulp by steam explosion or some chemical process which obviates having to cut them, sawdust being often added to the slurry as a filler. While still in a plastic state this grainless and knotless amalgam is pressed into rigid sheets $\frac{1}{4}$ – $\frac{1}{2}$ in. thick, and 14–16 ft. long by about 4 ft. wide, which are used for wall-coverings, partitions, ceilings, permanent interior shuttering for concrete walls and form-work for flat concrete roofs.

These boards can be made damp- and fire-resistant, and some kinds may be shaped or bent. That they have good insulating and acoustic properties has been demonstrated at Broadcasting House: their first important utilization for these specific purposes. Though not comparable to laminated wood in strength or resilience, they are stronger than most sawn timber of corresponding density and thickness. The strongest in these respects are made up of separate laminated layers pressed together with a hydrofuge cement.

LAMINATED WOOD

Laminated wood is available in three different forms:—

(a) Plywood,

(b) Laminated boards,
(c) Blockboards.

Plywood

Etymology

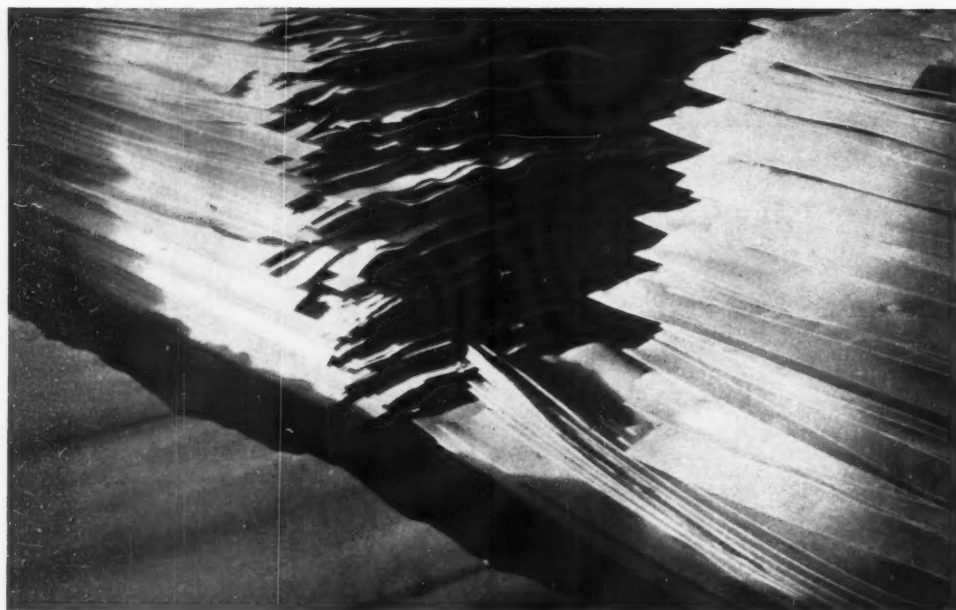
An advertisement in *The Timber Trades Journal* of April 17, 1907, is the first mention of the term in this country traced by the compilers of the O.E.D.; earlier uses on the other side of the Atlantic being very properly ignored in the one and only standard dictionary of the English language. Like most American experiments in vocabulary "plywood" is a misnomer. Whereas both the French and German equivalents, *Contreplaqué* and *Sperrholz*, stress its essential structural principle of cross-grained lamination, 'plywood' arbitrarily singles out a purely subsidiary characteristic of the material, implying the antithesis of rigidity to the layman, and ignores its intrinsic nature. If (as is claimed) 'ply' is not an abbreviation of 'pliant' or 'pliable' one can only say that this prefix is founded on an archaic sense of the transitive verb those adjectives were formed from, and one which is inapplicable to the manufacturing process involved. To 'ply' originally meant to curve, bend, or fold, as the French verb *plier*, from which it is derived, still does; the similar substantival form being employed to describe each of the several layers or thicknesses into which a bale of cloth could be folded, exemplified by a passage in Lovell's translation of *Therence's Travels* (1678): "They double into many plys till it be but four or five fingers broad." Far from being folded wood, the raw material of plywood is wood unfolded as a continuous ribbon from a tree's trunk, which would be utterly ruined by splintering if it were ever folded. This roll of wood-ribbon has to be sliced up into appropriate lengths and flattened out before it can be laminated. 'Crosswood' would therefore clearly be a far better name, but as publicity

experts whose commercially spiritual home is in the United States conspired to foist 'plywood' on us before a less illiterate substitute could be found, we shall have to make shift with it like the Swedes—who seem to prefer an American word to one of their own.

Structure

Three-ply offers the simplest and commonest illustration of the basic principle of laminated wood. If (to borrow a term from textile terminology) we "decompose" a 0.5 mm. sheet of airplane plywood—which is about the thinnest made—we shall find it consists of three equally thick layers (called 'veneers') of ordinary wood (two 'covering-sheets' and a 'core-sheet' inseparably cemented together by fine pencil lines of glue. Closer inspection shows that the grain of the two outer, or surface, veneers runs in one and the same direction: and that that of the intermediate stratum (the ham in the sandwich, as it were) crosses it at right angles.

All other stratifications of plywood—four-, five-, six-, seven-, nine-, eleven-ply, etc.—are built up with extra veneers on a manufacturing foundation of three-ply. As different kinds of timber have to be cut into veneer-sheets of different depth and section, they are built up into boards of varying dimensions: 3–25 mm. being the ordinary extremes of thickness and 60 × 60 cms. about the maximum size—except when woods like Douglas Fir, Ash and Gaboon are used, which run up to 70–100 cms. in height or breadth as the case may be. Birch plywood has recently been standardized into a hierarchy of grades, though its adoption by the timber trade is still only partial. Different importers use different name-codes, but all are based on a best quality free from knots on both sides, and a next best with small knots on one side only, followed by a sequence of gradings designating a progressively increasing proportion of knots on both surfaces.



2. Raw material: a sheaf of plywood "veneers" as they emerge from the drying-racks.

Laminated Boards and Blockboards

The only structural difference between a sheet of three-ply and a laminated board or blockboard is that in both the latter the core is of composite vertical formation instead of being a single or continuous horizontal sheet of veneer. In laminated boards this vertical core consists of a long row of some 6 mms. deep rotary-cut slats (in other words a succession of upright slices of plywood); whereas in blockboards 9-50 mms. thick square-sawn softwood battens are used. (All-Alder and All-Gaboon blockboards are also made.) Both are eased with horizontal covering-sheets of veneer just like plywood. Laminated boards and blockboards can be had in sizes up to 60 x 177 and 120 x 60 in. and $\frac{1}{2}$ in.—to 2 in. thick. They are used for wall-panel, partitions, flush-panel doors, table-tops, etc.

Decorative and Protective Veneers

With few exceptions all facing veneers of decorative woods are now rotary-cut in exactly the same way as the structural veneers of plywood. Teak, walnut and oak, however, are usually still straight-cut: the first two because they are more apt to split when turned, and the third because rotary-cut oak has much less attractive markings. There is, therefore, no logical point in treating fine veneers as a separate form of laminated wood, though a great deal of their cutting is done by firms that have never made plywood. Rotary-cut decorative veneers are used as facings for plywood, laminated boards, blockboards, and also on solid wood backings.

Plywood can also be obtained faced with metal (galvanized iron, stainless steel, copper, brass, aluminium, Monel alloy, chromium and nickel plating, etc.), bakelite, and (a somewhat perverse use apparently

confined to France) slabs of marble. The cements employed naturally vary according to the facing used, but all are of such adamant tenacity that even the sharpest knife fails to make anything like a clean division between facing and backing.

Metal-faced plywood has greater rigidity than an all-metal sheet of the same thickness, and yet can be sawn and drilled with ordinary carpenters' tools. It is preferable to employ sheets faced on both sides so as to have the edges permanently sealed against air and moisture. Metal-faced plywood is used for sinks, larders, bar-counters, lavatory partitions—swimming-bath cubicles, hospital work, prison cells—brewery-vats, etc.

History

Laminated wood is simply a structural modification of the principle of veneering: gluing a thin piece of wood on to a thick. There is nothing new about decorative veneering. It has been used by English cabinet-makers since the reign of Charles II, and was employed in Italy, France and Holland even earlier—if not indeed in the Egypt of Tutankhamen.

As the facing sheets used for veneering furniture could only be vertically sawn (or later on straight cut with a slicing machine), their width was limited to that of a cross-section of the broadest part of the tree's trunk: the result being that they had either to be butt-jointed together or framed into separate panels. It is important to bear this rather obvious fact in mind, since it was a modern technical improvement in the means of cutting decorative veneers that made the manufacture of laminated wood a practical possibility. About 1890 what is now called the rotary-cutter or veneer-lathe was perfected in France. This invention allowed much wider and thinner veneers to be cut than ever before; which meant that as far more surface could be obtained from a given log the cost of using precious woods fell pro-

portionately. Instead of chopping a log straight down the middle, or slicing up quarter segments of its circumference after the manner known as 'cutting in the square,' the knife had now to be set at an acute angle to the bole, which uncoiled the wood in one uniform shaving (as raw turnips are unravelled in German *Bierstuben* to promote more rapid thirst) that revealed new and unsuspected figurings in all sorts of domestic and exotic timbers.

It did not occur to anyone as yet that the favourite proverbial embodiment of honest workmanship, "solid mahogany" (or "solid oak"), and "a thin veneer," that disdainful metaphor for cheapness, imitative sham and skin-deep superficiality, might possibly become structurally interchangeable terms.

All the same, intelligent woodworkers must have begun to realize that with his new bent-wood furniture—steam-shaped beechwood frames, backs and legs of very slender round section: and very thin circular beechwood seats steam-pressed into a comfortable concavity—the Austrian Thonet had succeeded in making wood at once far more plastic and rigid material than anyone had ever imagined it to be. Some more than usually observant carpenter may have noticed that the heavy girders of a steel bridge were not rolled in a single piece, but built up with superimposed layers of thin uniform plates riveted together: and reflected that here was a case where the sum of the parts clearly exerted greater strength in separation than when fused into a homogeneous whole.

We have reached the point in the evolution of laminated wood when it became theoretically possible to produce much wider boards than any straight-cleft tree provides by glueing several rotary-cut veneers together under pressure. The essential qualification of the term "lamination," by "cross-grained" now becomes apparent. A board built up of three or more veneers with the grain running in the same sense in each will be neither sensibly tougher nor more rigid than a sawn-wood board of identical length, breadth and thickness. Here the very brief and undocumented history of plywood begins. Someone—we do not even know who—suddenly tumbled to the revelation that if a number of such veneers were superimposed in alternate grain-crossing layers, approximately equal tensile strength could be obtained in all directions, and virtually double toughness and rigidity compared to a sawn-wood board of the same size and section.

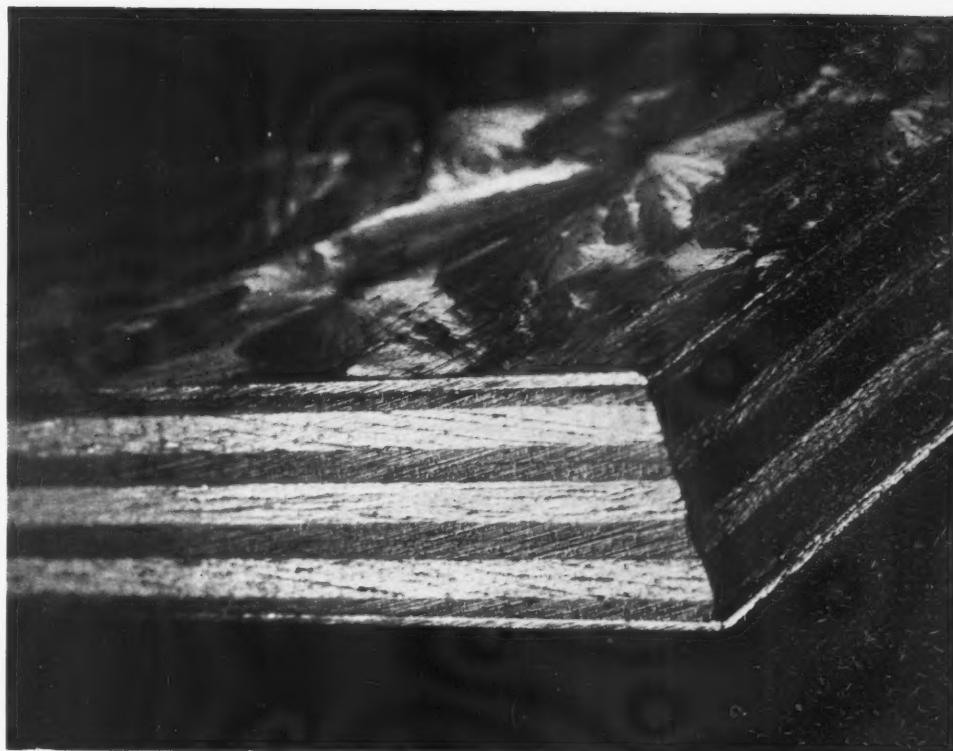
During the Eighteen-Eighties, the great corollary discovery had been made in Russia that a mixture of blood-albumen and casein furnishes a water-resisting cement which lock-joints the surface pores of wood together with a tenacity unapproached by any fish or animal glue.

Plywood seems to have been first made towards the beginning of the present century in the part of Russia that is now Estonia, where it was used in the mass-production of the seats fitted to bent-wood

chairs for the Indian market. The senior partner of a London firm of timber-importers which did an important business in shipping ready-cut sides, tops and bottoms for tea-chests to the plantations, happened at that time to be a very wide-awake Scotsman. One day someone came into his office with a piece of plywood, remarking that there might well be another good use for this new principle of lamination, but he did not quite see what. Having felt, smelt, licked, eyed and weighed it in his hand, our anonymous historical Scot tried to break it, but only succeeded in arching its back. While appreciating this immense rigidity and resilience combined with extreme lightness and thinness, it occurred to him that if he could send his tea-planters sections of plywood instead of softwood, there would be a considerable saving in weight and bulk. Accordingly he paid a visit to the Russian furniture-factory, and ultimately persuaded its owner to make parts of plywood tea-chests for him. This was the second practical application of laminated wood. The dawn of flying provided the third, as plywood soon proved to be the ideal material for wing-coverings. With the industrialization of airplane construction suddenly brought about by the war, plywood came into its own with a rush. The rest is common knowledge, for all the hundred-and-one uses it is now put to—uses that are being rapidly added to year by year—like the discovery of its excellent insulating and acoustic properties as wall-panelling, date from the end of that little interregnum. We owe plywood, therefore, almost equally to Tea and T.N.T.

Properties

The theoretic basis of laminated wood is the application of scientific methods to circumvent certain drawbacks naturally inherent in timber without recourse to any other material. Wood's outstanding weakness is that its tensile strength *with* the grain, is much (sometimes fifty times) greater than *across* it, while its sheer strength is much greater *across* the grain than *with* it. Thus, under temperature variations expansion and contraction generally occur *against* the grain. Cross-grained lamination makes tensile strength approximately the same in all directions. As a result, expansion and contraction become negligible, and a tendency to "work" in any one veneer is counteracted by its neighbour. The danger of an irregular degree of anhydration, which sometimes arises in artificially-seasoned sawn timber, is overcome in laminated wood because as all veneers are of the same thickness they can be kiln-dried to the same accurately controlled moisture-content. By the very nature of its formation plywood offers no plane of cleavage, and therefore cannot split under normal conditions even when screwed or nailed quite close to the edges. Plywood's outstanding qualities can be condensed into Maximum Strength and Rigidity with Minimum Weight and Thickness. Good



3



4



5

Finished material : three forms of faced plywood : 3, seven-ply cased on both sides with galvanized iron, 4 and 5, fitting panels together ; that in 4 being veneered with silky oak, and that in 5 faced with black bakelite.

grades will hardly warp at all. The thinner and more flexible sheets must naturally be tied down at the edges, but the thicker have sufficient intrinsic rigidity to keep true and remain flat in position without being fixed round their skirtings. This single property of laminated wood has opened up revolutionary perspectives in furniture design and the field of timber construction generally. With the use of wide flat surfaces that do not require framed support, the need for

sunk-in panelling (and with it the *raison d'être* for raised bevels and mouldings) disappears. We are apt to forget that traditional methods of woodwork have been far more the outcome of the weaknesses of solid timber than of its strength : since, as we have already seen, that strength is altogether disproportionate in terms of direction. To employ plywood for the old traditional forms of timber craftsmanship is therefore not only artificially



6. A contrast in birch-plywood veneers. Both halves of this sheet are of Finnish birch, the left being ordinary birch with a good streaky figure, and the right the rarer burr-mottled "Flame Birch" obtained from trees of the same species, growing in bogs.

to restrict its scope, but to use it both wastefully and irrationally. All types of laminated wood provide ideal foundations for the many decorative veneers of millimetric thickness they have called into being. Veneered plywood panels will not crack, split or warp through the independent action of their backing, as sometimes inevitably occurred when solid wood had to be used for the purpose, because they form homogeneously laminated structures throughout. Here, however, it is necessary to sound a warning: all plywood that is to be veneered must be cased on *both* sides; and the grain of the cheaper wood used for the back veneer must correspond with that of the front to readjust the balance of layers, and so counteract possible 'pull' by the core sheet. Though laminated wood naturally has its limitations (for instance a minimum-bending curve of greater radius than sheet-metal), most defects attributed to it are due to ignorant or faulty construction and illogical uses. The ventilation of wall-panelling offers a pertinent example. It is essential to provide an air space between the panels and the wall, and leave small openings at intervals along the top and bottom, as otherwise dry rot may set in. Nor must the depth of the studding used be shallower than that employed with solid-wood panelling. Most technical mistakes in the application of laminated wood can be avoided if the carpenter or joiner bears in mind that the material he is handling has ceased to be timber in the simple old Hearts-of-Oak sense, and has been transformed into a semi-scientific product with laws of its own.

Effective comparisons between the cost of plywood and ordinary sawn timber are almost impossible to establish, since their uses are, or should be, quite different. Prices per square foot tell us nothing, for much incidental work that has to be done on the site with the latter—such as cutting and glueing joints, planing and sand-papering—forms an integral part of the process of manufacturing the former. There is also little sorting out to be done on delivery, and far less mess and waste with plywood; while packing for despatch is enormously simplified, and the cost of freight greatly reduced.

Raw Material

Though plywood of a sort can be made from almost any kind of wood, really suitable varieties are decidedly limited. This is not to say that they will be in the near

future, for research into the laminating properties of tropical and sub-tropical trees is still in its infancy. Different countries use different kinds of timber: the factors governing their choice being accessibility, national predilections, the desire to encourage home-grown or colonial timbers, and above all, tariffs. Tariffs, for instance, explain why plywood made from Gaboon is that generally manufactured in France, and plywood made from Birch that most commonly employed in England.

Birch

There are many varieties of the genus *Betula*. Some score are native to North America, but only two or three of these—Quebec, or Yellow Birch (*Betula lutea*), being the most important—are comparable to European Birch (*Betula alba*), which has just two varieties: *pubescens* and *verrucosa*. Both are equally good for plywood, though the best qualities of *Betula lutea* run them very close.

Whereas the supply of unmixed Quebec Birch is somewhat limited, European Birch grows in sufficient density over a sufficiently wide area for intensive exploitation. Nor is there the slightest danger of the forests being worked out because *Betula alba* re-sows itself vigorously, and continues to thrive, wherever it has once taken hold. On the other hand, it is not a tree of rapid growth, and after about 120 years its girth virtually ceases to expand. The region in which *betula alba* is indigenous extends from the tundras of Arctic Russia almost up to the shores of the Mediterranean; but the area identified with its commercial supply is much smaller. This may be delimited north and south by an imaginary line running through northern Norway and Sweden, across the middle of Finland, and dipping down thence south of the White Sea; and by another crossing the middle of Sweden and Lithuania, a corner of Poland, and stretching well into Russia. It is only in this area that trunks with sufficient girth and sufficiently wide and uniform annular spacing can be found in sufficient number and proximity. The best Birch-logs come from Latvia, Estonia, and parts of Finland, Russia and Poland.

The outstanding laminating qualities of Birch are firmness and closeness of grain combined with pliability in an unrivalled degree, immense glueing strength, and relative freedom from knots. It is the only kind of plywood strong enough for airplane

wings and fuselages. Rotary-cut Birch has a beautifully smooth surface, of a pale yellow tint (usually reddish-brown in the Canadian variety); and broad, rather glossy, markings like watered satin that are quite decorative enough to constitute what some people call "self-veneers." It takes paint well and can be stained any colour. For most general, and nearly all of the more exacting specialized uses it furnishes an ideal plywood. In fact, it might be said that "All plywood would be Birch if it could." Alder, which like Hazel and Hornbeam is another *Betulaceae*, is lighter, but less firm and supple, than Birch. Its grain is very even but uninteresting. A certain amount of Alder plywood is made, and Alder is also used for the core-sheets of cheaper grades of Birch-faced boards.

Gaboon

Okoumé (*Aucoumea klainiana*), one of the *Burseraceae*, which comes from the savannah belt of the French West-African colony of Gabon, is known in England as Gaboon, or Gaboon Mahogany—though botanically it is not a mahogany at all. Its area is relatively restricted, but its density and rapidity of growth in it is sufficient to supply half the plywood-factories of Europe. In thirty years the dead-straight trunk of this tree attains the girth of a three-hundred-year-old European Oak. Gaboon is one of the lightest woods there are, but thanks to its much weaker structural composition it has nothing like the hardness, toughness or elasticity of Birch. The predominantly even-grained, cedar-coloured veneers of Okoumé (which are cut dry, or after a short boiling or steaming) are coarse and brittle in texture owing to their interlocking tissues. Gaboon makes an admirable backing for decorative veneers, and furnishes a good all-round general utility plywood where space-filling is the primary consideration.

Other Woods

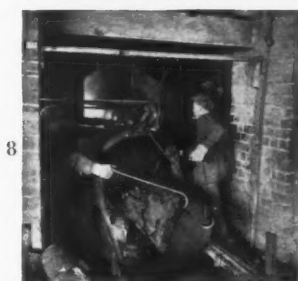
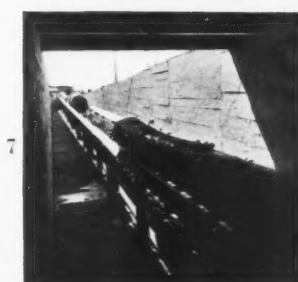
Rotary-cutting reveals a more pleasant grain in European Pine, which is used for core-sheets and door-panelling, but this wood has the defect of many loose and ugly knots. Douglas Fir (known as Oregon or British-Columbian Pine according to whether it was felled in the United States or Canada) has better markings, strength and durability, which make it popular for paneling. It is, however, rather difficult to work, and has the drawback that its grain is apt to show through paint. Beech plywood is made in Germany, as Poplar plywood used to be made in France, in order to utilize an abundant native timber. Since Beech readily absorbs moisture it is liable to warp. The plywood made from Siberian Ash is tough, elastic, and excellent for uses where particular strength is required. Its veneers have fair markings and an attractive colour. There is a limited production of All-Oak boards, though Ash is often used for their cores. As rotary-cut Oak lacks the character of flat-cut, some other plywood veneered with Oak cut in the quarter is generally preferred.

INSTRUCTIONAL FILM: PLYWOOD IN THE MAKING

In the case of Birch, the growing trees, 1, are selected and bought by factors acting for the different manufacturers; the trunks being left in the forest after they are felled till the snow falls. They are then brought to the nearest river on sleighs, and tumbled in to float down when the ice thaws in spring. At some convenient point in its course, usually at the estuary or an intermediate lake, there is a weir, 2, where logs can be sorted out according to their sizes, qualities and owners. Here they are lashed together into narrow rafts, about 16 feet deep, which float just awash in wide basins called pools, delimited by rows of stakes. As Birch needs prolonged immersion, it matters little to the manufacturer whether his logs have taken a few months or a few years (five being not unusual) coming into stock. Every morning a number of rafts sufficient for a day's production are unchained and towed by small tugs, 3, into a manœuvring area off the factory's wharf, where watermen proceed to cut their wires, 4. One by one the loose logs are then punted, 5 and 6, into the mouth of a little concrete lock that leads into a tunnel and through an open cutting to the saw-mill. Up this incline they are conveyed on an endless band, 7, the logs being kept about a yard apart: an interval representing the time necessary to saw off a trunk into its appropriate length (which depends on its thickness and straightness), push the two halves aside, and raise the blade of the circular saw to bring the next into position under it. 8. Ends of larger logs, and logs intended for shorter sizes of board (e.g. box-sides), are sorted out and cut up with portable electric saws, 9, rather like enlarged automatic ticket-machines, which the sawman carries round his neck on a strap.

The logs are now graded into lengths and stood on their ends in rows to have their bark roughly sliced off, 10; a manual operation that is incredibly speedily performed. The dripping wet log is then placed in the veneer-lathe and the cutting edge adjusted to it. The first 'apple-rings' come off the more protuberant parts and are therefore full of holes or bits of bark. These are torn off as waste, and pushed down a shoot in the floor to feed the furnaces. It is only when the knife has trimmed the log to a perfectly smooth and even cylinder that the unwinding proper begins. While a pleasant-smelling stream of milky sap pours from the knife's edge, the log now rapidly unrolls as a uniform ribbon, 11, which is as rapidly wound on to a bobbin by hand (12 and 13 are inset by way of contrast to show an average-sized Gaboon log before and during rotary cutting). Breaks are only made when cracks occur.

The bobbin is then transferred to a bench, where it is unrolled and cut up by a slicer, 14 and 15, into whatever lengths happen to be required. At this stage the veneers are sorted out into cover and core sheets. As continuity does not matter in the latter, smaller strips are gummed together with paper tape. Larger sheets are meanwhile





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Birch

There are many varieties of the genus *Betula*. Some score are native to North America, but only two or three of these—Quebec, or Yellow Birch (*Betula lutea*), being the most important—are comparable to European Birch (*Betula alba*), which has just two varieties: *pubescens* and *terrestris*. Both are equally good for plywood, though the best qualities of *Betula lutea* run them very close.

Whereas the supply of unmixed Quebec Birch is somewhat limited, European Birch grows in sufficient density over a sufficiently wide area for intensive exploitation. Nor is there the slightest danger of the forests being worked out because *Betula alba* re-sows itself vigorously, and continues to thrive, wherever it has once taken hold. On the other hand, it is not a tree of rapid growth, and after about 120 years its girth virtually ceases to expand. The region in which *betula alba* is indigenous extends from the tundras of Arctic Russia almost up to the shores of the Mediterranean; but the area identified with its commercial supply is much smaller. This may be delimited north and south by an imaginary line running through northern Norway and Sweden, across the middle of Finland, and dipping down thence south of the White Sea; and by another crossing the middle of Sweden and Lithuania, a corner of Poland, and stretching well into Russia. It is only in this area that trunks with sufficient girth and sufficiently wide and uniform annular spacing can be found in sufficient number and proximity. The best Birch-logs come from Latvia, Estonia, and parts of Finland, Russia and Poland.

The outstanding laminating qualities of Birch are firmness and closeness of grain combined with pliability in an unrivalled degree, immense glueing strength, and relative freedom from knots. It is the only kind of plywood strong enough for airplane

wings and fuselages. Rotary-cut Birch has a beautifully smooth surface, of a pale yellow tint (usually reddish-brown in the Canadian variety); and broad, rather glossy, markings like watered satin that are quite decorative enough to constitute what some people call "self-veneers." It takes paint well and can be stained any colour. For most general, and nearly all of the more exacting specialized uses it furnishes an ideal plywood. In fact, it might be said that "All plywood would be Birch if it could." Alder, which like Hazel and Hornbeam is another *Betulaceae*, is lighter, but less firm and supple, than Birch. Its grain is very even but uninteresting. A certain amount of Alder plywood is made, and Alder is also used for the core-sheets of cheaper grades of Birch-faced boards.

Gaboon

Okoumé (*Aucoumea klainiana*), one of the *Burseraceae*, which comes from the savannah belt of the French West-African colony of Gabon, is known in England as Gaboon, or Gaboon Mahogany—though botanically it is not a mahogany at all. Its area is relatively restricted, but its density and rapidity of growth in it is sufficient to supply half the plywood-factories of Europe. In thirty years the dead-straight trunk of this tree attains the girth of a three-hundred-year-old European Oak. Gaboon is one of the lightest woods there are, but thanks to its much weaker structural composition it has nothing like the hardness, toughness or elasticity of Birch. The predominantly even-grained, cedar-coloured veneers of Okoumé (which are cut dry, or after a short boiling or steaming) are coarse and brittle in texture owing to their interlocking tissues. Gaboon makes an admirable backing for decorative veneers, and furnishes a good all-round general utility plywood where space-filling is the primary consideration.

Other Woods

Rotary-cutting reveals a more pleasant grain in European Pine, which is used for core-sheets and door-panelling, but this wood has the defect of many loose and ugly knots. Douglas Fir (known as Oregon or British-Columbian Pine according to whether it was felled in the United States or Canada) has better markings, strength and durability, which make it popular for paneling. It is, however, rather difficult to work, and has the drawback that its grain is apt to show through paint. Beech plywood is made in Germany, as Poplar plywood used to be made in France, in order to utilize an abundant native timber. Since Beech readily absorbs moisture it is liable to warp. The plywood made from Siberian Ash is tough, elastic, and excellent for uses where particular strength is required. Its veneers have fair markings and an attractive colour. There is a limited production of All-Oak boards, though Ash is often used for their cores. As rotary-cut Oak lacks the character of flat-cut, some other plywood veneered with Oak cut in the quarter is generally preferred.

INSTRUCTIONAL FILM: PLYWOOD IN THE MAKING

In the case of Birch, the growing trees, 1, are selected and bought by factors acting for the different manufacturers; the trunks being left in the forest after they are felled till the snow falls. They are then brought to the nearest river on sleighs, and tumbled in to float down when the ice thaws in spring. At some convenient point in its course, usually at the estuary or an intermediate lake, there is a weir, 2, where logs can be sorted out according to their sizes, qualities and owners. Here they are lashed together into narrow rafts, about 16 feet deep, which float just awash in wide basins called pools, delimited by rows of stakes. As Birch needs prolonged immersion, it matters little to the manufacturer whether his logs have taken a few months or a few years (five being not unusual) coming into stock. Every morning a number of rafts sufficient for a day's production are unchained and towed by small tugs, 3, into a manoeuvring area off the factory's wharf, where watermen proceed to cut their wires, 4. One by one the loose logs are then punted, 5 and 6, into the mouth of a little concrete lock that leads into a tunnel and through an open cutting to the saw-mill. Up this incline they are conveyed on an endless band, 7, the logs being kept about a yard apart: an interval representing the time necessary to saw off a trunk into its appropriate length (which depends on its thickness and straightness), push the two halves aside, and raise the blade of the circular saw to bring the next into position under it, 8. Ends of larger logs, and logs intended for shorter sizes of board (e.g. box-sides), are sorted out and cut up with portable electric saws, 9, rather like enlarged automatic ticket-machines, which the sawman carries round his neck on a strap.

The logs are now graded into lengths and stood on their ends in rows to have their bark roughly sliced off, 10; a manual operation that is incredibly speedily performed. The dripping wet log is then placed in the veneer-lathe and the cutting edge adjusted to it. The first 'apple-rings' come off the more protuberant parts and are therefore full of holes or bits of bark. These are torn off as waste, and pushed down a shoot in the floor to feed the furnaces. It is only when the knife has trimmed the log to a perfectly smooth and even cylinder that the unwinding proper begins. While a pleasant-smelling stream of milky sap pours from the knife's edge, the log now rapidly unrolls as a uniform ribbon, 11, which is as rapidly wound on to a bobbin by hand (12 and 13 are inset by way of contrast to show an average-sized Gaboon log before and during rotary cutting). Breaks are only made when cracks occur.

The bobbin is then transferred to a bench, where it is unrolled and cut up by a slicer, 14 and 15, into whatever lengths happen to be required. At this stage the veneers are sorted out into cover and core sheets. As continuity does not matter in the latter, smaller strips are gummed together with paper tape. Larger sheets are meanwhile



INSTRUCTIONAL FILM: PLYWOOD IN THE MAKING



scrutinized for knots that might work loose. These are neatly struck out with a small oval hand-punch, and at once filled in with an identically sized piece of veneer, punched from a knotless strip which the examiner keeps by her side.

The still moist and pliant sheets of veneer are now rolled up separately, and put into the racks of the drying-kiln, 16, for a carefully regulated number of seconds; or else hung up with clothes-pegs in a drying-loft for a considerably longer period. When taken out, 17 and 18, (or down from the loft, 19), they look crinkled and much darker, as a result of the reduction of their moisture-content. The sheets are now ready for dry-cementing, which differs from the cheaper (and on the whole less satisfactory) wet-cementing process simply in that it is applied to pre-dried instead of damp veneers. In dry-cementing either a wet or dry adhesive can be employed, but in wet-cementing wet only. The dry cement at present used (and then mostly for airplane-fabric) is paper impregnated with synthetic resin that looks rather like fly-paper. This is cut to the same size as the veneers, a sheet being placed on each surface of the core-sheet. Under the combined pressure and heat to which the embryo three-ply is now subjected, the paper disintegrates and the liberated resin dries as a binding glue of immense strength.

Liquid cement is usually a compound of blood-albumen and casein, having the consistency of thick mud, the proportions of which depend on the nature of the wood used, that varies in colour between a deep red mahogany and the shade of lime-mortar. This mixture is kept in heated cauldrons, 20, by the side of the cementing-rollers, over which it is re-smearred from time to time. The twin rollers are incised with a small check pattern which is thickly printed on to both faces of the core-sheets (that alone pass through them), leaving the centres of the little squares very thinly coated. In the presses, however, these thick outlines are squeezed out sideways and cover the whole sheet uniformly without waste of cement. Core-sheets are fed in singly between the rollers, at one side, and drop on to a pile of bottom covering-sheets on the other, 21; top covering-sheets being taken from another pile and laid over their upper surface. These roughly made-up triple sheets, which look very warped and irregular, are at once transferred to the racks of the steam-presses, 22. Here they are simultaneously subjected to a gradually regulated pressure and increasing degree of heat. The three-ply boards come out absolutely flat and rigid, 23. After their uneven edges have been trimmed off with a slicer, they are passed through a planing and sand-papery machine, and emerge as finished plywood, 24.

The larger boards are now stood up on end for a final acoustic test, 25; light taps with a small wooden mallet round both surfaces to make sure that a knot has not worked loose, or a cavity been formed by a broken bit of core-sheet. The finished boards are now stacked horizontally ready for shipment, 26, (or in the case of box-sides, etc., 27 and 28, packed into sets and bonded with metal-tape).



A composition in plywood designed by Professor L. H. Moholy-Nagy at the invitation of Venesta Ltd. The background is of Bird's-Eye Maple, the tree is cut from $\frac{1}{2}$ in. plywood faced with Rio Rosewood and the scroll is in $\frac{3}{16}$ in. birch plywood.

LA

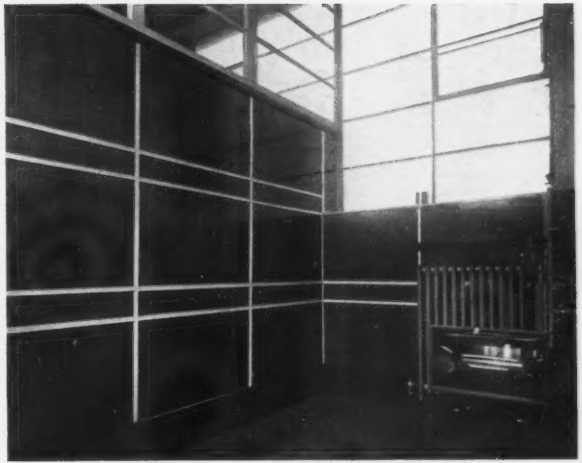
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LARGE PANELS

Examples of full-height plywood wall-panelling in large sheets. In three cases the veneers have outstanding markings, and are therefore quite legitimately butt-jointed; while in 4 (an office in the C.W.S. Tobacco Factory at Manchester partitioned off with corkwood-faced boards), where the grain is much closer and less conspicuous, very thin whitewood battens are both decoratively and logically used, since, though they cover the panel's joints, they are not required to give them structural support as framing. 1 shows the reception lounge of a private bank in

Old Jewry, designed by R. D. Russell; and 2, in the Speaker's Private Room in the Finnish Parliament Building at Helsingfors, designed by J. S. Sirén. In the latter ordinary unvarnished Pine plywood panelling is as much at home with traditional mural mouldings and heavy gilt picture-frames as a rich tapestry or boldly-patterned wallpaper. 3, a staircase in the Roxy Cinema, Brussels, illustrates a decorative contrast of characteristic streaky and *moiré* figurings with different Birch plywoods.



5



8



6



9



7

CEILINGS AND WALLS:

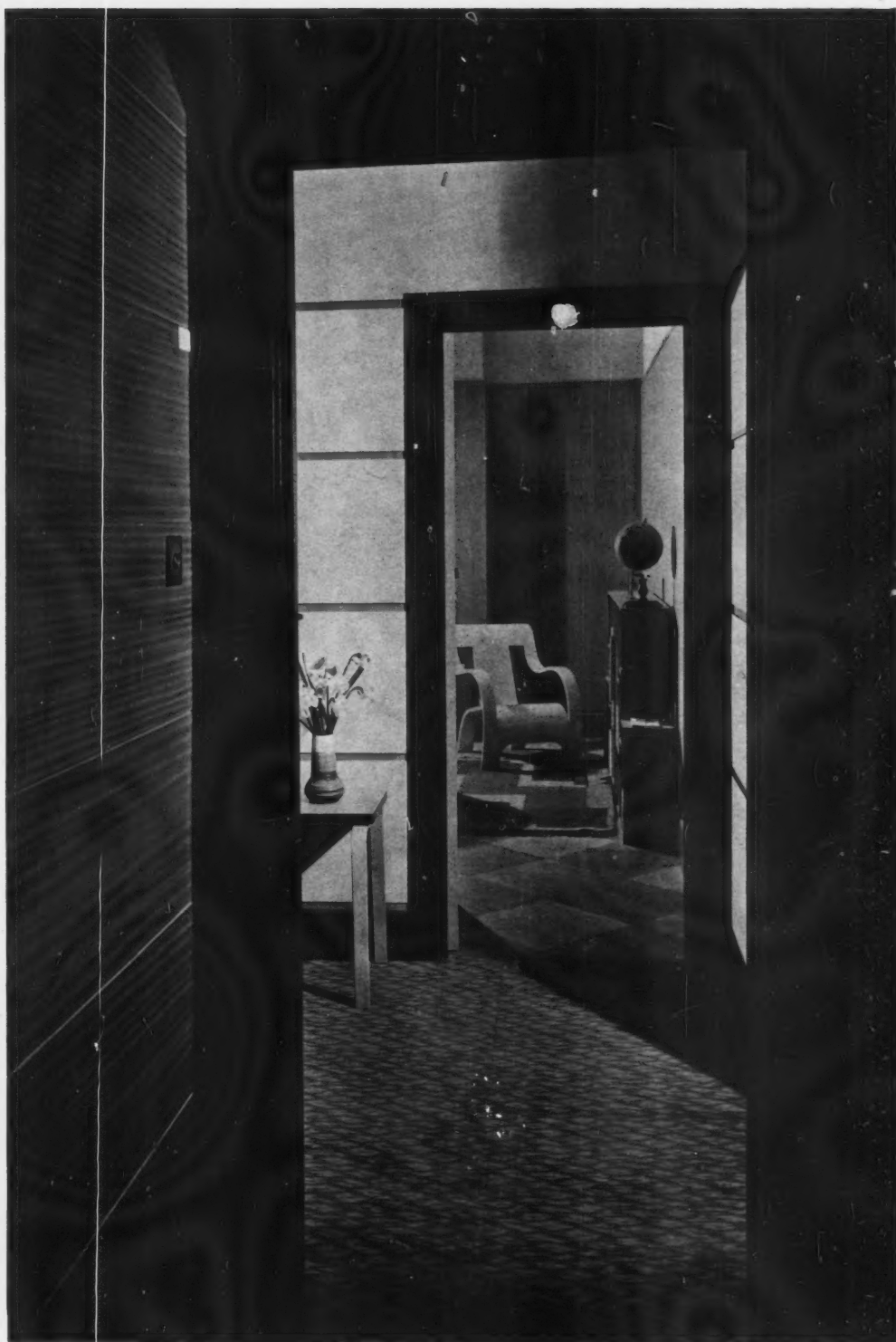
5 shows the standard living-room finish in the Drancy Housing Estate, near Paris, of which Baudouin and Lods were the architects: a wall-boarded ceiling and walls panelled with Gaboon plywood tied into formal unity by continuous-strip battens of the same thickness on both. 6 and 7 are bars: the former in the Chesterfield Salon, designed by P. E. Palmer, where the wall-skirtings and flooring-squares are of alternated knotless Birch and Siberian Ash; and the latter in the Shakespeare Memorial Theatre, Stratford-on-Avon, designed by Scott, Chesterton and Shepherd, in which stained sycamore,



10



11



12

DOORS AND FLOORS

separated by narrow horizontal fillets of Honduras Mahogany, framed with a broad Rosewood surround forms the back, and the counter is veneered in English Burr-Elm skirted with Gurjun and nosed with Ebony. The serving-hatch of a villa in the Taunus Mountains, designed by Professor Peter Behrens, shown in 8, is a detail of a dining-room completely panelled in polished purple Madagascar Rosewood. Still more exotic woods—Makoré panels cross-banded with Patapsco—are used in 9, the lounge of the Midland Hotel, Morecambe, designed by Oliver Hill. 10 and 11 are examples of flush-panelled doors.

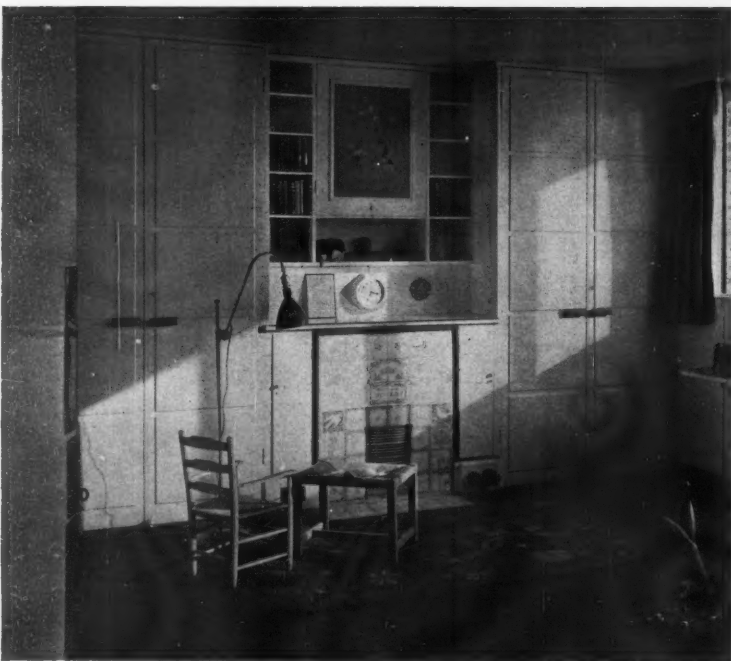
The former is one of several in a private house at Sutton that have all the same bold axially figured veneers of French Walnut; the latter a row of Birch-faced lavatory doors, with surrounds of cellulosed timber, in a Manchester office building, designed by J. W. Beaumont and Sons. 12 is a corner of furniture-showrooms at Bournemouth: Sapele Mahogany horizontally veneered on Alder, with dividing strips of white maple, in the foreground; and Oak wall-panels with Birch flooring-squares (and an all-plywood chair) in the background.



13



14



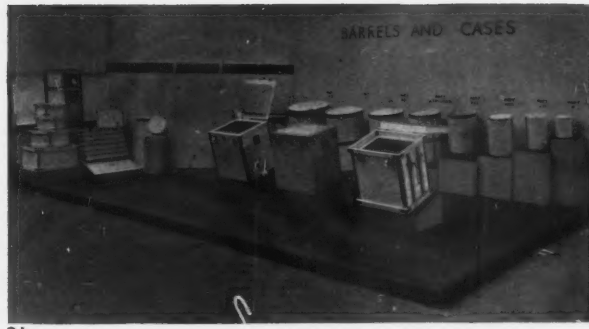
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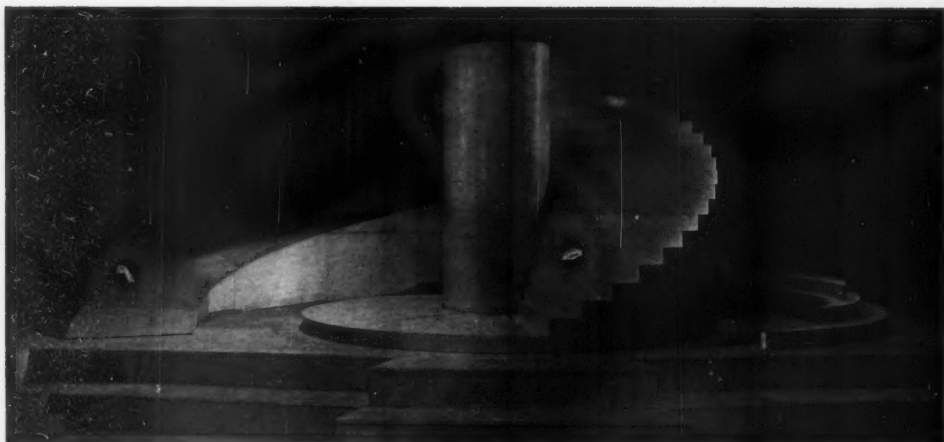
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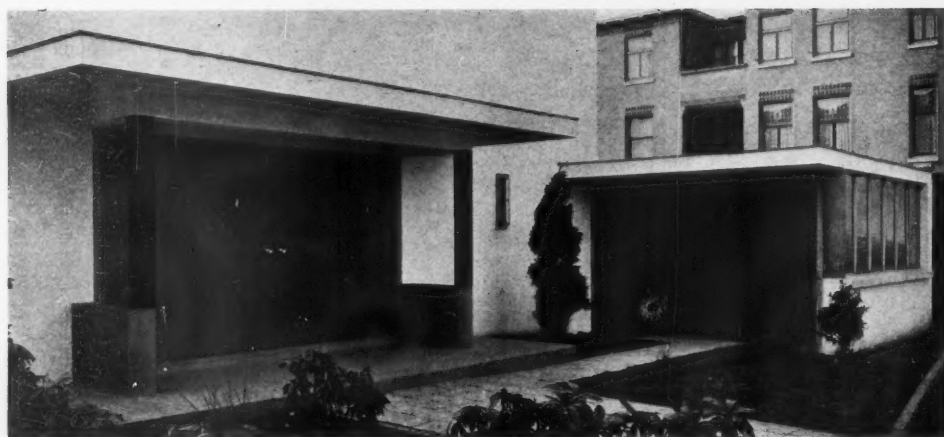
BUILT-IN FURNITURE : EXHIBITION WORK : TRANSPORT USES

13, 14, 15 and 16 demonstrate the use of laminated Birch for built-in cupboards and fittings, all but the first, a children's hanging wardrobe in a house at Purley, designed by C. H. Pearson, (which is of blockboard veneered with Australian Walnut), being finished in white enamel. 15 is a day nursery in Hammersmith, with rounded edges to all doors, designed by E. Maxwell Fry. 14 shows a bow-fronted wardrobe of Regency type, a boxed-in lavatory basin, and a Birch plywood floor in a private house at Highgate; and 16, a servery-natch, surrounded by very well-arranged larder-cupboards in the kitchen of a private house at Grunewald, Berlin, designed by Leo Nachtlicht. 17 is a practical demonstration of different ways of joining up contrasted varieties

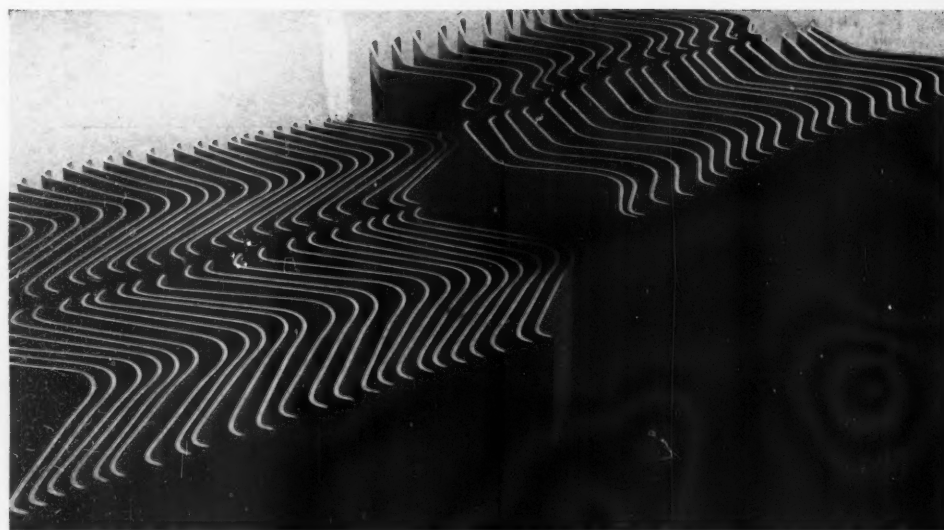
of veneer, designed by Oliver Hill for the 1933 Exhibition of British Industrial Art at Dorland Hall; and 18, an all-plywood stand at the 1934 Building Trades Exhibition at Olympia, designed by F. Skinner and Tecton. 19 illustrates the interior of a standard L.M.S. third-class corridor-compartment veneered between and above the upholstery with small figured panels of decorative woods; 20, a battery of automatic ticket machines at Highgate (Underground) Station, with fronts panelled in Indian Laurel-wood framed by ebonized borders; and 21, a display of all-plywood kegs, barrels and chests for various industrial and household purposes (chemical-containers, clothes-baskets, vegetable-bins, etc.).



22



23



24



25



26

MASS-PRODUCED PLYWOOD FURNITURE : METAL-FACED PLYWOOD USES :

24 is a factory assembly view of one-piece plywood seat-backs for tubular-steel nesting chairs, of the type designed by Alvar Aalto : a use the same architect has extended to buoyant models in which, the framework being of plywood as well, the resilient property of the material is also turned to practical account. 22 shows an aluminium-faced plywood stage-set for the Festival Theatre, Cambridge ; and 25 the bowed street-front of the Westminster Electric Supply Corporation's Victoria Street Showrooms, designed by E. Maxwell Fry, which

is of plywood faced on both sides with galvanized iron, painted in three shades of cellulose enamel as a background for the neon fascia. 23 and 26 are door uses of the same material : the former in the entrances of a church and its adjoining sacristy in Rotterdam, designed by J. J. Oud ; and the latter in the double tier of dressing-cubicles at the Fryston Pithead Baths, designed by A. J. Saise for the Mines Welfare Committee, where the doors were set in $3 \times \frac{1}{2}$ in. Teak framing, having $\frac{1}{4}$ in. grooves for slotting in their metal-faced



27



28



29

BUILDING-BOARD

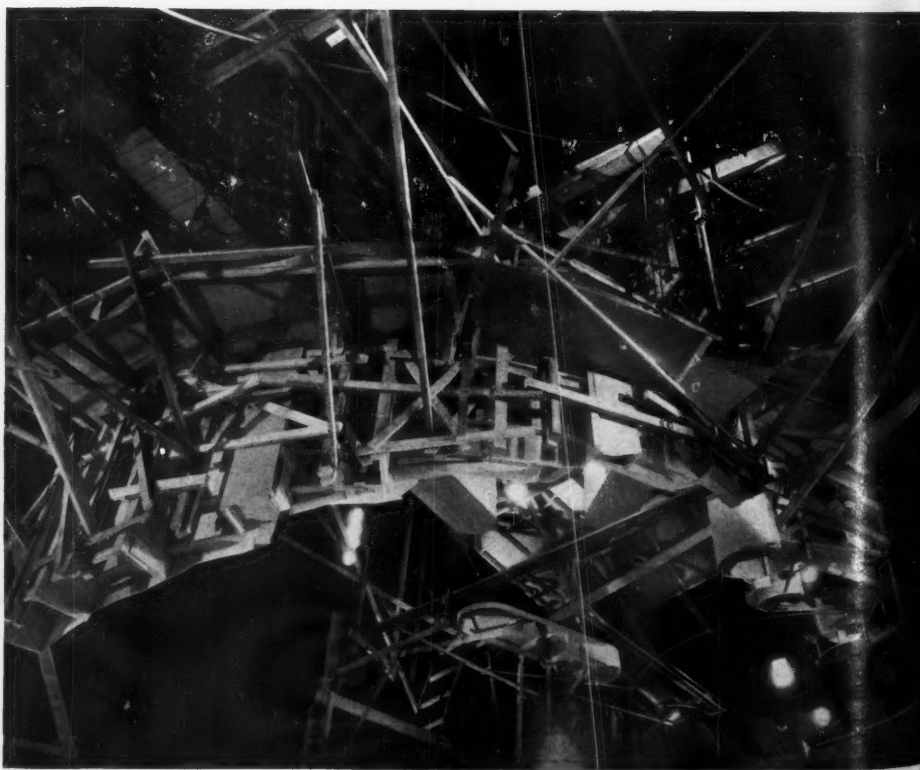
panels. The divisions between cubicles were rebated out and beaded on framing of only $2 \times \frac{3}{4}$ in. section. The photographs illustrating building-board show its three most important uses in architecture: 27, smooth-faced building-board made of wood fibre being used as permanent inside and temporary outside shuttering during pouring of the concrete walls of Pullman Court, Streatham, designed by Frederick Gibberd; 29 shows its use as the only structural material (apart from the necessary timber framing)

employed in a group of exhibition buildings at Helsingfors; 28 shows its chief interior use, for combined acoustic and decorative purposes. The picture shows an old room converted by Wells Coates into the B.B.C.'s Newcastle broadcasting studio. Here wall-board (of three different kinds) was used to cover all wall, ceiling and floor surfaces, with the exception of the reveals. The joints of the different sizes have been employed as contrasting patterns.

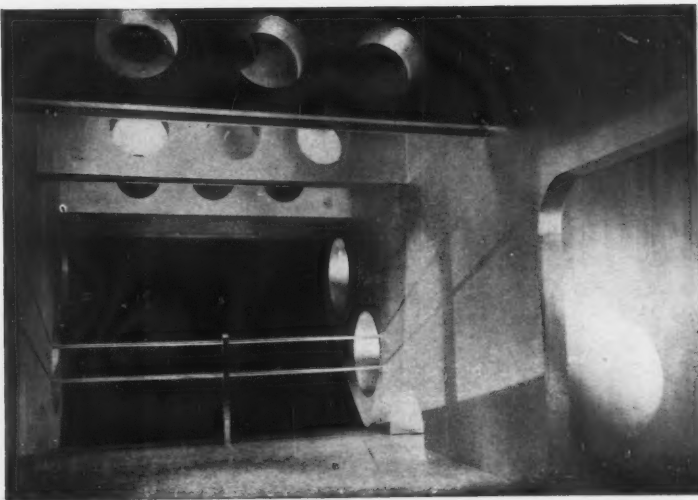
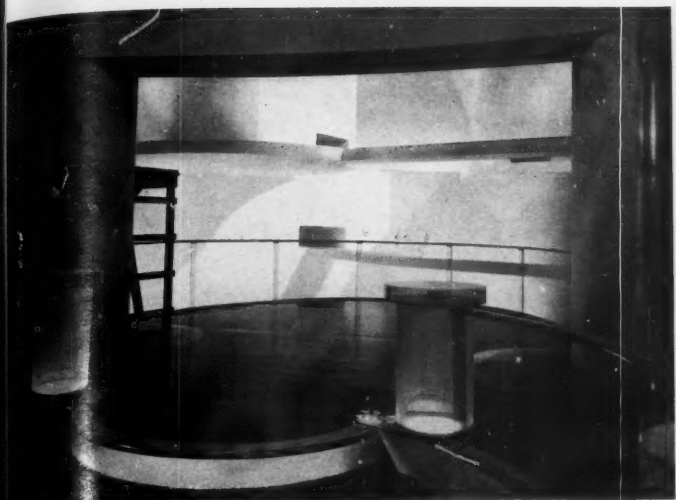


1, 2, 3, 4 and 5, are stills from London Film Production's forthcoming "Things to Come" (based on H. G. Wells's *The Shape of Things to Come*) of Light Architecture in the subterranean city mechanically constructed by the post-war generation of a yet better and brighter Armageddon than the last. 6 and 7, reverse - of - the - medal views, reveal all this gleaming solidity as only a veneer of plywood. No other 'concrete' was employed; and the whole was backed by the forest of sawn struts and shoring seen in the photographs. These architectural sets provide interesting comparisons with those from "Metropolis," and prove that in the interval film functionalism has kept pace with structural. All were designed by Mr. Vincent Korda, who was a post-impressionist painter well known in Paris before he turned to screen architecture. How encouraging they are — easily the best work of their kind yet done in England—will be obvious.

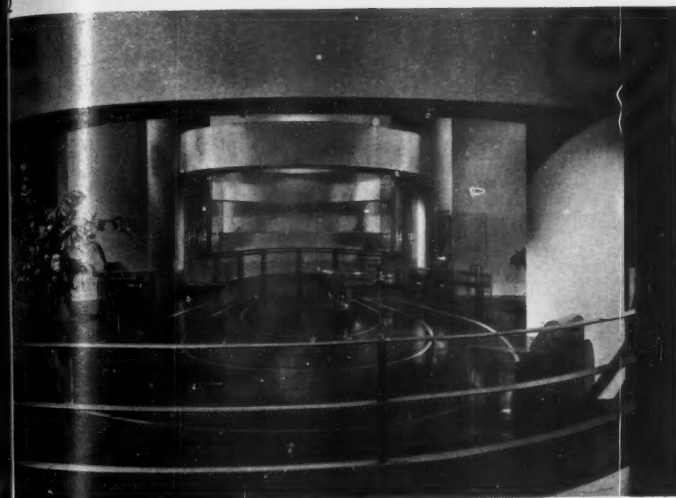
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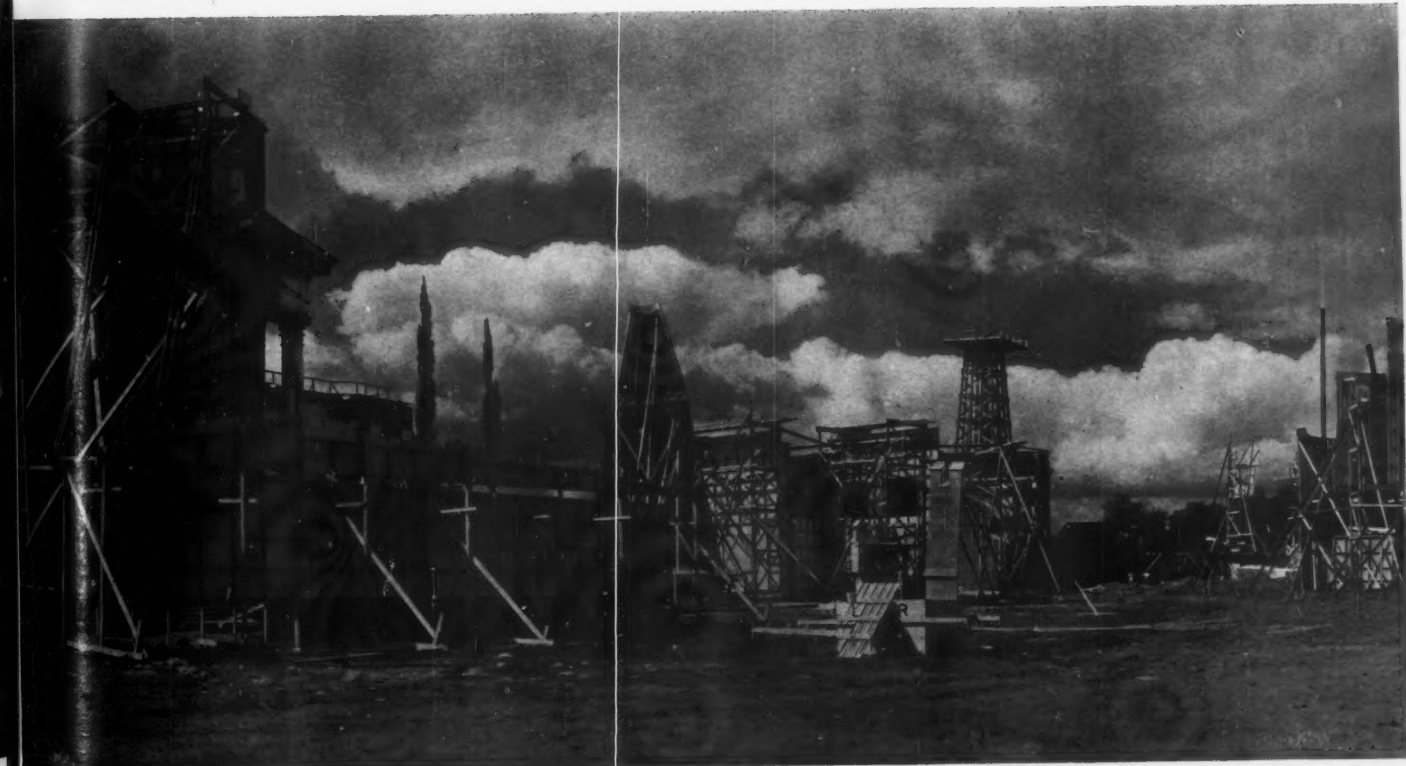
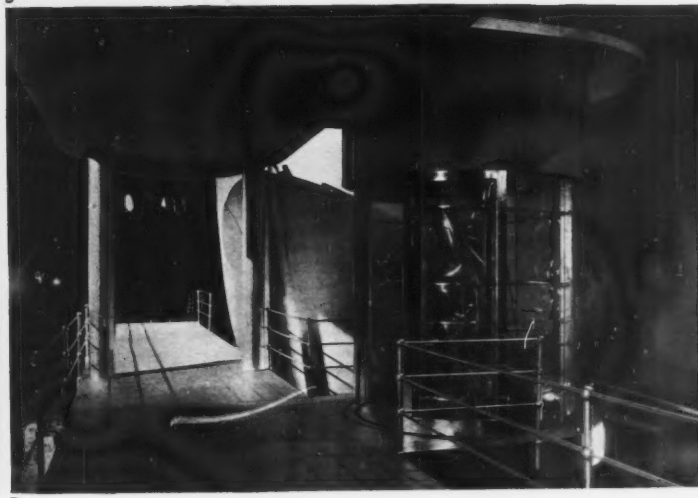
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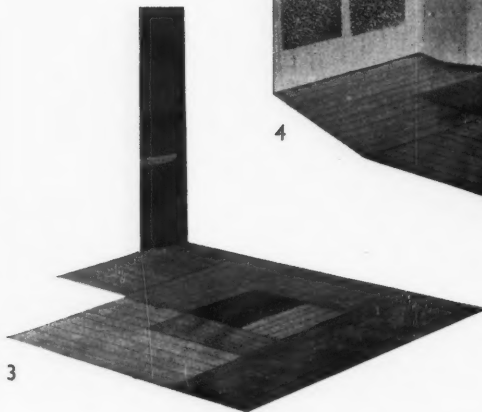
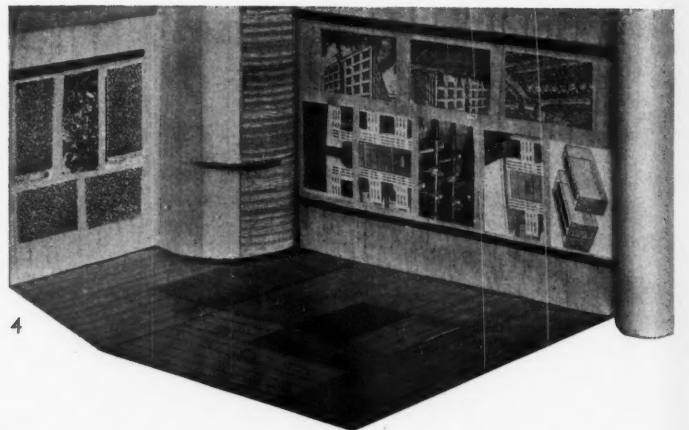
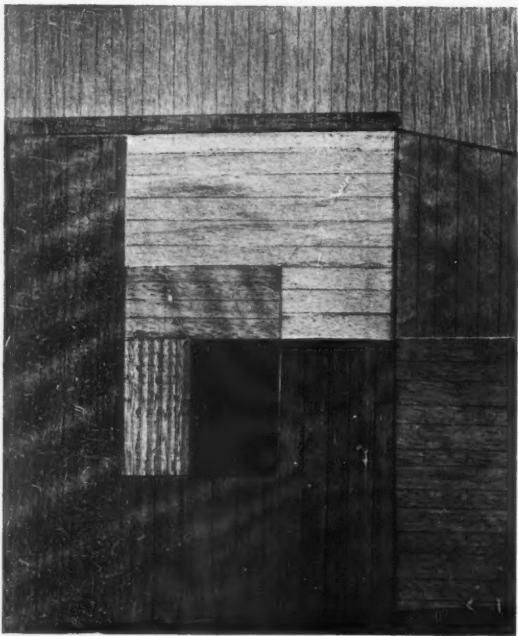
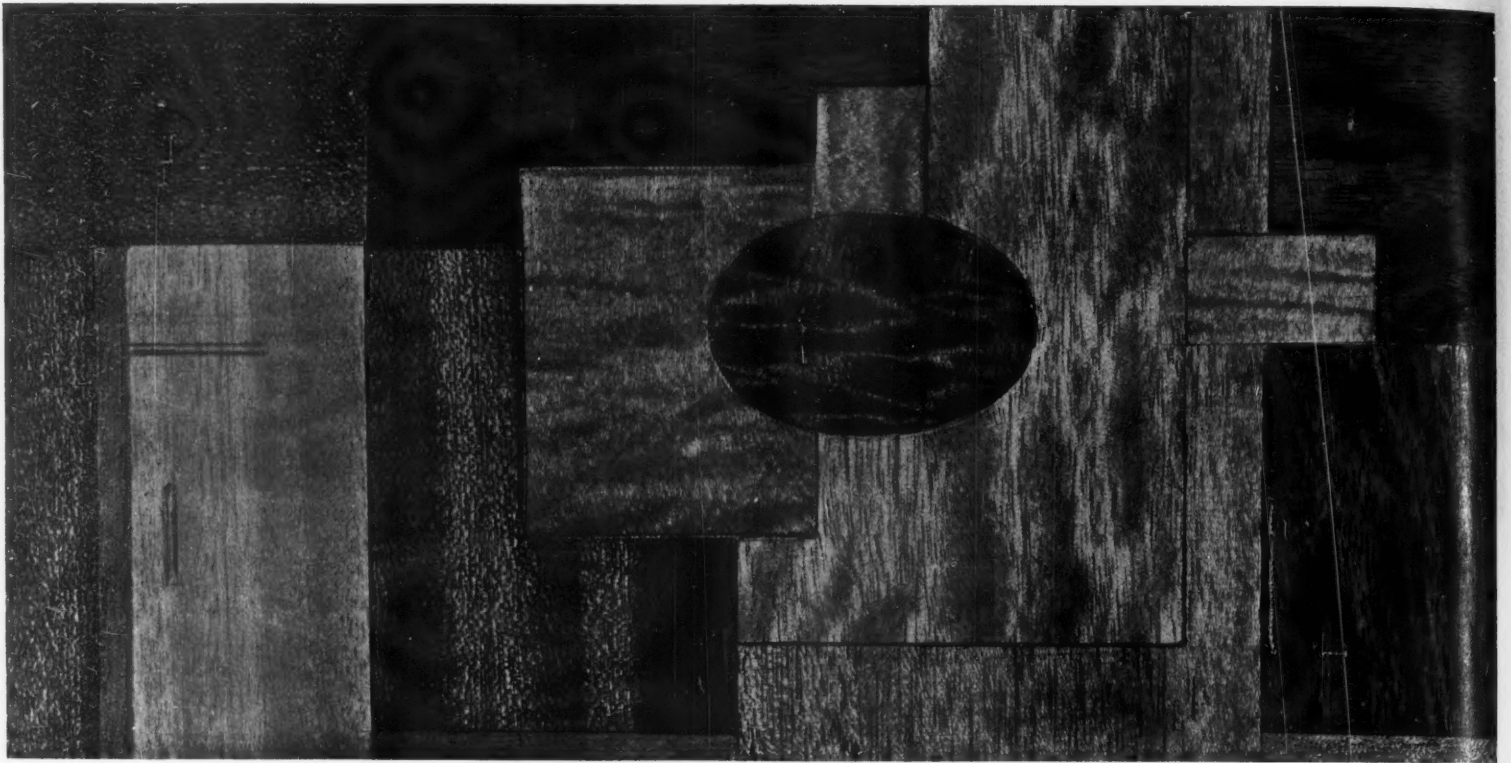
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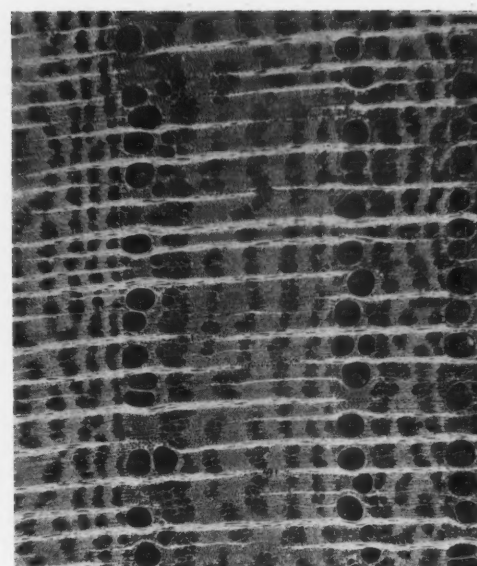
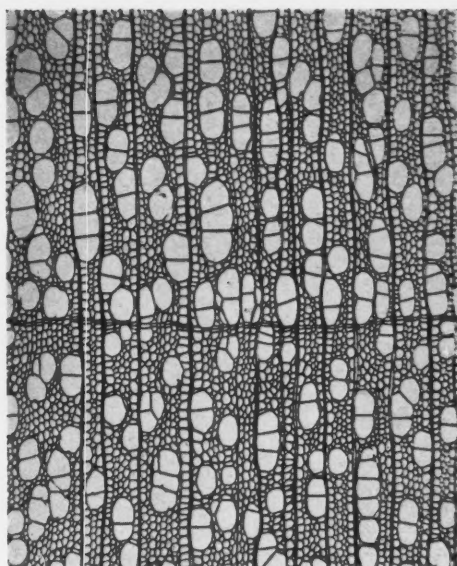
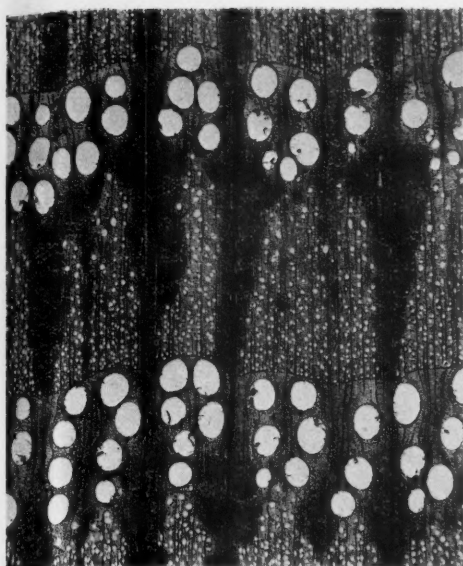


TIMBER DISPLAY BY PAUL NASH



The exhibition space at Charing Cross Station is to be occupied during February by a display designed by Mr. Paul Nash for the Timber Development Association. The walls and screens have been made to converge slightly to give maximum view and invitation to passing crowds. The space is divided into three sections, a specimen of one being shown in 3 and 4. The floors are separately designed in patterns of different woods, in relation to the divisions of their walls. All walls, except the back centre one, have display arrangements of photographs enlarged approximately to 3 ft. $\times$ 2 ft. The central display feature is a

wood mural, 10 ft. $\times$ 20 ft., incorporating a door. The sketch design for this mural, 1, executed in very thin, brittle veneers, to exploit effect of variations in the grains, unfortunately does not give a proper indication of colour harmony in half-tone reproduction. It is also misleading by reason of certain inevitable distortions of accent and direction. The mural is in eight separate veneers. The range of colours includes a pale grey-blue, golden ochre and a play of subtle-tinted brown and light yellow woods. The ellipse is a rich, figured chestnut red. The narrower bands are of cedar pink. 2 is a detail of the floor design also seen in 4.



Microscope-enlarged photographs made at the Forest Products Research Station, Princes Risborough, showing wood structure. 1, oak; 2, poplar; 3, common elm. The cover design of this issue is based on a similar photograph, showing the cellular structure of Scots pine. These photographs and the other illustrations in the Technical Section are Crown Copyright and are reproduced by courtesy of the Director of Forest Products Research.

TECHNICAL

THE GENERAL PROPERTIES OF TIMBER

TIMBER SEASONING FOR MODERN CONDITIONS

THE MECHANICAL TESTING OF TIMBER

THE PRINCIPLES OF WOOD BENDING

THE RESISTANCE OF DECAY IN TIMBER

THE PRESERVATIVE TREATMENT OF TIMBER

The General Properties of Timber

The general term timber embraces material obtained from hundreds of different species of trees, and since that produced by any one of them differs to a greater or less extent from that of any other it ensues that there must be a considerable variation in the different properties. It is convenient to approach the consideration of those properties from the point of view of the purposes to which timber is put. One class of timber is employed almost exclusively for decorative work, such as panelling or high-grade cabinet work, hence the woods in this category must possess

beauty of grain or colour, or better still, of both. For such purposes strength is not of primary consideration, whereas in the class of timbers used for structural purposes the strength properties are the main consideration. The term strength, however, is of general application only, and is loosely used to indicate strength in resistance to bending, strength in resistance to compression, strength in tension, toughness, hardness, resistance to wear, and resistance to splitting, all of which are really different properties which must be considered as such in selecting the most suitable timber for any specific purpose.

Weight is a very variable factor where timber is concerned, for while a really light timber may weigh as little as 4 lb. per cu. ft., a really heavy one will be 80 lb. or even more. This is in large measure owing to the difference in the space occupied by air in different woods, for the chief constituent of all woods is cellulose, which, by the way,

is heavier bulk for bulk than the heaviest wood.

Stability is another important quality in a wood, and it is mainly influenced by the structure. It is obvious that, whether employed for decorative or structural purposes, an unstable timber which is likely to "work" as atmospheric humidity increases or decreases is highly undesirable.

The working qualities of a timber are of considerable importance and are influenced largely by its structure and in some cases by the cell contents. Timbers with crossed or undulating grain often prove somewhat difficult to work to a fine finish, while those with gummy deposits in the cells soon clog the teeth of saws and the cutting irons of other types of tool. Some timbers are characterized by the presence of apatite, silica or other mineral deposits, and these exercise an abrasive action on the cutting edges of tools, necessitating frequent sharpening, which

naturally increases the cost of working them.

Where timbers are used in places exposed to the action of the weather, natural durability, by which is implied resistance to the various agents which produce decay, is of considerable importance. Some timbers possess this power of resistance to a remarkable degree and may safely be used, even without painting or other treatment, for work in situations highly favourable for the development of wood-destroying fungi. Others possessing little or no natural resistance may be rendered immune by some form of antiseptic treatment, and in such cases the ease or otherwise with which the timbers may be impregnated with creosote or some other preservative must be considered an important factor.

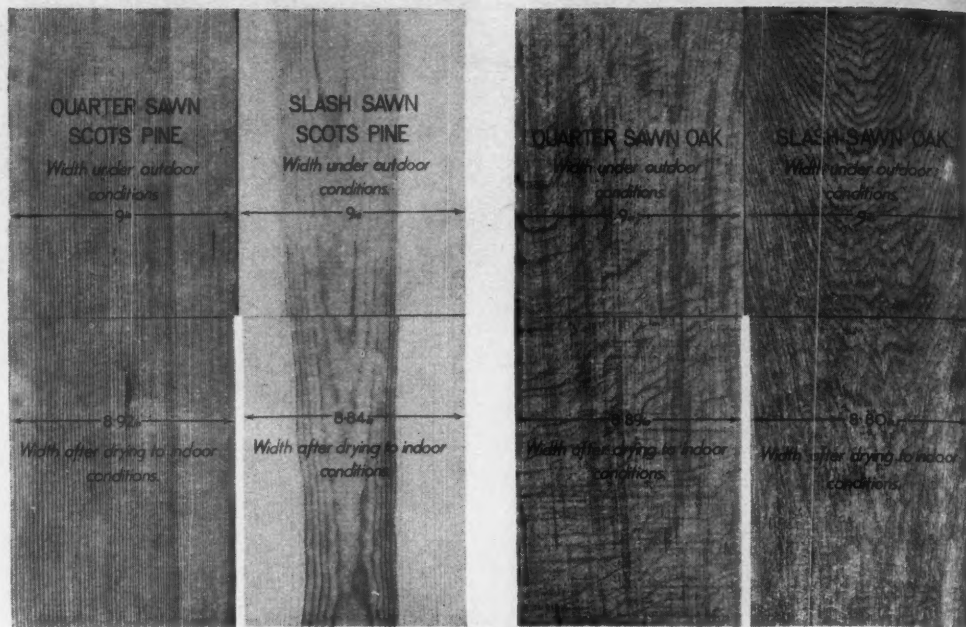
While all timbers are more or less inflammable, some are much less so than others, charring and smouldering rather than bursting into flame until relatively

high temperatures are reached. Naturally such timbers are preferred for use in situations where the hazard of fire is present; but again it may be possible to impregnate species which in the untreated condition would ignite readily, with a solution of some mineral salt which will largely increase their resistance to fire, provided they lend themselves to such treatment. Fortunately a good deal more attention is being given to the effective fire-proofing of timber which is to be used in places where the risk of fire is pronounced than was formerly the case.

In addition to the properties already mentioned there are certain other qualities which, although found only in a small proportion of the timbers of commerce, are nevertheless of some importance. One of these is scent, which is generally pronounced in woods containing some kind of essential oil. Such scented woods are used in the manufacture of pencils, cosmetics and perfumes, and also for making coffers and chests for the storage of woollens and furs. Other scented species, such as the Mahaleb cherry and the myall wood of Australia, are used for making tobacco pipes. It may be noted in passing that the natural odour of a wood is not always pleasant, and in a few cases can only be rightly described as a foul stench.

Very few people associate the sense of taste with wood, yet some woods have a distinct flavour which may be pleasant or the reverse. It is rarely that any wood is used solely on account of this property, but there is at least one example of such a use in the manufacture of "bitter cups" from the marupa of South America. The cups are filled with water overnight and in the morning the water has acquired a bitter taste and is supposed to have tonic properties.

One other quality in woods is worthy of mention, that of natural oiliness. *Lignum vitae* is a species in which this is marked, and it is on this account that it is used for the bearings of shafting in places where it is impossible to lubricate them, the natural oil in the wood providing all the lubrication necessary.



4. Photographs of specimens showing the shrinkage of air-dried timber (with a 19% to 20% moisture content) after storage in a centrally heated building (11% to 12% moisture content).

Timber Seasoning for Modern Conditions

By R. G. Bateson

From time immemorial man has appreciated that timber must be seasoned before it can be manufactured into most of the products for which it is used. The attitude of mind on this subject is very largely the same today

as it was thousands of years ago. Many modern timber users are still content to cut their timber into boards or planks and pile it in the open or a shed for a period. This period is either a conventional one governed by some such rule as "a year to the inch," or is dependent on the demand for timber. Higher standards of workmanship, competition from timber substitutes, and the advent of central heating are, however, demanding a more exact understanding of timber drying, and are often also demanding drier timber than it is possible to obtain by the old-fashioned methods.

It is clearly impossible to describe the dryness of timber with any exactness without having some standard method

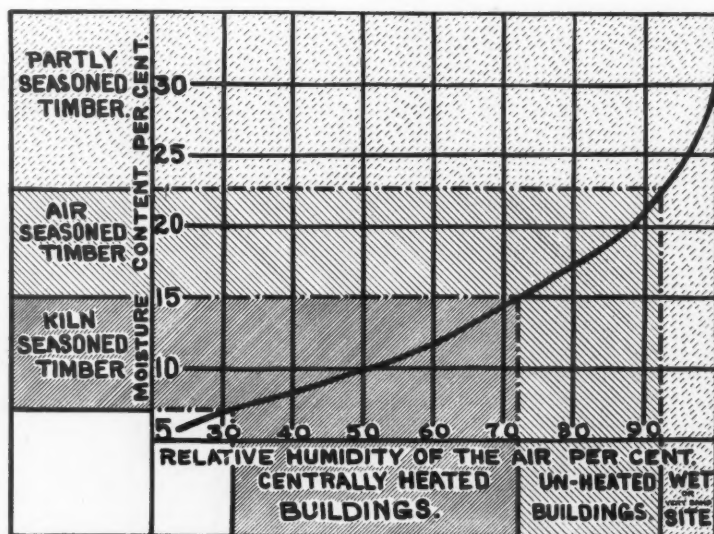
of measurement. The only reliable method at present known is that of determining the weight of moisture in the timber and expressing this weight as a percentage of the weight of dry timber. The result is known as the moisture content. Timber when green has a moisture content ranging from about 60 per cent. to over 200 per cent., depending on the species.

Thorough air-seasoning in this country will reduce the moisture content to about 18 per cent. This drying may be effected in a few weeks or in a few years, depending on the thickness of the converted timber, the species, the weather, and the time of the year that the timber is piled.

If the timber is destined for use in buildings which are artificially heated in winter thorough air-seasoning is not enough. In centrally heated buildings the timber work will dry down to about 9 per cent. moisture content in winter and will absorb up to about 14 per cent. in summer. If shrinkage and swelling are to be kept to a minimum the timber should obviously be seasoned to a moisture content of about 10 to 12 per cent.

Insufficient seasoning is responsible for most of the troubles experienced with timber used indoors, and it is safe to say that these troubles will not disappear until architects, builders and all timber users appreciate the meaning of "moisture content" and satisfy themselves that the wood is correctly seasoned before it is manufactured and installed.

Over-drying has been responsible for some trouble in recent years with the advent of warm storage and crude or improperly controlled timber drying kilns. Every stack of timber, whether piled in the open air or in a heated store



5. A diagram that shows the relation between the moisture content of timber and its environment.

or in a kiln, should contain sample pieces which can be withdrawn from the stack and weighed at intervals. These pieces should have their moisture content determined initially and should be weighed when the moisture test is made. Subsequent weighings enable the current moisture content to be calculated.

Timber which has been air-seasoned to a moisture content of about 20 per cent. can be placed in a warm store for further drying without fear of damage, provided the temperature of the store does not exceed the outdoor temperature by more than about 15° F. Wetter timber cannot be dried successfully by artificial means unless humidified air is used to protect the timber from too rapid drying. Higher temperatures cause the moisture in the timber to move more rapidly to the surface whence it can be evaporated. If high temperatures are employed without humidification the air becomes too dry and evaporation is more rapid than the flow of moisture to the evaporating surface. If this happens the surface layers of the timber will tend to shrink but will be restrained from doing so by the wetter core, and splitting may result.

A timber drying kiln is equipped with heating and humidifying arrangements and also has some means of circulating the air through the timber so that properly conditioned air is always in contact with the surface of the wood. Because the air circulation is positive and because higher temperatures can be used with safety, kiln drying is always faster than air-drying or drying in a warm store.

A difficulty often experienced with new buildings is that the timber work has to be installed before the shell of the building is dry. Correct seasoning is then no safeguard since the dry timber will absorb moisture from the mortar, plaster, etc., and will swell. Swelling may cause permanent damage, particularly in the case of flooring—hardwood floors have even been known to push the walls out—and tightly cramped up woodwork may become permanently compressed so that when building and timber work dry out gaps occur, even though the wood has returned to the moisture content at which it was installed.

The moral is, of course, that buildings should be given time to dry out before installing at any rate the decorative woodwork. Where it is not possible to do this it is probably wiser to dry the timber to a slightly higher moisture content than normal, i.e., about 14 per cent. in the case of centrally heated buildings.

Obviously, different woods require different treatment in seasoning, and it is not possible to discuss this aspect of seasoning here, but the necessary treatment is fairly well understood. It is the period of treatment and its relation to the moisture content of the timber that requires attention in so many cases. Once the full significance of correct seasoning is appreciated by those responsible for preparing specifications involving timber, it will not be long before a moisture content clause becomes universal, and one of the chief prejudices against the use of timber disappears.

The Mechanical Testing of Timber

By C. J. Chaplin

The results of mechanical tests of timber are applied to the solution of various problems which may be placed in three broad groups: (i) the grading or selecting of appropriate timbers, (ii) the controlling of processes which affect the mechanical properties of timber, and (iii) the designing of wooden structures. The data required to solve problems falling in the first two groups need only be comparative, but the information required for the designing of wooden structures in which the proportions of the members are calculated must be expressed in absolute quantities as safe loads or safe working stresses.

Comparative strength data have a wide application to those problems concerning the use of timber, where the actual strength required in the material is not known, and the solution depends on the selection of a quality of timber that possesses characteristics corresponding to certain requirements in service which may be stated after analysing the probable actions to which the timber will be subjected, or by making a direct comparison with the properties of a timber previously used. For example, to select a timber for chairmaking, the properties required might be analysed as bending strength, hardness, and resistance to splitting (cleavage), together with low shrinkage and possibly lightness; or it might be known that beech has proved suitable for the purpose, and timbers having somewhat similar properties to those of beech could then be selected. These two methods of approach may be adopted in selecting timbers for a certain purpose.

Comparative values of the strength properties of different species of timbers have been under investigation in forest products research laboratories in the Empire, the United States of America, Japan and other countries for some years, and the tests carried out have yielded a vast fund of information on the mechanical and physical properties of the timbers of the world. The tests are usually carried on by each laboratory as a routine process, the more important timbers of the respective country being tested in turn. The resulting data includes strength and stiffness in bending, strength in crushing, either on end or side grain, hardness and resistance to shear and cleavage as well as on density and certain characteristics of growth which may aid in selecting the suitable grade of the timber. Tensile strength of timber is not tested in routine, as this property is so high that it need seldom be considered in the design of wooden members.

Comparative tests of different species of timber require test pieces of clear material, that is, free from knots and other defects and having straight grain. The influence of defects on the strength of any species must be considered separately. The accepted procedure requires test pieces of 2-inches square cross-section and of lengths dependent on the particular test. Care must be taken in arranging the tests to ensure that accurate measurements of loads, deflections and other relevant data are made. Considerable refinement in the design of testing apparatus in recent years has followed the demands of research workers for closer correlation of results.

The same methods of testing, using small clear test pieces, has been applied with success in investigations into the influence of the moisture content of timber on its mechanical properties. By this means the great increases that occur in bending strength, crushing strength and stiffness on drying the timber have been demonstrated.

Small clear specimens are also employed when determining the influence of drying, preserving or other treatments on the strength of the timber.

The third group of problems, those requiring precise strength values from

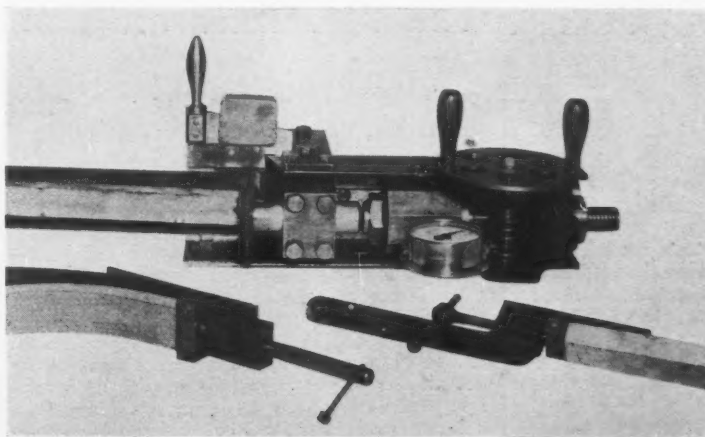
which the dimensions of wooden structures may be calculated, must be satisfied by other means. Clear material as a rule cannot be used on economic grounds, and the data must then be related to material with defects of varying degree and intensity. Since the defects in timber vary from piece to piece, the investigation into the influence of defects on strength must relate the mechanical properties to the degree of defect, and owing to the wide variation that occurs in the size and arrangement of knots and related disturbances in the direction of grain, the testing must include a very wide range of material. In practice, to assess the strength of each piece of timber and then design the structure would be difficult if not impossible, and the alternative method is to group or grade the timber according to its defects and determine the safe load or working stress for each grade—based on the maximum defect permitted in each grade.

The fact must be recognized that in designing the working strength of a grade of timber is calculated not from the average strength of the grade but from the strength of the weakest piece in the grade, at the same time taking into account other possible influences that tend to lower the strength and generally included in the figure known as the factor of safety.

Abrasion Tests of Flooring Timbers

A test to determine the relative wearing properties of flooring timbers has long been required. Those mechanical tests which yielded data on hardness and on splitting have been employed, but the assessment of the merit of flooring timber based on these properties has not been altogether convincing, and efforts have been made from time to time to devise an effective abrasion test which would subject the material to actions similar to those met with in service.

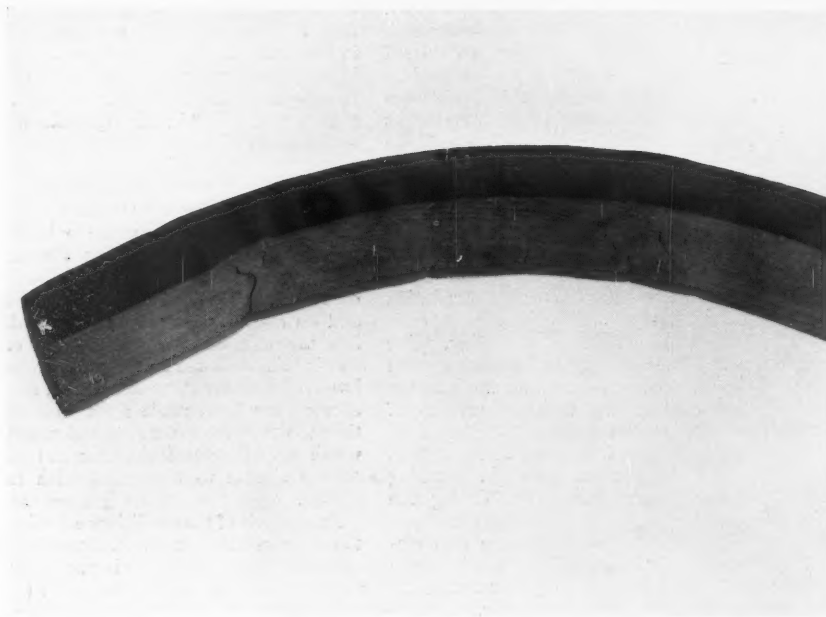
An analysis of the conditions affecting the wear of floors resolved the actions into two, (i) a stamping or impacting of the surface by various agents, and (ii) the rubbing or scuffing of the surface. The action of gritty substances was recognized as contributing to the rapid-



6. A machine with adjustable end-pieces used in the bending of timber. See description on next page.



7



8

Failure of timber in testing.
7, wood-bending tension failure.
8, wood-bending compression failure.

ity of the wear, but as the grit is not always present, it may be investigated as a secondary agent.

Many experiments led to the design of the machine now in use at the Forest Products Research Station, in which tests of 60 standard flooring blocks may be carried out at one time. This number of blocks may be comprised of those of one, two or three species, thus affording a direct comparison of their wearing properties. The conditions of test have been arbitrarily adopted but comparisons between blocks that have been tested with those taken from worn floors reveal similar conditions that are reassuring.

The tests so far carried out on some eight timbers used for floors in this country place Rhodesian redwood, Canadian rock maple and home-grown beech high in the scale of merit.

The Principles of Wood Bending

By C. W. Stevens

All woods may be bent to a certain extent without much difficulty, but when the ratio of bending radius to wood thickness is reduced beyond a certain value dependent upon the nature and state of the bending piece, fracture will inevitably result. The reason for this is that when a straight piece of wood cut with its ends square to the length is bent, there must finally be an appreciable difference in the length of the piece as measured along the inside or the outside of the curve. This difference is

brought about by stretching the fibres on the outside face and compressing those on the inside to an extent corresponding with the nature of the bend.

Very few woods, however, can be stretched any appreciable extent without fracture occurring, even after being subjected to a steaming treatment, and therefore, unless special precautions are taken a bent piece is very liable to rupture on the convex face in a manner similar to that shown in 7.

It has thus generally been found necessary, for the production of faultless bends, to keep the stretch of the outer face within limits by means of a supporting steel strap. The required difference in the lengths of the two faces can then be brought about by a limited stretch and comparatively large compressions of the inner face.

In some woods, compressive strains

as large as 30 per cent. of the original length may be obtained after subjecting the material to a steaming treatment, although this same treatment does not materially affect the permissible stretch. It is apparent, therefore, that by steaming the piece and supporting the outer fibres with a steel strap the ratio of bending radius to wood thickness can be very considerably reduced.

The steel strap is usually provided with end fittings which should be strongly made and capable of withstanding the end thrusts exerted by the compressed portions of the wood, so that, assuming the strap to be inextensible, failure in bending should be limited to the final breakdown of the inner face.

A failure of this type caused by excessive compressive strain is shown in illustration 8. Heavy compressions may also cause the piece to distort during bending, especially if its cross-section is small compared with its length.

The tendency for bends to buckle or distort can, however, be greatly minimised by allowing the end stops to move and the outside fibres to stretch a definite and pre-determined amount during the actual bending process. This allowable extension should seldom exceed about $\frac{1}{4}$ in. per foot length of the specimen and should be made to occur uniformly and continuously throughout the process. Special end fittings are, of course, required to obtain such accurate control of the end pressures, and two types suitable for this purpose are shown in 6. In both types the limited stretching of the piece, and hence the reduction in end pressure, is brought about by operating an adjusting screw connected with a metal end-stop.

The rather more elaborate arrangement shown in the illustration forms an integral part of a bending machine devised and built at the Forest Products Laboratory for carrying out experimental wood bending research.

It incorporates a device by means of which the actual end thrust may be measured at any instant, and hence regulated and controlled with considerable precision. The other type depicted is somewhat cruder in operation but has proved to be quite satisfactory in actual practice. By using such end stop devices the maximum tensile and compressive strains, and hence the minimum bending ratios may be attained, or the end pressures can be varied at will to suit each individual piece.

Steaming at atmospheric pressure renders many of the deciduous woods suitable for bending, but the presence of knots or other such defects tends to reduce the permissible compressions very considerably, and buckling is frequently the result. All defects should if possible be placed, therefore, near the outer face of bends where only a little if any compression occurs during the bending.

It has been shown that by using wood containing a high percentage of moisture, or by employing high steam pressures, the forces required for bending are only slightly reduced and the maximum compressions are hardly affected. It is, in fact, often advantageous to use air dried wood as this greatly reduces the time finally required for drying and "setting" the pieces at the completion of the bending process.

The Resistance of Decay in Timber

By K. St. G. Cartwright

The ever-increasing range of materials made available to engineers, architects and builders has led to the neglect in some cases of old-established ones and in the keen competition to secure markets advantage is naturally taken of any supposed failing the older ones may possess. One of the foremost of these failings applied to wood is the readiness with which it is said to decay, it being often represented as a most perishable material, falling an easy prey to attack by fungi, special emphasis being usually laid on the dry-rot menace.

Such arguments gain special force with the populace living in mass-produced houses which were run up by the thousand to make good the shortage of housing accommodation after the war.

Equally forceful evidence could be brought forward to illustrate the durability of timber; one has only to tour the countryside and examine the wood-work of many of the centuries-old tithe-barns and timbered houses, many of which still retain much of their original timber, or draw attention to the well-preserved remains of ancient lake dwellings and canoes still in a good state of preservation.

There is no denying that trouble from dry-rot is very prevalent; but what is the reason for this?

In old days care was taken with regard to the seasoning of the timber and the selection of suitable material. Like any other material there is good quality and bad, and if a material were condemned as a whole because poor-grade samples existed, most other materials would be open to equal condemnation. In addition, the mass production of houses has led in many instances to neglect of sound construction, more attention being paid chiefly to external appearance, and this has been further aggravated by the extended use of concrete without, in many instances, any consideration of the modifications in construction called for owing to its use.

These are a few amongst the many instances which could be quoted where the misuse of timber has brought about a reaction against its use.

There is plenty of room for the use of all the different types of materials; each one has its advantages and disadvantages for any given job, and it would be easy to bring forward arguments equally convincing against many of the modern substitutes. But, timber being the older, its defects are more widely known, and less is known of the new materials to counter such arguments.

It is not desired to deny the use of other materials in their rightful sphere, and everything in the long run must stand on its own intrinsic merits, not on the demerits of a competitor, but as a definite charge is often preferred against timber, that is lack of durability, it is intended to examine the facts of the case in regard to durability alone.

Now the word durability denotes hardness, but applied to timber it usually signifies resistance to fungus or insect attack, or exposure to weather conditions, which generally also means fungus attack.

In this article resistance to fungus attack is alone to be considered, as actually in this country fungi are by far the greatest agencies of wood destruction.

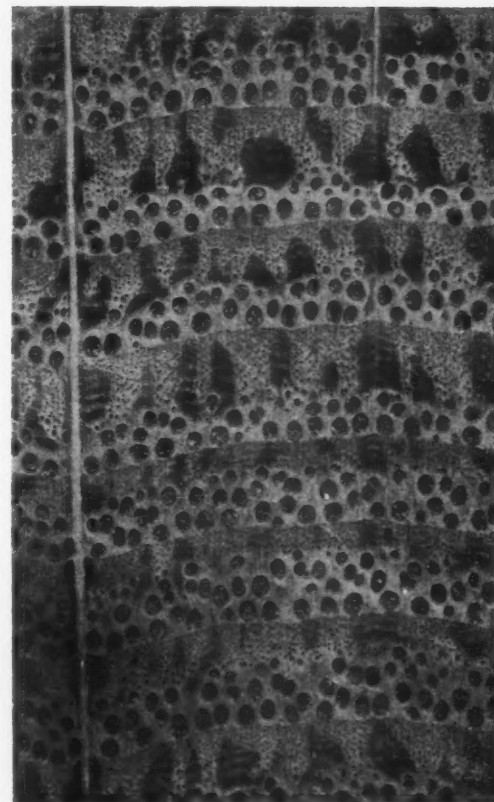
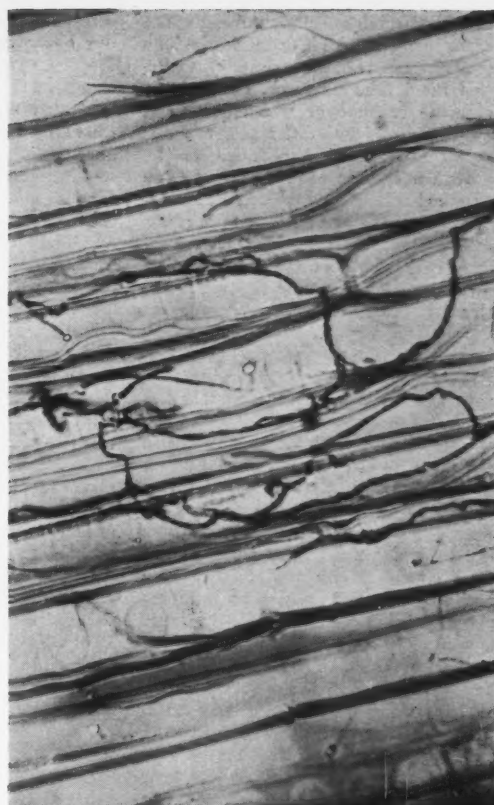
Now to most people directly the word durable is mentioned oak wood comes to mind; in fact, "as durable as oak" is almost a proverbial tag. Those who do not accept everything for granted must have often considered what were the reasons which make oak wood more durable than, say, ash or beech; and some would very likely say, "Oh, oak is a dense dark-coloured wood, whereas ash and beech are less dense and light in colour"; not so many would add that the dark colour was due to the abundance of tannin and that this was why it was not easily decayed; in further evidence of this they might point to the fact that the lighter coloured oak sapwood was readily attacked. Before, however, any reasoned argument can be brought forward it is necessary to know the conditions which wood-destroying fungi require in order to attack timber.

Now, like all plants, fungi require firstly sufficient moisture, secondly oxygen in order to breathe, thirdly suitable food material, and finally sufficient but not too much warmth, the temperature requirements varying according to the species of fungus.

Considering these in relation to the natural durability of timber, that is their natural resistance to fungus attack, moisture and air must be taken together, as every fungus requires a certain amount of both; for instance, inside a piece of timber there is a certain amount of air and a certain percentage of water, this obviously varying from saturation with water, when there is, practically speaking, no room for air, the water replacing it in the cells, to the other end of the scale, where the timber may be oven dried, so that very little water remains, and here no fungus attack will take place. The first condition would only rarely occur in practice in felled timber, except where water storage was practised, and it is well known that such timber remains free from decay during such storage, this being due to the absence of oxygen. It has been found that although fungi vary in their requirements, some requiring less air than others, yet as a general rule they are tolerant over a fairly wide range, but will not grow on wood dried off to a moisture content below 20 per cent., based on the oven dry weight of the wood. Most develop more readily at a moisture content of from 40 to 60 per cent.

With regard to food materials the presence of abundant starch, sugars and other reserved materials in the sapwood accounts in many instances for the fact that the sapwood of most species is more readily and rapidly decayed than the heartwood; this is the reason why many moulds and fungi causing stain only affect the sapwood, as these obtain their nourishment almost exclusively from the cell contents, being incapable of breaking down the substance of the cell wall.

The effect of decay on timber. 9, microscope-enlargement showing decay of Sitka Spruce by *Trametes Serialis*: radial longitudinal section (note penetration of the cell wall by fungus threads). 10, oak heartwood: transverse section (note blocking of pores by tyloses).



On the other hand wood-destroying fungi, although many of them are encouraged by the presence of sugars and starch, feed mainly on the substance of the cell wall, breaking it down, and many are entirely independent of the

cell contents, as are, for example, most of the fungi which attack the heartwood.

Temperature has little practical influence, in this country at any rate, although the reason that the dry-rot

fungus *Merulius lacrymans* does not occur in the tropics is owing to the high temperatures; but other equally destructive fungi take its place, as the temperature range over which growth is possible varies with different species.

During cold winters little or no growth will take place out of doors, and practical advantage is taken of this fact in the practice of winter felling.

To return to the consideration of durability in relation to fungus requirements, it is, as a general rule, true to say that dense dark-coloured woods are more durable than light ones, as density infers that there is more wood material and therefore less room for air and water, thus tending to render the timber less liable to decay.

The colour of a timber may be due to the presence of tannin or of other substances, some of which may definitely act as preservatives, that is to say they may check or prevent fungus growth: others, as, for instance, resins and gums, may not be toxic, but in so far as they are waterproofing agents and fill up spaces which otherwise might contain air and water they may render the timber more or less immune to attack. In the case of the heartwood of oak there is evidence to show that tannin inhibits the growth of many fungi and especially the dry-rot fungus. On the other hand certain fungi do not appear to be adversely affected by it and a few appear to be encouraged by its presence.

In addition, many of the vessels of the heartwood of oak are blocked by ingrowths known as tyloses, and these prevent free moisture movement and also restrict the oxygen supply, thus contributing to its comparative freedom from attack by wood destroying fungi: see illustration 10 showing section of oak with tyloses.

In certain timbers, such as teak and jarrah, the presence of essential oils assist in rendering them durable; in others, extractives from the wood act definitely as poisons to the fungi, such timbers possessing, as it were, a wood preservative in themselves; an example of such a timber is western red cedar (*Thuja plicata*).

Summarizing the properties which confer durability on a timber, one can say that it may be due to density, thus affecting the moisture and air relationships by restricting both, but possibly at times in varying proportions; resins and some other substances may act in the same way; or toxic materials may be present in the timber.

Decay

It is frequently stated concerning a timber that it is durable under dry conditions and that another is not durable; now these are misleading and inaccurate statements, as a timber, such as willow or birch, both of which are readily attacked by fungi, will remain perfectly sound if moisture is kept from them, and in perfectly dry situations would remain equally free from attack by fungi as the most durable of timbers; in fact in the building of a house it should not be necessary in the choice of a timber to consider durability for internal woodwork, as if full attention is paid to ensuring sound construction risk of damp should, and can, be eliminated. One might go so far as to say that it is preferable to use a non-durable timber combined with good

construction rather than one of proved durability with bad construction. On the other hand, for external use or for other situations such as mills where a humid air may even be necessary or at least unavoidable, the question of resistance to fungus attack may be of paramount importance, and then the choice of a durable timber comes into consideration. Here, again, however, too much importance is often placed on the relative durability of different species, as such differences as may exist are often not much greater than the variations between different samples within the same species. The difference in length of life between, say, white deal and red deal is rarely of first-rate importance from a practical point of view, although this is perhaps not generally realized.

Of far greater importance from the practical point of view is the relative treatability of the species, as it is frequently more economical to use a non-durable timber and treat it with a preservative than to use a more expensive one possessing greater durability.

It is thus seen that the importance of the quality of durability may often be exaggerated to the detriment of timber, and, further, that this idea of the perishable nature of timber has largely gained ground owing to its misuse through bad workmanship and misunderstanding.

The Preservative Treatment of Timber

By J. Bryan

Timber being a highly complex organic material is subject to various agencies of destruction, the most important being decay due to the action of wood destroying fungi, which under suitable conditions feed on the substance of the wood, destroying the structure and finally reducing it to powder. To attack timber fungi must have definite conditions of moisture and temperature, and if timber can be kept at a moisture content of under 20 per cent. it is not susceptible to fungus attack. This is the main principle underlying the preservation of building timbers where methods of construction ensure that the timber is kept dry. Outbreaks of dry rot in buildings can nearly always be traced to defects in construction whereby the timber has been allowed to become damp. It is not always possible to ensure that wood in service is kept dry, and wherever timber is in direct contact with the ground it can be definitely assumed that it will be kept sufficiently damp to be in a condition favourable to the attack and development of fungus. In such cases the only way to preserve the timber is to treat it with a chemical which renders it poisonous to fungi. There are, fortunately, a number of chemicals which are toxic to

wood destroying fungi, and wood impregnated with these will be immune from attack for as long as the chemical remains in the wood in sufficient concentration. Coal tar creosote is by far the most important wood preservative used in this country, and has been employed successfully for this purpose for over one hundred years. It is a distillate of tar which in turn is obtained from coal. A number of proprietary preservatives are derived from coal tar. These are carefully prepared from selected fractions, and are more suitable for brush application than ordinary creosote, being cleaner and having better penetrating powers. In some cases they are made colourless or, by the addition of pigments, in various colours. Another important class of preservatives consists of various inorganic salts used in aqueous solution. Zinc chloride, sodium fluoride, copper sulphate, mercuric chloride and arsenic salts are a few of this type. There is also another type of preservative of recent introduction which consists of a toxic chemical insoluble in water, and which for the purpose of application is used in an oil solvent. The solvent need not necessarily be either toxic or permanent as its main purpose is that of a vehicle for carrying the toxic chemical into the wood.

The efficient preservation of timber is dependent as much on the method of applying the preservative as on the actual preservative itself. It is not always practicable, neither is it necessary, to obtain complete impregnation of the timber in the majority of cases, but for permanent protection it is essential to obtain sufficient penetration of the preservative to ensure that at no time will unimpregnated wood be exposed either by splitting or by mechanical abrasion or cutting, and to provide a sufficient reserve of preservative in the timber to allow for losses which take place due to leaching, evaporation, etc.

Methods of applying preservatives fall into two groups, surface treatments and impregnation treatments. Surface treatments include brushing, spraying and dipping, and result in little more than skin deep penetration. Such treatments are of little value for the protection of timber which is constantly under conditions favourable to fungus attack, but do afford a certain amount of protection where conditions are not

so bad, i.e., for timber not directly in contact with the ground. Impregnation treatments include steeping, hot and cold open tank and pressure treatment. The most effective method of impregnating timber with preservatives is by means of pressure, and this process is always used when the quantity of timber justifies the capital outlay of a pressure plant, as, for instance, in the case of railway sleepers and telegraph poles. The process consists essentially of impregnating timber in closed cylinders with a preservative under pressure. The oldest and most widely used process is the Bethel or full-cell process, which consists of applying firstly a vacuum and after filling the cylinder with preservative, a pressure of 100 lb. to 200 lb. per square inch for a period of a quarter to five hours, depending on the species of timber being treated, and the results desired. This process is used for railway sleepers, fence posts and most general work. Where a permeable timber is being treated the full cell treatment results in high absorption and an increased cost due to the amount of creosote being absorbed. In such cases the Rueping or empty cell process is used, the difference being that instead of an initial vacuum an initial air pressure is used. This compressed air in the cell spaces is further compressed by the creosote, and on release of pressure expands, forcing out the excess creosote and leaving a coating only on the cell walls. Thus a deep impregnation may be obtained with a low net retention of creosote. Where pressure-impregnated material is not available effective treatment may be carried out by means of the hot and cold open tank process. This consists of heating the timber in a bath of creosote to about 180° F., maintaining the temperature for about one hour, and then allowing to cool. During the heating period the air inside the timber expands and some escapes as bubbles. On cooling contraction takes place, and creosote is sucked into the timber. It will therefore be seen that the impregnation takes place during the cooling period.

Timber properly impregnated with creosote has been known to last over 60 years, and when once the principles of timber preservation are understood timber may be used for permanent construction under practically any conditions.



11. A model block of common elm magnified 8½ times to show the wood-structure in section.

NATURAL SIZE

ANTHOLOGY

The Wickedness of the Grainer

But it will be said, that it is too expensive to employ real marbles in ordinary cases. It may be so: yet not always more expensive than the fitting windows with enormous plate glass, and decorating them with elaborate stucco mouldings and other useless sources of expenditure in modern building: nay, not always in the end more expensive than the frequent repainting of the dingy pillars, which a little water dashed against them would refresh from day to day, if they were of true stone. But, granting that it be so, in that very costliness, checking their common use in certain localities, is part of the interest of marbles, considered as history. Where they are not found, Nature has supplied other materials.—clay for brick, or forest for timber,—in the working of which she intends other characters of the human mind to be developed, and by the proper use of which certain local advantages will assuredly be attained, while the delightfulness and meaning of the precious marbles will be felt more forcibly in the districts where they occur, or on the occasions when they may be procured.

It can hardly be necessary to add, that, as the imitation of marbles interferes with and checks the knowledge of geography and geology, so the imitation of wood interferes with that of botany; and that our acquaintance with the nature, uses, and manner of growth of the timber trees of our own and of foreign countries, would probably, in the majority of cases, become accurate and extensive, without any labour or sacrifice of time, were not all inquiry checked, and all observation betrayed, by the wretched labours of the "Grainer."

But this is not all. As the practice of imitation retards knowledge, so also it retards art.

There is not a meaner occupation for the human mind than the imitation of the stains and striae of marble and wood. When engaged in any easy and simple mechanical occupation, there is still some liberty for the mind to leave the literal work: and the clash of the loom or the activity of the fingers will not always prevent the thoughts from some happy expatiation in their own domains. But the grainer must think of what he is doing; and veritable attention and care, and occasionally considerable skill, are consumed in the doing of a more absolute nothing than I can name in any other department of painful idleness. I know not anything so humiliating as to see a human being, with arms and limbs complete, and apparently a head, and assuredly a soul, yet into the hands of which when you have put a brush and pallet, it cannot do anything with them but imitate a piece of wood. It cannot colour, it has no ideas of colour: it cannot draw, it has no ideas of form: it cannot caricature, it has no ideas of humour. It is incapable of anything beyond knots. All its achievement, the entire result of the daily application of its imagination and immortality, is to be such a piece of texture as the sun and dew are sucking up out of the muddy ground, and weaving together, far more finely, in millions of millions of growing branches, over every rood of waste woodland and shady hill.

JOHN RUSKIN
[The Stones of Venice]

MARGINALIA

Faites vos Jeux!

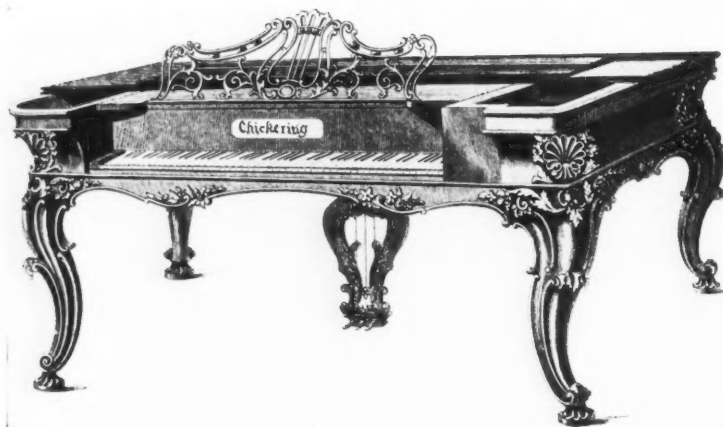
The Casino de la Jetée at Nice has been sold, but not for breaking up. The French are not so abandoned as the English to the daring pleasure of projecting themselves a few yards out to sea for their entertainment, and it would have been a pity if this almost unique monument should be destroyed, as has occasionally been rumoured in these days of uncertain opulence. Just as a number of overweening Cistercian abbots flouted the recommendation of their founder by building towers a short time before the dissolution of the English abbeys, so it was in 1930, just before the bubble burst, that the Casino de la Jetée was thoroughly embellished. And now, to quote the guidebook, "il peut rivaliser, à tous points de vue, les établissements les plus sélects de la région." Indeed it can rival almost anything, from the Taj Mahal to the Brighton Pavilion, and it is fitting that it should henceforth be under the same management as that other select establishment, the Monte Carlo Casino. A casino, after all, is the one building in which fancy should legitimately be allowed to run riot. It would be impossible to abandon one's profits or one's patrimony to the turn of a wheel in ferro-concrete surroundings that proclaim the undeviating law of parallel lines. To be able, on the other hand, to embrace in a single intoxicating glance a horseshoe arch, a classical entablature, a mosaic panel, a couple of baroque scrolls, and a romantic wall-painting, is to yield so completely to the blind goddess that the pleasures of numerology are irresistible.

FRANCIS WATSON

Unity of Purpose

"The Piano Forte, made by Mr. Chickering, of Boston, in the United States, is a most satisfactory example of American workmanship. When other qualities are the principal requisites in an object, as in a musical instrument, it would be an absurdity to allow the mere ornamentist to have the chief hand in its production, for however excellent his work may be, its beauty would not atone for any deficiency in more essential matters. The manufacturer of the piano-forte we have here engraved has wisely borne this truth in mind: he has produced an instrument that exhibits some very bold and elegant carving which shows a unity of purpose throughout the whole design." "Progress of Art Manufacture" in *The Art Journal* for February 1, 1852: for piano see next page.





Willow Men: and how it happened

"In times past men were contented to dwell in houses, builded of sallow, willow, pluntree, hardbeame, and elme. So that the use of oke was in manner dedicated wholie unto churches, religious houses, princes palaces, noblemen's lodgings, and navigation: but now all these are rejected, and nothing but oke anie whit regarded. And yet see the change, for when our houses were builded of willow, then had we oken men; but now our houses are come to be made of oke, our men are not onlie become willow, but a great manie, through Persian delacacie crept in among us, altogether of straw, which is a sore alteration."

R. HOLINSHED in
The Chronicles of England

Three Centuries ago they were saying this

"Now the multitude of Timber brought yearly from Norway, and other parts, doe plainly demonstrate the scarcitie thereof here: also it may be conjectured what a miserable case the Kingdom will be plunged into about an Age or two hence, for want of Timber. There is a law in Spaine, that he that cutteth down a tree, shall plant three young ones for it; and by this meanes there are builded in two Provinces, twentie ships yearly, and yet the wood increaseth: if this Law were observed here, how happie would it be for the posteritie? The charge is little, there is nothing wanting but one of my first inventions; to wit, love manifested by working for the general good; not only of all that are now alive; but also of those that shall come after."

GABRIELLE PLATTES in
A Discovery of Infinite Treasure (1639)

The Tree: The Friend of Man; how the Poets have looked at it

Eighteenth Century

... Nor small the praise the skillful planter claims
From his befriended country. Various arts
Borrow from him materials. The soft beech
And close-grained box, employ the turner's wheel,
And with a thousand implements supply Mechanic skill. Their beauteous veins the yew
And phyllerea lend, to surface o'er
The cabinet. Smooth linden best obeys
The carver's chisel; best his curious work
Displays in all its nicest touches. Birch—
Ah, why should birch supply the chair? since oft
Its cruel twigs compel the smarting youth
To dread its hateful seat. Tough-bending ash
Gives to the humble swain his useful plough,
And for the peer his prouder chariot builds.
To weave our baskets the soft osier lends
His pliant twigs; staves that nor shrink nor swell.
The cooper's close-wrought cask to chestnut owes.
The sweet-leaved walnut's undulated grain,
Polished with care, adds to the workman's art
Its varying beauties. The tall towering elm
Scooped into hollow tubes, in secret streams
Conveys for many a mile the limpid wave;
Or from its height when humbled to the ground,
Conveys the pride of martial man to dust.

And last the oak, king of Britannia's woods,
And guardian of her isle! whose sons robust
The best supporters of incumbent weight,
Their beams and pillars to the builder give,
Of strength immense: or in the bounding deep
The loose foundations lay of floating walls,
Impregnable secure. But sunk, but fallen
From all your ancient grandeur, O ye groves!
Beneath whose lofty venerable boughs
The Druid erst his solemn rites performed,
And taught to distant realms his sacred lore,
Where are your beauties fled? Where but to serve
Your thankless country, who unblushing sees
Her naked forests longing for your shade.

ROBERT DODSLEY in *Agriculture*

Pre-Raphaelite TAPESTRY TREES

Oak: I am the Roof-tree and the Keel;
I bridge the seas for woe or weal.
Fir: High o'er the lordly oak I stand,
And drive him on from land to land.
Ash: I heft my brother's iron bane;
I shaft the spear, and build the wane.
Yew: Dark down the windy dale I grow,
The father of the fateful bow.
Poplar: The war-shaft and the milking-bowl
I make, and keep the hay-wain whole.
Olive: The King I bless; the lamps I trim;
In my warm wave do fishes swim.
Apple-Tree: I bowed my head to Adam's will;
The cups of toiling men I fill.
Vine: I draw the blood from out the earth;
I store the sun for winter mirth.
Orange-Tree: Amidst the greenness of my night,
My odorous lamps hang round and bright.
Fig-Tree: I who am little among trees
In honey-making mate the bees.

Mulberry-Tree: Love's lack hath dyed
my berries red:
For Love's attire my
leaves are shed.
Pear-Tree: High o'er the mead-
flower's hidden feet
I bear aloft my burden
sweet.
Bay: Look on my leafy boughs,
the Crown
Of living song and dead
renown.

WILLIAM MORRIS

Georgian TREES

... They follow us and haunt us. We
must build
Houses of wood. Our evening rooms are
filled
With fragments of the forest: chairs and
tables.
We swing our wooden doors;
Pile up, divide our sheds, byres, stables
With logs, make wooden stairs, lay
wooden floors,
Sit, move and sleep among the limbs of
trees,
Rejoicing to be near them. How men
saw,
Chisel and hammer, carve and tease
All timber to their purpose, modelling
The forest in their chambers! And the
raw
Wild stuff, built like a cupboard or a
shelf,
Will crack and shiver in the night, and
sing,
Reminding everybody of itself:
Out of decayed old centuries will bring
A sudden memory
Of growing tree. . . .

HAROLD MONRO

Oxford—The New City

"It is indeed a strange and melancholy
experience to wander round our new in-
dustrial suburbs. Unplanned, unbeauti-
ful and naked, they are being run up at
a pleasant profit to the speculative
builder. You reach them often across
a muddy field or even an open ditch.
They are just dumped anywhere where
a field is for sale and drainage available.
The roads, which are still the property
of the owners of the building estate, are,
naturally enough, pocked with pot-holes

... Of course, this is just the normal
development which progress brings, but
it is particularly depressing in a Univer-
sity town once famed for its beauty.
The Preservation Trust struggles man-
fully against it, saving an acre here and
five acres there, but it can achieve little.
Now we are promised that a town-plan-
ning scheme is to be pushed through in
the near future: but it is a grim thought
that a little foresight ten years ago could

WHY?



"THE DRAX MAUSOLEUM.—The remarkable mausoleum in the
Byzantine style in Holnest Churchyard, Dorset, which is being demolish-
ed. It was built in 1858 and its removal will allow the 15th century
church to be seen from the high road once more."—*The Times*.
Aren't there other fifteenth-century churches up and down the country?

have saved us from most of our present
horrors. All that is left us is to plan the
last relics of a once beautiful town, and
to realize that we are still faced with the
problem of building those thousands of
workmen's cottages which our Peace-
haven policy has failed to provide. It is
too late to save very much."

From the Oxford Correspondent's letter
in the *Spectator*.

New Threat to Carlton House Terrace?

Savage Club's Farewell to Adelphi

"As the move had to be made from
Adelphi Terrace, he thought they were
to be congratulated on having secured
such a spacious new home in No. 1,
Carlton House Terrace. He feared that
the grandeur of the new home might
prove a shock to some Brother Savages,
and he had heard it suggested that some
of them proposed to secure a discarded
railway carriage and constitute it as a
kind of annexe to that magnificent new
building."

Times report of the President's speech
at the last annual dinner in the Club's
premises in the Adelphi.

Investment Tip

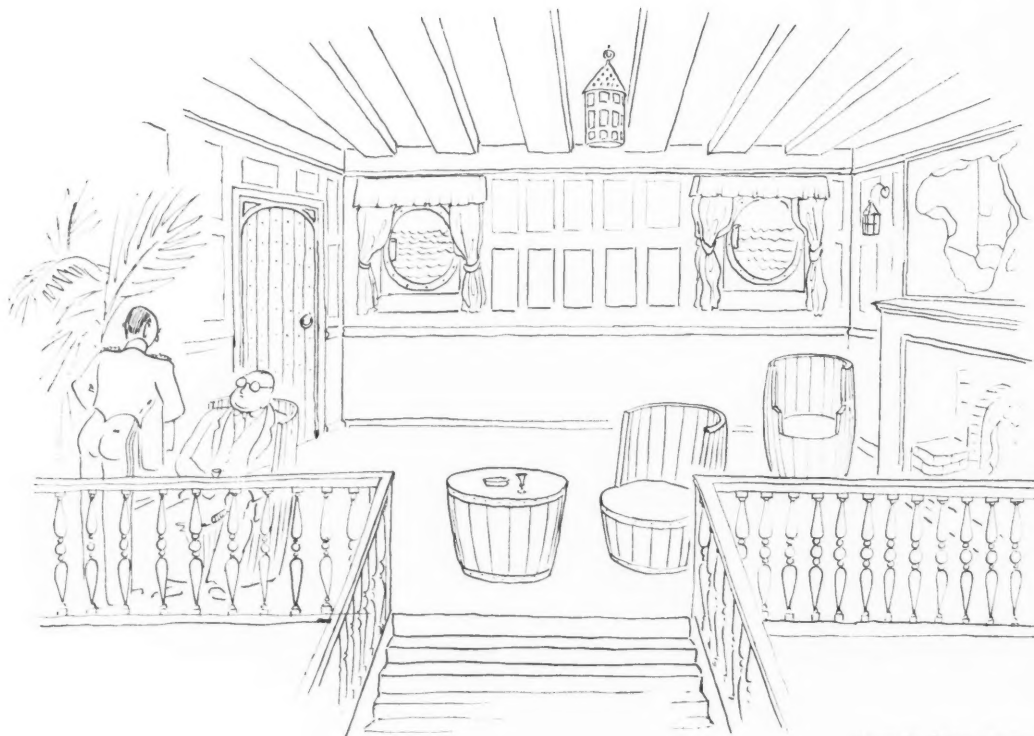
Vases made in lead are claimed to be
the latest thing in interior decoration.
Not so very new, when you come to think
of it. The Spartans were using lead for
decorative purposes right away back in
the sixth century, and we were using it
again with great effect in the seventeenth
and eighteenth centuries. Everybody has
known and appreciated its unique virtue
of diuturnity. That is still true today, of
course, but it is not the reason they are
now putting forward for its adoption as an

ornamental feature in the modern home.
The vase shown below, for instance, was
made by a jobbing plumber. Its design
was his own inspiration. It cost 15s., of
which 9s. was paid for the lead and the
remaining 6s. for the labour involved.

Now this is the important point: if
lead appreciates in value during the next
twenty years in the same degree in which
it has increased during the past two
decades, in twenty years' time, should
the vase be melted down, the scrap will
show a handsome profit on the original
cost of the vase. If, on the other hand,
the price of lead remains stationary, a
30 per cent. decrease in value is not a
proportion to be despised. It is prob-
ably worth the risk, and if you can't
afford to invest in potential Old Masters
and must allow yourself some artistic
outlet, you cannot do better, it would
seem, than invest a few odd shillings
from time to time in lead.



THE WOODEN WALLS OF ENGLAND



Drawn by Osbert Lancaster

It gives us enormous pleasure to be able to present to our readers the first pictures and description of the interior fittings and decoration of the new 100,000 ton super luxury liner the s.s. "Pelvishernia," whose maiden voyage, a super luxury cruise to Honolulu, will shortly be announced. The picture reproduced above shows the interior of one of the sixteen second-class lounge-bars. You can see at a glance that it is in the second-class section of the boat by the glimpse of sea through the portholes, for nowhere in the first class is it possible to come within sight of the ocean at all, an innovation that is sure to be much appreciated by the class of passenger for which a ship of this type is intended principally to cater. The decoration of the lounge is carried out entirely in wood. A novel feature is the large map over the fireplace in which the various countries are inlaid in different types of timber, each country being made of the wood of the

tree that is generally connected with it; thus the British Empire is all inlaid in oak, Scandinavia in pine, etc.

Notice particularly the chairs. Designed by a well-known Mayfair decorator, they are all made out of genuine old ships' barrels, and whatever they may lack in comfort is certainly compensated for by their strikingly appropriate appearance. Incidentally, all the wood used in the decoration of this room—except, of course, in the before-mentioned map—is taken from the timbers of old-time men-of-war, so that if the tempest rages without while you are sipping your martini you may reflect that you are still protected by the Wooden Walls of England. Next month we hope to show you the seventy-thousand-pound first-class swimming pool which is fitted with a unique gyroscopic device that ensures, no matter how rough it may be outside, a perfectly calm surface for the first-class luxury bathers.

"The Speed Villa"

"You almost expected to see 'Sold' or 'To Let' notices. Here in brief is the description of one Mansion on Wheels.

"Accommodation for four people, including bedroom and lounge, dining-room fully furnished, china cupboard, cutlery drawer, pantry, oval sink, hot and cold water supply, kitchen cabinet, cocktail cabinet, monks' dining-table, steel chassis, automatic brakes.

"The maker might have added 'no rates or land tax.' The price of this deluxe model house is £530.

"How would you like a streamlined 'flat'? Here it is: streamlined roof, bed-sitting-rooms for four people (each room gives a clear view of following traffic), wardrobe with plate mirror, deep multi-spring mattresses, hand brake and locking device for reversing and parking, linoleum, curtains, carpet and door mat, automatic brakes. Price £225.

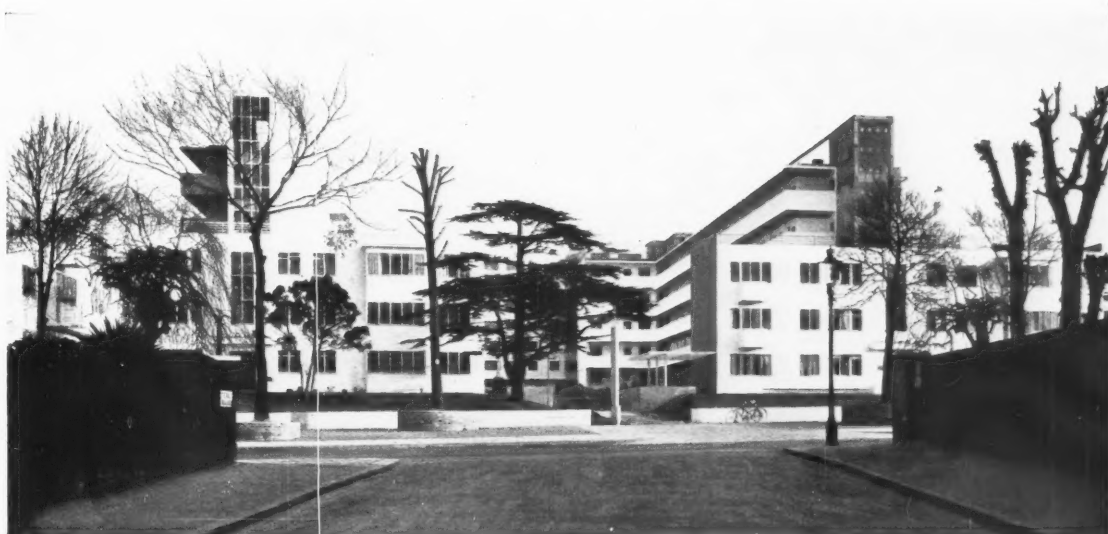
"From this we come down to the 'Speed Villa,' with two full-sized beds, for £78. They can be used separately or as double beds. It can be towed by the smallest car.

"No wonder women are thronging to the motor-house section. The only thing that seems to be lacking is a servants' hall."

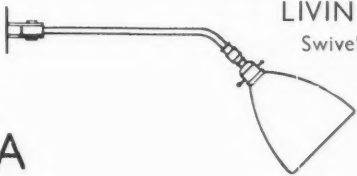
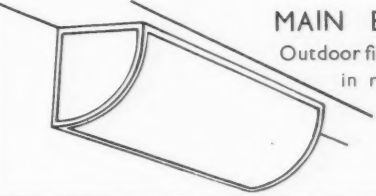
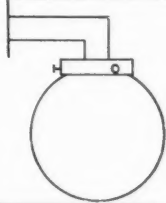
Daily Express.

Perhaps this is the solution, after all, and we've just been wasting our time.

PULLMAN COURT, STREATHAM



The standard lighting-fittings in all the flats were made by Best & Lloyd Ltd. to the design of the Architect: Frederick Gibberd, A.I.A.A.

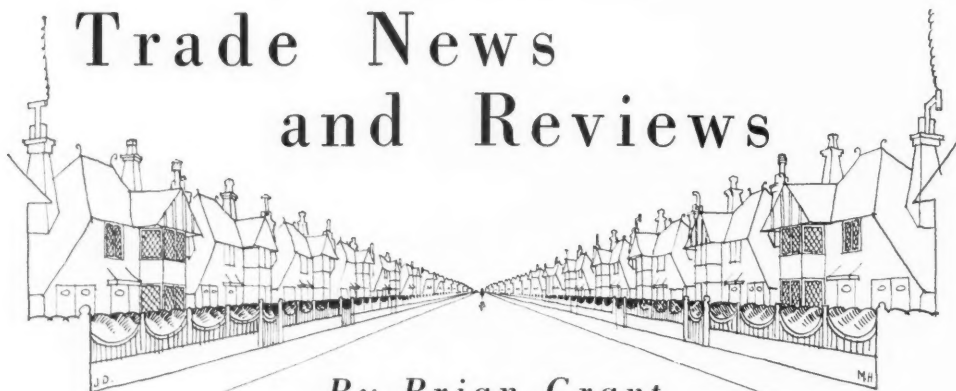
A  LIVING-ROOMS Swivel bracket over fireplaces, with opal glass shade	D  KITCHENS Dustproof ceiling fitting with opal shade, 7½ in. high overall.
B  VESTIBULES, DINING-RECESSES, ETC. Ceiling fitting with opal sphere, 7½ in. diameter.	C  MAIN ENTRANCES Outdoor fittings for 2 lamps in real bronze with opal shade
C  BATHROOMS Wall bracket with opal sphere, 7½ in. diameter	This large contract may be regarded to some extent as a tribute to Best & Lloyd's pioneer work in standardised simple lighting units for modern flats and small houses. Many of these are shown in List No. 200, sent on request. They are obtainable through all dealers.

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Trade News and Reviews



By *Brian Grant*

Architecture and the General Public

I remember being present, some ten to fifteen years ago, at a most lively discussion between a group of architects. The subject being debated was—Should professional bodies indulge in publicity. I had, myself, started their tongues vibrating by suggesting that such Associations as the R.I.B.A. and the British Medical Association were far too lofty and aloof in their relationships with the general public. It has always seemed to me that the proper function of an architect is too little understood by the average man

in the street; indeed, I have met many people who regard architects as a set of exclusive and most expensive interior decorators—the idea of employing an architect to design a small house costing eight or nine hundred pounds would never enter their heads. The right sort of educational publicity or propaganda, call it what you will, would do much to excite a wider and more genuine interest in, and appreciation of, good architecture.

The amount of appallingly bad estate development proceeding in all parts of the country is nothing short of criminal. Parts

of Kent and Surrey that at one time were "beauty spots" are now being ruthlessly scarred by ill-mannered jerry-building. It is not only that the houses themselves are in execrably bad taste, but their disposition to the site is so ill-considered and so completely destructive of all the natural beauty that once belonged to the countryside.

It is encouraging, however, to find evidence, particularly in the press, that the public is keener today to know more of what modern architects are up to. Unfortunately so much damage has already been done and



By
Appointment



To
H.M. The King

EXHIBITION OF DECORATIVE SCHEMES

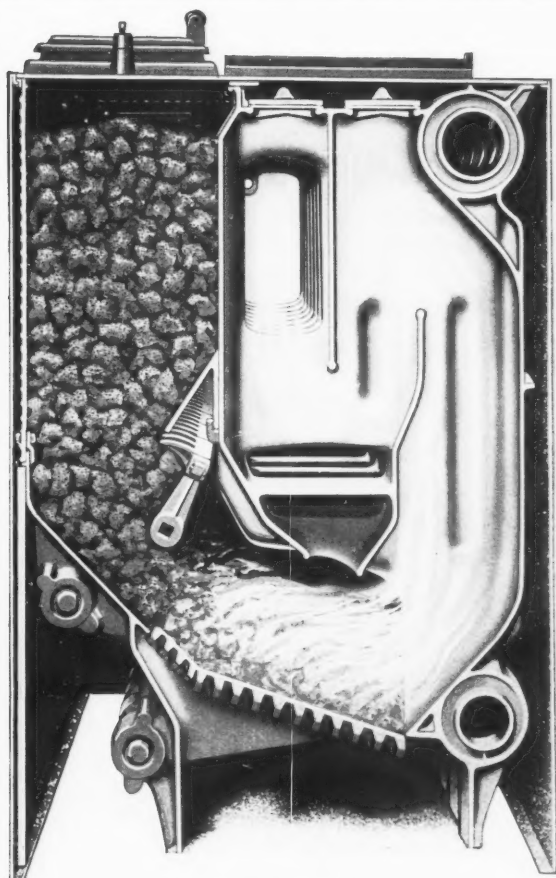
The Directors of John Line & Sons, Ltd., invite you to an Exhibition of Decorative Schemes in Wallpaper and Paint at the Company's Showrooms and Galleries 213-216, Tottenham Court Road, London, W.1. Daily 9 a.m. to 6 p.m. Sats. 9 a.m. to 12.30

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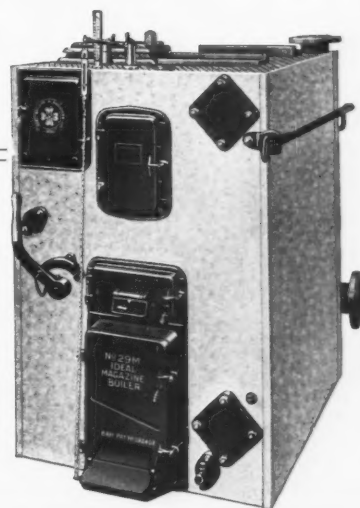
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is in process of being done, that not this generation, nor, I fear, the next, will live to see town planning and the development of the countryside proceeding in a well-ordered and intelligent manner.

A.D. 2035

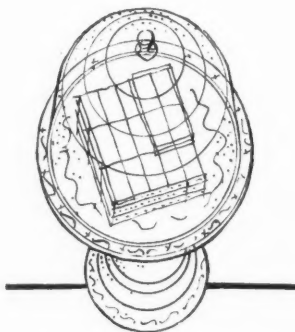
Early in the new year two popular penny newspapers published *leading* articles by architects. One, by so eminent a critic as Professor C. H. Reilly, was a survey of the outstanding architectural achievements of 1935; the other (I have forgotten by whom it was written) was an imaginative forecast of the City of 2035.

The author of the latter article showed great optimism in his calculation of the changes to be wrought during the next hundred years. In a drawing accompanying the article we were given a vision of a busy shopping thoroughfare—the Regent Street of one hundred years hence. Pedestrian and vehicular traffic were proceeding on separate planes, the shop windows and entrances being at first floor level, with wide pavements to accommodate the shopping multitude in comfort and safety. The main roadway for motor traffic was below, and the ground floor of each building provided adequate parking facilities. The flat roofs of the buildings were alive with aircraft.

I would that I could share such optimism! But let us look not quite so far ahead.

What of 1936? I can see a vista of orange-coloured balls surmounted upon black and white stilts; I can see mile after mile of dimly lit thoroughfares; I can see hundreds and thousands of cars, buses, tram-cars and horse-drawn vehicles—a long, long trail of complete immobility.

Will the picture be the same in 1937?



With all its antiquity the station buffet sandwich is quite the youngest inhabitant.

Something very Old—

I hear that the Aldershot railway station has been severely criticised at a meeting of the Aldershot Council. Councillors allege that nothing has been done to it for 50 years, that it is in a deplorable state, and that it

is antiquated. I do not know Aldershot station, but I have courted pneumonia on many another station belonging to the Southern Railway.

Is there any place quite so depressing as the average waiting-room on the average Southern Railway station—or any railway station, for that matter? If you know of it, please keep the dreadful secret to yourself.

There is a place on the map called Streatham—a "suburb" of the great city of London. In comparatively recent years the population of Streatham (an ever-growing population) have been provided with two gigantic super-cinemas, a very large theatre, an imposing and, I believe, well-attended dance hall, an excellent skating rink, and heaven knows how many Brobdingnagian blocks of flats. Passengers to Streatham travel by the Southern Railway: they may alight at one of three stations—Streatham Hill, Streatham, or Streatham Common—but my advice to anybody who can possibly avoid it is: don't. (Do not misunderstand me, I am not casting "nasturtiums" on Streatham, but am deploring the inadequacy of the three stations that serve it.

I wonder if Messrs. Pilkingtons could be persuaded to present the Southern Railway Company with a few million square yards of "Vitroflex"; and would Messrs. Waygood-Oris or Hammond Brothers and Champness,

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20th Century Craftsmanship

Flush panelled lounge and hall in English Walnut in a house at Harpenden.

Architect: F. G. Thomas, F.R.I.B.A.

"... The most striking and unusual thing about the house is the joinery... As a piece of craftsmanship it is, perhaps, unique... The semi-circular staircase, with its solid balustrade rising from the ground, is a technical triumph. The whole of the balustrade, which is also the outer string of the stair, was built up on a template in the shop. On section it shows a double core of Quebec pine plywood with deal studding in the centre; the twisted walnut handrail is flush with the veneer on both sides, a technical accomplishment requiring the utmost skill and precision."

Extract from "The Architect & Building News."

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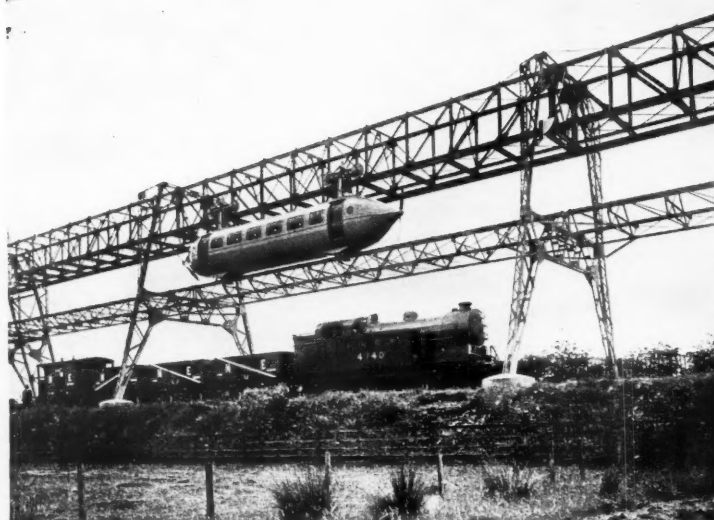


out of the kindness of their hearts, provide an escalator here, and a lift or two here and there; and would some competent electrical engineer undertake to cast a little adequate illumination upon a whole host of very dark subjects.

• • •
Yes, Gentlemen of the Aldershot Council, you indeed have something to shout about. More power to your lungs!

• • •
— And Something
New

Turning from the antediluvian to the neoterical, here's the very latest in "Flying Scotsmen"—a streamline railway car suspended on bogies running on a single overhead rail and propelled by airscrews. I must leave the illustration to tell its story, and, if you are sufficiently intrigued, you can see a sample line of track at Bearsden, near Glasgow.



• • •
Bishop Hooper's Lodging,
Gloucester

Bishop Hooper's Lodging is a happy example of what I would describe as "genuine timber construction." This form of construction is almost always referred to as "half-timber"; a wholly misleading term because, contrary to the impression

made by modern efforts in the kind (which too often consist of nailing lathes on plaster with a purely decorative or imitative intention to produce what is called "Tudor-style"), the older so-called "half-timber" buildings are really whole-timbered. They were built of wood from the foundation in a self-supporting and highly articulated framework and the spaces between the timbers were filled in with clay, mud, stone, brick or plaster according to the neighbour-

hood; whatever its thickness the wall had no supporting function except through the timber uprights. Just how many hundreds of years old this particular example is I know not, but we get a clue from the knowledge that on the night before he was burnt at the stake Bishop Hooper sheltered beneath its roof—and that was in 1555. The Gloucester Corporation have recently had the Lodging converted into a museum, and electric lighting and heating now do duty

"Just like
a magnet—"



—was what the foreman said when he started his first job with BOSTIK. He was fixing insulating panels *direct* to a brick wall. Both were treated with BOSTIK 292C, and the "pull" of an adhesive which can grip with a

strength like that of a magnet literally staggered the phlegmatic British workman. This tremendous surface adhesion is only one characteristic of BOSTIK, the really waterproof adhesive plus sealing compound that started a new era in—

the bonding of rubber to concrete, the fixing of all types of floor-covering to metal, wood and stone, the bonding of panellings to plasters, wood or brick.

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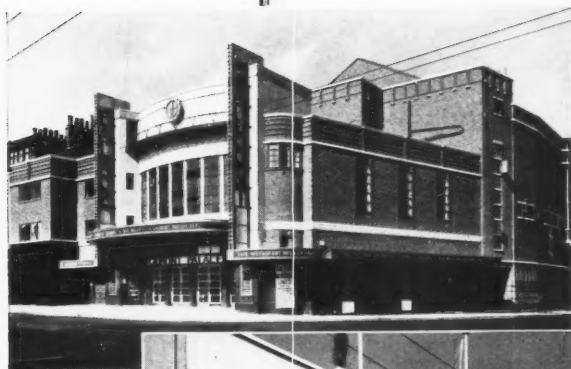
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CAST STONE

by

TROY COURT, KENSINGTON

Architect - - - Michael Rosenauer



GAUMONT PALACE,
DONCASTER

Architect:
W. E. Trent,
F.R.I.B.A.



BRITISH HOME STORES,
BOURNEMOUTH

Architect:
A. L. Farman, A.R.I.B.A.



PARAMOUNT THEATRE, GLASGOW

Architects: F. T. Verit & S. Beverley, F.R.I.B.A.

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where once ye olde log fire burned and the wax candles flickered. The architects for the modernisation were H. Stratton Davies and H. F. Trew. Beaven and Sons, of Gloucester, were the electrical contractors and Callender's Cable and Construction Co. supplied the cables.



In A.D. 1555—it was here that Bishop Hooper sheltered the night before he was burnt at the stake.

"Romance of Wood"

Conditions have just been issued by the Timber Development Association of a competition for an essay, not more than 5,000 words in length, entitled the "Romance of Wood." The assessors are Lord Iliffe, C.B.E., Mr. N. A. Cox, M.A., Dr. Frank Jane, B.Sc., and Mr. E. H. Boulton, M.A., and the following premiums are offered: First prize, £100; second prize, £25; five prizes of £10 each and ten prizes of £2 each. The latest date for the submission of manuscripts is Monday, February 24.

Application for particulars and conditions of the competition should be made to the Technical Director, Timber Development Association, 69-73, Cannon Street, London, E.C.4. The envelope should be marked "Romance of Wood—Competition."

teatural Profession and the E.L.M.A. Lighting Service Bureau. The conferences will be held in the recently reconstructed Bureau lecture theatre at 2, Savoy Hill, W.C.2. The meetings for February are as follows:—Wednesday, February 5—"Recent Experiences in Lighting Practice." Speakers, J. R. Leathart, Oliver P. Bernard, F. J. Blundell Harland and E. B. O'Rorke.

Wednesday, February 12—"Glass in Relation to Lighting in Architecture." Discussion opened by C. Lovett Gill: principal speaker, B. P. Dudding (President of the Institute of Glass Technology).

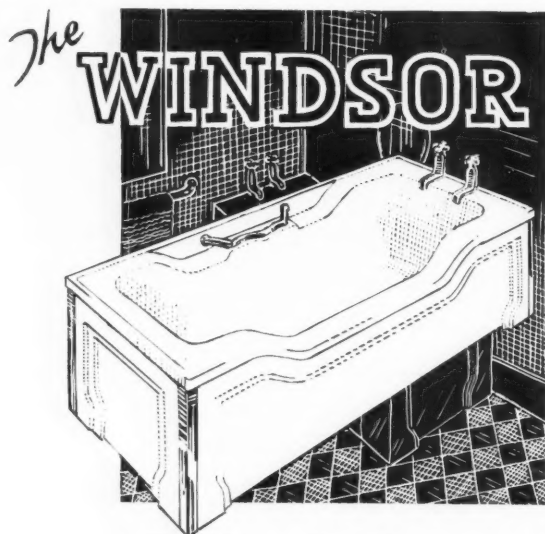
Wednesday, February 19—"The Application of Architectural Lighting to Existing Buildings." Discussion opened by Joseph Emberton: principal speaker, R. O. Sutherland. The Lighting Service Bureau ask that application for seats be made as early as possible. The conferences commence at 7.30 on each evening and between 6.30 and 7.30 cold buffet will be available. I should, perhaps, add that there are no fees or formalities connected with these conferences.

Architects' Conferences on Lighting

A series of conferences on electric lighting have been arranged by the Joint Lighting Committee of the Archi-

"Fabric Party" at the Savoy

I was invited to a new kind of party on January 2nd—a Fabric Party. Mine host was the Old Bleach Linen Company of Randalstown in Northern Ireland. We were shown an extremely fascinating range of new



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TRADE AND CRAFT

furnishing fabrics. Let me be one of the first to congratulate the O.B. directors on having co-opted such capable designers as Paul Nash, Marion Dorn and many others. Particularly well did I like the design by Marion Dorn named "Chorale"—a photograph of which I reproduce on this page—the nursery linens introducing "Winnie-the-Pooh" characters from A. A. Milne's story book, and a very jolly design with quaint little penguins chasing one another all over the fabric. I can speak from experience of the serviceability of linen as a fabric for upholstery and curtaining, as I have used it myself in many decorative schemes over the past ten years, and I am therefore the more pleased to find that so excellent a range of new designs is now available.

"Chorale"—a new fabric design by Marion Dorn for The Old Bleach Linen Company.



Through the Letter Box

A most attractively produced brochure has been sent to me by the Architectural Department of Nobel Chemical Finishes, Ltd. In the foreword the manufacturers say "We invited Mr. Chermayeff to give us his views on colour and its application to modern building. We believe that this book written, illustrated and produced by Mr. Chermayeff, will prove of general interest to the profession. The controversial views, as well as the practical suggestions, contained here may obtain for us the opinions and

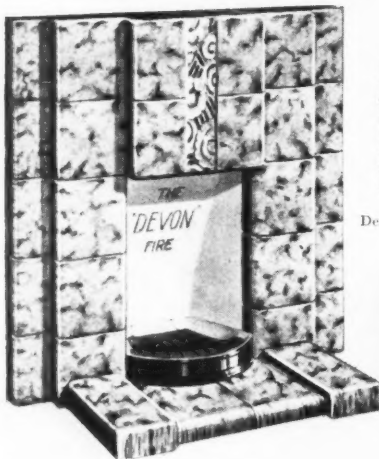
suggestions of others who are professionally interested in colour and its use." If more manufacturers would enlist the collaboration of architects in the production and presentation of their catalogues and advertising

literature, my morning post would be a great deal less tedious. Application for copies of this brochure, which is entitled *Decoration of To-day: No. 3*, should be addressed to Nobel House, Buckingham Gate, S.W.1.

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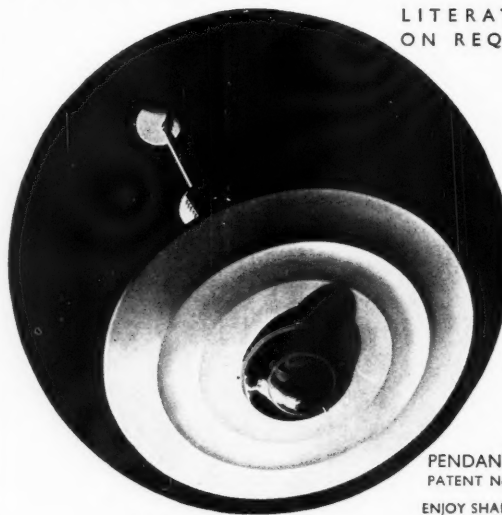
Write for the Devon Fire catalogue—illustrated, free—and for the name and address of your nearest ironmonger holding stocks of Devon Fires to Candy & Co. Ltd., Dept. N, Devon House, 60 Berners Street, Oxford Street, W.1.

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WOOD





Photograph by Humphrey and Vera Joel

ILLUSTRATED in this Supplement are 72 different kinds of constructional and decorative Timbers, arranged in alphabetical order and indexed, with technical information relating to their properties and uses. The technical information has been compiled from the most authoritative sources by the Timber Development Association, and it is hoped that the Supplement will prove a useful and convenient reference for architects, builders, designers, engineers and anyone who specifies and uses wood.

The Timber Development Association is a non-commercial organisation. It is not in any way concerned with the sale of any particular kind of woods. But it is equipped to provide technical information regarding the character, use, treatment and durability of wood.

A special research section is devoted to experimental research work in connection with new uses for

timber in every field of architectural and industrial activity.

Its Information Bureau is subdivided into specialised groups which deal with timber in relation to :

- (1) **BUILDING INDUSTRY** (including such allied activities as architectural decoration and furnishing).
- (2) **TRANSPORT** (including all railway equipment, and road and rail vehicle construction).
- (3) **SHIPBUILDING**.
- (4) **AGRICULTURE** (the employment of timber in connection with all branches of farming, and poultry farming).

Enquiries should be addressed to The Technical Director, The Timber Development Association Limited, 69-73 Cannon Street, London, E.C.4.

Telephone : City 2714.

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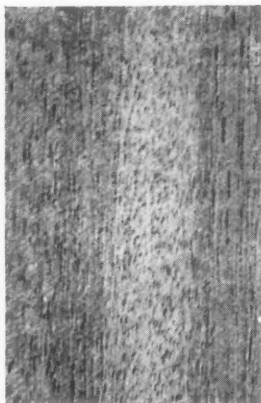
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Photograph by Eric Hosking

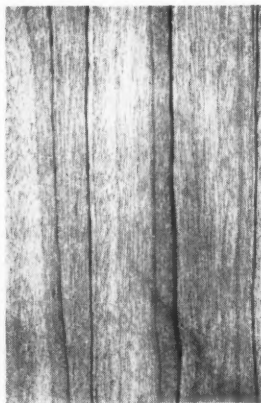
AFRICAN MAHOGANY

GENERAL PROPERTIES: *Colour.* Pinkish when first cut, darkening to reddish brown and rich mahogany on exposure. *Figure.* Often has a high "broken and mottle," or "fiddle-back" figure. *Workability.* Varies in hardness and working qualities. Turns well and lends itself to veneer cutting. *Durability.* Good. *Seasoning.* Seasons well. *Wt. per cu. ft.* 35-45 lbs. air dry. *Strength.* Good. **SIZE AND AVAILABILITY:** Squared logs 12 ft.-24 ft. long and sides of 20 in. up. **USES:** Furniture, cabinet making, panelling, joinery, interior decorative work, counter tops, chairs, fittings, turned work, mouldings, hand rails, veneers. **FINISHES:** Polishes well.

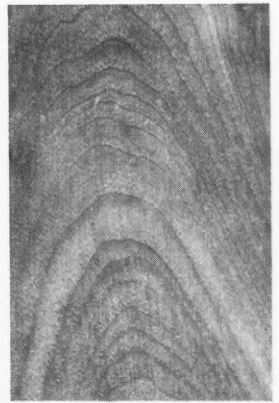
**AFRICAN WALNUT**

Benin Walnut. Nigerian Walnut

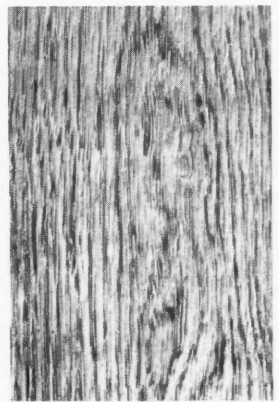
GENERAL PROPERTIES: *Colour.* Golden brown with dark brown and black bands. *Figure.* Ribbon, "blister" or "mail." *Workability.* Medium texture, works fairly well, quarter sawn stock has a tendency to "pick up." Nails well. Veneers well. *Durability.* Chiefly used for furniture; white ant proof. *Seasoning.* Seasons moderately well, may warp but shrinks little. *Wt. per cu. ft.* 35 lbs. approx. *Strength.* Good. **SIZE AND AVAILABILITY:** Logs 24 in.-36 in. square. Logs 12 ft.-20 ft. long. **USES:** Furniture, cabinets, chairs, counter tops, joinery, panelling. **FINISHES:** Properly filled takes a good polish. Takes stain well.

**AMERICAN BLACK WALNUT**

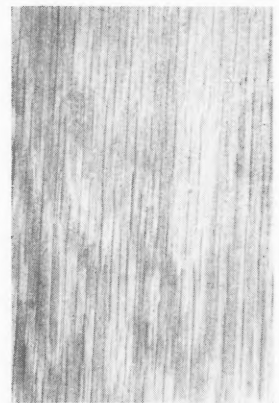
GENERAL PROPERTIES: *Colour.* Golden-brown with dark streaks. *Figure.* Highly figured, ranging from roll, mottle and burrs. *Workability.* Works easily, has a hard, fine texture and finishes to a fine surface. *Durability.* Excellent. *Seasoning.* Seasons well with little trouble. *Wt. per cu. ft.* 39 lbs. 12 per cent. M.C. **SIZE AND AVAILABILITY:** Logs, 6 ft. and up in length; lumber 6 in.-7 ft., 5 in. and wider. **USES:** Panelling, furniture, cabinets, flooring, carving, and turnery. **FINISHES:** Takes a very fine polish.

**AMERICAN RED OAK**

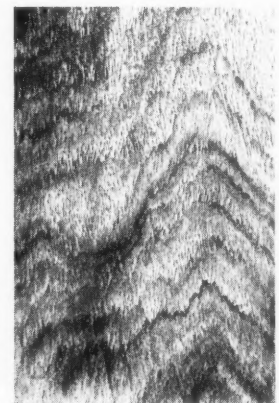
GENERAL PROPERTIES: *Colour.* Light brown, to reddish brown. *Figure.* Silver grain, not so pronounced as in English Oak. *Workability.* Works easily, glues well, fairly coarse-grained. *Durability.* Not durable when in contact with the ground or when exposed to the weather. *Seasoning.* Requires care in seasoning. *Wt. per cu. ft.* 41 lbs. 12 per cent. M.C. *Strength.* Strong when fast grown. **SIZE AND AVAILABILITY:** Lengths, 4 ft.-16 ft.; widths, 3 in. and up. **USES:** Interior joinery, furniture, cheap cooperage, general construction. **FINISHES:** Polishes well after filling, takes stain and paint.

**AMERICAN WHITE OAK**

GENERAL PROPERTIES: *Colour.* Yellowish light brown. *Figure.* Marked silver grain when quarter sawn. *Workability.* Heavy hard wood, rather coarse-grained, does not split easily, works well. *Durability.* Excellent. *Seasoning.* Seasons well. *Wt. per cu. ft.* 48 lbs. 12 per cent. M.C. *Strength.* Excellent. 4 ft.-16 ft.; widths, 3 ft. and up. **USES:** Flooring, panelling, furniture, tight and loose cooperage, general construction purposes, interior decoration, etc. **FINISHES:** Requires filling; otherwise polishes, varnishes, and stains well.

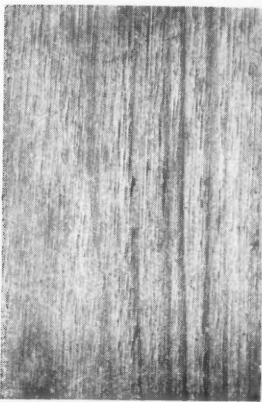
**ANDAMAN PADAUK**

GENERAL PROPERTIES: *Colour.* Deep crimson with varying shades of brown to red, occasionally streaked, turning to dark brown on exposure. *Figure.* Ribbon and curl. *Workability.* Coarse to medium even texture, saws and works well, though interlocking fibres make it a little difficult. Turns well. *Durability.* Good under most conditions (does not resist Teredo). *Seasoning.* Seasons well, either by air- or kiln-drying. *Wt. per cu. ft.* 45-48 lbs. air dry. *Strength.* Very strong. **SIZE AND AVAILABILITY:** Squares up to 35 ft. long 36 in. side. Usually 16 ft. to 23 ft. long by 18 in. to 30 in. square. **USES:** Decorative. Interior fittings, panelling, office and bank furniture, railway coach decoration, cabinet work, turnery. *Constructional.* Flooring, house building, staircases. **FINISHES:** Takes a high polish after suitable filling.

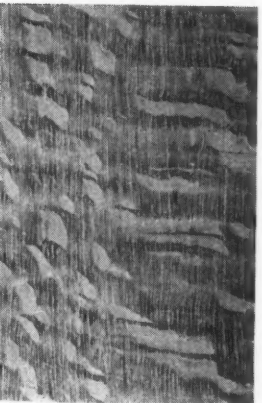


**ASH**

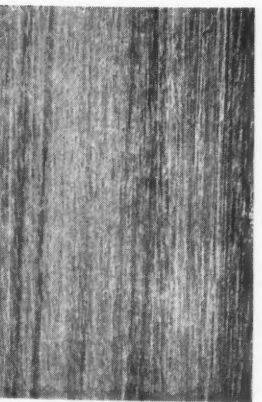
GENERAL PROPERTIES: *Colour.* White to light brown often tinged with pink. *Figure.* Due to alternate bands of porous spring wood and dense summer wood. *Workability.* Saws and machines readily, turns and cleaves well. *Durability.* Not durable when exposed, but preserves fairly well. *Seasoning.* Seasons fairly well and quickly, but tends to "shake" along the heart and to "cup." Can be reconditioned by high temperature steaming. *Wt. per cu. ft.* 35-55 lbs. *Strength.* Great toughness and elasticity. Good for all purposes where shock resistance is important. **SIZE AND AVAILABILITY.** Clean logs up to 20 ft. and over, and up to 2 ft. in diameter. Also planks and scantlings. **USES.** *Decorative.* Burns, for cabinet and furniture veneers. *Constructional.* Vehicles, farm implements, aircraft, sports goods, tool handles, hoops and barrels. **FINISHES.** Stains, paints, varnishes and polishes well.

**AUSTRALIAN BLACKWOOD**

GENERAL PROPERTIES: *Colour.* Reddish-brown to almost black, streaked with yellow brown, red or black. *Figure.* Often attractively figured "fiddleback." *Workability.* Fairly straight-grained, works well, turns and carves and finishes well. *Durability.* Good. *Seasoning.* Requires care as it is liable to warp. *Wt. per cu. ft.* 36-50 lbs. *Strength.* Good, especially in transverse-bending. **SIZE AND AVAILABILITY.** According to requirements; flooring or planks. **USES.** Furniture, cabinet work, decorative borders for floors, panelling, shop-fittings. **FINISHES.** Polishes excellently, having a satiny sheen.

**AUSTRALIAN SILKY OAK**

GENERAL PROPERTIES: *Colour.* Light brown with a pinkish tinge. *Figure.* Large silver fleck on quarter sawn surfaces. *Workability.* Rather coarse, even textured, but soft, easy and light to work. Nails well. *Durability.* Durable when not in contact with the ground. *Seasoning.* Seasons readily and not liable to check or shake. *Wt. per cu. ft.* 36-39 lbs. *Strength.* Moderate. **SIZE AND AVAILABILITY.** Boards and planks 6 in.-18 in. wide, 1 in.-8 in. thick, 8 ft. and up in length. Available quarter or plain sawn. **USES.** Cabinet making, panelling, furniture, carving, veneering. In Australia used for joinery and interior work. **FINISHES.** Stains and polishes well but does not respond to fuming.

**AUSTRALIAN WALNUT***Queensland Walnut*

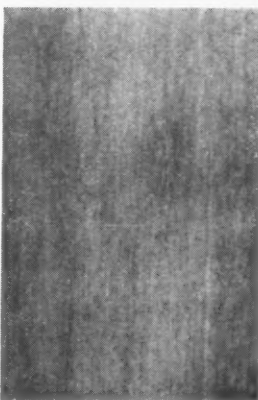
GENERAL PROPERTIES: *Colour.* Reddish brown to black with black streaks. *Figure.* Often has a strong "mackerel back" figure. *Workability.* Hard to cut, wavy or curly grain with interlocked fibres. Turns well, has a high percentage of silica. *Durability.* Not durable in contact with the ground. *Seasoning.* Seasons quickly, but requires care. *Wt. per cu. ft.* 41-49 lbs. *Strength.* Good. **SIZE AND AVAILABILITY:** In boards, planks and logs according to size of the tree. **USES:** Panelling, joinery, furniture, cabinets, veneering, electrical switch boards. **FINISHES:** Takes a good finish and polish.



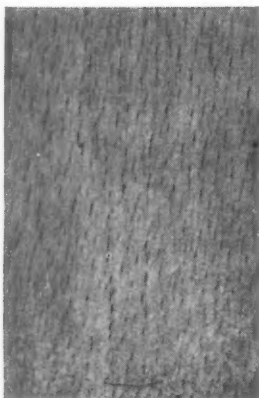
Photograph by Eric Hosking

**BALD CYPRESS***Red Cypress. Yellow Cypress*

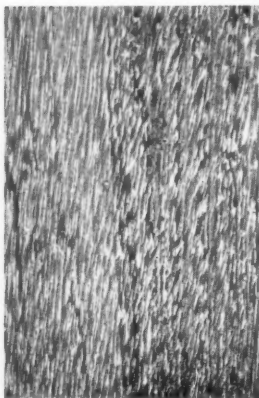
GENERAL PROPERTIES: *Colour.* Varies from almost white to reddish-brown or nearly black. *Figure.* None, or slight. *Workability.* Generally straight grained, light, soft, easy to work, glues well. *Durability.* Exceptional. *Seasoning.* Moderately easy to season. *Wt. per cu. ft.* 32-51 lbs. green. *Strength.* Not very strong, fairly good for its weight. **SIZE AND AVAILABILITY.** Lumber varying sizes and lengths up to 20 ft. **USES.** Tank construction, cooperage, greenhouses, silos, vats, posts, poles, fences, sleepers, shingles, etc. **FINISHES:** Takes paint well, and planes to a smooth finish.

**BASSWOOD**

GENERAL PROPERTIES: *Colour.* Light brown heartwood, nearly white sapwood. *Figure.* Slight, if any. *Workability.* Soft, generally straight-grained, fine texture, works easily, steams and bends well. Finishes to a smooth surface. *Durability.* Not durable when exposed. *Seasoning.* Care needed because of liability to warp and split. *Wt. per cu. ft.* 30 lbs. *Strength.* Not strong. **SIZE AND AVAILABILITY.** Variable according to size of tree. **USES.** Bent woodwork. Carriage construction. Cabinet work. Interior finishing. Furniture. Plywood. Wood-carving. Pulp. **FINISHES:** Takes stain and paint well.

**BEECH** *English Beech*

GENERAL PROPERTIES: *Colour*, Whitish or pale brown to light reddish brown. *Figure*, Rays appearing as flecks. *Workability*, Works fairly readily with all tools. Easily steam bent. *Durability*, Not normally durable when exposed; stands complete immersion in water. Useful for sea work. *Seasoning*, Requires care. In air-drying treat ends with moisture-resisting paint. *Wt. per cu. ft.*, 40-55 lbs. *Strength*, Good for weight. Excellent. *SIZE AND AVAILABILITY*, Planks and scantlings, 1 in.-6 in. thick, widths and lengths according to size of logs. *USES*, Chairs, furniture, block flooring. *FINISHES*, Stains and polishes well. Colour deepens when steamed.

**BLACK BEAN**

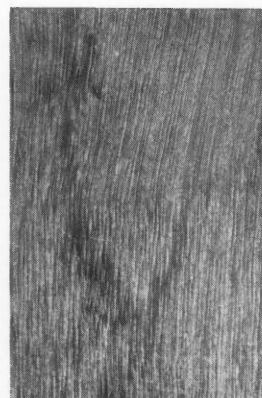
GENERAL PROPERTIES: *Colour*, Dark brown, streaked or mottled with black. *Figure*, None. *Workability*, Hard, straight-grained, moderately heavy, easy to work; difficult to glue owing to greasy nature, but finishes with a good surface. *Durability*, Durability good, either exposed or in contact with the ground. *Seasoning*, Difficult to season; requires great care. *Wt. per cu. ft.*, About 48 lbs. *Strength*, Excellent. *SIZE AND AVAILABILITY*, In boards and planks 8 ft. and upwards in length; 6 in.-18 in. in width. *USES*, Panelling, decorative work, veneers, furniture, carved work. Excellent for electrical work due to insulating properties. *FINISHES*, Takes an excellent and lasting polish.



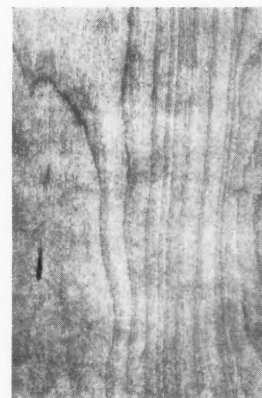
Photograph by Eric Hoskin

BORNEO
CAMPHORWOOD*Kapor. Kapur*

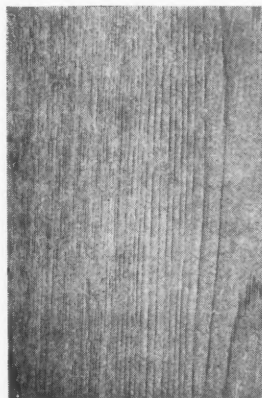
GENERAL PROPERTIES: *Colour*, Brownish-red in colour. *Figure*, Plain. *Workability*, Generally straight grained; moderately hard; tough; works fairly easily, requires care in finishing as the grain is liable to "pluck." *Durability*, Unsuitable for use in contact with the ground. Difficult to impregnate. *Seasoning*, Reported to be difficult to season. *Wt. per cu. ft.*, 40-50 lbs. *Strength*, Moderately hard, with medium strength value. *SIZE AND AVAILABILITY*, Logs up to 4 ft. in diameter and planks from 1 in. 6 in. in thickness. *USES*, For floorings, construction work, railway carriage members. *FINISHES*, Finishes with care, and responds to wax treatment.

**CANADIAN BIRCH***Yellow Birch. Quebec Birch*

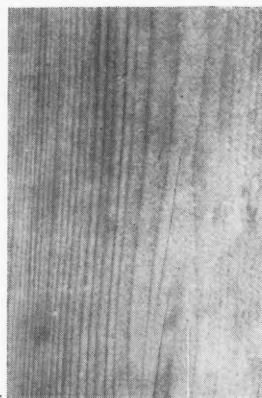
GENERAL PROPERTIES: *Colour*, Light to dark reddish brown. *Figure*, Wavy or curly grained. *Workability*, Works easily and cleanly. Holds nails and glues well. *Durability*, Not durable when exposed; treats readily with creosote. *Seasoning*, Difficult. *Wt. per cu. ft.*, 45 lbs. *Strength*, Very strong and tough. Shock resistant. *SIZE AND AVAILABILITY*, Logs up to 16 ft. Planks from 1 in.-4 in. thick, 4 in. and wider, and 9 ft. long and up. *USES*, Flooring, furniture, veneers, ladder-rungs, aeroplane construction. *FINISHES*, Polishes highly, stains, paints and enamels well.

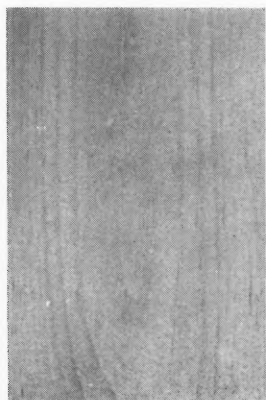
**CANADIAN ROCK ELM***Cork Elm. White Elm*

GENERAL PROPERTIES: *Colour*, Light brown. *Figure*, Not so pronounced as Common Elm. *Workability*, Tough, straight-grained, dense, not easy to work when dry, finishes fairly well, holds nails well. Flexible. *Durability*, Very durable under water. *Seasoning*, Difficult to season, tending to split, warp and shrink. *Wt. per cu. ft.*, About 45 lbs. *Strength*, Excellent, dense, tough, resistance to abrasion. *SIZE AND AVAILABILITY*, Round logs of good dimensions. *USES*, Dock and wharf construction, fenders, rubbing strips, rowing boats, bent work in van and motor building, etc., agricultural implements, cooperage, crates, sills. *FINISHES*, Takes stain and paint well, is capable of a high polish.

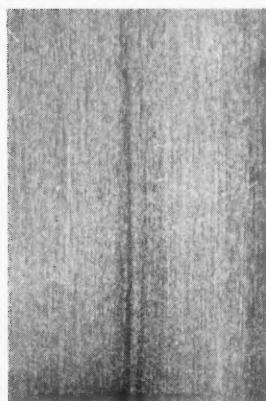
**CANADIAN SPRUCE***Quebec Spruce. White Spruce*

GENERAL PROPERTIES: *Colour*, White. *Figure*, Not prominent. *Workability*, Straight-grained light, easy to work, finishes well, and has good nail-holding properties. *Durability*, Negative and difficult to creosote. *Seasoning*, Seasons well but liable to warp. *Wt. per cu. ft.*, 25-30 lbs. air dry. *Strength*, Strong for its weight. *SIZE AND AVAILABILITY*, Deals up to 11 in. wide and 6 ft. and up long. *USES*, General construction purposes, scaffolding, joinery, carcassing, shelving; special material for piano sounding boards, violins, etc. Box and case and fruit containers. Oars, paddles and ladders. Wood pulp. *FINISHES*, Takes paint, stain and varnish well.

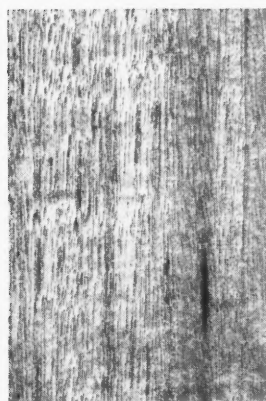


**CANADIAN WHITE PINE***Quebec Pine. Yellow Pine*

GENERAL PROPERTIES. *Colour*, Pale straw colour. *Figure*, Little or none. *Workability*, Straight grained, works easily with all tools, takes nails and screws without splitting. *Durability*, Moderately durable in contact with the ground. *Seasoning*, Seasons well with little shrinkage or warping. *Wt. per cu. ft.*, 24 lbs. *Strength*, Good for its weight. *SIZE AND AVAILABILITY*, In all forms of manufactured lumber in lengths from 6 ft. to 16 ft. *USES*, Joinery work, drawing boards, cores, background for veneers, grain and flour milling equipment, pattern making, etc. *FINISHES*, Takes stain, paint and polish excellently.

**CANARY WHITEWOOD***Whitewood*

GENERAL PROPERTIES. *Colour*, Light yellow, or greenish brown. *Figure*, Depends on colouring, occasionally "bilster" figure. *Workability*, Straight grained, soft, easy to work, finishes well. *Durability*, Not durable when in contact with the ground. *Seasoning*, Requires time and care. *Wt. per cu. ft.*, 28 lbs. 12% M.C. *Strength*, Not strong. *SIZE AND AVAILABILITY*, Large sizes available up to 16 ft. in length. *USES*, Furniture, cabinet work, plywood cores, interior joinery, backs and sides of drawers, etc. *FINISHES*, Takes stain, paint and varnish well.

**CRABWOOD**

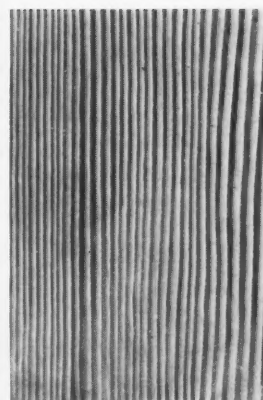
GENERAL PROPERTIES. *Colour*, Uniform reddish-brown. *Figure*, Ribbon figure. *Workability*, Usually straight grained, works well, takes nails and glues well. Turns and planes to a good finish, yields a glossy and lustrous surface. *Durability*, Durable. *Seasoning*, Requires care and proper methods. *Wt. per cu. ft.*, 37-50 lbs. *Strength*, Similar to American Black Walnut. *SIZE AND AVAILABILITY*, Upland timber logs up to 40 ft. by 9 in. to 14 in. *USES*, Similar to mahogany. Properly seasoned suitable for joinery work, furniture and cabinet work. Used successfully for motor-body building and showcases. *FINISHES*, Stains excellently, takes paint well, needs care in sandpapering for a smooth finish.

**DOUGLAS FIR [Flat Sawn]***British Columbian Pine. Oregon Pine*

GENERAL PROPERTIES. *Colour*, Pink, toning down to light reddish-brown. *Figure*, When flat sawn or cut into veneer Douglas Fir has an ornamental value. *Workability*, Comparatively well, machines well, usually requires sanding. *Durability*, Requires preservation for exposed work. *Seasoning*, Rapidly, kiln temperature should not be high. *Wt. per cu. ft.*, 30-33 lbs. *Strength*, Strong. *SIZE AND AVAILABILITY*, Marketed from 1 in. boards to squared logs and spars. A wide variety of dimensions obtainable, often clear of defects. *USES*, Doors, panelling, plywood, furniture, interior fittings, flooring (edge grain), bridges, wharves and piling, masts and spars, sleepers, wood blocks, vats and tanks, etc. *FINISHES*, Stains, varnishes and polishes well. Does not take paint well as grain shows through the paint.



Photograph by courtesy of the High Commissioner for Canada

**DOUGLAS FIR***[Rift Sawn]**British Columbian Pine. Oregon Pine*

GENERAL PROPERTIES. *Colour*, Pink, toning to light reddish-brown. Rift sawing produces edge grain or straight grained timber. For flooring Douglas Fir should always be rift sawn, or the grain will lift and the wood wear. *Figure*, Prominent. *Workability*, Comparatively well, machines well, usually requires sanding. *Durability*, Requires preservation for exposed work. *Seasoning*, Rapidly, kiln temperature should not be high. *Wt. per cu. ft.*, 30-33 lbs. *Strength*, Strong. *SIZE AND AVAILABILITY*, Marketed from 1 in. boards to squared logs and spars. A wide variety of dimensions obtainable, often clear of defects. *USES*, Doors, panelling, plywood, furniture, interior fittings, flooring (edge grain), bridges, wharves and piling, masts and spars, sleepers, wood blocks, vats and tanks, etc. *FINISHES*, Stains, varnishes and polishes well. Does not take paint well as grain shows through.

**EAST AFRICAN****CAMPBOR**

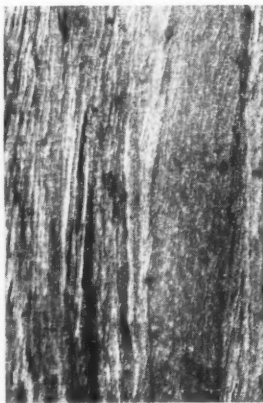
GENERAL PROPERTIES. *Colour*, Brown, deepening on exposure. *Figure*, "Stripe" when quarter sawn. *Workability*, Works moderately well, requires sharp tools in finishing. *Durability*, Moderate. *Seasoning*, Fairly easy to season. *Wt. per cu. ft.*, 34-36 lbs. *Strength*, Good for its weight. *SIZE AND AVAILABILITY*, In planks and log form, varying according to size of logs. Lengths from 6 ft. to 18 ft. *USES*, Interior joinery work, mouldings, etc. *FINISHES*, Requires "filling" but gives a good polish.



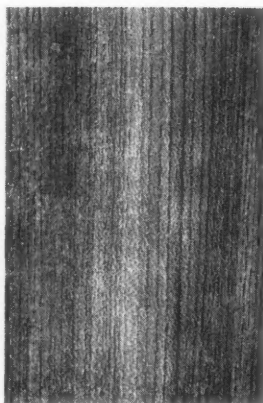
Photograph by Eric Hosking

EAST AFRICAN OLIVE*Mushage*

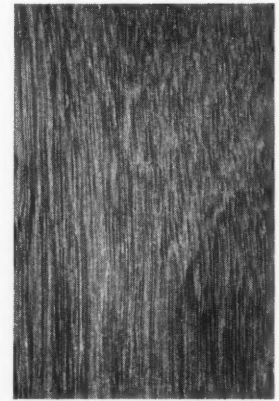
GENERAL PROPERTIES: *Colour*. Yellowish-brown, with irregular black markings. *Figure*. Chiefly dependent on colour streaks. *Workability*. A heavy hard wood, fairly easy to work with suitable tools, turns well. *Durability*. Not durable in the ground. *Seasoning*. Requires care. *Wt. per cu. ft.* 56-60 lbs. *Strength*. Excellent. *SIZE AND AVAILABILITY*. Lengths up to 14'; widths, 10" and wider. *USES*. Furniture, panelling, flooring, turnery, wagon flooring. *FINISHES*. Polishes to a marble-like appearance.

**ELM***Common or English*

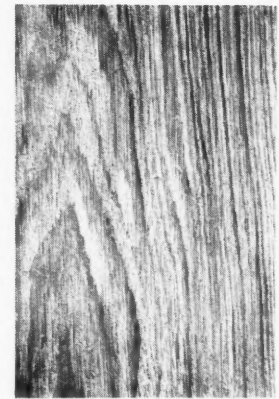
GENERAL PROPERTIES: *Colour*. Dull reddish brown. *Figure*. Grain often "swirly" and decorative. *Workability*. Common elm is rather coarse, more difficult to convert than Wych Elm, which has straighter grain. Both work well and glue well. *Durability*. Durable if kept thoroughly wet or thoroughly dry. *Seasoning*. Both season readily but inclined to warp. Reconditioning will usually remove this. *Wt. per cu. ft.* 33-43 lbs. *Strength*. Good, tough and elastic. Wych Elm is superior. *SIZE AND AVAILABILITY*. Logs up to 25' long and from 2'-3' diameter. *USES*. Wharf construction, sea groynes, piles. Weather-boarding, wagon building, barge planking, chair seats, coffins, chests, anvil blocks, etc. *FINISHES*. Takes stain, paint and varnish well. Polishes well.

**ENG***In*

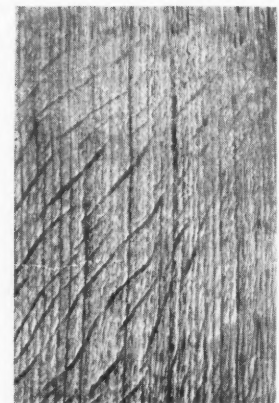
GENERAL PROPERTIES: *Colour*. Reddish-brown, darkening on exposure. *Workability*. Straight-grained, even-textured wood, saws and machines well, finishing to a good surface. *Durability*. Not durable under exposed conditions. *Seasoning*. Care is required and time. Liable to warp and shrink in the process. Must be reduced to proper moisture content for the work to be done. *Wt. per cu. ft.* About 53 lbs. *Strength*. Heavy, hard, and strong. *SIZE AND AVAILABILITY*. Obtainable in log and in converted form. *USES*. Constructional work, boat-building, wagon flooring, staircase treads, flooring, heavy fittings, etc. *FINISHES*. Similar to but does not polish so well as Gurjun.

**ENGLISH OAK***[Plain Sawn]*

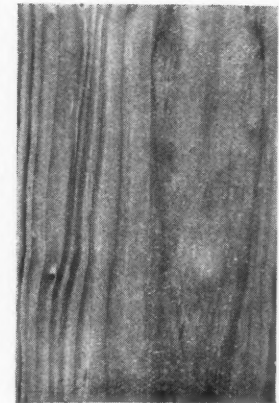
GENERAL PROPERTIES: *Colour*. Light yellow-brown to deep warm brown. *Figure*. Plain-sawn oak shows no silver grain. *Workability*. Works fairly well, finishes to a good surface, glues well, holds nails and screws well. *Durability*. Heartwood is exceptionally so, not durable in contact with acids. *Seasoning*. Requires careful drying: rather intolerant of high initial heat when green. *Wt. per cu. ft.* About 40-50 lbs. air dry. *Strength*. Excellent. *SIZE AND AVAILABILITY*. Logs converted according to length and girth, varying from 1/2" to 6" thickness. *USES*. Decorative. Veneers, panelling, wainscoting, carving, furniture. *Constructional*. Beams, rafters, gates, doors, carriage framing, fencing, etc. *FINISHES*. Stains well, lends itself to fuming, liming and silver treatment.

**ENGLISH OAK***[Quarter Sawn]*

GENERAL PROPERTIES: *Colour*. Light yellow-brown to deep warm brown. *Figure*. Prominent silver grain when quarter sawn. *Workability*. Works fairly well, finishes to a good surface, glues well, holds nails and screws well. *Durability*. Heartwood is exceptionally so, but durable in contact with acids. *Seasoning*. Requires careful drying: rather intolerant of high initial heat when green. *Wt. per cu. ft.* About 40-50 lbs. air dry. *Strength*. Excellent. *SIZE AND AVAILABILITY*. Logs converted according to length and girth, varying from 1/2" to 6" thickness. *USES*. Decorative. Veneers, panelling, wainscoting, carving, furniture. *Constructional*. Beams, rafters, gates, doors, carriage framing, fencing, etc. *FINISHES*. Stains well, lends itself to fuming, liming and silver treatment.

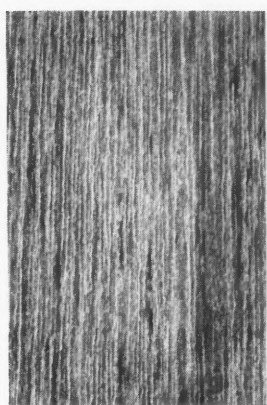
**EUROPEAN LARCH**

GENERAL PROPERTIES: *Colour*. Heartwood pale reddish brown to brick red. Sapwood light yellow. *Figure*. Slab-sawn shows figure similar to Douglas Fir. *Workability*. Not easy owing to its resinous nature—finishes well, but knots are hard and tend to dull cutters. Glues and nails well. *Durability*. Exceptional, difficult to impregnate. *Seasoning*. Seasons easily and well but knots tend to split and loosen. Can be dried rapidly. With care, does not check or split. *Wt. per cu. ft.* 35-48 lbs. air dry. *Strength*. Good, very tough. *SIZE AND AVAILABILITY*. Clean logs up to 18" diameter. Conversion according to specification. *USES*. Fences, gates, posts; out-buildings, mining timbers, scaffolding; keelsons and planking of lifeboats. Breakwaters, wharves, piling, telegraph and power lines, garden rustic work. *FINISHES*. Takes stain, paint and varnish well.

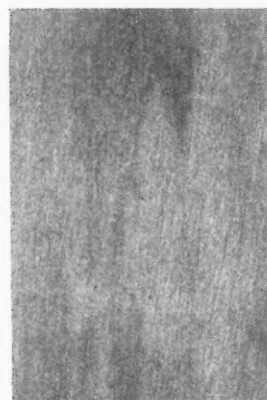


**GREENHEART**

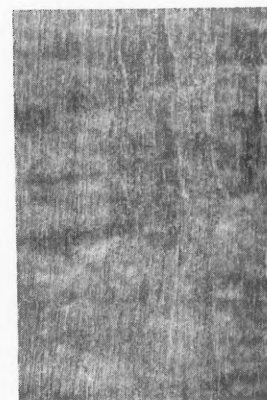
GENERAL PROPERTIES. *Colour.* Light to dark olive green, marked with brown and black streaks. *Figure.* Variation of colour only. *Workability.* Hard, straight-grained, even texture, difficult to cut, planes well, but too hard for nailing, tendency to split during conversion. *Durability.* Exceptional, especially in contact with sea water. Resists marine borers more than other timbers. *Seasoning.* Care necessary owing to tendency to check and split. *Wt. per cu. ft.* 60-75 lbs. *Strength.* Exceedingly strong, stiff, in small dimensions very flexible. **SIZE AND AVAILABILITY.** Logs up to 45 ft.-60 ft., 12 in.-14 in. square. **USES.** Piling, wharf and bridge construction, fences, flooring, spokes, stair treads, fishing rods. **FINISHES.** Requires careful polishing.

**GURJUN**

GENERAL PROPERTIES: *Colour.* Red to dull reddish brown, sapwood pale reddish white. *Figure.* Little or none. *Workability.* Saws and works easily, can be finished to a good surface. *Durability.* Durable only when under cover. Easily impregnated with creosote. *Seasoning.* Takes time, but seasons moderately well. *Wt. per cu. ft.* 45-50 lbs. air dry. *Strength.* Excellent. **SIZE AND AVAILABILITY.** Flooring, planks and scantlings up to 30 ft. long and 20 ins. wide. Longer lengths are available. **USES.** Flooring, parquet or strip, staircases, wagon building and constructional purposes. **FINISHES.** Difficult to polish because of resins and oils.

**HALDU**

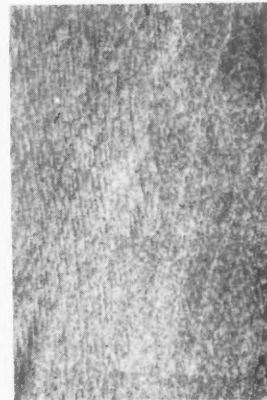
GENERAL PROPERTIES. *Colour.* Yellow, darkening on exposure. *Figure.* Roll figure, common. *Workability.* Fairly straight-grained wood, sometimes with interlocking fibres. Works well with all machines, curves and turns well. Light and moderately hard. *Durability.* Good under cover; moderately durable in exposed places, fairly immune to white ants. *Seasoning.* Seasons well with care, slight tendency to warp and check. *Wt. per cu. ft.* About 42 lbs. air dry. *Strength.* Good for its weight. **SIZE AND AVAILABILITY.** In long logs, and in converted form. **USES.** Turnery work, brush backs, carved mouldings. Light coloured furniture, fittings for rooms, etc. Used for telegraph and telephone instruments. Extensively used in India for all sorts of purposes. **FINISHES.** Polishes well. To retain natural colour, a white polish should be used. Takes stain well.

**HONDURAS MAHOGANY**

GENERAL PROPERTIES. *Colour.* Light red to pale reddish brown, not so dark as Spanish Mahogany. *Figure.* Usually plain, sometimes mottled or showing swirl and crotch also blister and fiddle-back figure. *Workability.* Works easily and well, veneers readily, does not warp or twist. *Durability.* Good. *Seasoning.* Seasons readily, either by kiln or air seasoning methods. *Wt. per cu. ft.* 30-36 lbs. *Strength.* Good. **SIZE AND AVAILABILITY.** 12-22 ft. lengths. Diameter 14-40 in. Usually shipped as sawn timber. The supply of Mahogany is plentiful in some varieties, fairly so in others and still obtainable in the finest qualities. **USES.** Decoration, panelling, veneers, furniture, show cases, shop fittings, cabinet, turnery, propellers. **FINISHES.** Natural finishes, stains, wax, and french polish. High polish readily obtainable.



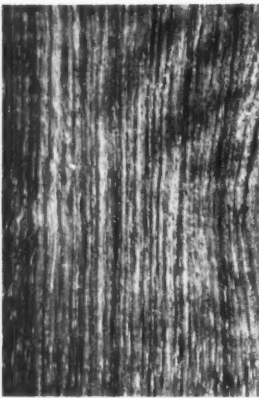
Photograph by Eric Hosking

**HORNBEAM**

GENERAL PROPERTIES. *Colour.* Yellowish-white. *Figure.* Plain, except when quarter sawn. *Workability.* Moderately heavy, hard, tough, commonly cross grained, splits with difficulty, has a fine even texture. *Durability.* Does not stand up to alternate wetting and drying. *Seasoning.* Seasons fairly well. *Wt. per cu. ft.* 45-55 lbs. **SIZE AND AVAILABILITY.** Up to 8 ft. long and 1 ft. and up in width. Also obtainable from the Continent. **USES.** Machinery cogs, pulley blocks, umbrella sticks, whip-stocks. When dyed black is used as a substitute for Ebony for piano keys; has been used in this form for flooring, but not successfully. Sold as Blackwood for inlaying and decoration. **FINISHES.** Takes stain, paint and varnish well.

**INDIAN LAUREL WOOD**

GENERAL PROPERTIES. *Colour.* Dark brown with wavy streaks of darker colour. *Figure.* Ripple and stripey. *Workability.* Firm, even texture, straight or wavy grain, works fairly well, rather difficult to work with hand tools. *Durability.* Moderately durable under exposed conditions. *Seasoning.* Difficult to air-season but kiln seasons well. *Wt. per cu. ft.* 50-60 lbs. **SIZE AND AVAILABILITY.** Logs available from 11 ft. up. **USES.** Cabinet making, furniture, panelling, and interior decoration. **FINISHES.** Takes a high polish.

**INDIAN ROSEWOOD***Bombay Blackwood*

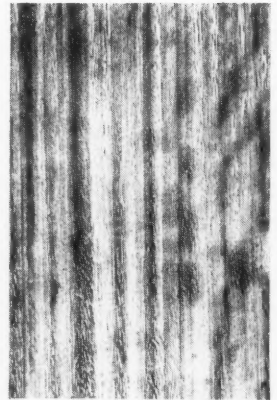
GENERAL PROPERTIES: *Colour*, Dark purplish-brown, with dark markings. *Figure*, Depends upon colouring. *Workability*, Difficult to saw; machines well. Is a hard, heavy wood. Veneers well. *Durability*, Exceptionally durable, rarely attacked by white ants. *Seasoning*, Seasons well. *Wt. per cu. ft.*, 54-56 lbs. *Strength*, A strong wood capable of hard wear. *SIZE AND AVAILABILITY*, In logs 8 ft. to 16 ft. long and 18 in. to 36 in. in diameter. *USES*, High-class furniture, piano work, cabinet making, panelling, parquet flooring, railway carriage decoration. *FINISHES*, Requires filling, but polishes well.

**INDIAN SILVER GREYWOOD**

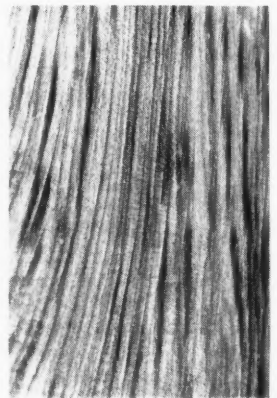
GENERAL PROPERTIES: *Colour*, Grey or smoky yellow brown, mottled and striped with irregular dark-colored markings. *Figure*, Highly ornamental. *Workability*, Works well with machine and hand tools, medium textured, moderately hard and heavy. *Durability*, Moderately so when exposed. *Seasoning*, Air and kiln seasons fairly well, but needs care to prevent end-splitting. *Wt. per cu. ft.*, 40 lbs. average. *Strength*, Medium strength. *SIZE AND AVAILABILITY*, Planks and scantlings up to 16 ft. long and 14 in. wide. *USES*, Cabinets, furniture, panelling, framing, moulbing, joinery, interior public office decoration, railway carriages, yacht fittings, veneers. *FINISHES*, Polishes well, having a beautiful finish.

*Photograph from the Imperial Institute Collection, South Kensington***IROKO**

GENERAL PROPERTIES: *Colour*, Light to dark brown. *Figure*, Good figure when flat sawn. Ribbon figure when rift sawn. *Workability*, Works well with hand and machine tools, quarter sawn material has a tendency to "pick up." Nails, glues and screws well. *Durability*, Good: said to be white-ant proof and fire-resistant. *Seasoning*, Requires care, but is said to kiln-season satisfactorily. *Wt. per cu. ft.*, 38-45 lbs. *Strength*, Excellent, both under compression and bending. *SIZE AND AVAILABILITY*, Logs round or square 12 ft. to 30 ft. or more in length, squaring 15 in. to 42 in. *USES*, Exterior fittings, doors, window frames, and sashes, sills, treads, flooring, if rift-sawn, laboratory benches, kitchen draining boards. Recommended for joinery. *FINISHES*, Polishes and stains well, when filled. Requires sanding for a smooth finish.

**ITALIAN WALNUT**

GENERAL PROPERTIES: *Colour*, Brown, with golden streaks, sometimes with black and purple markings. *Figure*, Ribbon, crotch and burr. *Workability*, Uniform texture, works easily, not brittle, and has no tendency to split. *Durability*, Stands excellently to alternate wetting and drying. *Seasoning*, Requires time and shrinks during the process. *Wt. per cu. ft.*, 40-48 lbs. *Strength*, Strong, tough and elastic. *SIZE AND AVAILABILITY*, Varies according to the log. *USES*, *Decorative*, Veneers panelling, furniture. Also used for rifle butts, but is too valuable for any other purposes. *FINISHES*, Natural, wax and French polished.

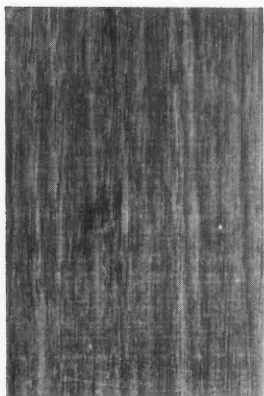
**JAPANESE OAK***Ohnara*

GENERAL PROPERTIES: *Colour*, Lighter than English oak. *Figure*, Not such a pronounced "silver grain" as in English Oak, the rays being smaller. *Workability*, Very even textured, quality good, works easily and well, planes to a smooth finish. *Durability*, Excellent. *Seasoning*, Seasons well, but has a slight tendency to shrink. *Wt. per cu. ft.*, 40-46 lbs. *Strength*, Good for its weight, but not equal to English Oak. *SIZE AND AVAILABILITY*, Squares 8 ft. to 20 ft. from 14 in. to 26 in.; also in boards and planks. *USES*, Flooring, panelling, furniture carving, etc. *FINISHES*, Stains and finishes well.

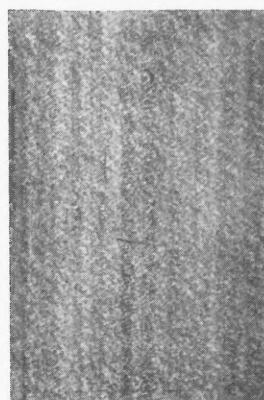
**JARRAH**

GENERAL PROPERTIES: *Colour*, Reddish brown, darkening to a rich mahogany. *Figure*, Occasional figure. *Workability*, When green cuts easily. When dry care is required to obtain a good finish. Turns well and carves well. Generally straight grained. *Durability*, Exceptionally durable, also fire resistant, white ant and Teredo proof. *Seasoning*, With care, seasons satisfactorily. *Wt. per cu. ft.*, About 55 lbs. *Strength*, Excellent, 25% greater resistance to end crushing than Oak (*Quercus pedunculata*). *SIZE AND AVAILABILITY*, Flooring and planks and squared timber lengths from 12 ft. to 22 ft., 2 in. to 9 in. thick. *USES*, Piling, wharf construction, bridge building, flooring, stair newels, door facings, furniture parts, stair treads. *FINISHES*, Finishes well. Takes varnish and requires no stain or filler.

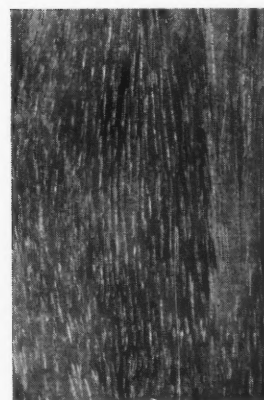


**KARRI**

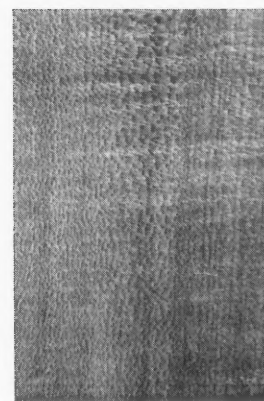
GENERAL PROPERTIES. *Colour*. Reddish-brown. *Figure*. Occasional curly, or wavy figure. *Workability*. Heavy, hard and tough, fairly difficult to work, finishes well with suitable machining. *Durability*. Not naturally durable in contact with the ground. Exceptionally fire-resistant. *Seasoning*. Requires care, but is liable to check and case-harden. *Wt. per cu. ft.* 58 lbs. *Strength*. Stronger than Jarrah, very dense and tough. *SIZE AND AVAILABILITY*. Planks 2 in.-6 in. thick, 4 in.-14 in. wide, and in correspondingly long lengths. *USES*. Superstructural work where strength and long lengths are required. Wagon scantlings, telegraph poles, motor-body building, shipbuilding. For fire-resistant floors and beams, piles; railway sleepers when treated with preservatives. Telegraph cross arms, and mining timbers. *FINISHES*. Polishes excellently.

**KAURI PINE**

GENERAL PROPERTIES. *Colour*. Pale yellow to light brown. *Figure*. Sometimes mottled. *Workability*. Light softwood, even textured, straight-grained, works easily, does not splinter. Slight cedar-like smell. *Durability*. Exceptionally durable, relatively non-absorbent to water. *Seasoning*. If of good quality seasons well, but not rapidly. *Wt. per cu. ft.* 30-40 lbs. air-dry. *Strength*. Very strong and elastic for its weight. *SIZE AND AVAILABILITY*. Good supply of all sizes up to 30 ft. long, 24 in. wide. *USES*. Vats, patent stills, decking of yachts, swimming bath and playground slides, pattern making joinery, decorative work. *FINISHES*. Finishes excellently. Takes stain and paint well.

**KOKKO. Koko**

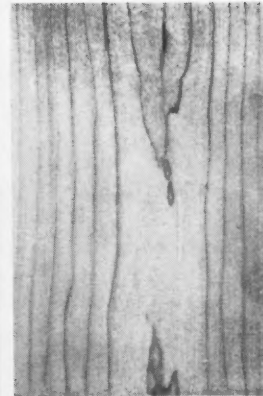
GENERAL PROPERTIES. *Colour*. Dark walnut brown. *Figure*. Often quite handsome, due to irregular colour and interlocked fibre. *Workability*. Difficult to saw and machine, due to woolly nature, but turns and veneers well and finishes well with hand tools. *Durability*. Moderately durable when exposed. *Seasoning*. Care required in air-drying. Kiln seasons well. *Wt. per cu. ft.* 42 lbs. air-dry. *Strength*. Hard, but brittle. *SIZE AND AVAILABILITY*. Squares from 9 ft. long by 12 in., siding up to 30 ft. *USES*. Decorative furniture, cabinet-making, flooring, panelling, moulding, interior work. Suitable for counters and table-tops and office fittings. *FINISHES*. Polishes excellently, but requires careful filling.

**LIME**

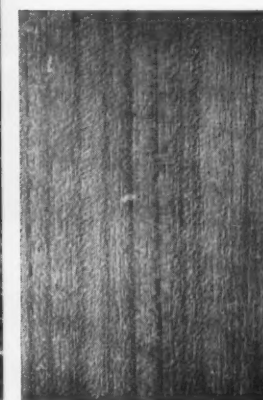
GENERAL PROPERTIES. *Colour*. Uniform white, to cream. *Figure*. Flake figure. *Workability*. Light to moderately heavy, straight grained, easy to work, turns well. Has a fine even texture. *Durability*. Not very durable. *Seasoning*. Seasons fairly well. *Wt. per cu. ft.* 30-42 lbs. *Strength*. Moderately strong. *SIZE AND AVAILABILITY*. Varying according to the size of logs available. *USES*. Carving, turnery, rollers, platters, sounding boards, three-ply ply wood and camera fittings. *FINISHES*. Takes stain, paint and varnish well.



Photograph by courtesy of the High Commissioner for Canada

**MAPLE****Hard Maple. Rock Maple**

GENERAL PROPERTIES. *Colour*. Light yellowish-brown with darker lines. Sapwood, creamy white. *Figure*. Fiddle back, Bird's-eye, Blisters and Curly. *Workability*. Fine even texture, works fairly easily when green, but is hard when seasoned. Holds nails and screws well, turns and veneers well. *Durability*. Not durable unless preserved. Said to be white-ant proof. *Seasoning*. Seasons well with moderate shrinkage. *Wt. per cu. ft.* About 45 lbs. *Strength*. Strong stiff and hard. *SIZE AND AVAILABILITY*. As flooring 1 in. to 4 in. thick, 4 in. and upwards in width; 9 ft. lengths and over. And as blocks. *USES*. *Decorative*. Panels, furniture, veneers, cabinet making. *Constructional*. Flooring, plywood, laundry and dairy appliances, shoe lasts, piano actions. *FINISHES*. Excellent for enamels and paint. Stains well, and takes a high polish.

**OBECHÉ****African Whitewood**

GENERAL PROPERTIES. *Colour*. Pale straw to yellow. *Figure*. Sometimes contains attractive figure. *Figured veneers* are available. *Workability*. Soft, light, works easily, planes well. Glues well, and cuts for veneers. *Durability*. Surface hardens on drying, and the wood lasts well according to reports. *Seasoning*. Seasons well, without checking, but is liable to warp. *Wt. per cu. ft.* 20-25 lbs. air-dry. *Strength*. Comparable to Poplar. *SIZE AND AVAILABILITY*. Logs of large girth 12 ft. 22 ft. long. *USES*. Interior joinery, plywood. Excellent for built-in fittings. Recommended for cheap furniture, linings of drawers, and for shelves and panelling and fascias. *FINISHES*. Takes stain and paints well. Polishes well after filling.



Photograph by courtesy of the High Commissioner for India

PITCH PINE

Long Leaf Pitch Pine

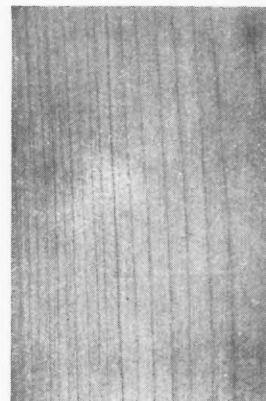
GENERAL PROPERTIES: *Colour*. Light red or orange coloured heartwood. *Figure*. Occasionally has an attractive bold blister figure. *Workability*. Hard, heavy, works well, moderately coarse-grained, holds nails and fastenings well. *Durability*. Exceptional, whether exposed to the weather, or in contact with the ground. *Seasoning*. Good, does not split nor warp. *Wt. per cu. ft.* 51 lbs. green, 41 lbs. dry. *Strength*. Excellent, elastic as well as stiff. *SIZE AND AVAILABILITY*. Obtainable as flooring, scantlings, decking, planks. Length: 10' and up. Widths: 3" 9" and up. Thicknesses: 1" 9". *USES*. Beams, wharf construction, piling, floorings, decking, masts, spars, railroad sleepers, rolling stock, signal posts, interior trim. *FINISHES*. Takes varnish well, grain tends to show through paint or stain.



PORT ORFORD CEDAR

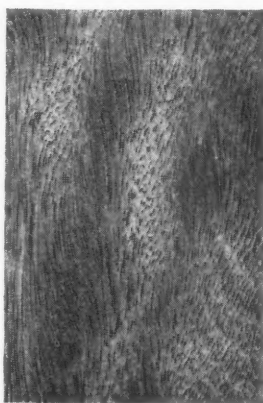
Lawson's Cypress

GENERAL PROPERTIES: *Colour*. Light yellow or nearly yellow. *Figure*. Slight, if any. *Workability*. Close compact grain, rather gummy, fragrant, difficult to work. *Durability*. Exceedingly durable under all conditions. *Seasoning*. Seasons well. *Wt. per cu. ft.* 32-34 lbs. *Strength*. Excellent for its weight. *SIZE AND AVAILABILITY*. Boards and planks. Trees obtainable up to 200' in height. *USES*. Joinery, shipbuilding, clothes chests, linings of drawers and cupboards. *FINISHES*. Takes paint, stain and polish.



OPEPE

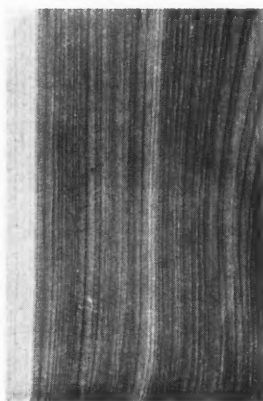
GENERAL PROPERTIES: *Colour*. Golden yellow to yellowish-brown. *Figure*. Roll sometimes present. *Workability*. Moderately hard and heavy, planes well but requires care in finishing: straight-grained and free from knot. *Durability*. Exceptionally good, resists the white ant. *Seasoning*. Seasons well, and does not shrink or warp much. *Wt. per cu. ft.* Average 48 lbs. *Strength*. Good for its weight. *SIZE AND AVAILABILITY*. Varies according to size of tree. Good lengths, widths and thicknesses usually available. *USES*. Bridge building, general construction work, flooring, and general joinery. *FINISHES*. Polishes well, takes paint well.



PENCIL CEDAR

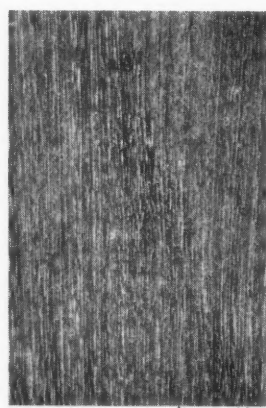
Juniper. Red Cedar

GENERAL PROPERTIES: *Colour*. Bright pinkish red, deepening to reddish brown on exposure. *Figure*. Attractive when cut flat. *Workability*. Light, soft, close-grained, easy to work, has a fragrant smell, which is repellent to insects. *Durability*. Exceptionally good, very resistant to decay. *Seasoning*. Easy to season. *Wt. per cu. ft.* 34 lbs. *Strength*. Not strong. *SIZE AND AVAILABILITY*. Lengths, 6' and longer; widths, 4" and wider. *USES*. Pencils, panelling, house fittings, linings of drawers and chests, tubs, pails, shingles, posts, sleepers, etc. *FINISHES*. Smooth finish obtainable with all tools; paints well.



PURPLEHEART

GENERAL PROPERTIES: *Colour*. When first cut is a dull brown, changing on exposure to purple. *Figure*. Wavy, or "Roxy" grain. *Workability*. Very hard and heavy, fine even texture, works well and fairly easily with all tools, planes to a good finish. *Durability*. Excellent. *Seasoning*. Reported to season well and easily. *Wt. per cu. ft.* Average 65 lbs., air-dry. *Strength*. Good, elastic, resists strains and shocks. *SIZE AND AVAILABILITY*. Hewn squares, also in planks up to 20" wide and up to 30' in length. *USES*. Inlaying, marquetry and turnery. Useful for purposes where shock and strain are likely, such as machinery bedding, etc. Used for billiard tables, cues, etc. *FINISHES*. Spirit varnishes are said to dissolve the colour, in all other respects finishes well.

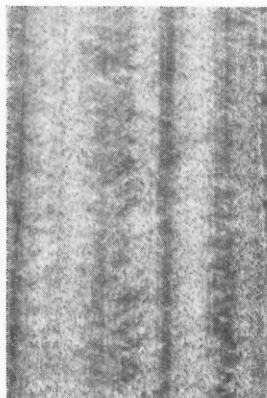


PYINKADO

Pyingado

GENERAL PROPERTIES: *Colour*. Dark reddish-brown. *Figure*. Ribbon, when quarter sawn. *Workability*. Cross-grained, fairly even-textured, hard; difficult to saw when green; with care finishes smoothly and turns well. *Durability*. Excellent under all conditions. *Seasoning*. Difficult to season unless kiln-dried. *Wt. per cu. ft.* About 64 lbs. *Strength*. Moderate. *SIZE AND AVAILABILITY*. Squares up to 40' long and 16" wide. *USES*. Constructional purposes, bridge building, piling, sleepers, telegraph poles, wharf piling, lock-gates, landing stages, laboratory bench tops, etc. *FINISHES*. Excellent results with polishing.

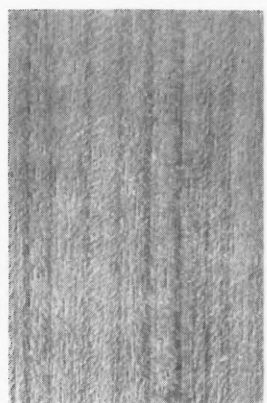




QUEENSLAND MAPLE

Maple Silkwood

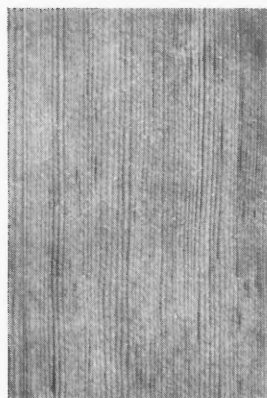
GENERAL PROPERTIES: *Colour*, Pink, to rose red. *Figure*, Ripple, riband, and bird's eye with a high sheen. *Workability*, Somewhat interlocked grain, it works well, has a slight tendency to "pluck," glues well and has good bending properties. *Durability*, Not durable in the ground or in damp places. *Seasoning*, Seasons excellently without discoloration or warping. *Wt. per cu. ft.*, 35-40 lbs. *Strength*, Excellent in proportion to its weight. *SIZE AND AVAILABILITY*, Varies according to size of log. Average girth measurement about 8'. *USES*, Furniture, panelling, mouldings, decoration of railway carriages, bent wood work in motor cars, aeroplane construction, cabinet work, etc. *FINISHES*, Stains well, takes an excellent polish, and fumes.



RED GUM

Sweet Gum. Satin Walnut

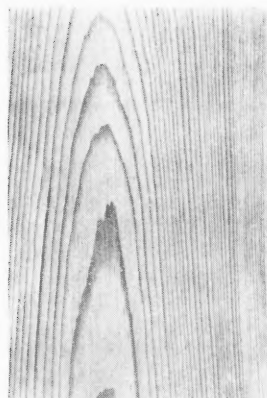
GENERAL PROPERTIES: *Colour*, Brown, tinged with pink, streaked with chocolate stripes. *Figure*, "Ribbon stripe." *Workability*, Easy to work, moderately hard, close-grained. Glues well. *Durability*, Moderate, but chiefly used for interior work. *Seasoning*, Difficult, shims and warps badly unless care is taken. *Wt. per cu. ft.*, 34 lbs. *Strength*, Not strong. *SIZE AND AVAILABILITY*, Planks up to 15" wide and up to 16' long. *USES*, Interior finish, mouldings, handles, fruit and vegetable containers, veneers, furniture, plywood. *FINISHES*, When filled and polished has a satiny, transparent effect. Stains and paints well.



RED PINE

Canadian Red Pine. Quebec Red Pine

GENERAL PROPERTIES: *Colour*, Light red or reddish yellow. *Figure*, No special figure. *Workability*, Straight-grained, works easily with all tools, nails and screws well. *Durability*, Requires creosoting when used in contact with the ground. *Seasoning*, Seasons well. *Wt. per cu. ft.*, About 32 lbs. air-dry. *Strength*, Harder and stronger than Canadian White Pine. *SIZE AND AVAILABILITY*, In lengths up to 18' in deals and boards. *USES*, Flooring for railway wagons, joinery, general building, greenhouses, garden frames, flour and grain milling and equipment boxes, etc. *FINISHES*, Takes paint and stain well, gives an excellent finish with machines.



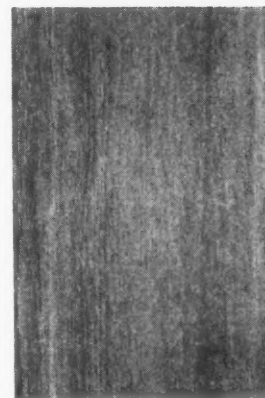
REDWOOD

Red Deal. Yellow Deal (SCOTLAND Red Pine)

GENERAL PROPERTIES: *Colour*, Heartwood, pale reddish-brown; Sapwood, light yellowish-brown to straw coloured. *Figure*, Rarely figured. *Workability*, Works easily and cleanly with all tools. Takes nails and glues well. *Durability*, Heartwood very durable under cover, moderate when exposed, very durable when impregnated with preservative. *Seasoning*, Easily and well. *Wt. per cu. ft.*, 25-45 lbs., average 32 lbs. *Strength*, Excellent in proportion to its weight. *SIZE AND AVAILABILITY*, *Trees*, 100' height, 2-4' diameter. Obtainable in planks, deals, battens, scantlings, boards. *USES*, General joinery, window frames, doors, joists, rafters, flooring, paving blocks, panelling, plywood, telegraph poles, railway sleepers, piles, wharf construction, wagon flooring, pitwood. *FINISHES*, Stains, paints, varnishes and polishes well.



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RIMU

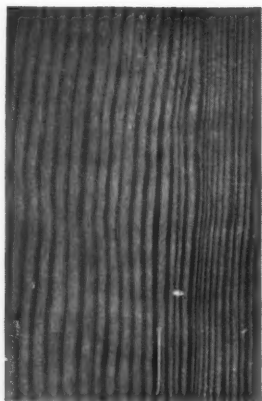
New Zealand Red Pine

GENERAL PROPERTIES: *Colour*, Light brown. *Figure*, Not common. *Workability*, Straight-grained, even-textured, easily worked with all tools to a good finish. *Durability*, Not durable when subjected to weather. *Seasoning*, Seasons well. *Wt. per cu. ft.*, 30-40 lbs. air-dry. *Strength*, Good for its weight. *SIZE AND AVAILABILITY*, Lengths from 10'-20'. Widths 8"-16". *USES*, Rimu is the chief house-building wood in New Zealand. Figured logs for veneers, for panelling, doors and furniture. Turnery, packing cases, cooperage, flooring, etc. *FINISHES*, Polishes excellently.



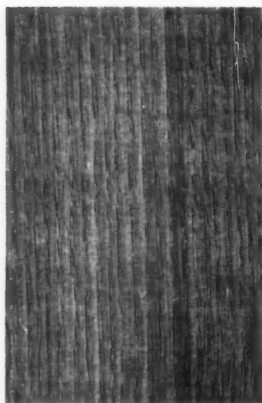
SANTA MARIA

GENERAL PROPERTIES: *Colour*, Reddish-brown. *Figure*, Roll and ribbon, often pronounced. *Workability*, Works well but requires sharp tools. Possesses a fairly straight grain and is moderately hard. *Durability*, Durability good. *Seasoning*, Seasons well with little splitting and shrinkage. *Wt. per cu. ft.*, 53 lbs. *Strength*, Good. *SIZE AND AVAILABILITY*, Varies according to the size of the logs. *USES*, Panelling, furniture, veneers, mouldings, etc. *FINISHES*, Polishes well.



**SHORT LEAF
PITCH PINE**
Short Leaf Yellow Pine

GENERAL PROPERTIES. *Colour*, Light brown heartwood, nearly white thick sapwood. *Figure*, Produced by difference between spring and summer wood. *Workability*, A close-grained, fairly soft wood. *Durability*, Varies considerably. Not as durable as long-leaf pitch pine. *Seasoning*, Seasons fairly easily. *Wt. per cu. ft.* 38-40 lbs. *Strength*, Varies greatly, but is moderately strong on an average. About equivalent to Douglas Fir. *SIZE AND AVAILABILITY*, Fair lengths obtainable, varying according to the size of tree. *USES*, Wharf construction, piles, flooring, wagon building, railroad sleepers, etc. *FINISHES*, With a lustrous surface.



SWEET CHESTNUT
Spanish Chestnut

GENERAL PROPERTIES. *Colour*, Resembling Oak, lacks the silver grain. *Figure*, Ripple figure and burr figure. *Workability*, Moderately heavy, strong, easy to work. Finishes well with all hand and machine tools, has good nailing and gluing properties. *Durability*, Exceptional, and highly resistant to decay. *Seasoning*, Seasons comparatively well. Requires care. *Wt. per cu. ft.* 30-45 lbs. air-dry. *Strength*, Resembles Oak in properties and is used as a substitute for Alder. *SIZE AND AVAILABILITY*, Various dimensions according to the size of the tree. *USES*, Lorry and wagon framing, coffin boards, beams, sills, ladders, gates, gate posts, furniture, panelling, copice for cleft fencing and hop poles. *FINISHES*, Takes stain, paint and varnish excellently.

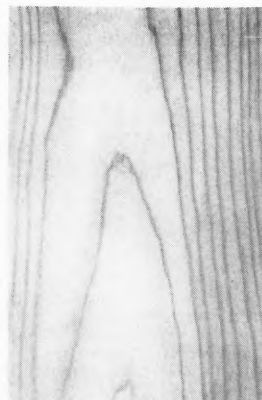


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SYCAMORE

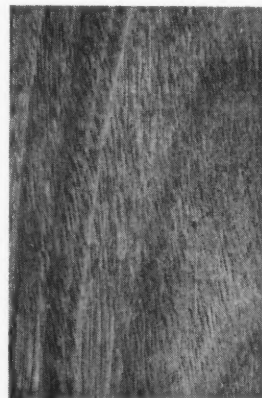
—Plane (SCOTLAND)

GENERAL PROPERTIES. *Colour*, White or yellowish white, with a fine natural lustre. *Figure*, Wavy grain producing ripple. *Workability*, Planes easily. Holds nails and screws well. Slight tendency to bind when sawn. Veneers well. *Durability*, Not durable under exposed conditions. *Seasoning*, Seasons readily, but requires low kiln temperatures to prevent darkening. *Wt. per cu. ft.* 35-45 lbs. air-dry. *Strength*, Moderately hard and strong. *SIZE AND AVAILABILITY*, According to trees available. *USES*, *Decorative*, Furniture and cabinet work, panelling, table tops, veneers. *FINISHES*, Stains well and takes a high polish.



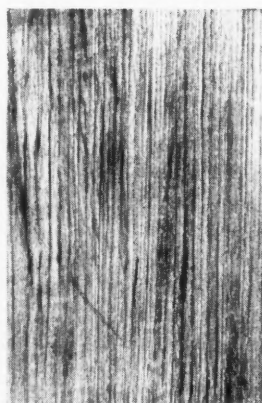
TALLOW WOOD

GENERAL PROPERTIES. *Colour*, Yellowish-brown. *Figure*, Rare. *Workability*, Hard, close-grained; of greasy nature. Works moderately well. *Durability*, Excellent. *Seasoning*, Needs careful supervision. *Wt. per cu. ft.* 50-60 lbs. *Strength*, Very strong. *SIZE AND AVAILABILITY*, Obtainable in good lengths, and as flooring material. *USES*, Flooring, window sills, sleepers, decking; constructional work, posts and rails. *FINISHES*, Planes to a good finish, difficult to polish owing to its greasy nature.



TEAK

GENERAL PROPERTIES. *Colour*, Light golden-brown, darkening with age. *Figure*, Sometimes of great beauty and value. *Workability*, Works moderately well with all tools. *Durability*, Excellent. Fire-resistant and acid-resistant. *Seasoning*, Seasons well, either by air-drying or kiln-drying. *Wt. per cu. ft.* 37-43 lbs. *Strength*, Moderately hard, strong and elastic. *SIZE AND AVAILABILITY*, Round, squares and planks. Sizes according to logs. *USES*, Shipbuilding, backing armour plates, railway coach construction and panelling, staircases, balustrades, doors and window frames, general house carpentry, draining boards, greenhouse construction, garden furniture, trolleys work, fencing, etc. *FINISHES*, Finishes well, takes an excellent polish, and responds to an oil finish.

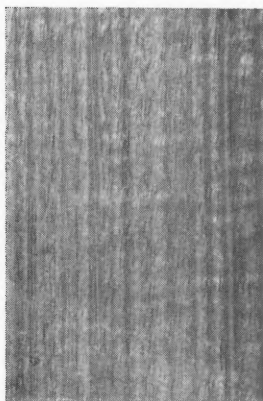


TUPELO

Tupelo Gum

GENERAL PROPERTIES. *Colour*, Varies from yellowish-white to light brown. *Figure*, Little or none. *Workability*, Soft, close-grained, difficult to split, works moderately well, glues well and nails well. *Durability*, Not durable. *Seasoning*, Requires care. *Wt. per cu. ft.* 35-40 lbs. *Strength*, Not strong. *SIZE AND AVAILABILITY*, Lengths, from 4 ft.-16 ft.; widths, 3 in. and wider. *USES*, Wooden-ware, broom handles, fruit containers, net floats, etc. *FINISHES*, Finishes well, takes stain, paint and varnish well.





VICTORIAN OAK

Australian Oak. Mountain Ash

GENERAL PROPERTIES: *Colour*, Light brown or pinkish. *Figure*, Occasionally has fiddle back figure. *Workability*, Straight-grained, moderately hard, and works easily. Moderately coarse-textured. *Durability*, Exceedingly durable when not in contact with the ground. Good resistance to fungal and insect attacks. *Seasoning*, Seasons well and quickly. *Wt. per cu. ft.*, 37-41 lbs. *Strength*, Good, elastic and resilient. *SIZE AND AVAILABILITY*, In log form, and planks up to 8 ft. long, 6 in. and wider, and from 1-3 in. thick. *USES*, Flooring, furniture, general building construction, weather boards, coach building, cabinet work, panelling, veneers, etc. *FINISHES*, Takes an excellent polish.



WESTERN HEMLOCK

British Columbian Hemlock. Grey Fir

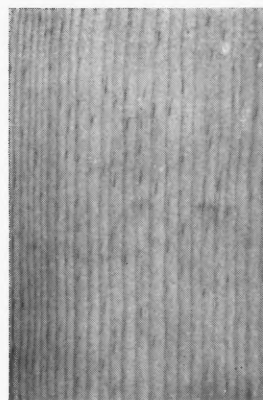
GENERAL PROPERTIES: *Colour*, Light yellowish to reddish brown heartwood; sapwood somewhat brighter. *Figure*, Similar to but not so prominent as in Douglas Fir. *Workability*, Straight-grained, light, works well with all machines. Planing cutters must be sharp as they tend to bruise or flick the surface. Holds nails and screws well. Free from resin. *Durability*, Durable under conditions of extremes, but not alternating. For railway sleepers requires preserving. *Seasoning*, Seasons fairly easily and well; requires care. *Wt. per cu. ft.*, About 30 lbs. air-dry. *Strength*, Not so strong as Douglas Fir, but good for its weight. *SIZE AND AVAILABILITY*, Boards and dimension material. *USES*, *Decorative*, Selected material for interior fittings, panelling, flooring, enamelled furniture, backs and bottoms of drawers and cabinets. *Constructional*, Temporary shuttering, trench lining, bulkheads for grain ships, house framing, boarding, slack cooperage, step ladders. Fruit and food containers. *FINISHES*, Takes stains, paints and varnishes well. Polishes and enamels well.



WESTERN RED CEDAR

*British Columbian Red Cedar
Pacific Red Cedar*

GENERAL PROPERTIES: *Colour*, Reddish brown. *Figure*, Slight, grain well-prominent when "slash" sawn. *Workability*, Works easily, excellent glue and nailing properties, straight grained, soft, and light. *Durability*, Exceptional under all conditions. Insect resisting. *Seasoning*, Seasons easily and rapidly without warping or checking. High kiln temperature to be avoided. *Wt. per cu. ft.*, About 23 lbs. air-dry. *Strength*, Fairly strong for its weight, rather brittle. *SIZE AND AVAILABILITY*, Trees, 100 ft.-150 ft. in height, 3 ft.-6 ft. in diameter. Exported as shingles, weather boards, wainscoting, planks 10 ft. and upwards long, 6 in. and upwards wide, 1 in.-6 in. thick. *USES*, Roofing shingles, bevel siding, posts, panelling, mouldings, sashes, cabinet making. *FINISHES*, Stains, paints and enamels well.



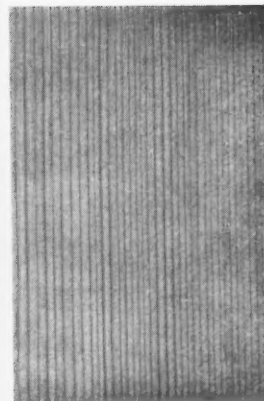
WESTERN WHITE PINE

B.C. Western White Pine

GENERAL PROPERTIES: *Colour*, Pale straw or light reddish-brown with white sapwood. *Figure*, Little or none. *Workability*, Straight-grained, even texture; works easily, finishing to a good surface, nails well. *Durability*, Fairly durable. *Seasoning*, Seasons well with very little checking and warping. *Wt. per cu. ft.*, 26 lbs. *Strength*, Fairly good, comparing closely with Spruce. *SIZE AND AVAILABILITY*, Exported as waney logs, fitches and deals. *USES*, Interior joinery, window frames, etc., pattern making, boxes, packing crates, knotty pine panelling, matches, etc. *FINISHES*, Takes paints, enamels, and polishes excellently.



Photograph by courtesy of the High Commissioner for Canada



WHITEWOOD

*White Deal. European Spruce
European Whitewood*

(SCOTLAND: White Pine)

GENERAL PROPERTIES: *Colour*, White, to yellowish-white. *Figure*, Very slight. *Workability*, Hard knots make it slightly difficult, small knots not detrimental. *Durability*, Not durable under exposed conditions, needs preservation. *Seasoning*, Seasons well, checking and warping very little. *Wt. per cu. ft.*, 30-40 lbs. *Strength*, Moderately strong. *SIZE AND AVAILABILITY*, Planks, deals, battens, scantlings, boards. *USES*, General joinery, flooring, shuttering, trench linings, wagon flooring, match boarding, framing, food containers. *FINISHES*, Stains, paints and polishes well.

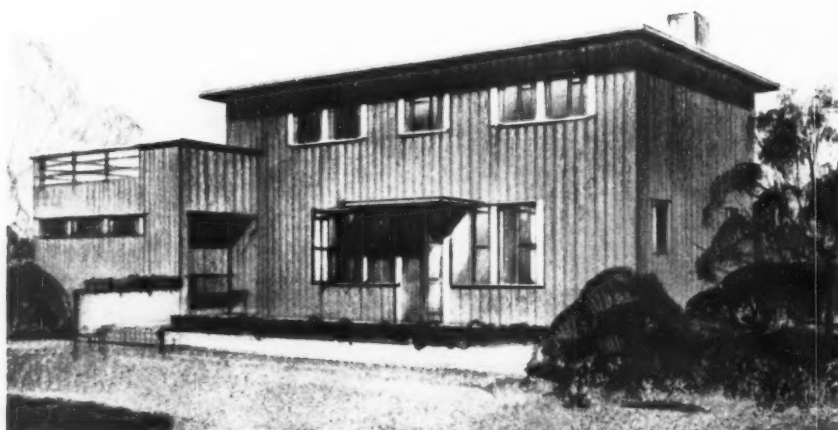


WYCH ELM

GENERAL PROPERTIES: *Colour*, Pale reddish-brown. *Figure*, Ornamental when slab sawn. *Workability*, Straight-grained, finer texture than Common Elm. Works fairly well, planes and machines well, has good glueing properties, lends itself to bending. *Durability*, Excellent, if kept in conditions of extremes. *Seasoning*, Seasons fairly readily, but is liable to warp unless care is taken. Can now be very successfully kiln-dried. *Wt. per cu. ft.*, 33-43 lbs. *Strength*, Has high mechanical properties, tough and elastic. *SIZE AND AVAILABILITY*, Logs up to 25 ft. long, and up to 24 in. in diameter. *USES*, Cart and wagon building, brake blocks, keelsons, barge plank-ing, chair making, and all purposes where resistance to wear is required. Excellent for sea work. Also bent wood-work and panelling. *FINISHES*, Good results with stain, paint and varnish.

REGINALD A. KIRBY, STUDENT R.I.B.A., 1 Fraser House, Larkhall, S.W.8
1st PRIZE : SECTION 1

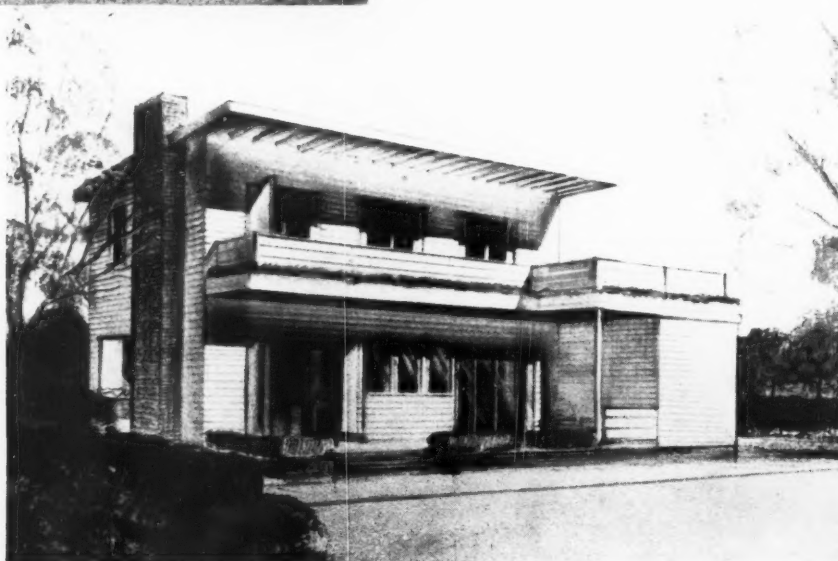
THE SIX



PRIZE-WINNING

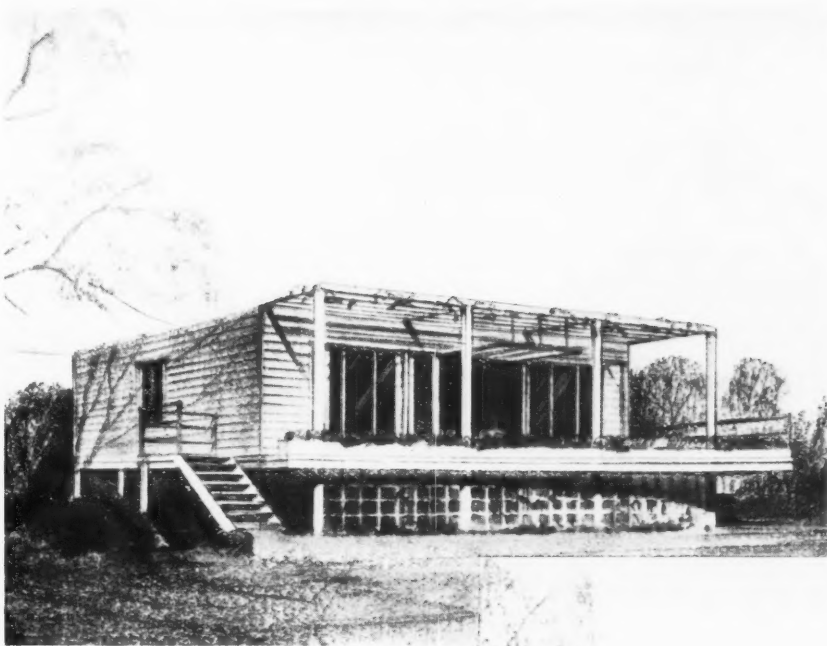
2nd PRIZE : SECTION 1
E. H. LOCKTON, STUDENT R.I.B.A., 4 Rose Hill Road,
Wandsworth, S.W.18

TIMBER HOUSES



3rd PRIZE : SECTION 1
B. A. LE MARE, A.R.I.B.A., 29 The Drive, Walthamstow, E.17

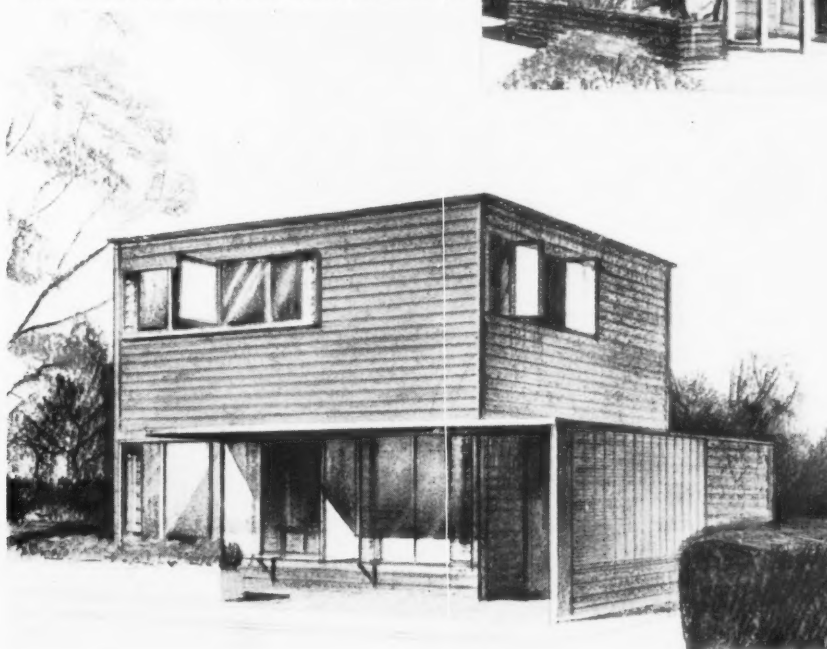
WILLIAM TATTON BROWS, R.A., A.A.D.P., 6 Bedford Square, W.C.1.
1st PRIZE: SECTION 2



IN THE

COMPETITION

2nd PRIZE: SECTION 2
HARRY MONCRIEFF, A.R.I.B.A., 9 Victoria Square, Newcastle-on-Tyne



ORGANISED
BY THE TIMBER
DEVELOPMENT
ASSOCIATION

3rd PRIZE: SECTION 2
CAMERON KIRBY, F.R.I.B.A., 14 Duke Street, Manchester Square W.1



TYPICAL EXAMPLES OF THE MODERN AMERICAN COLONIAL STYLE



Photograph by courtesy of the National Lumber Manufacturers' Association

