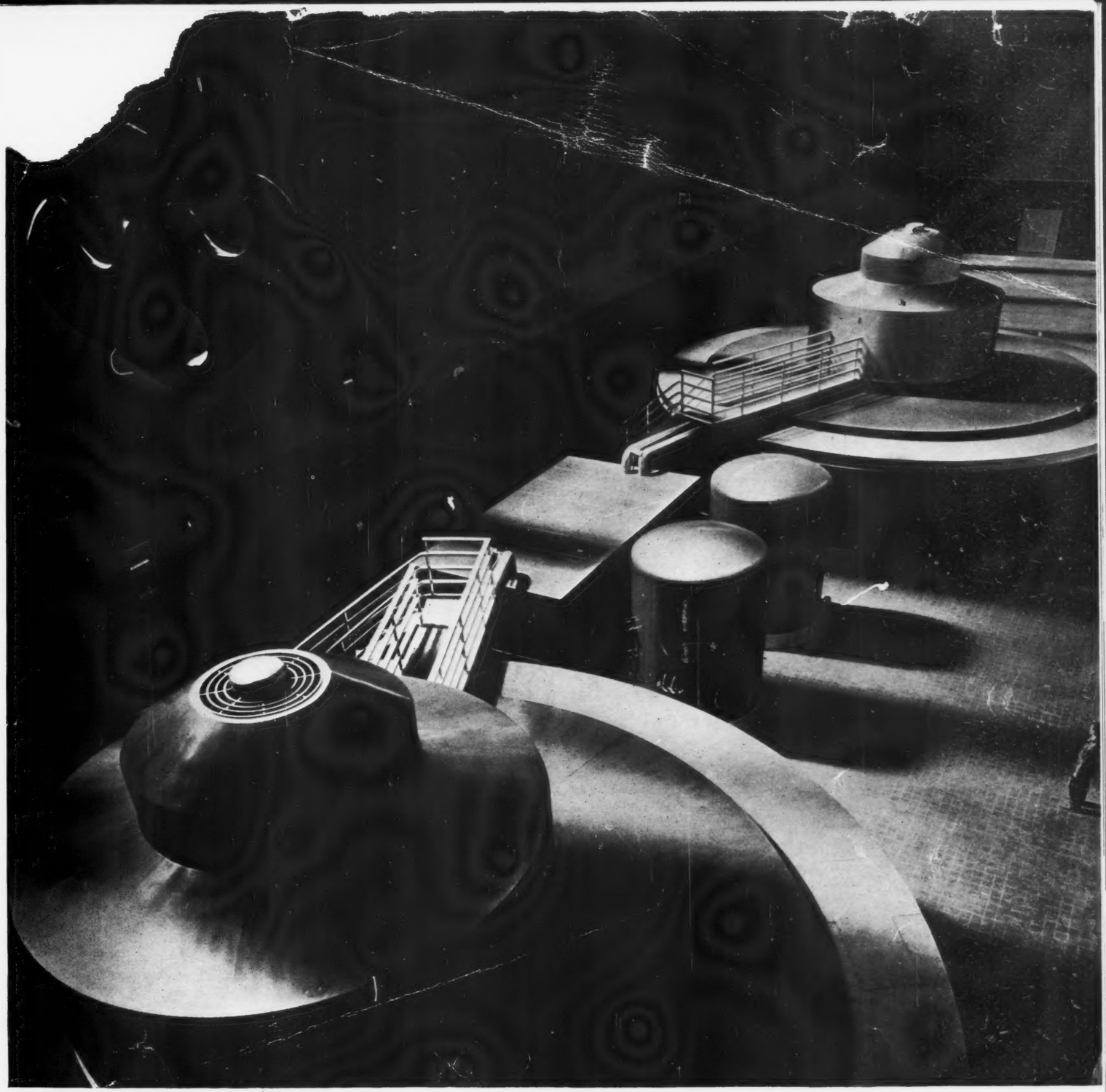

The initials TVA are beginning to be familiar as the symbol of a new possibility for the democratic countries—the possibility of obtaining the efficiency of a co-ordinated plan without totalitarian regimentation. TVA stands for Tennessee Valley Authority, and the Tennessee Valley Authority is the outstanding example of democratic planning. When it was initiated in 1933 it was the first large-scale regional planning organization which operated wherever possible on the principles of persuasion, consent and participation; and to-day it still remains the most important example of such an organization. It looks as if it were now safely established as a permanent organ of American life. But even if this should prove not to be the case, the TVA during the ten years of its existence will have definitely established the validity of over-all, regional, democratic planning: and this is an achievement of first-class importance in the evolution of human society. **JULIAN HUXLEY.**

JUNE 1943 TWO & SIX

TVA

THE ARCHITECTURAL REVIEW

TVA

AN ACHIEVEMENT of DEMOCRATIC PLANNING

by Julian Huxley

The Architectural Review

CONTENTS FOR JUNE, 1943

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The work of the Tennessee Valley Authority has not until now been adequately described in Britain. In America a wide literature exists, chiefly in reports and pamphlets, but even there a concise yet comprehensive account of TVA in all its implications seems still to be lacking. As far as Britain is concerned, information on TVA is just now imperatively needed. There will be so much planning on a large scale after the war that the country cannot afford to neglect the experience gained in ten years' work on the world's boldest venture in regional reconstruction. The scale in Britain will perhaps not be quite as gigantic as that of TVA, but it will be considerable. TVA covers an area four-fifths the size of England. The Tennessee Valley used to be known as one of the most depressed areas of the United States. Its disastrous state was due to reckless exploitation by early settlers. The soil was barren, the woods had been cut down. The rivers, time and again, broke out in enormous floods. So TVA began its work of water control. Huge dams were built, and lakes created forty-four times the size of the Lake District. Concurrently a network of research was flung across the whole area. State universities and colleges helped to survey it and to recover prosperity. Soil regeneration, afforestation, malaria control and the like were tackled scientifically. National parks were created, tourism developed, cultural and educational activities started and promoted. All this TVA regards as part of the regional planning authority's job. It is good for us to realize that. Too many people in Britain still think of planning in terms of advisory town-planning committees without any executive power drawing up schemes for urban and district councils. There is no object lesson anywhere so convincing of the possibilities of judiciously and democratically applied regional planning as TVA. It is in this spirit that Dr. Julian Huxley has written this special number of THE ARCHITECTURAL REVIEW. He has, during his American visits, studied the work of TVA with that fanatic intensity which characterizes his approach in matters that he knows to be vital. The books and pamphlets on TVA which Dr. Huxley brought back with him and used for his article can be consulted by readers, on request, at the offices of Political and Economic Planning (PEP). Hardly any of the photographs illustrating this issue have been published before in this country. The majority of them are new to the United States too. The captions to the illustrations are by Mr. and Mrs. Gordon Stephenson. Gordon Stephenson has worked for three summers as an architect in the United States. He knows the Tennessee Valley thoroughly as the many additional data in his captions prove. Mrs. Stephenson is herself an American.

The Architectural Review is greatly indebted to His Excellency the Ambassador of the United States for having consented to introduce this special number by a foreword, and to Mr. Herbert Agar and Mr. Victor Waybright of the Department of War Information, Embassy of the United States, for having hundreds of photographs brought over specially and placed at the disposal of The Architectural Review.

FOREWORD

by the Hon. John G. Winant, Ambassador of the United States to the Court of St. James

The Tennessee Valley Authority initiated regional planning on a scale never before attempted in history. Its earliest conception was perhaps in the recognition that the development and distribution of electricity had become an essential of life in modern communities. In the words of Senator Norris, "Every locality in the United States has an interest in this unseen force, which has become a necessity of life, which goes into every modern home and from the home on up to the largest factory, and which turns the mightiest wheels of commerce."

In a larger sense the TVA envisioned in its entirety something beyond power development. It entered the "wide fields of flood control, soil erosion, afforestation, elimination from agricultural use of marginal lands, and distribution and diversification of industry. In short, this power development of war days leads logically to national planning for a complete river watershed involving many States and the future lives and welfare of millions. It touches and gives life to all forms of human concerns."

So much for the objective. But to understand the inception and consummation of this great project and its practical realization in human terms it is also necessary to understand the problem of authority as it is related to the intervention of government.

The control board was "authorized and directed to make studies, experiments and demonstrations to promote the use of electric power for agricultural, domestic and industrial purposes, and instructed that it may co-operate with the widest possible variety of other agencies from State and local governments to educational and research institutions, so as to ensure the application of electric power to the fuller and better balanced development of the resources of the region."

The President, advocating the creation of the Tennessee Valley Authority in 1933, said in a message to Congress: "Many hard lessons have taught us the human waste and results from lack of planning. Here and there a few wise cities and counties have looked ahead and planned. But our Nation has 'just grown'. It is time to extend planning to a wider field, in this instance comprehending in one great project many States directly concerned with the basin of one of our greatest rivers. This in a true sense is a return to the spirit and vision of the pioneer. If we are successful here we can march on, step by step, in a like development of other great natural territorial units within our borders."

In spite of the fact that private enterprise had neither envisioned this project nor was implemented to carry it through, vested interests in the United States fought it with a bitterness that has seldom been equalled in any controversy involving private property and the public welfare.

The problem of intervention by government for the common good has always been the concern of statesmanship. The continuing development of the Tennessee Valley marks the advance that science, in combination with the popular will, can evolve out of a co-ordinated national and local authority; it is proof that democratic government under wise leadership can direct our natural resources to serve present human needs. It is a unique experiment in government as well as an engineering feat of tremendous significance.

For its attainment we owe a special debt of gratitude to Senator Norris of Nebraska and to President Roosevelt.

The extraordinarily able presentation of the story of the TVA by Dr. Julian Huxley permits a wider knowledge of an American democratic experiment that can be applied in many areas of the world and would add to the wealth of nations and the general welfare of the common man.

John G. Winant.

TVA

AN ACHIEVEMENT OF DEMOCRATIC PLANNING

By Julian Huxley

THE initials TVA are beginning to be familiar as the symbol of a new possibility for the democratic countries—the possibility of obtaining the efficiency of a co-ordinated plan without totalitarian regimentation. TVA stands for Tennessee Valley Authority, and the Tennessee Valley Authority is the oustanding example of democratic planning. When it was initiated in 1933 it was the first large-scale regional planning organization which operated, so far as possible, on the democratic principles of persuasion, consent, and participation; and to-day, after nearly ten years, it still remains the most important example of such an organization.

The precise delimitation of the region over which the TVA exercises its functions was determined by certain constitutional facts. In the U.S.A., the powers permitted to the Federal Government, as opposed to the separate States, are strictly limited. Among those powers, however, are measures for flood-control and for improving the navigability of rivers, in the interests of inter-State commerce. Flood-control and navigability accordingly had to be the pegs on which the legislation necessary for regional planning was hung; and for flood-control and improvement of navigability you require an entire river basin.

The Tennessee is but a tributary of a tributary—it flows into the Ohio shortly above the latter's confluence with the Mississippi. Yet it is a big river—by British standards a huge one. For some distance above its junction with the Ohio it is a mile wide, and it drains most of Tennessee and portions of six other States. Its total length (not all under the same name) is about 900 miles, as against 210 miles for the Severn, the longest British river. The largest river basin in Britain, that of the Thames, covers less than 6,000 square miles, while the area of the Tennessee Valley is some 42,000 square miles, or about four-fifths that of England and Wales, but with a population of only some two and a half millions, about one-eighth consisting of Negroes, mostly very backward.

The Tennessee Valley Authority Act was one of the earliest New Deal measures, having been passed in May 1933—less than three months after Roosevelt took office. The preamble states that the purposes of the Act include navigability and flood-control; reafforestation and the proper use of marginal lands; agricultural and industrial development; and national defence, by operating the Muscle Shoals chemical plant.

In the body of the Act, the Board is "authorized and directed to make studies, experiments and demonstrations" (a delightfully comprehensive definition of research!), to promote the use of electric power for agricultural, domestic and industrial purposes, and is instructed that it may co-operate with the widest possible variety of other agencies, from State and local governments to educational and research institutions, so as to ensure the application of electric power "to the fuller and better balanced development of the resources of the region." Throughout, its terms of reference are kept extremely broad.*

Why was the Tennessee Valley singled out as the site of this massive experiment? There were several mutually reinforcing reasons. There was the existence of a great Government-built nitrate plant in the area. There was the fact that proper control of the Tennessee River was crucial for the prevention of disastrous floods on the lower Mississippi. There was the further fact that flood control could be readily tied up not only with improved navigation, but with the profitable generation of electric power; and there were finally the crying needs of this backward region which might largely be met by cheap electric power. Much of the rural area of the valley was inhabited by peasant farmers, who, although originally of excellent British stock, had in their mountain isolation too often developed into poverty-stricken poor-whites. Primitive in their reproductive habits as in their farming methods, they multiplied rapidly until they presented a typical Malthusian population, pressing hard upon its means of subsistence. Under the influence of this pressure, the farmers began in many places to encroach upon the wooded mountainside. A steep slope would be burnt off and cleared of its timber, ploughed up, and planted with maize. The climate is moist, with spells of heavy rainfall: more than half of all the rain of over 50 inches a year that occurs in the U.S.A. falls in the Tennessee Valley. With the removal of the forest cover, and with the failure to apply fertilizers, the soil rapidly lost its fertility and large amounts of it were simply washed away, **22.** After a few brief years, the slope was no longer worth bothering about, and was abandoned in favour of a fresh cleared area nearby, so that in the heart of the most modern of countries you could find shifting cultivation of the type usually associated with primitive African tribes.

The resultant erosion was appalling, **4-9.** It was brought home to me when, surveying the turbid flow of the Tennessee River, I was told that there were men still living who remembered it as a clear blue stream. Up till that moment I had taken the pea-soup appearance of so many American rivers for a fact of nature: the realization that it was a recent man-made phenomenon was staggering. Here, under my eyes, was the basic productivity being stripped from a vast area and hurried along to sterile waste in the sea. I also saw outcrops of bare rock which three generations back had been covered with rich soil over a yard in depth. For those who like figures, it may be added that the amount of soil annually washed or blown out of the fields of the United States is conservatively estimated at 3,000 million tons.

Throughout most of the region debilitating diseases like malaria and hookworm were common, and others caused by vitamin deficiencies. The few towns and cities were still largely suffering from the ruinous after-effects of the Civil War, though a certain amount of industrialization had belatedly grown up in them.

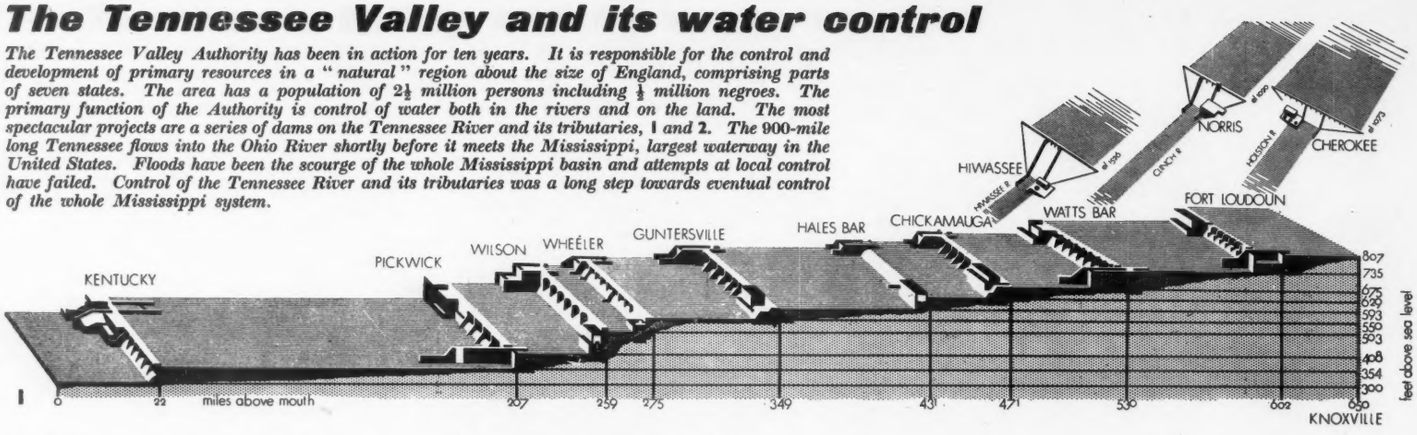
The Muscle Shoals nitrate works at the Wilson Dam were built during the last war. After 1918, various proposals were made concerning its future use; at one time Ford evinced an interest in it. The threat that this great plant might fall into private hands called for public action. Twice, in 1928 and 1930, Congress declared in favour of Government operation of the plant, but on both occasions the Bill was vetoed by the then President. With the accession of Roosevelt to power, however, the atmosphere was altered, and so it came about that the need for public operation of a particular plant helped on the decision to make the whole Tennessee basin the beneficiary of the first large-scale American plan.

It was the inclusion of Muscle Shoals in the area which dictated the reference to national defence in the preamble to the TVA Act. Curiously enough, Muscle Shoals had before 1940 been almost entirely switched over to the peaceful business of producing phosphates for agriculture (though the

*For instance, it is authorized to make such general plans "as may be useful to the Congress and to the several States in guiding and controlling the extent, sequence, and nature of development that may be equitably and economically advanced through the expenditure of public funds or through the guidance and control of public authority, all for the general purpose of fostering an orderly and proper physical, economic, and social development" of the Tennessee Valley area.

The Tennessee Valley and its water control

The Tennessee Valley Authority has been in action for ten years. It is responsible for the control and development of primary resources in a "natural" region about the size of England, comprising parts of seven states. The area has a population of 2½ million persons including ½ million negroes. The primary function of the Authority is control of water both in the rivers and on the land. The most spectacular projects are a series of dams on the Tennessee River and its tributaries, 1 and 2. The 900-mile long Tennessee flows into the Ohio River shortly before it meets the Mississippi, largest waterway in the United States. Floods have been the scourge of the whole Mississippi basin and attempts at local control have failed. Control of the Tennessee River and its tributaries was a long step towards eventual control of the whole Mississippi system.



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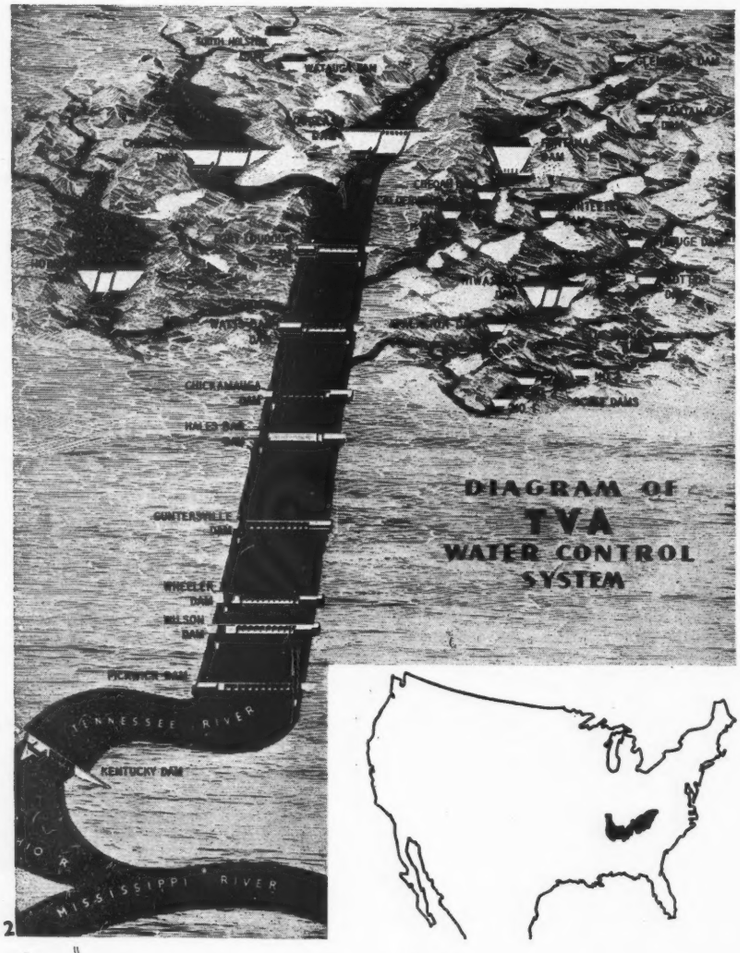

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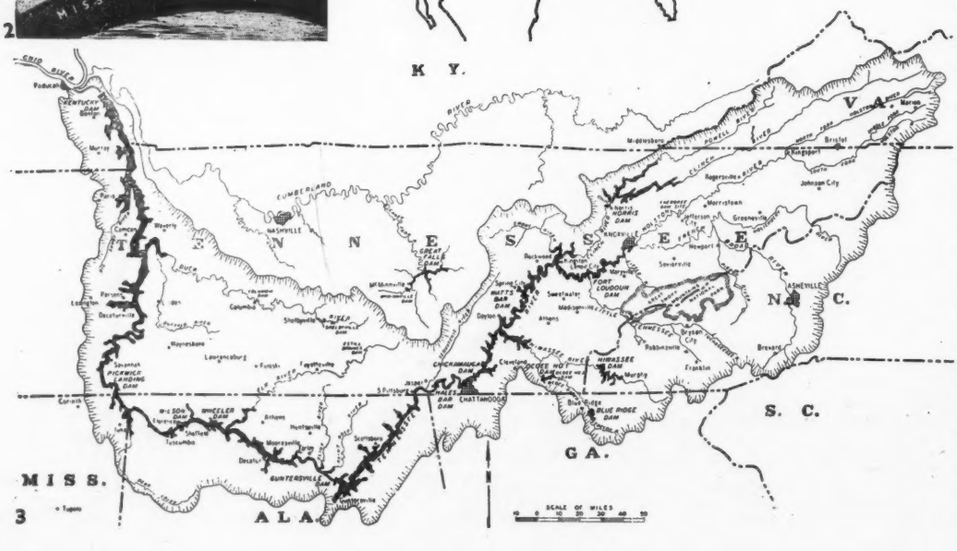

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nitrate plant had been maintained, and is now once again producing explosives), while the war activities of the TVA are increasingly concerned with providing power for the extraction of aluminium.

GENERAL ORGANIZATION

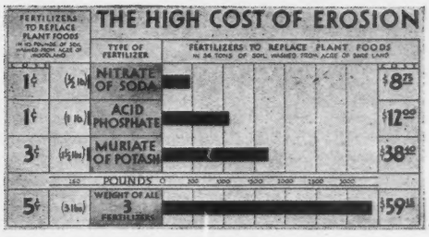
The organizational chart of the TVA shows five main divisions—Water Control in the River Channel; Water Control on the Land; Power; and two Councils, the Management Service Council and the Regional Planning Council. The *Management Service Council*, as its name implies, has servicing functions, being concerned with personnel, materials, finance and the like. *Water Control in the River Channel* and *Power* explain themselves. *Water Control on the Land* is a euphemism: in point of fact it concerns itself with everything to do with the soil, its utilization and conservation, including anti-erosion measures, farming, forestry and the manufacture of phosphates. The *Regional Planning Council* covers everything else.

The total range of activities covered by the TVA is immense. In addition to the primary aims of navigation, flood-control and power-production, it includes forestry, chemical engineering, anti-erosion measures, improved agriculture, pure and applied research, recreation, fisheries, town planning, publicity, malaria control, constructional work of all kinds, wild life conservation, housing, survey, the encouragement of co-operatives and rural industries, the building of roads, the running of fleets of boats, planes and trucks, of hospitals, of police and fire departments, personnel training, electricity distribution, and education. But our major interest lies not in mere quantitative range, but in the way in which the different activities are co-ordinated, and in the new techniques of research, survey, co-operation and execution worked out by the TVA to realize the new type of function which it is called upon to undertake.

TVA PROGRAMME

I will not spend much time on the concrete achievements of the TVA; the data are readily accessible in various official documents. But a brief statement of some of the salient facts will give some idea of the scale of achievement and the speed with which it has been realized.

The core of the plan is the great series of works along the river and its tributaries. Along the main course of the Tennessee River are nine huge dams, **49-70,** ranging from rather under half a mile to over a mile and a half in length, and from 72 to 160 feet in height, which have converted this stretch of the river (over 600 miles in length) into a series of large lakes—so large that the barges and other craft navigating the river have to be specially constructed to protect them against waves. On the tributaries are a further eleven dams (including four acquired from a private company), ranging up to over 300 feet in height.



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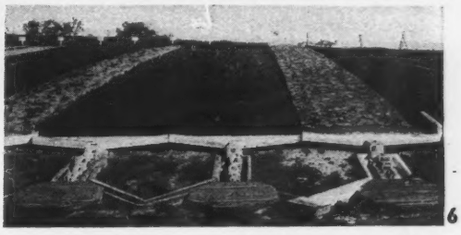

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In the Tennessee Valley erosion has devastated hundreds of square miles on the hillsides. Climate combined with poor farming gradually caused ever-increasing spoliation of top soil. In the nineteenth century, many farmers, chiefly of Scots-Irish stock, moved up the hillsides in search of land. Richer lands of the valley bottoms were in the possession of large-scale farmers employing slave labour. The families of hillside farmers were later to provide cheap labour in the towns. Poverty and ignorance distressed the whole valley. The story of erosion is one of the individual, forced by circumstances, acting against the collective good. Timber was ruthlessly cut and vegetation burned. One-crop farming spread up the slopes. There was nothing to hold heavy rains. Soil was washed down and land gullied, 4. The loss to the nation was enormous. Top soil can be restored only at great cost. By encouraging an extensive use of fertilizers, 5, and right cropping methods, great progress has been made. In the plant at Muscle Shoals TVA produces vast quantities of fertilizers, and experiments with various types of vegetation are conducted. One method of experiment is to sow strips with alternatives, collect the run-off from each strip and measure it, 6.

Collectively they represent a total of major engineering work greater than that involved in the Panama Canal, and several times as large as Grand Coulee or Boulder Dam, though, of course, those latter are much bigger than any of the individual dams on the Tennessee.

All the dams serve for power generation. Those on the main river also help in promoting navigation (being equipped with locks), **71-77,** and in flood regulation; those on the tributaries are essentially storage dams, helping to regulate the flow of water. For generating electricity there are also six steam plants. The total power capacity already installed or authorized comes to over two million kilowatts, and the ultimate possible to over two and a half million. This will bring the TVA to second place among United States electric systems, and will considerably exceed the total power production of the whole of Central and South America.

The total area of the lakes and reservoirs thus produced is over 1,100 square miles—a figure whose magnitude can be visualized by comparison with the less than 25 square miles of all the lakes in the English Lake District taken together! Windermere is one mile wide; the width of the lakes along the main course of the Tennessee River is usually from two to four miles and sometimes much more.

I have seen the area behind the Norris Dam both before and after it was flooded. The effect of the immense body of water extending far up into the hills, with bays and inlets everywhere among the woods, is extraordinary. Not only has water been brought under beneficent control, but in the process a new kind of beauty has been introduced into the region.

The length of 9-foot navigable channel now extends for 464 miles up-stream from the Ohio to Chattanooga, and by July of this year will be extended another 184 miles to Knoxville. The waterborne traffic (measured in ton-miles) has increased nearly five-fold since the TVA began work. Several quite new types of freight are now beginning to move along this waterway, including pig iron, petroleum products, grain and automobiles. The Tennessee River ports are now linked with the largest connected system of inland waterways in existence, mostly of 9 ft. depth or more, which will soon attain a mileage of nearly 9,000 miles, and spreads its huge tentacles in various directions—to beyond Pittsburgh, to Chicago, north-west through Kansas City and Omaha to the edge of South Dakota, north to Minneapolis within 200 miles of Canadian soil, south-east through New Orleans well into Florida, south-west through Galveston and Houston almost to the Mexican border.

We who live in England find it difficult to picture the damage which floods can do on a vast river system like the Mississippi. Entire regions can be inundated, crops destroyed, buildings swept away, railway tracks washed out. The storage dams on the tributaries of the Tennessee River can be used to hold back water while there is danger of flooding anywhere between them and the sea. Let me give an example to show how important this can be. In 1937, there was a bad flood on the Mississippi. By then, Norris was the only storage dam completed by the TVA, yet it held back enough water to lower the flood-crest by 4 feet on the Tennessee River at Chattanooga, and by 6 inches at Cairo, over 500 miles away, where the Ohio joins the Mississippi. Six inches does not sound much, but in point of fact the six inches saved the city. When the entire dam system is completed, it will reduce the height of floods on the Mississippi by 2 feet in some regions, 3 feet in others.

One final example in terms of hard cash: It is estimated that the construction of the Kentucky dam alone—the lowest and largest of the TVA main river dams—will save the Illinois Central and two other smaller railroads a sum of over $10 millions for such purposes as the raising of tracks out of flood danger.

The TVA does not undertake the retail distribution of power (except in a few rural areas), though it supplies power directly to large industries (such as Alcoa, the huge Aluminum Company of America). However, though it still supplies some utility companies, it has made every effort to persuade municipalities to organize their own distribution, and to see to the formation of Electric Co-operatives in rural areas, **96-99.** This policy has been very successful; in general, the municipalities and co-operatives have made a profit, and the consumption of electricity in the region has gone up by leaps and bounds. The TVA annual revenue from the sale of power had reached $1 million by 1938, $5 millions by 1939, and over $21 millions by 1941.

The total amount of power sold by the TVA during 1941 showed an increase of nearly 40 per cent over 1940, and almost reached 5,000 million kilowatt-hours. Nearly half this amount went to 78 municipalities and 38 co-operatives, 37 per cent direct to large-scale private industry, 11 per cent to private utility companies for further distribution, and 5 per cent either to TVA agencies such as the fertilizer plant or by way of direct sale to rural consumers.

THE ELECTRICITY "YARDSTICK"

One of the original aims of the TVA, and one much publicized in its earlier years, was to set up a "yardstick" by which to measure the relative efficiency of private and public organizations for the generation of electricity, and to assess the degree to which the private organizations, the utility companies, had been carrying out their duty to the public of providing cheap and abundant power, as well as securing the interests of their shareholders. In the period before the depression, many utility companies had been guilty of undue watering of stock, and there was also the impression that their general policy was to make sure of their profits by keeping rates high, without making special efforts to expand consumption.

"Yardstick" was an unfortunate term, because much too static. The real value of the TVA experiment has been in demonstrating the elasticity of everything connected with electricity supply. It is not cost which dictates rates, but vice versa: low rates bring high use, and this in turn low cost per unit.

Where the TVA has produced a real yardstick is in the field of distribution. Its experience has shown that any urban distributing system which can obtain power at something like the TVA wholesale rate, and is willing to use the same sort of advertising which has increased consumption in the Valley, can fix a retail price below the usual range of private companies, and yet be sure of a reasonable return.

There is no doubt that the achievements of the TVA in fostering consumption and so being able to reduce rates to new low levels while yet making a profit, has had a marked effect on the utility companies both in the U.S.A. in general and in the Tennessee region in particular. Thus from the time the TVA was first able to operate on a large scale (in 1937), its rate per kilowatt-hour for residential consumers has been very little above 2 cents—almost as low as the 1¼ cent rate achieved by that paragon of hydro-electric supply, the Ontario system. In 1933 the average rate for the U.S.A. was 5¼ cents, and that for three big utility companies covering parts of the Tennessee Valley area nearly 5¼ cents. By 1939 the U.S. average had dropped to 4 cents; but that of the local companies, more directly stimulated by competition with the TVA, to below 3 cents.

Similarly the average residential consumption of electricity (in kilowatt-hours) by TVA customers, which was below 600 in 1933, had risen to over 1,200 by 1937, and to nearly 1,450 by 1940. The average for the U.S.A. as a whole was just about 600 in 1933, and for the three above-mentioned local utility companies under 750; by 1939 the U.S. average had increased by slightly over 50 per cent, and that of the local companies by no less than 80 per cent. The net revenue of the private utility companies of the region has actually increased by about 25 per cent. In 1940 the sales of electric appliances per residential customer, averaged $32 for the U.S.A., but $46 for the "backward" Tennessee Valley.

TVA power is sold to large industrial firms at a rate which ultimately drops with increasing consumption to 0.15 cents per kwh. As a reduction of 0.1 cent per kwh will make a difference in the cost of producing aluminium, for instance, amounting to $24 a ton, and this in most cases will outweigh differences in labour or transportation costs, the importance of low industrial power rates is clearly very great.

Thus by these criteria the TVA had certainly justified its existence, and had induced the utility companies to change their policies. But though the facts demonstrated that the private companies could still make a profit at considerably lower rates, if they took the trouble to stimulate consumption, the upholders of private initiative and the financial interests behind the utility companies maintained that the still lower rates at which the TVA claimed to be able to make a profit could not be justified on strict business principles. The TVA, they urged, could assign an undue share of the capital cost of the dams to navigation and flood-control, and could then, of course, show on paper a profit on their power. Criticisms have also been made of the accounting methods of the TVA, especially those involved in calculating depreciation. Thus, it was asserted, the yardstick provided by the TVA was a false one, and private companies could not be expected to cut their rates to the TVA level without going bankrupt.

COSTING AND TAXATION

The problem of allocating the cost of multi-purpose structures like the TVA dams, so as to determine what proportion is properly chargeable to one of the purposes, such as power generation, is without question a difficult one, and the TVA has devoted much thought to it. Certain costs can be allocated wholly to one or other purpose—the power-houses to power, the locks to navigation, the flood-gates to flood-control. But the cost of the general water-control system—the dams themselves, and the lands that are to be submerged by the reservoirs—must be split up. The method eventually adopted was as follows: Estimates were made of the cost of erecting three water-control systems, devoted respectively to power-production alone, to navigation alone, and to flood-control alone, each securing in its own field approximately the same results produced by the existing system. On this basis, the allocation of multi-purpose costs is as follows:—36 per cent to navigation, 24 per cent to flood-control, and 40 per cent to power. When the single-purpose costs which can be directly allocated to one or other of the functions are added, the proportions of the TVA's total investment in its water-control and water-utilization system, which are chargeable to the separate purposes, become 21.8 per cent for navigation, 12.4 per cent for flood-control, and 65.8 per cent for power. In other words, if the TVA's power programme is to be self-supporting, as directed in the Act, power revenues must cover not only power running costs, but depreciation and interest on 65.8 per cent of this total investment.

In any case, the allocation for power applies only to the wholesale cost: the real advantage to the region springs mainly from the methods of distribution employed.

For calculating depreciation, the TVA offers the choice of two methods—a sinking fund at 3 per cent, in which the computation of the return is based on the average investment in power facilities before depreciation, or the more drastic straight line method, in which the basis is the average depreciated investment.

The return for 1941 on the investment in power-production (i.e., 65.8 per cent of total investment) on the former method was 4.4 per cent, on the latter method 4 per cent. The corresponding figures for 1940 were 3.6 per cent and 3 per cent, showing, as might be expected, an improvement as new sources of power came into operation. This is not a rate of profit over which shareholders in a private company would be very enthusiastic (though it was higher than the dividends of most private utility companies during the '30's), but is quite satisfactory for a public agency, one of whose primary concerns is with the general development of a region.

It should be added that the annual appropriations for the TVA varied between $25 and $50 millions up to 1940, but were then increased, under the impetus of war production needs, to $65 millions for 1941 and $197 millions for 1942. The total from the inception of the TVA for the 9 years through 1942 has been over $530 millions.

It was also objected that the TVA did not pay taxes like a private company. However, payments in lieu of taxes had always been made, so that State and County authorities and Municipalities should not lose, and the position was made definite by an amendment to the TVA Act passed in 1940, the TVA itself helping with the drafting of the new provisions. It is there laid down that the TVA is to pay in lieu of taxes a definite proportion of its gross revenues received from the sale of power, beginning with 10 per cent and dropping in 8 years to a final figure of 5 per cent. It is estimated that the expansion of tax-yield will approximately offset the decrease in rate. The detailed evaluation of the relation of all the in-lieu payments to the taxes which would have been paid by a private enterprise is complex. In addition the benefits accruing from the TVA, including increased land values near reservoirs, and the large consumer saving (about 9 million dollars a year), due to the TVA's low power-rates, must also be taken into account.

From the general point of view it is clear that the TVA has financially benefited the region. From the standpoint of accounting, however, it seems almost impossible to compare the operations of a private company, where direct profitability is the yardstick, with those of a multi-purpose long-term development agency like the TVA, where much profitability is indirect, and many benefits cannot be assessed in simple financial terms. But we can say that it has been able to sell power at a rate well below that of its private competitors, while at the same time earning a good return in the form of some actual cash profit together with a general increase in the prosperity of the region.

THE SOIL

The other major objective of the TVA has been to check soil wastage and improve soil utilization, **10-22.** In this field a number of measures are integrated into a single programme:—the manufacture of fertilizers; the putting back of land unsuitable for arable crops into grass or forest; the saving of gullied slopes by the building of check dams and the planting of shrubs and trees; the prevention of erosion on arable land by new methods such as contour ploughing, **17-20**, or new cover-crop plants, **13**; the diversification of agriculture and the encouragement of dairying and livestock industries in the large regions of the Valley better suited to them than to maize and cotton; the provision of new outlets for new types of produce, as by the organization of co-operatives for canning or quick-frozen fruit (this latter having demanded the production of new refrigeration machinery as well).

Here, as always, the TVA co-operates with other agencies in the execution of its programme. For instance, the C.C.C. (Civilian Conservation Corps), one of the most successful and popular New Deal Organizations, was set up to provide unemployed boys and young men with work which should be useful to the community while not coming into conflict with private industry or business. Here was an instrument ready to the TVA's hand; and arrangements were made by which the building of check-dams and the planting of shrubs and trees for anti-erosion purposes were carried out mainly by the C.C.C., whose admirable camps were scattered about the region. No less than 75 million seedlings have thus been planted in the Valley by American boys who would otherwise have been out of work (another 44 millions have been planted by individual farmers). The total area of gullied and badly eroding lands reclaimed in the Valley by planting amounts to over 150 square miles.

But the long-term improvement of agriculture is naturally the most important positive aim in this field. In agriculture there was, of course, an elaborate regional and field organization already in existence in the U.S.A. This began in 1862, when the Land Grant Colleges were established—so called because in every State lands were granted from the public domain to endow a College for the teaching of "Agriculture and the Mechanic Arts." Twenty-five years later these were supplemented by Federal provision for experiment and research, by way of the establishment of an Agricultural Experiment Station attached to the Land Grant College in each State. Twenty-seven years later again, in 1914, the need for forging a link between research and practice led to the establishment of a national system of Agricultural Extension. The funds are provided jointly by the Federal Government, the States and their constituent counties, and the system operates mainly through County Agricultural Agents. Meanwhile, the U.S. Department of Agriculture at Washington (the largest Agricultural Department in the world) helps to co-ordinate as well as to finance these various local agencies.

The TVA naturally wished to operate through this comprehensive system. Accordingly, it arranged for the setting up of a Co-ordinating Committee, which represented the seven local Land Grant Colleges, the U.S. Department of Agriculture (in regard to the Agricultural Extension Service) and the TVA; and was based on a three-way co-operative agreement or "memorandum of understanding." Thus the region is provided with a system pooling all available agricultural knowledge and agricultural personnel, and unified agricultural planning is made possible.

Some States have introduced compulsory "agricultural zoning," by which certain types of farming are prohibited in certain areas. In the TVA, however, there is no compulsion, and everything is done by persuasion. What is more, the persuasion is not mere exhortation, but involves the active participation of the farmers. The idea of the official demonstration farm has been turned down, as so many farmers feel that there is a catch in anything run officially and backed by unlimited public money. In its place, farmers run their own farms as test demonstration farms. The usual procedure is for the county agent to call together a group of farmers, who then select one of their number—naturally with his full agreement—as the *corpus vile*. He undertakes to run his farm for a definite period of years on lines recommended by the agent, **11-16.** The TVA pays the salaries of assistant county agents, whose primary duty is to supervise the test demonstration programme. The TVA also provides the fertilizer required, but only on condition that the farmer employs it on soil-protecting or fertility-building crops, such as certain types of grasses which retain water, or of legumes which in addition fix nitrogen. The farmer pays the freight and handling charges, and can, of course, buy additional fertilizer out of his own pocket for use on other approved crops. The TVA now concentrates on phosphates to the virtual exclusion of nitrates (which are supplied by legumes instead of as fertilizer), but with calcium as a supplement where needed. The farmer must also adopt anti-erosion methods, such as contour-ploughing or terracing.

The group of farmers, together with the county agent and his assistant, constitute themselves into a supervisory committee, which decides which crops shall be grown on which part of the farm, and other points of farm management. One important point is the farmer's undertaking to keep detailed accounts and operating records, and to make these as well as his farm available for inspection to the other farmers in the group.

Man-made deserts

These deserts are caused by mining, 7, by erosion, 8.

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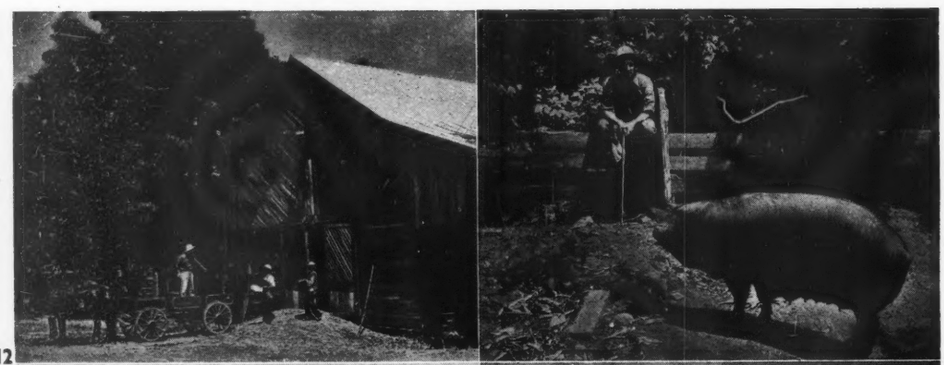

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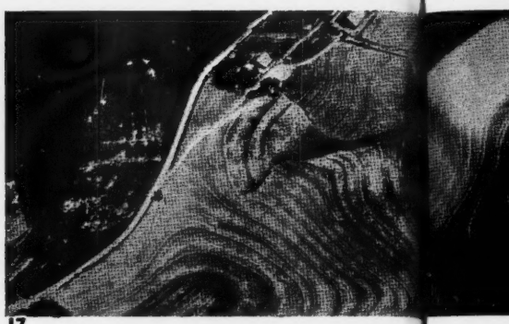

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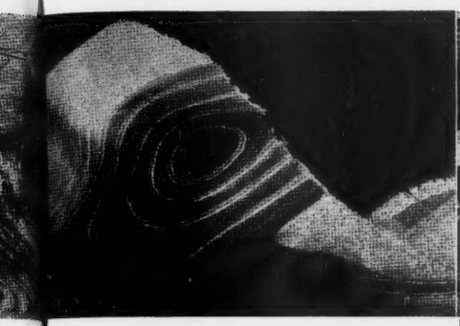
Soil regeneration

It is not impossible to reclaim land from devastation. In 18 *months tree planting begins to heal gullies,* **9** *and* **10**. *Every year more than twenty million trees are planted by the TVA. Roots penetrate and bind soil, while vegetation spreads over the surface of the ground. Decaying leaves and twigs build top soil. Marginal land can be reclaimed for farming. The Cox's own a typical* 500*-acre farm,* **11-16**, *which is being revitalized by TVA.* **11**, *Cox's farm hands load TVA produced super-phosphate fertilizer on to a wagon.* **12**, *Mr. Cox admires his prize sow. Improved breeding and feeding has resulted from University and Agricultural Station research. Alfalfa grass for cattle binds top soil and retains water,* **13**. *Farmer Cox's land can again support a sizeable herd of cattle,* **14**. *The big power dams of the TVA run electric incubators,* **15**, *as well as vast munitions plants. Mrs. Cox can now press her laundry in the most modern way,* **16**. *Timber, clover and pastures are good cover for land, but all the land cannot be kept under cover ; some of it must be cultivated. On the gentler slopes the tilled fields are given substantial protection by a new modification of the age-old method of terracing,* **17** *to* **19**. *The terraces and the plough follow contours. Terraces are formed by a tractor-drawn grader,* **20**, *and retain* 85 *to* 90 *per cent of the rainfall. Terraced and contour-ploughed fields, increasingly prevalent in the Tennessee Valley, produce better crops, which in turn help to hold the moisture,* **22**. **21** *shows the success of scientific soil fertilization.*



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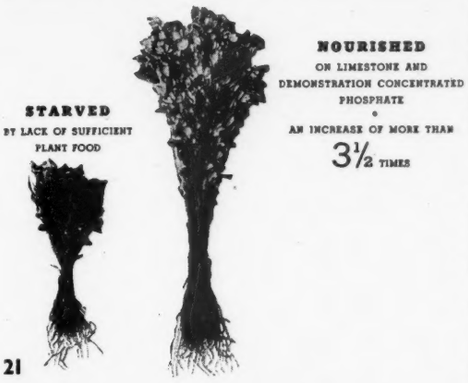
In some areas the farmers are so backward that they won't be bothered to form a group of this kind. In such cases, purely individual demonstration farms are sometimes set up. At the other end of the scale, we have area demonstrations where all or almost all the farmers of a small watershed



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or other fair-sized area are willing to participate actively in the experiment. While in the case of single-unit demonstration farms it is quite usual for the other farmers in the neighbourhood to copy the new methods to a certain extent, only area demonstrations can bring out the full advantages of co-operation.

So successful has the method proved that it has been widely applied outside the boundaries of the Valley, and not merely in the Valley States, but in 19 others as well, though almost entirely in unit farms, not in area demonstrations.

This agricultural demonstration is on a huge scale. Over 42,000 farms have at one time or another been the subject of a test demonstration, and over 27,000 are still actively engaged on the work; about half of these numbers are unit demonstration farms, while the rest form parts of area demonstrations. The total area involved has been no less than 9,500 square miles, while active demonstrations are still in progress on 6,400 square miles—nearly one-eighth of the entire area of England.

The total number of farmers affected, including the neighbours who make up the committees for the unit demonstration farms, is round about 800,000, as compared with about 300,000 in all England.

Out of the 6,265 unit demonstration farms in the Valley, I visited two. One belonged to a tough old fellow of the old school. He had proved rather recalcitrant, and had obstinately refused to terrace, though in accepting free fertilizer he had, of course, pledged himself to adopt any new methods required. So the county agent came one day when he was away and did it for him. He was very cross when he got back, but now admits it is an improvement. Wherever possible the TVA encourages the raising of livestock, and this farmer is extremely proud of the fine herd of beef and dairy cattle they have helped him to build up, with considerable resultant increase in his personal prosperity, as well as in the value of his farm to the agriculture of the region.

The other farm was exceptionally interesting. It was owned by a young man who was the only farmer in the neighbourhood to take any interest in the TVA's new-fangled ideas, so that he ran his farm without benefit of a committee of neighbours. Sometimes he even disregarded the advice of the county agent, as when he insisted on buying a mechanical manure-spreader and using it with a tractor on hillsides so steep that the agent advised against it. However, he got away with it, and after five years' occupancy, was offered $4,500 for the farm that he had bought for $1,200.

The reaction of the neighbours was interesting. At first they were entirely sceptical and put down all his successes to luck. After five years, however, they began to think there must be something in the new ideas, and are beginning to think of doing something themselves. Five years seems a long time-lag; but at least converts under these circumstances are not likely to backslide.

This type of demonstration programme takes time to produce results. It is cumulative in the long run, but it starts slowly. Though its eight years of existence are not long enough to evaluate anything in the nature of final results, the trends are clear. To take a concrete measure of prosperity, there has already been a considerable increase in the purchases made by farmers at their local stores, markedly so in the case of those who are using the new methods. Then the type of farming is becoming visibly altered. There are fewer hillsides planted with maize and other row crops; more Lespedeza and other legumes; more grass, including the famous Kentucky blue grass (which won't grow without plenty of phosphorus); more livestock; more terracing on the slopes; more trees.

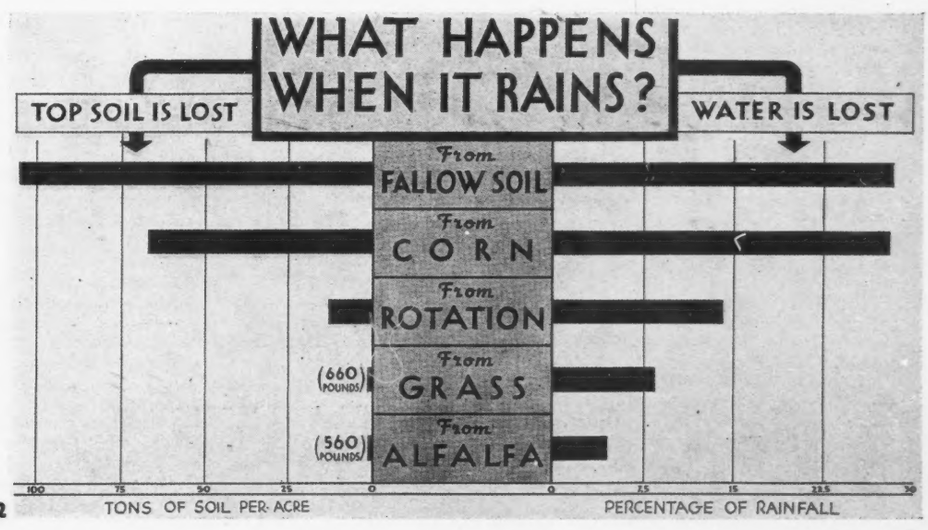
I may sum up in the words of Mr. Lilienthal, the Chairman of the TVA, "All over the Tennessee Valley region you can look upon land that eight years ago was gullied and exhausted, declared too far destroyed for productive use; now it is restored and helping to support farm families. You can go into community after community and find farmers and whole communities alive with energy and hope and renewed faith in themselves and their capacity to meet their responsibilities to their land and to their country."

RECREATIONAL RESOURCES

The TVA has many secondary functions, which it is impossible to discuss at length in a single article. However, we may take recreation as an example, partly because it so well illustrates the TVA's method of securing results by co-operation with other agencies, partly because nowhere else in the world has the problem of recreation within a considerable region received such careful and exhaustive treatment.

All TVA projects are initiated either by research or by that careful survey which in social studies is often the necessary substitute for research in the strict sense. Recreation was no exception. The first task was to make a general study of recreation outside urban areas. This was one of the earliest attempts at a functional analysis of the subject, and led to a classification of the public's recreational requirements and, leading on from this, of recreational areas on the basis of types of use. This was done in 1934. In 1935, an inventory of the scenic resources of the region was undertaken; and a report based on this was issued three years later.

For these purposes, existing maps were quite inadequate, and a vast body of new information



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and photographic record was amassed, while new methods were developed, notably for the evaluation of different areas for recreation purposes. Further inventories were later made of other recreational resources, such as water areas, wild life, points of pictorial and scientific interest, etc. Such a project could not well have been undertaken by counties and municipalities, or even by States: it would inevitably have tended to become a mere catalogue of projects for local development rather than a true inventory of a basic resource of the whole region.

Also in 1938 a detailed report was published on Recreational Development of the Southern Highlands Region, as being the part of the Valley most suitable for recreation. (In passing, we may well envy the far-sighted conservation policy of the U.S.A., initiated by Theodore Roosevelt, when we find that over a quarter of the 40,000 square miles of the Southern Highlands is or will shortly be public domain, under either Federal or State ownership.) One of the chief recommendations of this report was that both the conservation and recreation activities of each State within the area should be consolidated in a single department, which should include a special division for parks.

Already in 1936, long before publication of the report, the Authority had taken the initiative in calling a conference on the subject. This was noteworthy as an early example of successful co-operation on the inter-State level. Planning and conservation officials of six States attended, as well as representatives of the National Park Service, the National Resources Board, and, of course, the TVA itself. One important result of their discussions was an agreement as to the form of State legislation required for conservation and recreation purposes, the most important points being the consolidation of all conservation functions under one administrative agency, and the agreement as to the type of laws needed for the enabling of local planning and for the regulation of development. These points, in slightly modified form, were embodied in the Conservation Act subsequently adopted by the State of Tennessee, and have influenced legislation in other States.

Later, an attempt was made to establish a Council to co-ordinate recreational planning in the Southern Highlands, but difficulties arose owing to the fact that only a portion of each State fell within the area, and so far only a provisional and more or less unofficial committee with limited powers has been created, though it has already done useful work.

Returning to the basic problems of survey, we find that the TVA has also made studies of transport facilities from the point of view of recreation, and of tourist travel within the area. These again have been made co-operatively, in conjunction with the U.S. Bureau of Public Roads, the various State and Country Highway Boards, the State and local planning agencies, and the C.C.C. Then, since fishing and shooting are recreational lures for a great number of people, the TVA brought in the U.S. Bureaus of Fisheries and of Biological Survey, and the appropriate departments of the various States concerned, to study the whole problem of the wild life of the Valley, aquatic as well as terrestrial, with a view to restoring it from its present sadly depleted state (deer, for instance, had been virtually exterminated except in the most remote regions) to become a self-perpetuating resource at a high level of productivity.

In regard to fish, the new conditions caused by the conversion of the river channel into a series of lakes, and by the creation of the storage reservoirs, have been most carefully studied. Over half a million acres—nearly 1,000 square miles—of fishable water will soon be available, and are already being taken advantage of in a big way. It is estimated, for instance, that the number of people now fishing on Norris Lake is at least 75 times as great as the number who used to fish in the rivers of the area before the lake was created. Already by 1940 about a million and a half individual fishing trips (including those by commercial fishermen, though these were in the minority) were made on the various new TVA lakes, and over 2,000 tons of fish were brought in; and new lakes are still being created. A great many new types of fish have had to be encouraged, since many river fish do not thrive in the lakes.

In other regions reservoir fishing, after a good beginning, has often gone downhill badly in the course of a few years. The TVA is making a careful study of the restrictive and positive measures needed to avoid this, and is confident that the TVA lakes should continue indefinitely as good fishing grounds. In justification of its belief it can point to Wilson Lake, which is already 15 years old, but shows no signs of exhaustion. The largest fish hatchery in the world has been built at Elk River near Wheeler Dam, and is operated jointly by the TVA and the U.S. Bureau of Fisheries; and aquatic vegetation of the right sort is being encouraged in the lakes to provide shelter and food.

Quite apart from the prosperity brought to the region by this new resource of fish, there is its value for recreation. As one of the TVA biologists has expressed it, "a million fishing trips on TVA lakes represent far more than the economics involved. They represent a million adventures in healthful recreation, having a value that cannot be estimated." Sailing, rowing, canoeing, and motor-boating is also providing an enormous amount of new recreation and continues to expand steadily, **27-37, 101-103.** On Norris Lake alone there are over 2,000 pleasure boats. The TVA operates one boat dock as a demonstration and standard, but otherwise grants facilities to private concessionaires under revocable licence. At Pickwick, the licensee is a company which operates a complete recreation centre. Within a decade, the Tennessee Valley, where this form of recreation was previously almost unknown, has become the main outlet for the pleasure boat industry of America.

PARKS AND WILD LIFE

The United States is a land of parks, in the sense of areas of natural landscape set aside for public enjoyment, **23-26.** The TVA early made an agreement with the National Park Service, whereby it was recognized as a "Park Authority," and proceeded to use its powers to set up five demonstration parks in the Valley. These contain group camps, family cabins, restaurants, picnic facilities and the like, **104-107,** and were set up to stimulate States and cities within the area to make the most of their recreational resources by following suit. It must be remembered that the inhabitants of the Valley had had little previous experience of tourist traffic, save in a few mountain areas, and found it difficult to visualize the enormous possibilities in this field. Thus the demonstration parks and camps had as one of their main functions the kindling of popular imagination. As a further method, the TVA also draws the attention of the State authorities to areas which seem suitable for development as State parks, and is willing to lease the land at a nominal rent, conditionally on all plans being approved, and all actual parks being inspected, by the TVA. One of the most interesting of such projects is the Booker T. Washington State Park, close to Chattanooga, which is entirely reserved for Negroes. The TVA, in conjunction with the U.S. National Park Service, is willing to act as advisers on all park matters in the area.

At the moment, the TVA is attempting, with some success, to stimulate the State Recreation Departments to expand their programmes by adding city parks, golf courses, youth hostels (which are still often looked on as "immoral" in the south), playgrounds, summer schools, and the like, and making them available to all sections of the community. Attempts are also being made to educate the public in the best use of the region's recreational resources. Up till recently they have tended to want everything made easy for them, and have rarely felt any pride of ownership in what after all are *their* parks and *their* wild landscape. However, this attitude was beginning to change rapidly in the period just before America's entry into the War.

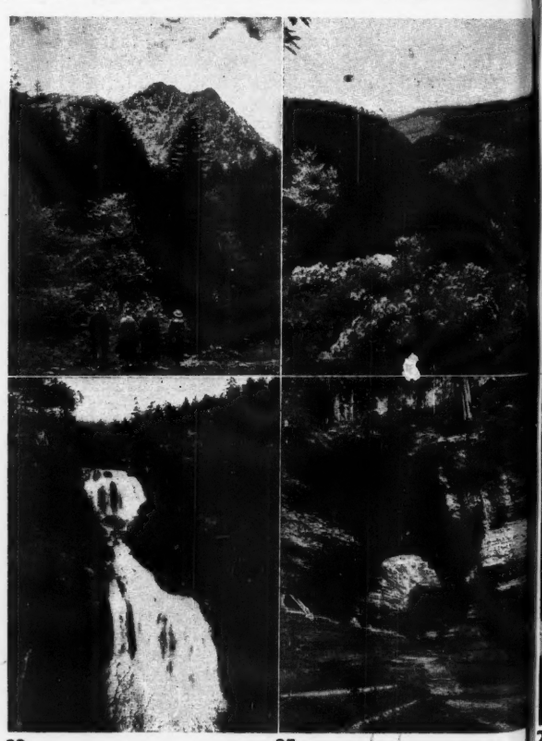
This type of activity, in catalysing and canalizing action, is one of the TVA's special contributions to democratic planning. The creation of a special Department of Conservation by the State of Tennessee is a direct outcome of this. As a result of the joint stimulus provided by the TVA and the Federal Government, the State parks programme has undergone great expansion. For instance, in the two years 1936–38, the U.S. National Park Service spent $3½ millions on recreational demonstrations in the region, and allocated a further $8 millions to State and local agencies for parks. The States themselves set aside rather under $500,000 for parks in the same period.

To sum up, we may say that instead of regarding their reservoirs merely as reservoirs (as occurs too frequently in Britain) the TVA has from the outset realized their enormous potential value for recreation, and has gone on from this to plan for the sane development of all aspects of recreation in the Valley. Already, as a result of only ten years' work, provision has been made for the conservation of the natural beauty of the region and the permanent development of its wild life; the Valley has become one of the major tourist centres of the U.S.A. and recreation in it brings in at least $100 millions annually to the region; the health and happiness of its citizens and its

Under the stimulus of the TVA the wonderful natural scenery of the Valley is attracting an ever-increasing flow of visitors. The tourist industry is beginning to be of great economic importance to the inhabitants. Within the region is the Great Smoky Mountains National Park, 695 square miles in extent. It comprises as large a concentration of unspoiled scenery as exists in the United States east of the Mississippi, including the finest primeval hardwood forest in the country. Rocky peaks (the Two Chimneys in the Great Smokies, 23), waterfalls buried in the forest (Whitewater Falls in Nantahala Forest, 24), mountain laurel (Trenton Gulf on the west of Lookout Mountain, 25), and natural bridges (Waynesboro, Wheeler Basin area, 26), are features of the National Park.

By creating reservoirs behind the dams, TVA has itself made vast recreational areas. These protect the shoreline, 6,000 miles of which are now in public ownership, and make it accessible to tourists and campers. The new national playgrounds may become State Parks. TVA has directed the design and building of camps and has set standards appropriate to Valley conditions. Cove Lake Inn, 27, with a group of tourist cabins on Norris Lake became a favourite point for local recreation as well as an important overnight stopping place for tourists on the nearby highway. Various types of well-furnished cabins, 28, and picnic shelters, 29, have been built in frequented spots. Yachting, 30, swimming, 32, fishing, 34, canoeing and boating, 36, are now a sport of the many instead of the few.

Well-balanced farming will eventually complete the rural scene, 31. Already Mississippi river boats can navigate the length of the main river, 33. The great lakes with their vast surrounding forests, 35, form beautiful recreational areas and make playgrounds for the



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visitors has been increased; and—not least important—the people of the Valley have become conscious not only of the economic but also of the social importance of its recreational resources.

With all this, however, the TVA is not satisfied. In its latest report on the subject, it asks Congress to broaden its statutory powers so as to permit it, in due co-operation with other agencies, to undertake the actual development of the recreational resources over which it has jurisdiction, notably the vast system of lakes. If so, the present achievements in this field, large though they are, would be quite dwarfed by what might be expected in the future.

I spoke earlier of the wild life survey of the region, and of the development of the fisheries. On land, too, considerable progress has been made. Game management areas and game refuges or sanctuaries have been set up at various suitable spots on the lands owned by the TVA round its reservoirs, and close to Wheeler Dam a huge sanctuary, the Wheeler Migratory Waterfowl

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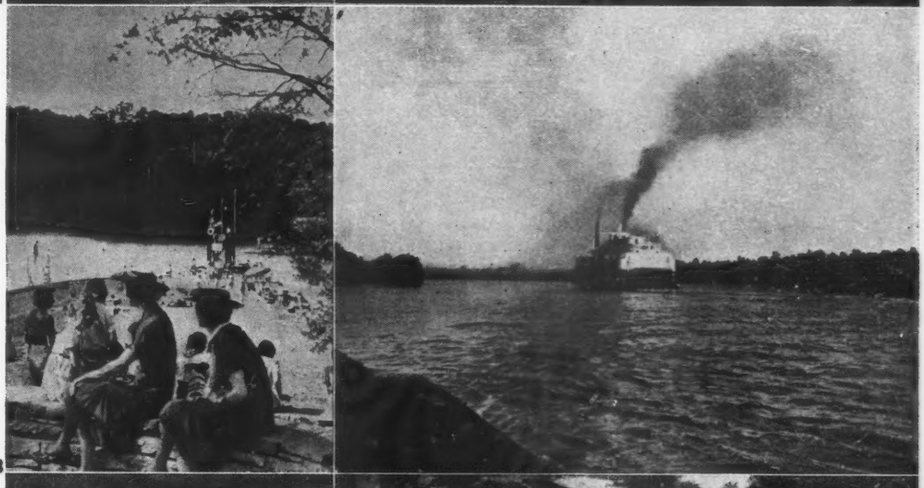

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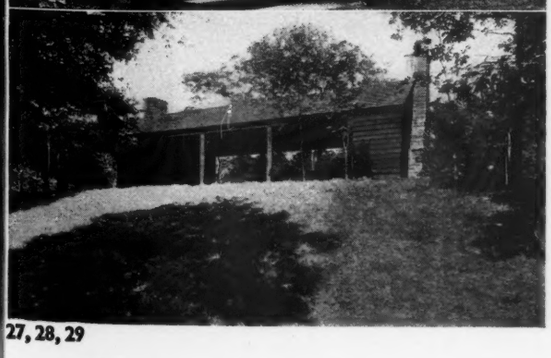
generation and generations to come, **35.** *There is, however, one grave danger in the TVA's creation of such wide areas of very slowly flowing lakes. Malaria has long been a serious plague in the Valley. The flood-control has considerably increased the potential breeding places for anopheline mosquitoes. Active steps are being taken to prevent the spread of the disease by destroying larvæ in breeding grounds and teaching people how to protect their homes. The chart on the next page,* **38,** *shows the estimated social and economic losses due to malaria in eight counties, for the population living within one mile of the shoreline of TVA reservoirs. Malaria is most common in rural communities and, because the attacks often occur in the spring or autumn when crops need to be planted or harvested, they interfere with farming life and the principal source of income.*



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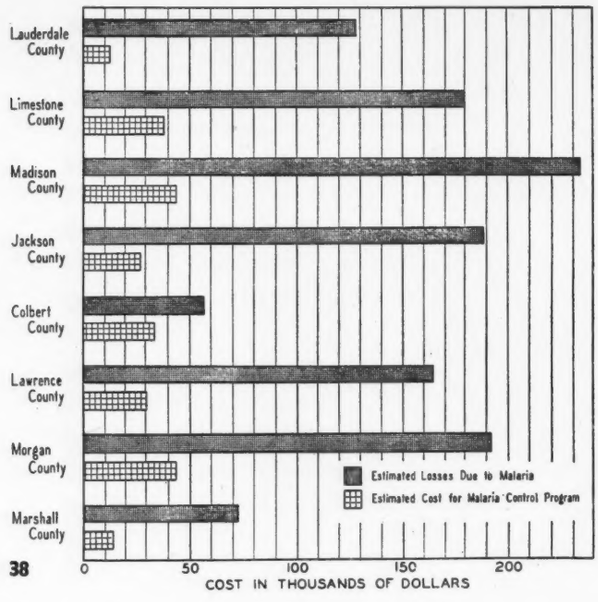


Costs of malaria and of the anti-malaria campaign. **38**

Refuge, over 60 square miles in extent, has been established by executive order, and is managed jointly by the TVA and the U.S. Bureau of Biological Survey. The game of the region, brought to a very low ebb by thoughtless overshooting, is slowly being brought back, and with it much other wild life; in some places the deer, not so long ago on the verge of extinction, are now having to be thinned out.

HEALTH, LABOUR, EDUCATION

The TVA's public health activities would equally repay analysis, but space forbids. Here I will only mention one particular aspect—that of malaria. Malaria was always a grave problem in the Valley, **38,** and the activities of the TVA in creating huge bodies of standing water, often with a much indented shore-line, of course accentuated its extent and its gravity. The shore-line of Norris Lake alone is over 800 miles in length. Some of the later dams have been sited and designed with malaria control in view—I believe the first examples of such integrated planning. Ingenious new methods of temporary draw-down of water-level, and the damming of small inlets, have been used to minimize the breeding of mosquitoes in the lakes. In conjunction with Federal, State and local authorities, intensive educational and prophylactic anti-malarial campaigns have been undertaken. Malaria is very far from disappearing in the Valley, but it is beginning to show a decline.

The TVA practises an enlightened social policy. A fine type of young engineer who in 1934 motored me down the Valley, told me that he would in the normal course of events never have dreamt of entering Government service, it was so red-tape-ridden and so corrupt; but that the TVA, with its high standards and its avowed social purpose, had attracted him and many other young men and given them a sense of enthusiasm above what they could have found in private business.

The attitude of the TVA to the Negro problem has been a gleam of light in that murky region of race prejudice and fundamentalism which included Dayton, scene of the notorious evolution trial, and Scottsboro. It employs Negroes in the same proportion in which they occur in the general population of the Valley—about 12 per cent; and pays the same wage for the same work irrespective of the colour of a man's skin. One interesting result of this, and of the TVA's general encouragement of Trade Unionism, has been an increase in local Negro membership of Trade Unions.

The TVA is now embarking on a programme of Joint Co-operative Committees, somewhat similar to our Joint Production Committees, designed not merely to improve labour conditions, but to give the men a greater sense of participation and of pride in their job.

Elaborate training programmes are provided, designed not only to increase the men's efficiency for their work under TVA, but to enlarge their range of skills as a basis for the future. A body of specially selected men is deliberately transferred from one job to another until they have run the gamut. This not only gives them greater interest in their work, but provides a workers' *corps d'élite* from whose ranks men can be picked to undertake the more skilled jobs and to become foremen. And all employees are given the chance of extending their occupational competence: some 12 per cent of the total labour forces of 33,000 take advantage of this.

Education deserves a passing mention. I visited Norris, the town built originally to house the workers on the dam site, but planned from the outset to be convertible to permanent use by various sections of the TVA staff. There I found the school, the centre of the life of the community, rather like one of the village colleges in Cambridgeshire. Here once more the network of co-operation with other agencies is of great interest. The school itself is taken over and operated by the University of Tennessee, in agreement with the County Education Authority, as a demonstration school where teachers can be trained in practical work. Graduates of the University may come out and teach and study here for a year, and this counts towards their higher degree. Children from neighbouring areas are brought in also, to provide more variety of material for the trainees, and to benefit by the special teaching and admirable modern curriculum which has been introduced.

Adults and children play Box and Cox with the school facilities. Thus the school art room is used for art and handicraft work by adults in the afternoons and evenings, and the school workshop for engineering work. The playground is floodlit to give the adults a soft-ball court after their day's work is over. The school auditorium, which is also equipped as a gymnasium and a theatre, is used by the community at large as church, meeting hall, cinema, gymnasium, theatre and concert and lecture hall. I don't think I have ever seen a better school library; this is, of course, available to the rest of the population as well. The school also provides excellent study classes for adults.

ARCHITECTURE AND DESIGN

I will pass over many other facets of the work going on in the Valley, but I must devote some space to architecture, for in this field the existence of the TVA has had important cultural repercussions in the field of architecture. In its programme, as so often elsewhere in the modern world, utilitarian needs and new techniques have set the pace for purely architectural advances. The great series of dams and power-houses which are transforming both the landscape and the life of the region have made a notable contribution to the central architectural problem of to-day—how to integrate human construction and its natural

Buildings for employees. The school, **39,** *is operated in collaboration with the North Carolina Department of Education. Much of it will remain in permanent use for local residents. Art with a capital A had its first formal recognition in the Tennessee hill country when the Anderson County Art Center,* **40,** *was built. Here the work of local craftsmen and school children is exhibited, as well as that of Federal Art Projects. This is typical of the TVA effort to awaken new interests and self-respect among the "backward" peoples of the region.*

39

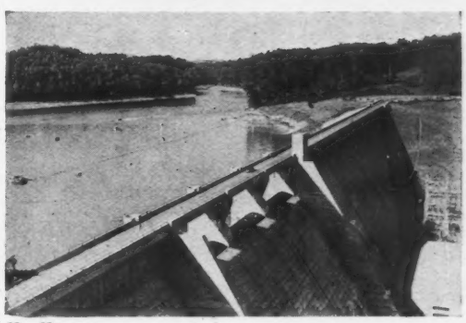
40

41

Prosperity recovered through control of water

Water control by the Federal Government was not a new concept in the U.S.A. In the middle of the nineteenth century President Fillimore recommended in his first annual address, that the Federal Government undertake works for waterway improvement. He said " that if these works are not to be accomplished by Congress they cannot be accomplished at all." Eventually the question of water power *came into being. This at last suggested a ready means of reimbursement for Governmental outlay. States and private interests made efforts to secure a portion of the resources that could be captured by waterway structures. It was not until* 1916, *after the great Mississippi flood, that Congress recognized the extensive and national character of flood control, and substantial expenditures were authorized. It recognized that floods are controlled by rains hundreds of miles from flood zones, that the area affected by a flood is often tremendous in size, and that local protection cannot cope with the problem. Earlier, in* 1912, *a National Waterways Commission reported that the Federal Government must undertake unified development of river systems by multi-purpose projects. The Federal Water Power Act, the Boulder Canyon Project Act and the Rivers and Harboring Act of* 1930 *preceded the TVA Act of* 1933. *It seems certain that some such experiment in regional planning was inevitable. The Roosevelt Administration hoped that experience gained in the Tennessee Valley could some day be applied to similar projects throughout the country and lead to a wise national programme of soil and water management.*

Emergency conditions in 1933 *made the experiment immediately possible. Wilson Dam, one of the properties acquired by the Federal Government in* 1918, *together with the two nearby nitrate plants, was keystone of TVA development. Norris Dam,* **41** *to* **44**, *was begun late in* 1933 *and completed in* 1936, *a year and a half ahead of schedule. Its design is a triumph of engineer-architect co-operation. By night and day visitors come to see the dam. At the entrance to the powerhouse is a special visitors' building,* **44**. *The surface pattern of the concrete work successfully achieved at Norris has been the basic finish for other buildings including those at Chickamauga,* **45**. *It comes from the vertical and horizontal boarding of the formwork alternated in each " lift."*



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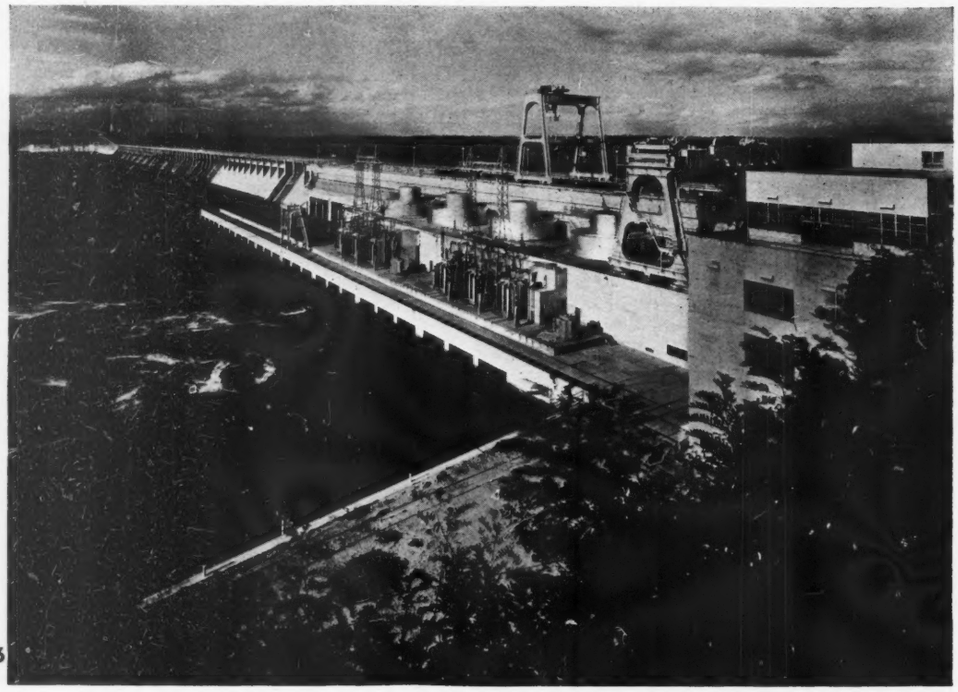
TVA DAMS

WHEELER



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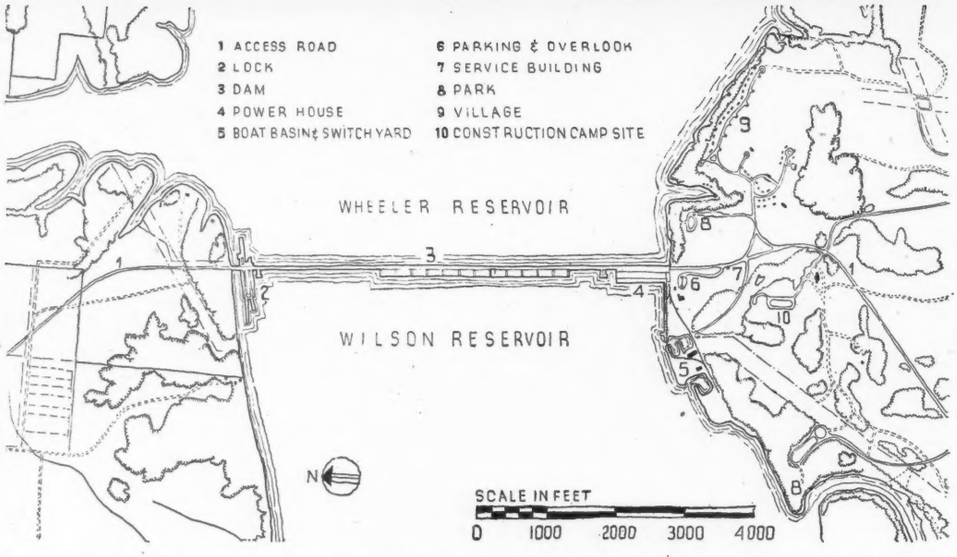


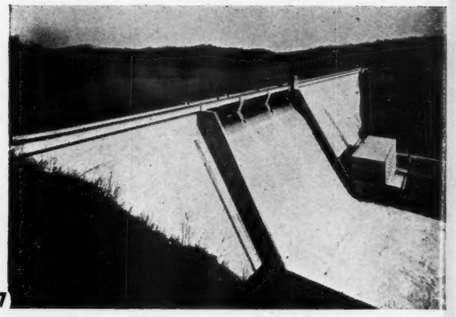
Already twelve huge dams, operated by the TVA, furnish electric power throughout the region. A vast group of munition industries are now being fed by them. If for no other reason, the planned development of the Tennessee Valley has been amply justified by the smoothness and speed with which it has been enlisted in the war effort. In no other part of the U.S.A. has this turnover been so easily accomplished. War has greatly speeded the completion of the final dams. In all, there will be twenty dams, nine on the main river and eleven on the tributaries. The dams on the main river are of great length but generally lower than those in the narrow valleys of the tributaries.

DAMS ON THE TENNESSEE RIVER

Dam.	*Height.*	*Length.*	*Location above mouth.*	*Completed.*	*Ultimate power installation*
1. *Kentucky*	160 *ft.*	8,650 *ft.* (1,788 *concrete* ; 6,862 *earth*) ..	22.4 *miles*	1944 (?)	160,000 *k.w.*
2. *Pickwick*	113 *ft.*	7,715 *ft.* (2,051 *concrete* ; 5,664 *earth*) ..	206.7 *miles*	1938	216,000 *k.w.*
3. *Wilson*	137 *ft.*	4,860 *ft.* (*all concrete*)	259.4 *miles*	1926	444,000 *k.w.*
4. *Wheeler*	72 *ft.*	6,342 *ft.* (*all concrete*)	274.9 *miles*	1937	259,000 *k.w.*
5. *Guntersville* ..	94 *ft.*	3,979 *ft.* (1,384 *concrete* ; 2,595 *earth*) ..	349 *miles*	1935	97,000 *k.w.*
6. *Hales Bar*	83 *ft.*	2,315 *ft.* (1,571 *concrete* ; 744 *earth*) ..	431.1 *miles*	1913	50,483 *k.w.*
7. *Chickamauga* ..	129 *ft.*	5,794 *ft.* (1,410 *concrete* ; 4,384 *earth*) ..	471 *miles*	1941	108,000 *k.w.*
8. *Watts Bar* ..	97 *ft.* .	2,965 *ft.* (1,764 *concrete* ; 1,201 *earth*) ..	529.9 *miles*	1942	150,000 *k.w.*
9. *Fort Loudoun* ..	135 *ft.*	4,835 *ft.* (1,835 *concrete* ; 3,000 *earth*) ..	602.3 *miles*	1944 (?)	96,000 *k.w.*

The eleven dams on the tributaries vary in height and length. Hiwassee, 307.5 feet high and 1,287 in length, is the highest, and Ocoee No. 2, acquired from a private company, the smallest, being only 30 feet high and 750 feet in length. By 1944, the total power installation of the twenty dams will be over two million k.w.
*Wheeler, **46**, was the first main river dam completed by TVA. The layout at the abutments is fairly typical. Norris, **47**, 265 feet high and 1,860 feet long, set a high standard in design for the smaller dams, and Wheeler for the larger. The bold designs and simple lines have been maintained in all subsequent projects, but it is interesting to see the gradual refinement of certain typical details. For example, the latest type gantry crane, **57**, used at Guntersville, Chickamauga and Pickwick, effects appreciable savings in machinery maintenance and gains aesthetically by simplification.*

NORRIS



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PICKWICK

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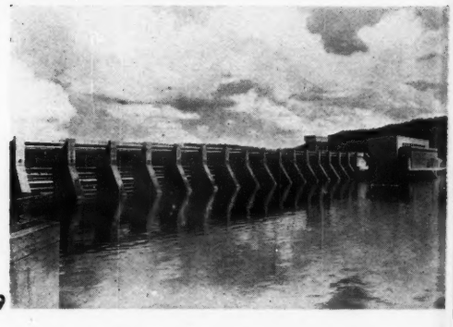
GUNTERSVILLE



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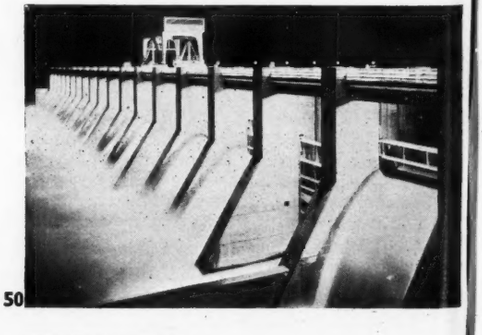
CHICKAMAUGA



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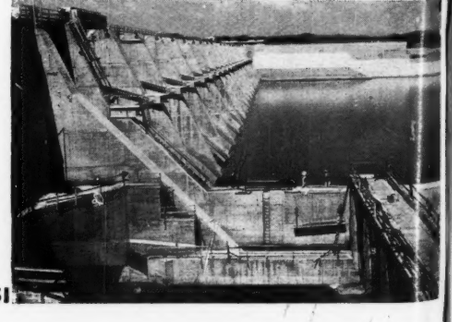
WATTS BAR



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HIWASSEE

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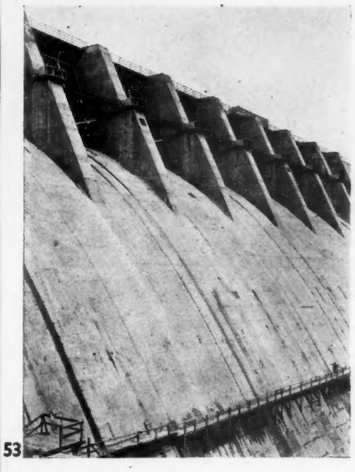
CHEROKEE



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FORT LOUDOUN

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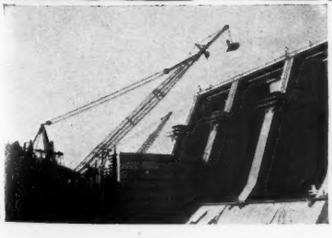

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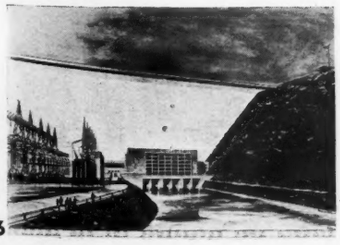

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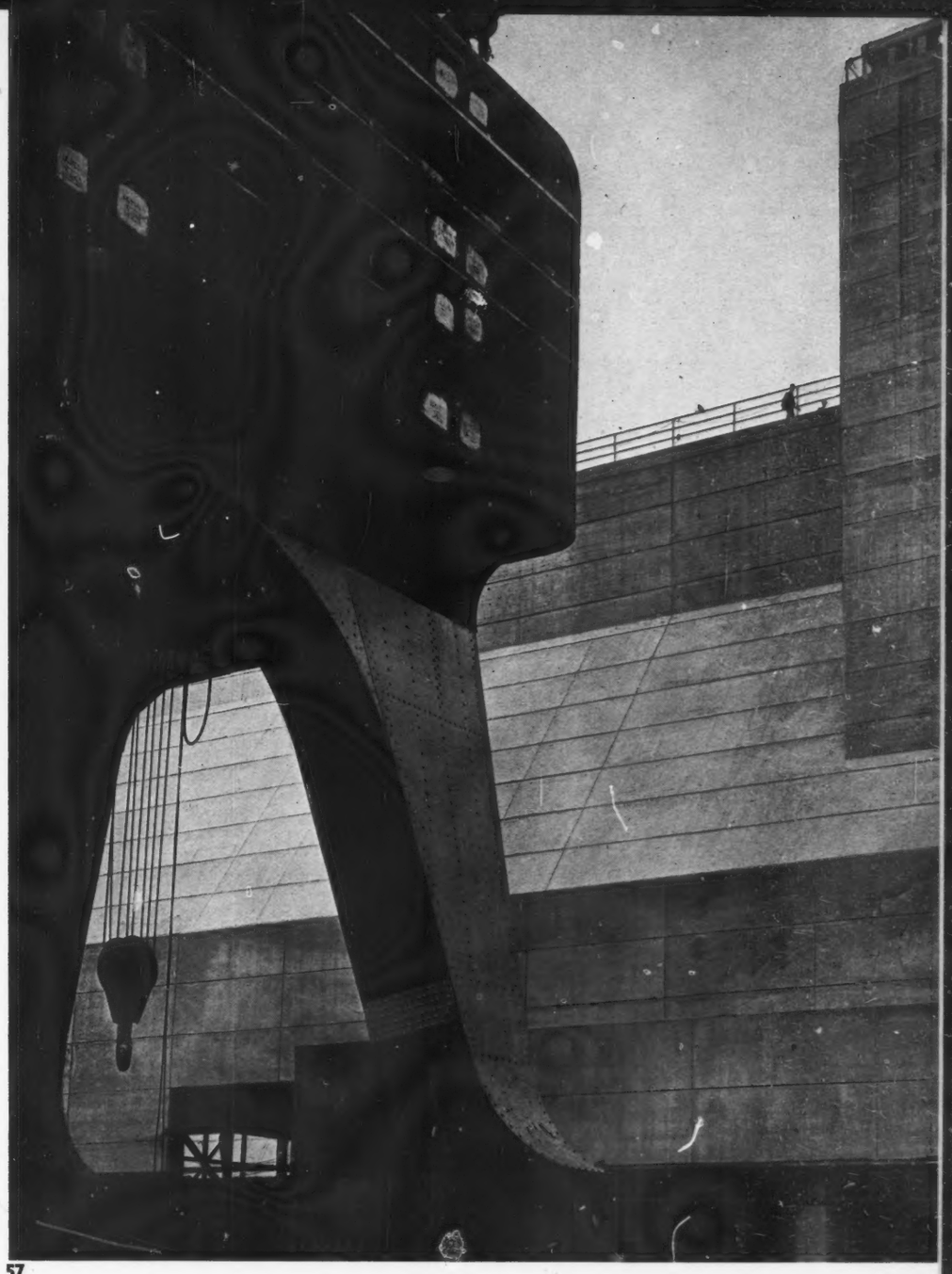

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Compare the small tower, **58**, *on the Norris Dam with the later architecture of Guntersville,* **59**, *and Watts Bar,* **60**. *The blocky Beaux Arts detailing, vigorous though it be, is giving way to a style of architecture which is more elegant without being less forceful and robust.*

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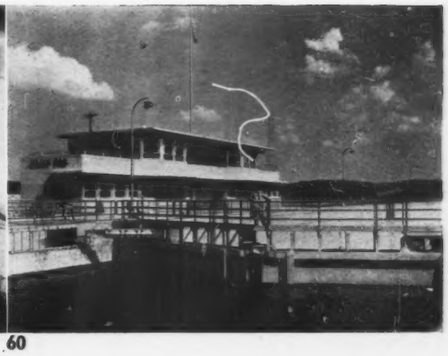

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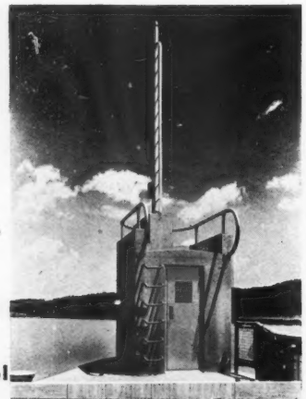
The architectural possibilities have been appreciated on the largest as on the smallest scale; everything is trim and shipshape. Details range from amusing and decorative gauge houses and navigation light poles, **61**, *to austerely functional stairways, with galvanized mesh railing as at Pickwick,* **63**. *Note the flush light boxes with patent lenses at the side of the stairway. The monumental detailing of the aluminium doors to the generator hall, Norris Powerhouse, is bold and logical,* **62**. *In isolation the "blockhouse" appearance of the employees' and visitors' entrance to Chickamauga Powerhouse may appear clumsy and heavy,* **64**, *but such details have to be read as part of the whole design. The cube-like control room at Hiwassee,* **65**, *which standing alone might be judged crude, is appropriate in its place at the foot of the high wall of the dam. The eight semi-outdoor type generators at Wheeler,* **66**, *blend, yet contrast splendidly, with the continuous repetition of the lamp-posts and railings of the roadway. The open steel railing is of car-building rolled shapes, a guardrail for the heaviest vehicles,* **67**. *The two gantries,* **68** *and* **69**, *show the considerable advance that has been made in the design of mechanical parts. At first glance, the Wheeler gantry seems a superb piece of engineering, dramatic in form. Yet the newer cranes at Guntersville, Pickwick and Chickamauga are vastly improved. In them everything has been co-ordinated, made more compact, and then housed in well-ventilated protective coverings. Incidentally, the newer machines are not only smaller and more graceful, but also more efficient.*

DETAILS



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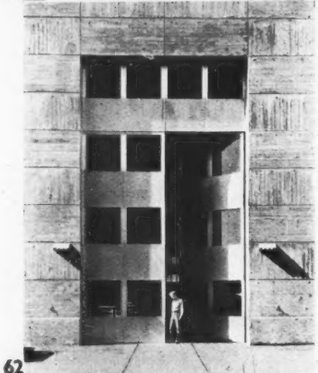

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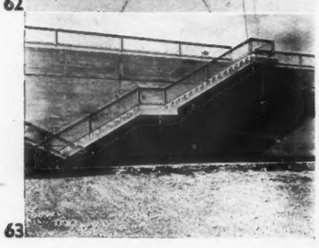

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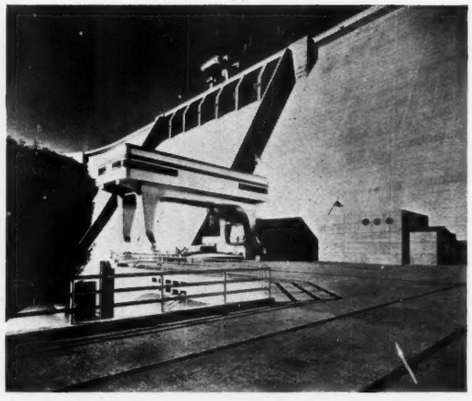

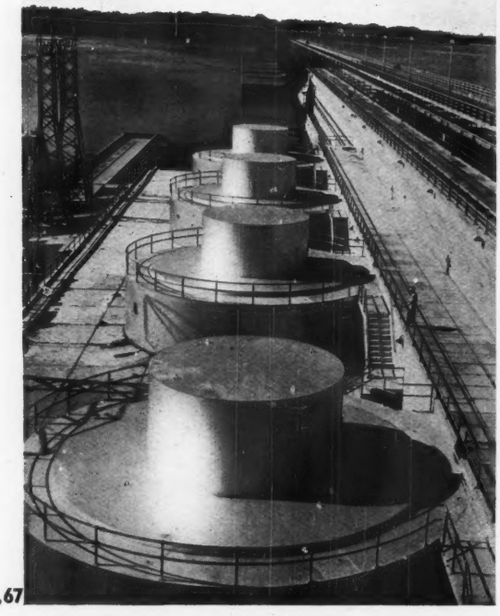

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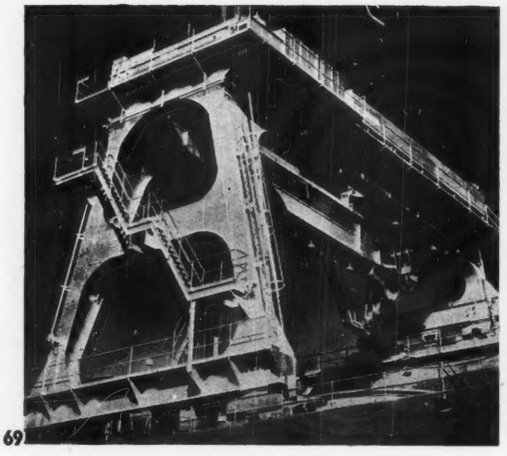

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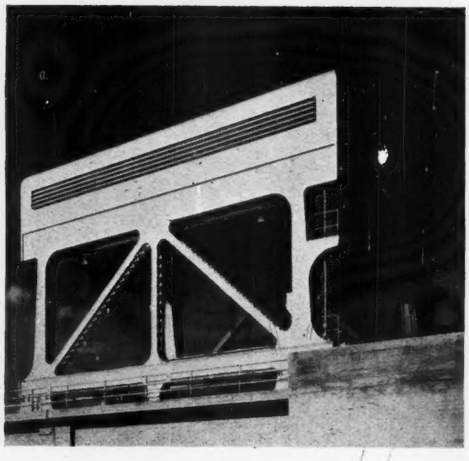

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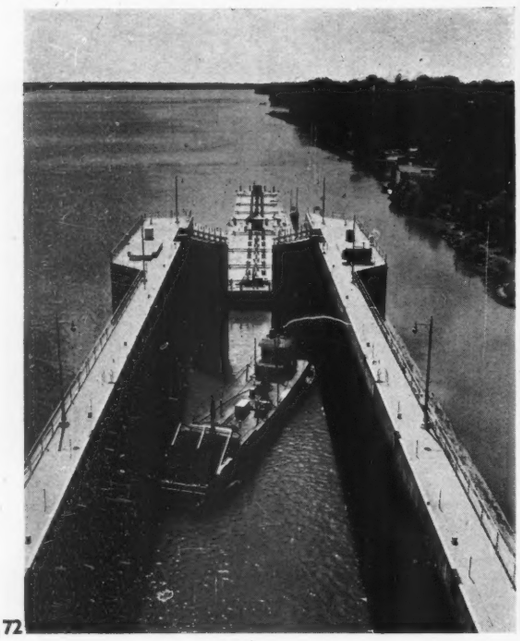
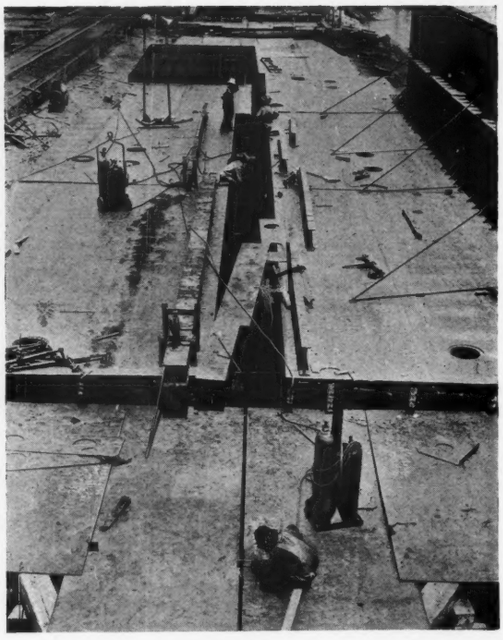
CONSTRUCTION

To the hundreds of thousands now visiting the Valley, the dams are the outstanding symbol of the great undertaking. To the engineers and architects they are the most exciting technical problems of the many which they have had to solve. They are also the greatest monument to successful teamwork. In all the structures, dams, and buildings there is a consistent logic and sensibility. This is due in large measure to the quality of technical personnel, but it could never have been completely achieved, if the engineers and the architectural and site planning group had not, from the first, developed a mutual understanding of each other's aims and specific skills. Logically, the engineer was the dominant partner in designing the great dams and the architect in designing the many buildings and details of the engineering structures. The correct placing of dams was the job of the Project Planning Bureau. Surveys of sites were made to determine optimum topographical and geological conditions ; they were then checked against the nine-foot channel requirement in the Act. Dam heights determine flood storage levels in the reservoirs, and these were balanced against damage to communities, farm lands, highways and railroads. Power as a by-product of flood control was considered in relation to the entire development as well as to individual dams.

Where the dams are located on the main river, as it passes through plains, long earth dams form an extension to the concrete structure. The first step in construction was to erect a coffer dam. Several of these were built before a dam was completed. Generally only two were kept closed for any considerable time. While these held back the water the men worked on the river bottom. They are seen in **70**, *showing Fort Loudoun Dam now under construction. Several million tons of rock were displaced in preparing foundations for dams. On the main river, concrete for the structures was prepared in floating mixing plants. At Wheeler, four of these, on steel barges 40 feet by 90 feet, were moved as required. On each of the four barges, a crane with a 75-foot boom transferred the aggregates from transport barges by means of a clam-shell bucket. Six gantry cranes, equipped with 95-foot steel booms, swung the concrete from the mixing barges to the forms in drop-bottom buckets. All the equipment was electrically operated. The dam was built in alternate 15-foot and 30-foot blocks. On the Wheeler Dam job the concreting equipment handled from 650,000 to 700,000 cubic yards of sand and gravel, and approximately 700,000 barrels of cement. The sand and gravel was excavated from the river bottom and barged upstream.*

Different techniques are used on the high dams. At Norris before the great blocks of concrete forming the dam could be built 275,000 cubic yards of rock and 170,000 cubic yards of earth were excavated. A nearby hill furnished rock and sand for the concrete. Quarried at the dam site, the rock was carried to the crusher, thence to the screening plant, then to the tower housing the batching plant and concrete mixers. More than 1,000 cubic yards of concrete were produced in this mixing plant, and hauled in six-yard batches to the cableways at a rate of three cubic yards per minute. The cableways running nearly a 2,000-foot span above the dam site, provided a speedy run for the concrete buckets, which carried 12 tons on each trip. Electric vibrators, operating at the rate of 4,500 r.p.m. compacted the freshly dumped concrete. Each block was built in five-foot lifts and joints sealed by copper strips and cement.





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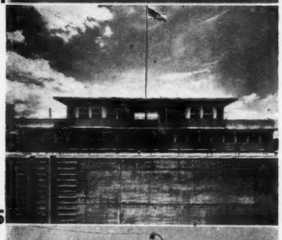

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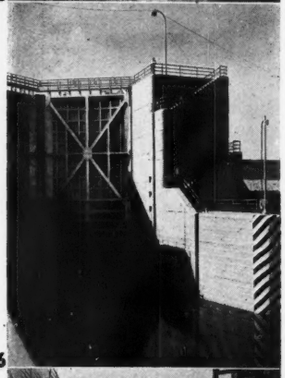

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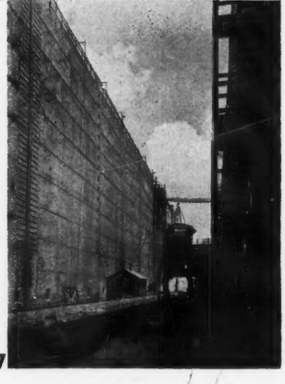

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RIVER NAVIGATION

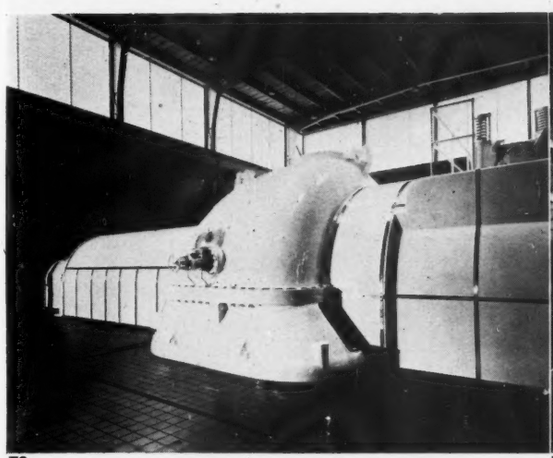
The TVA programme for making the Tennessee River navigable from Knoxville to Paducah adds 650 miles to the far-flung inland waterway system of America and joins the Tennessee Valley by a cheap transportation route to the Great Lakes region, the Middle West and the Gulf Coast. A 9-foot navigation channel alone would not secure a more liberal use of water transport. The Authority constructs navigation locks, dredges the channel, prepares navigation charts. It makes comparative studies of railway and water freight rates ; it makes traffic estimates and identifies the commerce that might be transported economically. With the Tennessee Valley Waterways Conference, representing the municipalities on the river, the Authority co-operates in studies which will lead to the establishment of a unified system of public-use terminals.

Waterways are particularly suited to moving heavy bulk materials. New traffic on the improved Tennessee includes nearly 200,000,000 gallons of petrol since 1939 and thousands of automobiles since December, 1940. Pig iron from Birmingham, Alabama, is moving down river to defence points in the Mid-West. Thousands of tons of soda ash come up-stream from Louisiana to the aluminium plant at Muscle Shoals. Bulky grain and forest products are continually on the move. The volume of traffic increased from just over 20,000,000 ton-miles in 1933 to 100,000,000 ton-miles in 1941.

The lock at Wheeler, **71**, *lifts large barges and river boats 53 feet. At Wilson, double-lift in tandem locks can raise vessels 90 feet. The Ingalls Shipbuilding Company is building welded barges at their plant on the river in Alabama,* **72**. *These freight barges carry large cargoes,* **73**. *In collaboration with the University of Tennessee the TVA designed and built refrigerated barges,* **74**, *to encourage the fruit and vegetable freezing industry in the Valley and the marketing of its products over the inland waterways system. The superstructure was erected on a standard steel barge. Sheathing is of T and G boards, roof of galvanized sheet metal. Colours are light shades of grey, with upper and lower bands of superstructure in maroon. The operation building for the navigation lock at Watts Bar,* **75**, *contains control machinery, the commanding officer's work space, and a sheltered observation platform for visitors. The lock gates at Watts Bar demonstrate the grandeur of the architectural engineering,* **76**. *Even the underwater parts of the lock are carefully detailed,* **77**.

INSIDE THE POWERHOUSES

78, 79, 80 *are the generator halls at Watts Bar Steam Plant, Guntersville Powerhouse and Norris.* **81,** *visitors' reception room in Wheeler control building.* **82,** *main control room, Chickamauga. Large glass panels permit observation by visitors and view of plant by control room operators.* **83,** *hall off reception room, Chickamauga.* **84,** *generator hall, Guntersville.*



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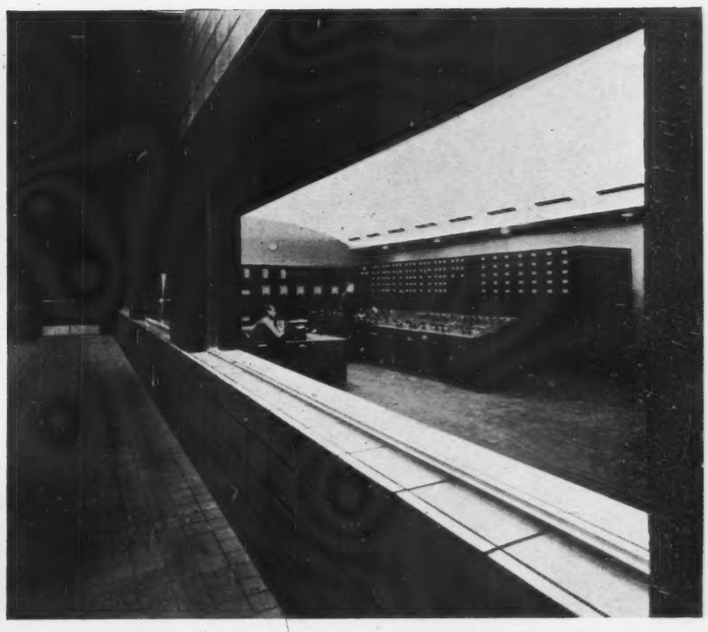

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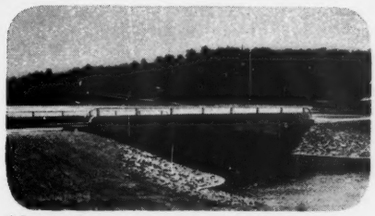
environment into a planned whole, and to do so in a way which shall conduce to better living, including æsthetic satisfaction.

The separation between purely functional engineers' building and purely imitative or superficial architects' building which characterizes the past hundred and fifty years, has been left behind by the TVA. There is conscious collaboration between the architect and the engineer, and the great dams are planned from the outset as works of art as well



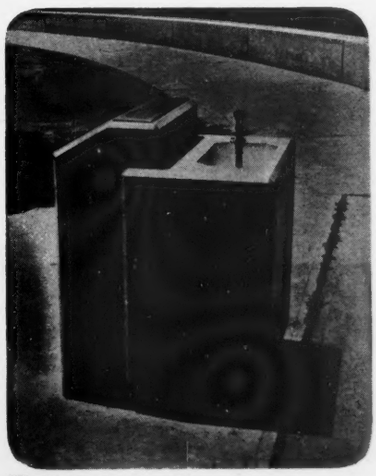
86 *Bridge*

as utilitarian constructions. How successful this collaboration has been is shown by the illustrations in these pages.

Mr. Wank, the chief architect of the TVA, has narrated how, at the outset, there was a good deal of mutual suspicion to be overcome between the architects and the engineers. "Engineers apparently accepted the architect for what he said he was: dispenser of divine revelation in the realm of æsthetics. But they also told him to chase himself if he ventured beyond.

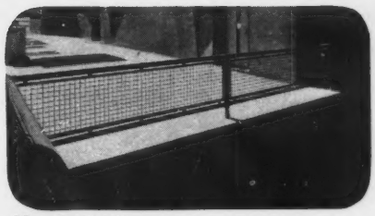
"Small wonder the engineer felt bewildered when the slightly younger edition of the architect came back and said that he was no longer interested in columns and cornices, but that he would like to see how the engineer was making out on the disposition of the structure to its surroundings and of its component parts to each other. The matter was finally resolved, within TVA at least, upon the mutual discovery that both were interested in good, honest, efficient structures, and never mind the mayonnaise"—an admirable American epitome of the new joint partnership.

The two points that struck me most forcibly were, first, the way in which the dams and power-houses have been designed in relation to their surroundings, so that they form a unity with the landscape and enhance its interest and beauty, instead of standing out, like so many nineteenth-century utilitarian constructions, in gross and defiant conflict with the natural environment. The second point was the attention everywhere paid to good design of details, **61-63, 84-86, 89,** of hand-rails, lighting standards, gates and



87 *Drinking Fountain*

doors, and all the fittings and furnishings. Perhaps I should add a third—the gradual but definite improvement to be noticed in design, in architectural conception, and in planning relations, in the later as against the earlier dams. Problems like those presented by the TVA dams are new to architecture; they can only be fully and satisfactorily solved by actual practice.



88 *Handrail*

The dams attract a steady and increasing stream of visitors—over two million a year in peace time, **108-113.** Though doubtless the attraction of the

89 *Door, Wheeler Dam Powerhouse*

dams for most visitors lies in their stupendous quality as engineering works, yet few can escape being influenced by their architectural quality.

Besides the dams, TVA has undertaken many other large building projects—huge warehouses, waterworks, laboratories, repair shops, freight terminals, offices, demonstration and display units, and so forth.

But the architectural influence of the TVA is not confined to that exerted by its own architects. Besides the great dams and other major works, the TVA programme has itself stimulated or created a host of secondary and minor projects. And here the TVA has for one thing thrown all its influence into securing the use of architects, and not merely builders or merely engineers, on these projects; and for another has preferred to employ private architectural firms (with varying degrees of central supervision) rather than undertaking the work with its own staff. This latter policy was adopted, partly to widen the horizon of small firms in remote areas, and partly to ensure that the standards of design which TVA arrived at should become rooted in the general community, rather than always being imposed from above.

Further promotion of good architecture and design is achieved by the TVA exerting its persuasive influence on the large number (well over a hundred) of its own sub-contractors—the counties, municipalities and rural co-operatives who buy its electricity for distribution, until they came to realize that their headquarters were really public

90 *House*

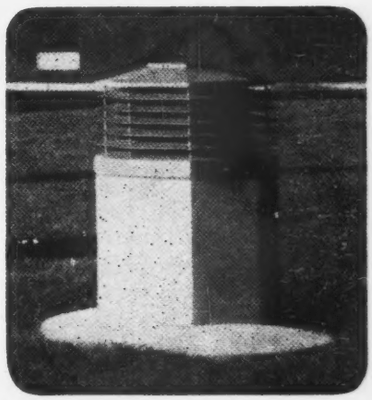
buildings, and should be centres of civilization in the small towns and rural areas.

In domestic housing, TVA architecture has not been so successful as in its big engineering works. At the little town of Norris, for instance, which was built in connection with the Norris Dam, the houses, though labour-saving, are somewhat nondescript and architecturally uninteresting, **127,** and, though the dwellings are agreeably dotted about over the landscape, the general planning is half-hearted.

91 *Demountable House*

In war emergency housing, however, the TVA has done some valuable work. Its demountable house is an original contribution to the problem, **88, 128-129.** It is mass-produced in sections, which are then transported to their destination on special trailers, and erected on pre-cast concrete foundations built on the site. This method of sectional prefabrication has now been successfully applied to larger buildings, such as dormitories and recreation halls.

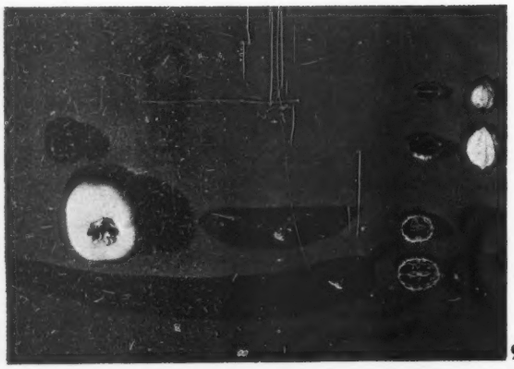
Another TVA contribution to good design has been in highway construction, **117-121.** The road



92 *Traffic Light*

needed to bring materials to Norris Dam was deliberately constructed not only to enable motorists to enjoy scenery to the best advantage, but to become itself a landscape asset. I can personally testify what a satisfying æsthetic experience it provides. This cross between a parkway and a highway was christened the Norris Freeway; its construction led to the State of Tennessee building a similar Freeway from Chattanooga to one of the State parks, and has introduced the idea of the scenic highway far and wide in American road construction.

The TVA has not only practised a deliberate architectural policy; it has also practised a deliberate policy about relating architecture to its other activities. To quote Mr. Wank once more, it has "consciously adopted architecture as one of the instruments of policy in building up a sounder, more vital civilization in the Valley." It has called in the architectural designer to help not only in site and city planning, but in the work of general planning. Further, TVA developed its own philosophy about its public buildings. It felt that they should be "expressive of the pride a whole nation takes in itself," in some ways a modern equivalent of medieval cathedrals or renaissance palaces. For this purpose "the TVA, in working to revitalize the Valley, accepts a concomitant responsibility that, as the Valley is rebuilt economically and socially, its physical aspect shall express the order, amenities, and



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The efforts of the TVA research programme are unique in that they have always endeavoured to maintain the "consumer viewpoint." In the afforestation, for instance, of steep eroded hillsides, the need of owners and tenants for speedy returns has been considered. Experiments were conducted to find what types of trees and shrubs would grow quickly and yield crops of fruit and edible nuts. Nurseries have made available improved varieties of walnut, hickory nut, thornless honey locusts with large pods and large fruited oriental persimmons, **93.**
*The black locust, useful for fence posts, railroad ties, etc., is planted for erosion control, but unfortunately the trees are usually bushy and crooked in shape (***94** *left). The tall "shipmast" variety of locusts (***94** *right), equally useful, produce practically no seed. In collaboration with other research workers, the TVA is developing methods for propagating these trees vegetatively, in quantity, and at low cost.*
*The redevelopment of forests, the natural cover of the region, is essential to prosperity in the Tennessee Valley. Fires or careless cutting cause depletion (***95** *left). Publicity campaigns organized by the TVA and the State forestry divisions are enlisting public help to prevent forest fires. In North Carolina a farm marketing organization provides all-year-round cash markets for wood products and helps landowners to have producing forests (***95** *right). The annual growth of saw timber in the Valley can be increased from its present 50 board foot per acre to a possible 250 or more.*

beauty that should characterize a well-functioning society." In that spirit, the buildings of the TVA, instead of being furnished with bronze tablets setting forth the names of the members of the TVA Board, the architectural staff, the contractors, and the like, are all inscribed with the simple legend: "Built for the People of the United States."

RESEARCH FROM THE CONSUMER END

Continuous research and survey are of the essence of any large-scale planning, and we find that a great deal of both goes on in the TVA system. Research is exceedingly varied: I will give a few examples. In relation to the huge Muscle Shoals plant, a new phosphatic fertilizer has been developed which is much more concentrated than the usual type, and therefore much less bulky and much less expensive to transport. I shall never forget the effect produced on me in 1934 by the scale of the chemical engineering there carried on. To one whose chemical experience had been mainly derived from the science laboratories of an English public school, it was almost alarming to see large tanks full of phosphoric acid and to hear methods discussed of piping off phosphorus itself in liquid form!

The TVA's chemical laboratories have also worked out a method for extracting aluminium from certain common types of clay, which has reached the pilot plant stage. The U.S. Government have, after an exhaustive investigation, advised against its immediate large-scale employment on the grounds of high cost, but the TVA chemists are now busy with attempts to cheapen the process. It certainly appears to be one of the most hopeful methods yet worked out for tapping this almost limitless supply of an important metal.

Another light metal of which there is an even more acute war shortage than of aluminium is magnesium: I was told that the U.S.A. could do with a hundredfold expansion. The TVA is experimenting on the extraction of magnesium from olivine, one of the more abundant minerals. The work is just coming to the pilot stage; it looks as if it might compete on reasonably equal terms with the alternative large-scale method of extracting the metal from brine, which has already come into operation.

In the biological field, valuable research has been done on such diverse problems as malaria control, tuberculosis incidence, and the encouragement of fish life.

In agriculture, work is in train on the drying of sweet potatoes to provide a feeding stuff rich in carbohydrates. But the most important aspect of TVA agricultural research is connected with the prevention of erosion. This has a dual importance—to reverse the terrible depletion of soil fertility, and to prevent the silting up of the dams. Some of the work has been empirical, such as the testing out of the best methods of constructing check-dams and of contour-ploughing. Some is concerned with the growing of new cover-crops which will be profitable while also checking erosion: flax and the oriental legume Lespedeza are among these.

Then there is research devoted to the perfecting of agricultural machinery. This is an excellent example of something all too rare in capitalist countries—research carried out and applied from the standpoint of consumer interests. The U.S.A. has long been celebrated for its agricultural machines: but these have mostly been designed for the large-scale operations of mid-western farming. The great harvesters so well adapted to the prairies would be useless in the mountains of Tennessee, and the poverty-stricken farmers of the South were not, from the standpoint of big business, very good financial prospects on whom to expend money in research or sales campaigns. The TVA accordingly set to work to design machinery suited to the physical and economic peculiarities of the region. Once the machines had been thoroughly tested, arrangements were entered into with private manufacturers of farm equipment, who then made and sold the machinery at an agreed price. (This, by the way, is one of the numerous examples where the planning authority, far from interfering with private enterprise in the region, has provided it with new opportunities.) Two of the most interesting results are an electric hay-drier, costing less than 10 per cent of the previous cheapest drier on the market, and a cheap furrow-seeder.

One piece of research not undertaken by the TVA may be mentioned—that on the eradication of the tick which causes Texas fever in cattle. In the old days, no cattle could be kept in the cotton-growing areas of the Valley because of this; but by the beginning of the TVA the work had been so successful that those and many other areas of the U.S.A. had been opened up for cattle-raising. Dr. H. A. Morgan, now Vice-chairman of the TVA Board of Directors, had played a prominent part in this important triumph of applied science.

An unusual line of TVA research concerns the development of so-called tree-crops, **93-95.** Much land in the Valley which had been put under cultivation, is too steep, and therefore too prone to erosion, for anything but forest. Wherever possible, this is being reafforested; but the Authority naturally wishes to ensure that this should continue to yield to its owners or tenants some return more speedy and more regular than that of lumber alone. They have, therefore, conducted elaborate experiments to discover suitable trees and shrubs which will yield crops of fruit or nuts which are either directly saleable for human consumption, or are available for pigs or other animal stock. This work is under the Department of Forestry Relations, which has several hundred demonstration farms, as well as a very large experimental arboretum.

Black walnut is proving very suitable, provided correct methods of picking and drying the nuts are used. Filberts are also being experimented with. As the local sweet chestnuts and persimmons have been either exterminated or gravely threatened by disease, experiments are being made with the introduction of Asiatic species. Sumachs are being developed as a commercial source of tannin. Some trees are grown to provide farmers with wood for their own purposes. Thus some varieties of Black Locust are proving very useful sources of timber for fences and posts. Certain strains of Honey Locusts, on the other hand, have very large sugary pods, which are nearly as good as maize as a maintenance ration for stock. They also perform another function: when grown in pastures, their shade helps to keep the desirable blue-grass from being dried out, and the leaves they shed help to fertilize the pasture.

A great deal of research has been put into the development of a new type of pressure-cooker for producing cotton-seed meal and oil. Local production is here of considerable importance, because three-quarters of the cotton-seed had been shipped out of the region to be processed and used elsewhere—a lamentable export of fertility. Previous research at one of the Southern State universities had shown theoretically that a much more efficient cooker could be produced, but funds had been lacking for the research necessary to convince the practical man. Here is where a big public body like the TVA could step in. It joined with the University of Tennessee Engineering College in the task, and now the new cooker, sold under licence, is operating throughout the region.

The problem has another aspect. To prevent the drain on fertility, the cotton-seed meal must not only be locally produced, but locally consumed by being fed to cattle. It is the business of an over-all planning agency to think of the interrelations of its work, and research directed to increasing the amount of livestock in the region is well under way.

TVA research has also led to the marketing of new types of quick-freezing machinery suitable for use by farmers' co-operatives, which have much increased the growing of various fruit crops. It has found new and profitable outlets for sawmill waste, and for the employment of culls and inferior grades of timber to produce high quality laminated flooring. It has developed a process which has enabled North Carolina kaolin to compete successfully with imported English china-clay. It has

produced a new mica-resin plastic for use as insulating material. There is indeed scarcely an aspect of life in the region which it has not benefited.

A great deal of all this research is farmed out under co-operative contracts, research funds being made available to colleges and universities in the region. This may not always be the quickest method of obtaining results, but the TVA adopts it because it believes in co-operation with the existing institutions of the region, and also because it feels it is thus promoting a desirable educational aim, by giving graduate students a taste of research work which is of local importance and practical value.

In quite another field, when the site of the Pickwick Dam was fixed, it was decided to make an archeological investigation of the area destined to be flooded, as it was known to contain many remains of prehistoric man and his culture. This survey was directed by the TVA in co-operation with the University of Alabama, while unemployed labour for the excavations was made available by the WPA—the U.S.A. Works Progress Administration (which, be it noted, had a distinguished archeologist on its staff as archeological consultant). Funds were also provided by the National Research Council; and the Bureau of American Ethnology of the (Government-supported) Smithsonian Institution at Washington undertook the preparation of an exhaustive report, which was published in 1942 with funds provided by the TVA.

The survey lasted for nearly three years, and obtained much knowledge which would otherwise have been permanently lost, and which proved of considerable importance. For instance, it established the probability that the people of the shell-mound culture of the region were for almost the whole of the long period both the first and the sole human inhabitants of the area, living a completely peaceful life in close association with the river and its products, at a primitive level of non-agricultural hunter-fisherman-collector culture, without pottery and probably without weaving. One of their chief sources of food-supply was constituted by the fresh-water mussels from which Muscle Shoals takes its name, and during the period there was a steady evolution of the practice and art of cookery. The later prehistoric inhabitants were agriculturists, but they were warlike, placing their villages in protected positions and often fortifying them with stockades, while the shell-mound people never built stockades, and sited their settlements in exposed positions.

PLANNED SURVEY

Survey, if accurate and dispassionate, and planned with definite ends in view, is itself a form of research, since it provides knowledge which dictates action.

The basic problems demanding survey were the mineral and agricultural resources of the Valley. In regard to mineral resources, the survey early undertaken by TVA established that over 75 different exploitable minerals were located in the region, while only about half a dozen had actually been exploited, and that in a far from satisfactory way. Research was then devoted to the utilization of common but hitherto neglected minerals, like olivine for the production of magnesium and certain clays for aluminium. The huge phosphate deposits of the region were conveniently placed for conversion into phosphatic fertilizers at the Muscle Shoals plant.

Even the basic survey of mapping had to be largely done by the TVA, which discovered on taking over in 1933 that there were hardly any maps of the area that were adequate for their purpose. Under a co-operative agreement with the U.S. Geological Survey, a series of planimetric maps at 2,000 ft. to the inch was completed by 1936 for the entire area, constituting a record for speed for such an enterprise. This was useful as a start, but topographic maps (showing the contours) were also desirable, and the preparation of these, again in co-operation with the Geological Survey, was begun almost as soon as the planimetric series was completed; by now over a third of the Valley has thus been mapped, with 20-foot contours over flat country and 40-foot contours in hilly terrain. In both cases the latest techniques of aerial photography have been employed.

For the Authority's agricultural programme in general, and in particular for the resettlement of the thousands of farmers who had to be moved out of the lands flooded by the new reservoirs, a soil survey was needed. Arrangements were made for this to be done co-operatively by the State Agricultural Experiment Stations in the Valley, working in conjunction with the Division of Soil Survey of the U.S. Department of Agriculture. A considerable number of entire counties have now had their soils mapped. The maps are models of what soil survey maps should be, with soil types graded into five classes in respect of their productivity or the reverse, including their susceptibility to erosion and their response to fertilizers. Through the test-demonstration programme, the results of experience are classified in relation to soils, and valuable new data are thus accumulated on the productivity of the various soil types and their response to different kinds of agricultural management. All this has been achieved within a few years, while in Britain our soil survey had been dragging on for over a decade without a single soil map having yet seen the light.

With the co-operation of the N.R.P.B. (National Resources Planning Board), a new type of land-use classification has been worked out, and a land-use survey prepared for the most important areas of the Tennessee Valley. This includes a survey of the inherent characters of the land, both geological and geographical, and of the surface minerals, with the potential and recommended use of different areas. The recommended use takes account of anti-erosion measures, agricultural possibilities (on the basis of the soil survey), power generation, and recreation. Certain sites are listed as being more valuable for parks or recreation than for any other purpose; and a schedule is given of sites which should be preserved because of their natural beauty, their prehistoric or historic interest, or as National Monuments, or as containing representative examples of plant or animal wild life or of interesting geological formations. Particular attention is paid to the siting of "historic and scenic parkways." This survey has provided the foundation for the future planners of the region.

Survey may be equally important in sociology and economics. I will only mention one example from these fields, the survey of the inter-territorial freight-rate problem of the U.S.A., which was carried out by the TVA because the Board of Directors had found by bitter experience how differences in freight-rates between different areas were acting as barriers to impede the free flow of traffic into and out of their area. This was due to the sharp regionalization of freight-rate schemes, which had come to pass owing to the railroad groups in the five major railroad regions of the U.S.A. having failed to agree, or rather having failed to bother to think about agreeing, on the broad lines of their freight-rate policies. The survey, published in 1937 as a Government document, demonstrates in detail how the freight-rate barriers "tend to retard substantially the commercial and economic development of the Tennessee River drainage basin and adjacent areas," gives a lucid picture of the existing situation, which of itself indicates the general lines to be pursued to remove these quite unnecessary barriers to internal trade, and makes important recommendations which would help to convert the present patchwork of railroad systems "into a complete unity, functioning for national purposes in an economic sense."

The example is of considerable interest as showing how the express charge laid on the TVA of promoting the "general development" of their region, leads automatically to its feeling called on to take the initiative in various problems of national scope, when, as is not infrequent, they impinge on the prosperity of the Valley.

This is perhaps the place to mention other instances where the TVA has extended its operations beyond the boundaries of its specific region, usually at the request of some Government Department or other organization, anxious to profit by TVA's special experience. Thus it has helped with the general power planning of the War Production Board throughout the U.S.A.; with the proper exploitation of the phosphate deposits of the American West; with the design of "greenbelt towns" in the Middle West and Maryland; with war housing for the workers in aeroplane factories in the Great Lakes region. Indeed, it has not been confined to the United States: for it has been asked to help with constructional projects on some of the island bases belonging to the U.S.A.; with power projects in Russia and in Central and South America; and even with malaria control in China. One is reminded of the saying about the man who invents a really good mouse-trap—only what the TVA has invented is something a good deal more important than a mouse-trap.

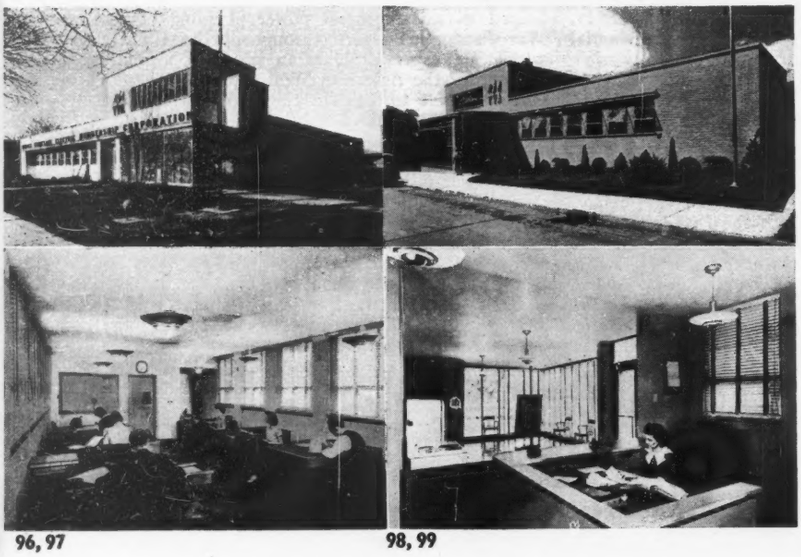
THE ENEMIES OF TVA

The TVA has met with much hostility. Hostility to large-scale Governmental planning is bound to occur in democracies during the transition from a *laisser-faire* to a planned economy. But in the U.S.A., where for historical reasons the tradition of private enterprise has remained more strongly entrenched than elsewhere, this hostility has been particularly acute and has often clothed itself in political forms. As an important part of the New Deal policy, the TVA has been sharply criticized by most Republicans and many anti-New-Deal Democrats as "un-American"; as interfering with the sacred constitutional rights of citizens to engage in trade or business for themselves; as involving an entire area in the entanglements of bureaucratic red tape; as Socialism: while hostile Southerners have attacked it as the misbegotten brain-child of a set of Northern highbrows interfering with the South. Then the TVA incurred the wrath of the professional politicians by steadfastly refusing to have anything to do with the traditional system of political patronage: all appointments under the Authority are made on merit. Within the first few months of its existence, tens of thousands of letters and telegrams were received (mostly from Congressmen and local political bosses) demanding that TVA jobs should be distributed according to the bad old system. However, the President refused to budge, and this particular storm soon died down, all the sooner because the inhabitants of the Valley were not long in discovering that the absence of patronage, graft, and the spoils system made for more efficient and more understanding administration.

Other attacks have had economic motives. For instance, the private utility companies engaged in generating and selling electricity, and their financial backers, bitterly resented the intrusion of governmental competition into their field, while to many of them the "consumer attitude" adopted by the TVA in expanding sales by lowering rates, was anathema. The constitutionality of the TVA's activities, especially its intrusion into the electric-power field, has been challenged in the Courts on no less than 41 occasions but has in the long run been definitely upheld, twice by the Supreme Court. Mr. Wendell Willkie, when representing the Commonwealth & Southern Co., disputed the compensation offered his company by the TVA in lieu of certain important rights, and succeeded in obtaining a considerable increase in the award. But in spite of the bitterness with which he fought the case at the time, he would now, I imagine, though assuredly not a particular admirer of the TVA, at least be prepared to admit that it is an honest and efficient agency, and has accomplished a good deal of useful work.

Other opposition came from the coal-owners, who disliked the competition of cheap power. The ice industry (which is, of course, much more important in America than in Britain) also disliked cheap power, because this means cheap electric refrigerators, and this in turn means that people do not buy their ice. And the artificial fertilizer industry could not view with equanimity the entry of the Federal Government into the fertilizer business.

In spite of this, the general attack on behalf of private enterprise has lost much of its force, especially locally, now that time has shown that the TVA's activities are helping instead of hindering commerce and the establishment of industries



96, 97 98, 99

"Rural Electrification Administration" buildings, **96, 98,** *are parts of a nation-wide system. Through REA, TVA power is distributed among rural consumers by co-operatives formed and managed by the farmers. These buildings provide a first contact with modern architecture, as well as with electricity itself,* **97.** *Reception and display rooms,* **99,** *and club meeting rooms make them minor cultural centres*

within the Valley, partly owing to cheap power, partly owing to the creation of new opportunities (e.g., in regard to recreation, see page 145), partly through the general raising of the standard of life, especially among the farmers. The recent dangerous attacks by Senator McKellar on the principle of TVA freedom from politics were largely defeated by the people of the Valley themselves, some Chambers of Commerce even inserting full-page advertisements in the local paper, urging voters to write to their congressional representatives urging them to "keep TVA out of politics."

The following story is illuminating. A friend of mine who was in the area early in 1940 asked the Republican manager of a local phosphate mine whether, in the event of a Democratic defeat in the Presidential elections, the Republicans would try to modify or reverse the general policy of the TVA. He replied, certainly not—partly because his business, like others in the region, had increased markedly since the TVA began its work, but mainly because private enterprise could never afford either the educational campaigns (e.g., on behalf of phosphatic fertilizer) or the research facilities which are possible to a body like the TVA. He was especially interested in the fact that the TVA made its research results available, and indeed invited co-operation from firms like his; and also in the TVA's work in making a comparative survey of rates and conditions in all the fertilizer plants of the region, which helped materially in promoting better labour relations.

In 1939, an important Congressional Committee, aided by technical experts, and with the evidence of many witnesses, published a 500-page investigation into the methods and operations of the TVA. There is a somewhat critical minority report, but the majority report paid the highest tributes both to the integrity of the TVA's work, and to its efficiency and social value.

There is still plenty of potential opposition; this may sometimes become actual, as when political pressure on behalf of a group of canneries who depended for their produce on land which would have been flooded by the proposed Douglas Dam, caused the project to be banned by Congress (actually after Pearl Harbour!), until the war emergency became too acute for any such shortage of power to be tolerated. However, opposition has undoubtedly decreased both in volume and in intensity, as the Authority has demonstrated its efficiency and its capacity to bring new life and hope to a depressed area that had been one of the black spots of the American scene.

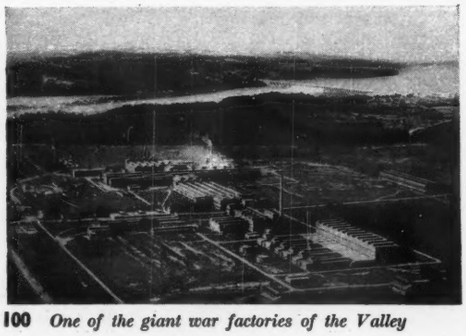
TVA WAR ACTIVITIES

The war has further damped down opposition and stimulated the public's acceptance of TVA as a valuable national agency. The navigation programme of the TVA was also attacked in the early days of the New Deal either as wasteful, or as something which was necessary as a constitutional peg on which to hang other activities, but in itself mere eyewash; or as a plot to drive the railroads into Government ownership. However, once coastwise shipping began to be torpedoed and sunk, an extra strain was placed on the railroads, and any alternative method of internal transport was at a premium. The electric-power resources of the United States, large though they are, were not large enough for the defence programme even before Pearl Harbour, and once the U.S.A. actually became a belligerent, the need for more power became even more apparent. As a result, the above-mentioned decision not to proceed with the Douglas Dam was reversed, and an emergency programme authorized by which the TVA's August 1941 output of just over a million kw. was increased by 50 per cent by the end of 1942, and is to be doubled by the middle of 1944. The TVA's remarkable success in building its new dams in record time (the huge Douglas Dam has been completed in under thirteen months—less than half the time normally supposed necessary) has done a great deal to influence public opinion in its favour.

The emergency value of a system like that of the TVA was well illustrated in the early part of 1941, when a severe drought accentuated the shortage of power in the south-east, which had already become apparent as defence needs multiplied. During this period the TVA was able to supply Alcoa, the largest aluminium plant in the world, with nearly 150,000 extra kilowatts, and so to keep it in full production. It is interesting to note that a good deal of this extra power was obtained by the TVA from adjoining utility companies, while the existence of the TVA grid made possible the direct transmission of a further amount to Alcoa from other private companies.

In the early days it was often argued, in one case before the Supreme Court, that the capacity envisaged for the TVA was so excessive that it was wasteful and would bankrupt all neighbouring Utility Companies. A mere six years later, it turned out that the developments as planned were not merely not excessive, but inadequate.

At the request and with the help of the War Department, the old nitrate plant at Muscle Shoals has been modernized and brought into operation, with a daily production of about 300 tons of ammonium nitrate for explosives; and a large and strategically important part of New York State is being mapped from the air by a TVA unit.



100 *One of the giant war factories of the Valley*

The work of TVA on the design and provision of special housing for workers in war industry has already been mentioned. In addition to erecting and managing a 250-house site of its own at Muscle Shoals, TVA is giving valuable co-operation to the Defense Housing Co-ordinator in regard to all aspects of the subject in the Valley, and to some projects elsewhere in the U.S.A.

It is interesting that 40,000 tons of concentrated superphosphates, of the type developed by the TVA, have been supplied to Britain during the war. These were specified because they are more concentrated than the usual commercial superphosphates and thus occupy less shipping space. The demand for concentrated superphosphates within the U.S.A. is rapidly exceeding the supply, and by 1945 is expected to reach about double the present production capacity. To help meet this shortage, the TVA has been authorized to build a new electric furnace to increase its annual production from 150,000 to 250,000 tons.

One final point. Long before the public was aware of the shortages that were bound to develop in certain raw materials, or the Government had taken any action, the TVA, with a foresight natural to an all-round planning body, had been examining all its own projects and eliminating from them all critical raw materials, such as copper and aluminium, for which substitutes could possibly be found, even when this meant higher costs or in some cases somewhat greater fire-risk or reduced efficiency.

PLANNING FOR THE PEOPLE OR WITH THE PEOPLE?

It is one thing to have a good plan, another to put it into practice. For this, popular interest, popular backing and enthusiasm, and popular participation are needed. Careful attention to these requirements is especially necessary in countries like Britain and the U.S.A., and indeed in all advanced democratic countries. For here the adjustment of the individualist traditions of private enterprise to the needs of central planning is apt to generate friction; but the friction can be minimized by understanding.

The trouble is not all on one side. The rugged individualists and the still more rugged monopoly capitalists who find their interest threatened by planning in the interest of general welfare, will assuredly make difficulties; but so may the over-enthusiastic planners. The planner placed in charge of the destinies of a region finds himself in a position not unlike that of Jesus when the devil took him up into the high mountain to tempt him with all the kingdoms of the earth and the glory of them: "All these things will I give thee, if thou wilt fall down and worship me." So the planner sees the grandeur and beauty of his plan, and thinks of all the happiness that he will be able to confer. But what really tempts him is the lure of power. It is his plan, and he wishes to impose it and the resultant happiness on his subjects. But he forgets two things—that happiness cannot be imposed, and that power, even when as intellectual and beneficent as his, corrupts.

The planner must understand the nature of this temptation—a natural one, like most temptations—and learn how to resist it. He must not fall down and worship the devil of power, masquerading in the shape of his own beneficent plan. Jesus said, "Get thee hence, Satan, for it is written, Thou shalt worship the Lord Thy God, and Him only shalt thou serve." The planner must reply to his tempter with the rejoinder that the free activity of individual human beings is a basic element in democracy, and must override any temptation of efficiency or immediate prosperity. In other words, he must not think of the people in his region as his subject plannees, but as participating co-planners. Though his plan may

The new Prosperity: Holiday-making and Tourism

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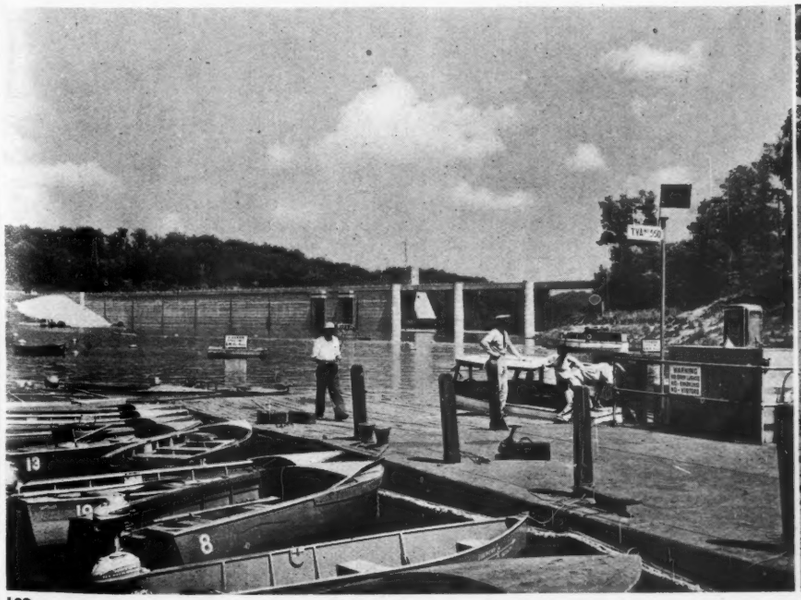
At Big Ridge Lake, **101,** *a 45-acre body of water has been formed. Recreation areas have been developed by the National Park Service and the Civilian Conservation Corps in co-operation with the TVA. In ten years the Tennessee Valley has become the chief centre in America for the pleasure boat industry, although this type of recreation was formerly almost unknown. At Norris the TVA operates one boat dock,* **102,** *as an example and lets others to concessionaires. Behind Norris Dam there is a boat harbour,* **103,** *to accommodate some of the 2,000 pleasure boats used on the lake.*



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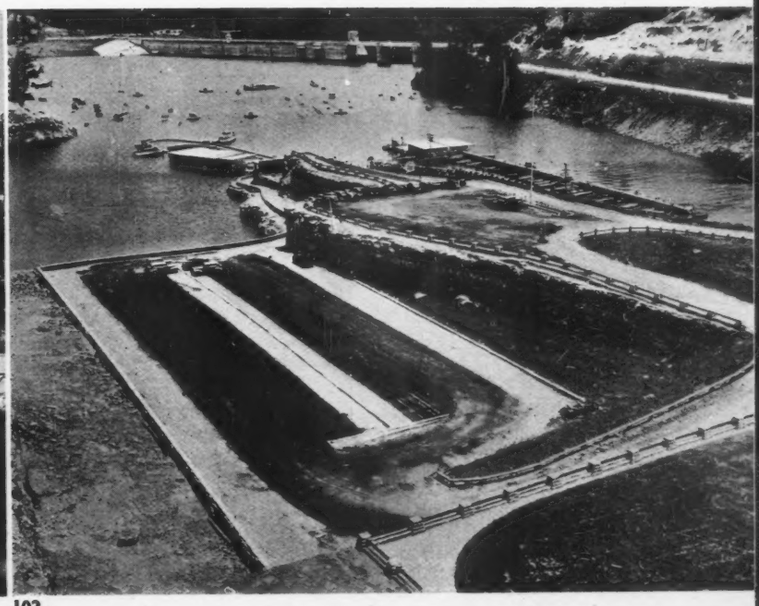

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The new Prosperity: Holiday Makers

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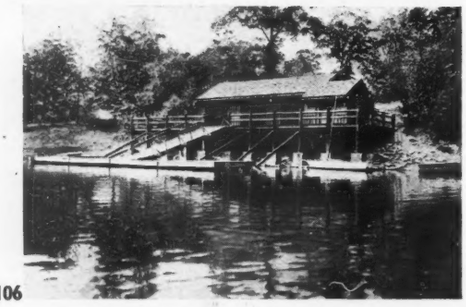

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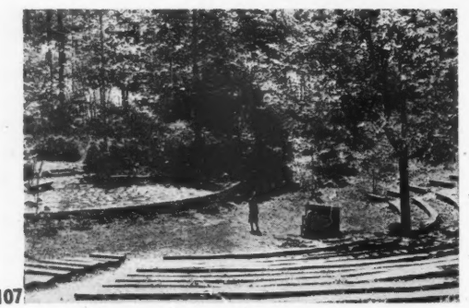

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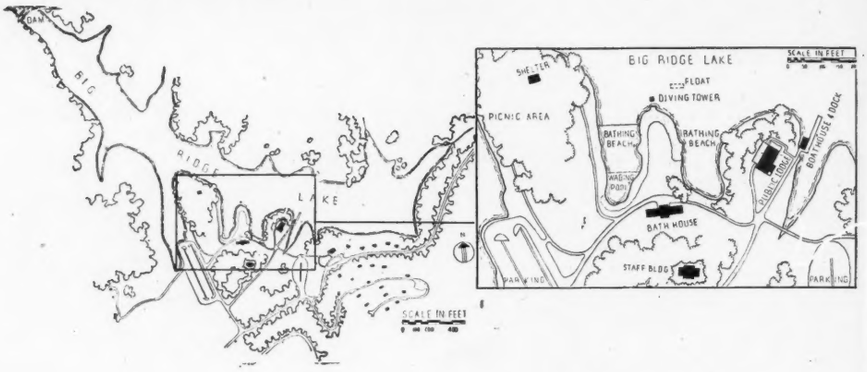
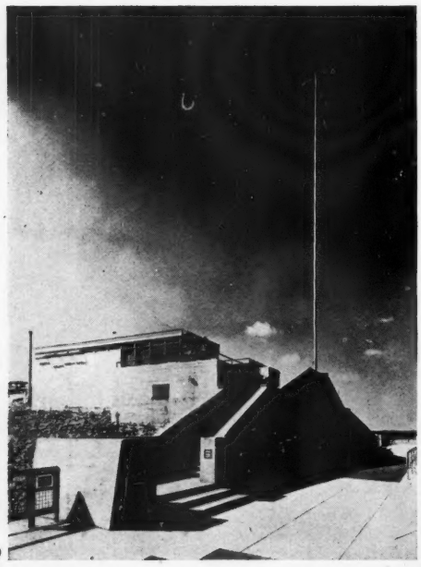
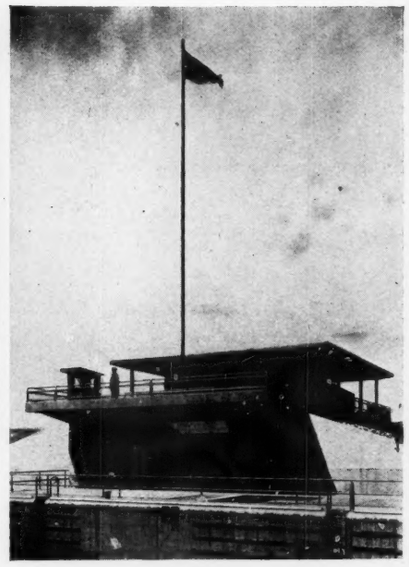
A large variety of structures caters for the tourist industry, which forms an ever-growing asset in the economy of the area. Tourist cabins built by the TVA at Cove Lake State Park, **104**, *will accommodate visitors in simple comfort. The community centre in a park near Wilson Dam,* **105**, *is used intensively by the local population. The small boat landing,* **106**, *on Pickwick Lake was made from timber on the spot. At Norris Park the outdoor amphitheatre,* **107**, *with split log seats, is used for informal theatricals and meetings.*

Special visitors' buildings with rest rooms, kiosks and overlook terraces are provided at each dam. At Pickwick Landing, **108**, *twin visitors' buildings with terrace between, straddle the earth fill portion of the dam. Chickamauga visitors' building,* **109**, *has its terrace partly covered and faces the chamber of the navigation lock so that the locking operation may be easily observed. At Guntersville,* **110**, *the same functions are performed, but in addition the flight of steps leads to a landing for pleasure craft. On the terrace,* **111**, *visitors can lean in comfort on the rail supported by bent structural T-shapes. The visitors' reception room at Chickamauga,* **112**, *overlooks the lake. Through the glazing on one side, the switch-room can be seen, and on the opposite side, the generator hall. Note the inscription, "Built For The People of The United States." In the reception room,* **113**, *at Norris powerhouse a mural by a WPA artist helps the guide to explain the functions of the project.*



TVA Visitors





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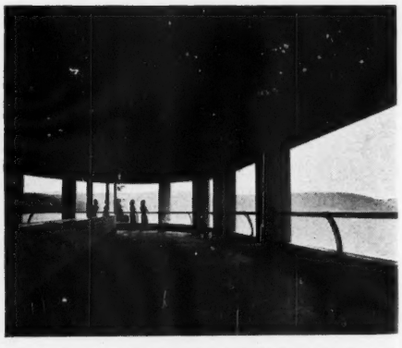

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The new Prosperity: Industry

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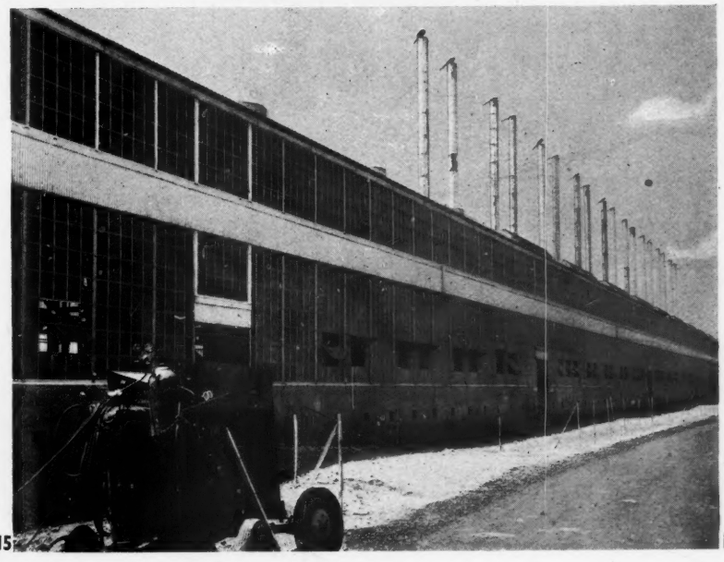

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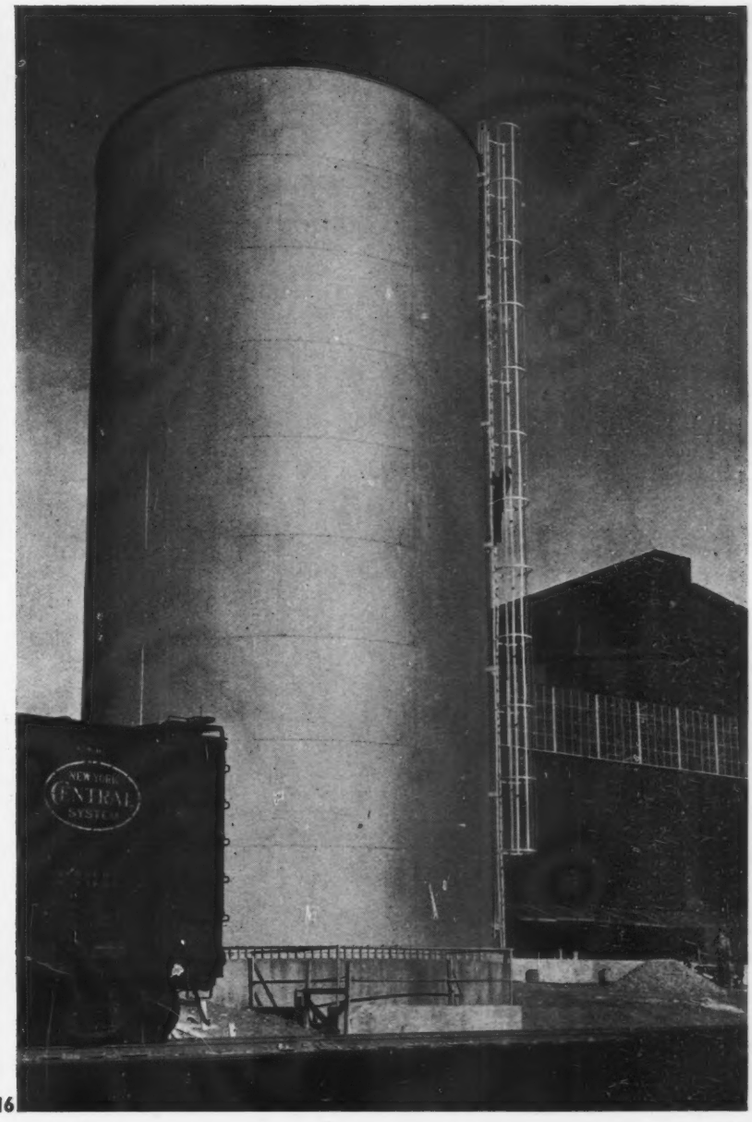

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Industry in the Tennessee Valley has received a great stimulus from the TVA. Not only is a large quantity of cheap electrical power now available for heavy industry, but the research departments of the TVA have developed new processes and new machinery in relation to the agricultural programme of the Valley. There are large deposits of iron ore, zinc, lead, and copper in the region; also possibilities, which are being developed by TVA chemical laboratories, as to aluminium, manganese and chromium. There is a good supply of coal suitable for coke and by-products, and there are reserves of rock phosphate and limestone.

TVA power goes directly into two large aluminium plants, one at Alcoa, Tennessee, **114, 115, 116,** *and one at Muscle Shoals, Alabama, as well as to other smaller plants whose products are now essential to the war programme. Through municipal or co-operative systems, the power goes to scores of other industrial plants vital to the war effort. During the last war an ammonium nitrate plant was built at Muscle Shoals. In the eight years before* 1941, *the TVA made plans for modernizing it. They were able to proceed quickly when the War Department ordered its reconditioning. In one part of the Muscle Shoals plant the TVA has developed new and improved methods of manufacturing concentrated phosphate fertilizers. In addition to saving shipping space, these concentrates represent a reduction of* 50 *per cent in cost to the farmer.* 40,000 *tons were shipped to Britain in* 1942.

Small industries have sprung up as a result of TVA research into new methods and improved processes, for dealing with farming and farm products. New types of low-cost equipment which is suited to the needs of this region have been developed and will help the private landowners in doing their share in soil and water conservation. The equipment, such as furrow seeders, small threshers, and hay driers, is now manufactured by farm implement companies in the Valley. Experiments were made in quick ageing of hams and other meats, and electrical cabinets for the purpose are being made in Tennessee.

One of the most interesting pieces of research, now past the experimental stage, has developed the quick freezing process for fruits and vegetables. A test plant was built and has since been let to farmers' co-operatives for freezing their products. A cotton-seed pressure cooker has been developed and is being manufactured and used in the region. The cotton-seed meal and oil is now locally produced and used instead of the seed being sent elsewhere for processing.

The new Prosperity: Communications

All the cement and equipment for Norris Dam was carried over a construction road which was to become Norris Freeway, **117**, *a scenic highway in which access is limited to a very few points and where no building is allowed within several hundred yards on either side. The reinforced concrete bridge,* **118**, *on the Norris Freeway is cantilevered on the land side of the foundations to meet the highway fill. The roundabout,* **119**, *at the end of Norris Dam is lighted at night by low fixtures which eliminate glare. One arm of Norris Lake is spanned by a reinforced concrete bridge,* **120**, *designed for pleasure traffic. As on all TVA bridges where the view is important, it has a partially open parapet to permit a good view. At the approach to Norris, where the Freeway by-passes the town, is the first example in the United States of the centrally placed filling station,* **121**, *which eliminates the danger from motors crossing a stream of traffic to reach the pumps. Following its policy of making permanently useful structures when possible, the TVA decided to build a town rather than a mere construction camp near the Norris Dam. For two or three years there were to be* 1,500 *men working on the Dam. Many of them, however, particularly those in technical or supervisory work, had a long-term job before them. For an eight or ten-year period they needed homes, not camps. A school,* **122**, *was built for the employees' children and for county residents and operated in combination with the State Teachers' Training Program. The library,* **123**, *was built entirely of local materials. The small post office,* **124**, *uses simple materials and gay colours to achieve its attractive appearance. The grocery store,* **125**, *is used also by other residents in the vicinity. Like other shops and administrative buildings in Norris, it was designed as a demonstration of the attractive possibilities for buildings which are usually drab in rural areas. The cafeteria for construction workers,* **126**, *was built of simple local materials. Domestic building,* **127**, *included* 291 *single family houses,* 10 *two family and* 5 *apartment houses.*
Part of the research carried out by the TVA for housing its construction workers has been on the development of a demountable house which is built in sections by factory methods and then taken by lorry to the selected site, **128**, **129**. *Assembling takes a small crew four to six hours. Since the war, the experience of the TVA with this type of house has enabled them to make valuable contributions to defence housing.*

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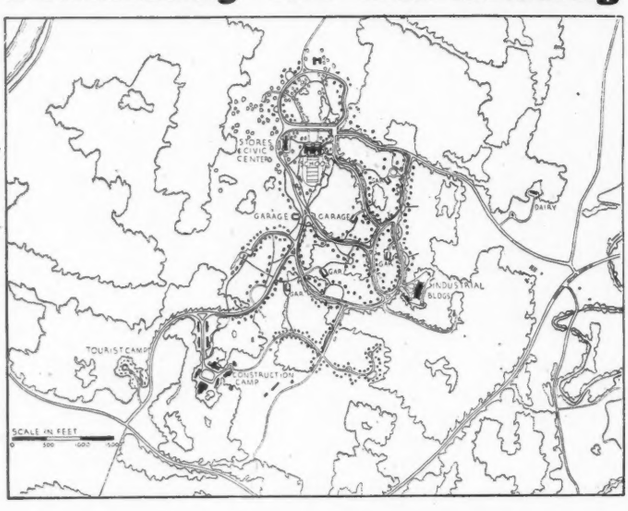
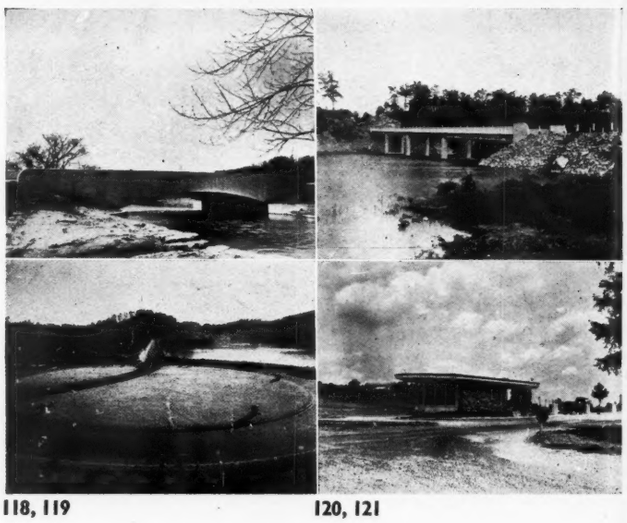
Community life and housing





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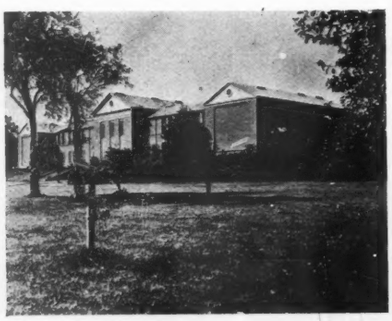

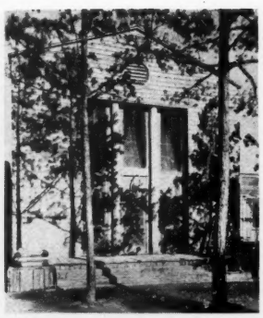

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take longer in coming to fruition, even though it may be distorted in the process and emerge in quite other guise from that in which it first dazzled his imagination, he must resist the temptation that leads to beneficent dictatorship, and must merge himself and his plan in a movement which springs from the people.

This does not mean that there are no fields in which full and compulsory powers should not be given to the planner. In the Tennessee Valley, the TVA has rightly been given almost complete command over the water-control programme—the siting and construction of dams and all their implications—just as in city planning,any authority must have compulsory powers of purchase and redesign for slums and blighted areas and for traffic and open spaces. But in a democracy, compulsory powers should never constitute more than the skeleton of planning, which provides the framework for the life of the region and determines certain aspects of its general shape. The living plan itself must evolve and grow and can only do so on the basis of co-operative participation.

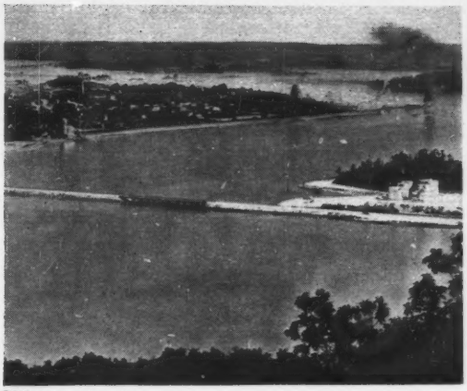
Of this there are two distinct aspects. One is co-operation with other governmental bodies and official and unofficial agencies; the other is co-operation with the people at large, through arousing their sense of participation and making them feel that it is their plan and that they have a real share in bringing it to fruition.

The TVA has practised the former from the start. I have given numerous examples of its methods of enlisting the co-operation of official organizations, by way of specific agreements and memoranda of understanding. Here I will only recall that these organizations are of all types and at all levels. They include previously existing agencies — Government departments, like the Department of Agriculture, and other Federal agencies, such as the National Park Service or the Bureau of Biological Survey; State governments and their departments and special agencies; county governments and their branches; municipalities; State and private universities and colleges; Agricultural Experiment Stations; private corporations and associations. They also include bodies set up specially to participate in TVA planning — electricity and agricultural co-operatives, farmers' committees and the like.

With all these, TVA has entered into working agreements, varied to suit the needs of each case, but always involving an active partnership. The net result has been the virtual creation of a new type of organizational framework for the region, one designed to knit separate agencies together with a view to getting specific jobs done, and done co-operatively. A particular example of some interest concerns the accounting methods used by counties. These often left a good deal to be desired, especially in rural areas. The TVA has issued manuals indicating the best methods, and has used its power of inspection of county books (in relation to its function as electricity supplier), to raise accountancy standards throughout the Valley.

It is worth recalling that TVA does not operate on the grant-in-aid principle. If it gives money, it is for a specific purpose, as when it pays the salaries of Assistant County Agricultural Officers for the supervision of the test demonstration farm programme; or for a limited time, until the local agency can stand on its own feet.

As examples of TVA co-operation with local committees, I may cite Guntersville and Decatur. Guntersville was a little town close to the Tennessee River. As the result of the new lake produced by one of the main river dams, much of the surrounding agricultural area was flooded, and the town left on the end of a narrow peninsula jutting out into the lake, which was here unusually broad. The inhabitants were much concerned at what at first sight seemed unmitigated disaster. The TVA, in co-operation with the Alabama State Planning Commission, suggested that Guntersville should set up its own City Planning Commission, and when this was done, lent the city some of its own experts. In the upshot the invading water which threatened ruin was turned to advantage. Replanned so as to provide docks and terminals as well as facilities for fishing and pleasure boating, Guntersville has become transformed from a sleepy little country



130 *Guntersville*

town and trading centre for the local farmers into a key point of trans-shipment for the steadily increasing volume of water-borne foods that are now finding their way up the Tennessee, and also into an important tourist and recreation centre, **130.** When Guntersville staged its first regatta, it attracted a crowd of over 50,000 people, and it can now look forward to a more varied and prosperous life than it previously imagined possible.

A later example comes from Decatur, another Alabama town a little lower down the river. Here the initiative came from the city, through its Chamber of Commerce, which in 1941 applied to the Alabama State Planning Commission for help and advice. The TVA was speedily brought in as well, and assisted further by seconding technicians of many kinds to work for the City Planning Commission which was promptly set up. A land-use survey, a water-front plan and a major street plan have been made, and a city zoning ordinance is in preparation. The citizens, it appears, are finding a great deal of zest in planning the future of their city.

As a result of the success of such efforts, there is now an entire section of the TVA staff devoted to assisting committees in framing master plans, building codes, zoning ordinances and so forth.

PLANNING BY THE PEOPLE

The other aspect of co-operation, with the general population of the region, is of more recent development. In its early years, the TVA was fully occupied with the immediate jobs of building dams, checking erosion and persuading farmers to adopt better methods. Gradually, however, the men directing the TVA began to realize that something was lacking. By and large, the people of the Valley did not feel that the future of the region was in their hands and that the TVA was an instrument at their disposal: the TVA was managing to put across a good deal of its plan; but the people had no sense of ownership or of participation. There were exceptions. The bigger towns and cities had become conscious of the power aspects of the TVA and of their responsibility for taking advantage of what the TVA was providing; a large section of the farmers had grown aware of the TVA's agricultural programme as a co-operative enterprise in which they had to play their part; and towns like Guntersville and Decatur had been made to realize the advantages of planning themselves. But many sections of the community were unaffected, and hardly anywhere was there any awareness of the significance of over-all general planning for the region as a whole.

As one remedy for this state of affairs, a joint committee has recently been set up, including educational specialists from the various State Universities in the region, together with subject-matter specialists from the various departments of the TVA. This has access to the technical and research material of the TVA and other public agencies concerned with health, malaria control, agriculture, and all other problems of concern to the people of the region, and uses it as a source of instructional material in the schools and colleges. This body, which goes by the cumbersome title of the Advisory Panel on Regional Materials of Instruction, thus constitutes a new form of relationship between the governmental and planning agencies of a region, and its educational system, from the primary school to the university post-graduate departments. The method is an experimental one: material is issued for trial in certain schools, and then revised for publication in the light of experience. The Panel does not itself undertake publication, but sees to it wherever possible that its material does get published. In addition to thus providing for regular publications, the Panel provides a considerable amount of "raw material," in the shape of mimeographed documents which are issued in response to special requests from schools and educational authorities all over the region. Much of this is used as the basis of class discussions on the problems of the region or the local community. Sometimes material designed for the community at large is tried out first in High Schools. This was done, for instance, with the TVA booklet, "Communities for Living," which was later revised and published as a stimulus to small towns to plan themselves.

In passing, mention should be made of the School Forests that have been established in various wooded areas of the U.S.A. These not only provide the school with a constructive corporate activity related to the life of the region, but also a useful training for those pupils who may later wish to make forestry their career.

In this and other ways the TVA is beginning to make the 2½ million people in the Valley feel that the TVA belongs to them, and that they can co-operate with it in planning their own future.

I may be pardoned for diverging briefly to another part of the United States, the Columbia basin of the North-West, including portions of Oregon, Washington, Montana and Idaho, as well as of British Columbia, where the lesson of the TVA has been sufficiently taken to heart to enlist public interest a stage further back—in the framing of the plan itself, not merely in its development and implementation.

In this region, much larger than that of the Tennessee Valley, the Columbia River is being harnessed on a spectacular scale, and in relation to the Coulee Dam a diversion of some of the waters of the river through its old Ice Age bed will bring fertility to a huge area now entirely desert. Planning here was initiated by an official Federal body, the Pacific North-West Regional Planning Commission, an offshoot of the National Resources Planning Board in Washington. Another official body, the Columbia Basin Joint Investigation Board, under the Bureau of Reclamation, is looking into the irrigation projects. Some of the members of the Regional Planning Commission felt that there was not enough public interest in and support for the idea of a regional plan, and themselves took the initiative in the formation of a non-official body, the North-West Regional Council, to supplement their own activities, which were to a certain extent limited by their official status. The new Council has, among other things, become a clearing-house for regional research, as well as finding funds for new research, and has compiled an exhaustive critical bibliography of regional problems, with an annotated list of all research projects in progress or contemplated. This it has put into the hands of all the relevant bodies in the region, such as Universities, Experiment Stations, State Governments and their departments, etc.

Equally important, it has set out to educate the population on the subject of planning its own future. It produces popular books and pamphlets. It undertakes specialized publicity to various professional groups. It permeates the educational system even more thoroughly than the TVA has done in its area—by means of special maps and pamphlets (such as one for secondary school-leavers, on jobs in the forests of the Pacific North-West); by teaching the teachers—it has made touch with over 10,000 of them by means of short two-day discussion meetings, and has given 400 others a deeper insight into planning by means of what the Americans call "Educational Workshops," lasting for four weeks; by a panel of educational consultants; by special pamphlets on educational material and curriculum; and by the preparation of an important book for college and university students, on the geography, natural

resources, sociology and economics of the region, which was prepared by the co-operation of twenty departments in various colleges, with no more aid than that of central initiative and of clerical assistance. It was struck by the absence of any agency in the region concerned with the management of State-owned lands, and accordingly itself undertook an investigation of the subject in Idaho, with reference to forestry, agriculture and grazing; this is likely to guide future practice.

In all these ways a healthy interest in the region's own potentialities is being stimulated, and the population is likely to insist on shaking off the control so long exercised by the financial interests of the East, so as to emerge from what is economically speaking a colonial status into real self-determination.

In specific cases popular and local participation has already been achieved in detailed practical projects. The best example so far is Elma, in the State of Washington. Elma is a little community of under 10,000 people, which had been largely dependent on timber. Over-cutting of the forests resulted in the closing of its one big mill, and the area was faced with disaster. The local Chamber of Commerce asked the State Planning Commission for help. The commission enlisted the further support of the two regional bodies already mentioned, the unofficial council as well as the official commission, together with other agencies, and the Elma survey was initiated. But Elma was not treated as merely a passive subject for investigation. Help was given on the express understanding that the community would participate; and participate it did to the fullest extent, and already with the most encouraging practical results. Facts and figures needed for the survey were collected by picked High School students; the town's problems were discussed in the schools and the homes, in the local newspaper and in a series of public meetings. The people of Elma made the survey and the plan so thoroughly their own that they were able to carry out some of the recommendations even before the report was presented. Groups of teachers are now being enlisted under the general supervision of the State University, to initiate somewhat similar surveys for other such areas.

DECENTRALIZED ADMINISTRATION

To return to the TVA, I must refer to an aspect of its organizational machinery which is of the greatest importance for securing that its planning shall be at one and the same time efficient and democratic—its extreme decentralization. First of all, it is decentralized from the Federal Government—no small achievement, considering that Washington is the home of the largest bureaucracy in the world. The new Army Department, for instance, houses no less than 40,000 Government servants. By way of contrast, the number of TVA personnel in Washington is 8, out of a total of nearly 40,000.

It is also decentralized within its own region. Its officials are encouraged to make their own decisions, within quite wide limits, on the problems that confront them in the field. And it possesses a headquarters staff of experts abundant enough for someone to be always readily available to go out into the field to where special problems arise, and of high enough calibre to be trusted to make their own decisions when they get there. A town planning expert will be seconded to help a city that wants to draw up and execute a town-planning scheme; a man from the Regional Studies Department will be asked to bring together representatives of all the bodies interested in the recreational resources of the region and to secure that their deliberations have a fruitful issue for the integrated planning which is the TVA's main concern; the research people keep contact with all the universities and colleges of the Valley to see how specific jobs of research can best be farmed out to their departments; experts from the various sections of the TVA are delegated to serve on the educational panel, and so on. So far as I can judge, this capacity to provide high-grade human catalysts, so to speak, whenever they are wanted, for the solution of problems on the spot, is one of the main secrets of the success of the TVA.

In a recent address, Mr. David Lilienthal, Chairman of the three-member TVA Board, expressed the conviction of the Board that "the way of doing the job and the results that have been achieved are interdependent." They have accordingly been experimenting to discover the best means of achieving administrative decentralization as the only means of reconciling planning with democracy, and feel that the three essential characteristics of a decentralized administration are these:—

1. It is "one in which the greatest number of decisions is made on the spot".
2. It must develop as far as possible the active participation of the people themselves.
3. It must co-ordinate the work of all other agencies concerned, and "the co-ordination must be in the field".

To these we may perhaps add a fourth: the decentralization of the idea behind an administration so that its planning becomes a part of public opinion. This is to be achieved not merely through customary channels of publicity and public relations but also through the educational system.

CONCLUSION

So we come to the end of this account. It is inevitably incomplete, as must be any attempt to compress into a single article the story of a decade of intensive and all-round development in a region nearly the size of England. But certain points emerge clearly and encouragingly. The new techniques of over-all and interrelated planning have proved their worth. It is not too much to say that TVA practice has shown that they are essential, if development is to be both rapid and smooth and improvement lasting. The TVA has adopted the scientific method of research, survey and experiment. Indeed it is itself a true experiment, because it is one of a number of reasonably comparable backward areas within the United States, the rest of which can be taken as controls in the scientific sense. A comparison between the Tennessee Valley and a region such as Arkansas, for instance, would be of very great demonstrative value. For this, the changes in the standard of living of the two areas, measured by the greatest possible number of indices, should be studied between 1933 and the present. Even in the absence of such an investigation, however, the general success of the experiment is evident. There has been an increase in the all-round prosperity of the Valley, in the individual well-being of the bulk of its inhabitants, and in their general hopefulness and contentment, which is definitely greater than in other backward areas of the south or south-west.

To quote an American authority writing in a British publication (Professor Mitrany of the Institute of Higher Studies at Princeton, in a recent number of *Agenda*): "The history of the TVA provides in itself an illuminating epitome of the passage of public attitude from the Old Deal to the New, and of the struggles that marked its progress.... The TVA also supplies the outstanding example of the changes which the New Deal is bringing about in the Government of the United States." Further, "the TVA is itself a hatchery of public enterprise, as in the disposal of electric power it is required by statute to give preference to States, counties, municipalities, and non-profit co-operative associations." He concludes with the interesting reflection that "the TVA has really introduced a new dimension into the constitutional structure of the United States—without any formal change in the Constitution. Acting as an autonomous authority, it has entered into contractual relations with the individual States of the region, their institutions and local sub-divisions; these relations have grown together into a co-operative, unified, multi-purpose undertaking which crosses and envelops all political boundary lines. That was practicable because the TVA's jurisdiction was limited to the functions entrusted to it by Congress—another case of full powers for a limited function."

This last point is of considerable interest in relation to the possible employment of TVA methods in the international sphere. Its Memoranda of Agreement with other agencies, its own organizational structure, its special methods of survey, its system of research deliberately adjusted to consumer needs, are all new tools which will be of service to any democracy in its struggle to control its own social destiny.

Even its mistakes have been of service. It has realized, for instance, that it was wrong in concentrating too much at the outset on its function of producing a "yardstick" in the matter of electricity, successful though this has been in certain important respects: it realizes now that achievement of any planning authority worthy the name must be measured first and foremost in all-round development and general welfare.

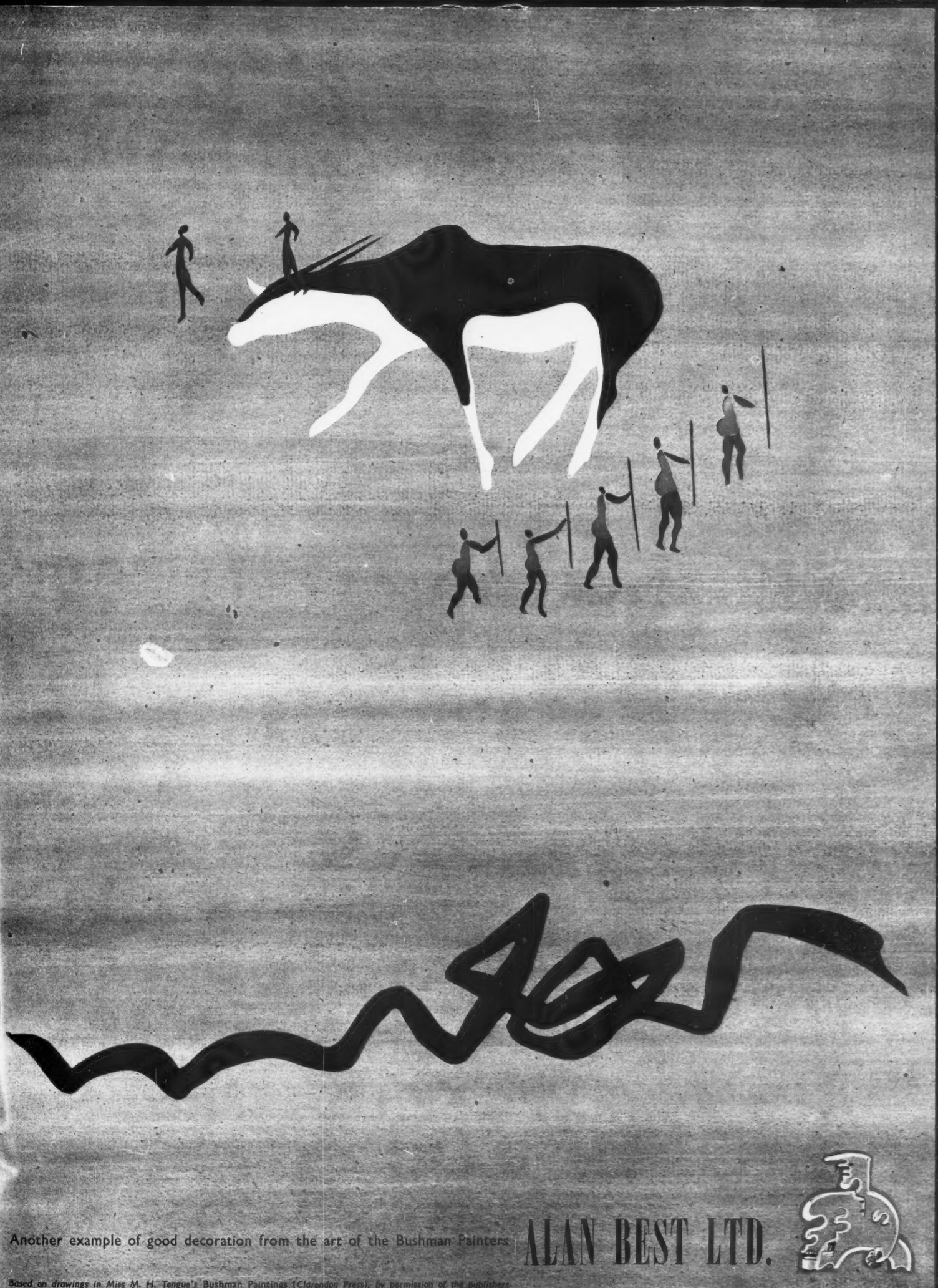
In a way most significant of all, the TVA has succeeded in demonstrating that there is no antithesis between democracy and planning, and that planning cannot only be reconciled with individual freedom and opportunity, but can be used to enhance and enlarge them. Here, too, it has invented new social tools; the enlistment of the educational system to induce a sense of participation in the plan on the part of the population at large is perhaps the most original.

The speed of its advance is also very encouraging. Ten years is a very small period in human history, yet in less than ten years the TVA has set a new stamp on the Valley, not only on its physical face, but also on its administrative machinery and on the social attitude of its people. Its major constructional programme is now practically complete, and the resultant economic and social benefits show signs of rapid and cumulative growth.

Last, but not least, the TVA idea, of the planned development of natural regions such as river valleys, has already found its way into the world's general thinking. TVA ideas and methods are helping to guide the growth of new planning agencies such as the Middle East Supply Council; studies are being made of how a set-up of general TVA type could be adapted to serve as an international instead of a national agency (thus among other things undercutting and transcending nationalist sovereignties, as the TVA undercuts and transcends States' rights and boundaries), and adjusted to promote the planned development of regions of greater backwardness, like parts of Africa.

Nearer home, detailed suggestions have been made for a "DVA" or Danube Valley Authority. However, here (and the same in greater or lesser degree will apply to all international development schemes) we must remember the many differences which will make a mere copy of the TVA system and methods inapplicable. In the Danube Valley, for instance, we would not be dealing merely with separate States of a unified federal nation, all of them imbued with the same tradition and speaking the same language. We should be confronted with separate nations, for which no adequate overriding international authority has yet been set up, with different languages, cultures, currencies and economic systems, inheritors of different national traditions, and equipped with separate national armies. A "DVA" would have to be fitted in to the framework of a European security system, and adjusted to the development of new and untried agencies of European economic organization and political control. This is not to say that the use of natural areas like river basins as the basis of international development schemes is bound to fail or should not be attempted—merely to warn us against a facile optimism and to point out that the organization of a possible DVA is bound to differ in many important ways from that of the TVA within the framework of the American constitution.

With all this it looks as if the TVA were now safely established as a permanent organ. But even if this should prove not to be the case, the TVA during the ten years of its existence will have definitely established the validity of over-all, regional, democratic planning: and this is an achievement of first-class importance in the evolution of human society.



Another example of good decoration from the art of the Bushman Painters

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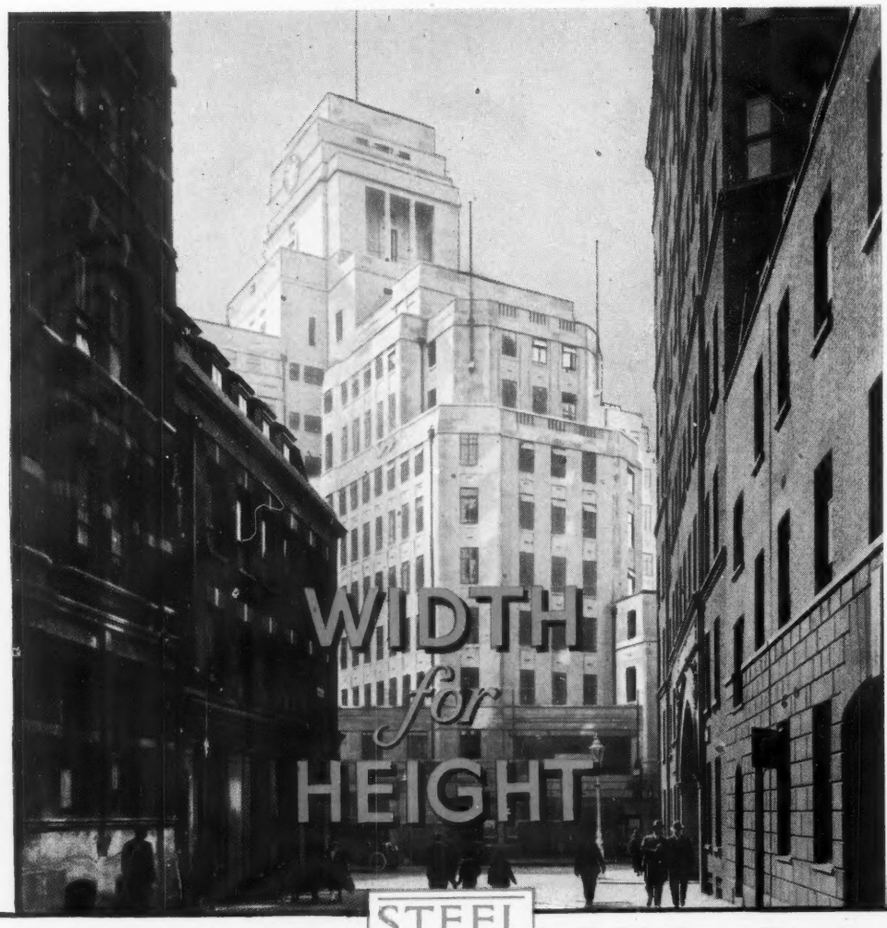
Based on drawings in Miss M. H. Tongue's Bushman Paintings *(Clarendon Press), by permission of the publishers*



Post-war planning is engaging many minds to-day, and here is a photo of the London Transport headquarters which shows how much more air and light can be given to the streets and to the buildings themselves. Architects: Adams, Holden & Pearson, F.F.R.I.B.A. The smaller photo shows a model designed by Sir John Burnet, Tait & Lorne, F.F.R.I.B.A., to show the comparison with the existing and proposed planning, which calls for a slight revision in the present building regulations. This formed the subject of a booklet, now out of print, issued by The British Steelwork Association in 1932

ANTHOLOGY

Damn'd to the Mines

Having read, in a description of Newcastle, an account of a subterraneous passage, by which coals were conveyed in waggons from the East-Kenton colliery to the river Tyne, a distance of three miles, I proceeded the next day three or four miles along the north bank of the Tyne, to visit that colliery. But when I reached the aperture of the waggon-way, a man informed me that that passage was no longer in use. I, however, entered the waggon-way ; but the infectious state of the air soon obliged me to return.

Being determined to visit a coal-pit, I went into a public house, to ask the landlord's advice. He very civilly told me that a gentleman, who was viewer, or overseer, of the West-Denton colliery, lodged at his house, and would, he had no doubt, be very happy to gratify my wish. The landlord then sent for the gentleman, who, on his arrival, immediately complied with my request, and very handsomely offered to furnish me with his own pit-clothes. I quickly undressed myself, and put on a white flannel shirt, a grey jacket and trowsers, of a very thick stuff, with a red night-cap. The guide, who was appointed to attend me, put a stick into my hand, and we set off for the bank of the pit. When we arrived here, my guide said a few words, but in a language totally unintelligible to me, to a labourer, who emptied the baskets as they were drawn up from the pit. This person then called out most audibly to the pit-men, whose answer, at this moment, vibrates on my ear. The sound, indeed, was so terrific, that I really did not feel altogether disposed to prosecute my subterraneous journey.

I asked my guide if we were going down in a basket, which question he answered by a smile, and desired me to put my thigh along with his own through a stout piece of rope, in the shape of a loop, suspended from an iron chain at the extremity of the long rope by which the coals are drawn up. I was then requested to throw my arms round the iron chain, and we were both turned off. We hung for a short time immediately over the abyss, and were then let down. A mixture of water and particles of coal drizzled on us during almost the whole of the descent. In less than a minute, I found myself upon my legs, and naturally very much amazed at this sudden transition. At the bottom of the pit, a huge cauldron blazed with great fury ; round it were seated a number of pitmen and boys. Their spokesman, while addressing me, " grinn'd horrible a ghastly smile," and a person so very lately immersed in theatricals may perhaps be forgiven, if he were led to assimilate the present occasion to the cauldron-scene in Macbeth. By degrees, as I recovered my sight, I felt somewhat reconciled to the novelty of my situation, and sat down by the cauldron, till my guide had made the necessary preparations for our progress. He placed a candle in a piece of clay, and fixed it between my fingers. The lowness of the seam obliged us to stoop immediately on setting out. We soon met a galloway, that drew six or seven baskets of coals, placed on several small waggons chained to each other. The seam continued to decrease in height, which, with the wetness of the ground, rendered walking very tiresome. We sat down to rest near a part of the pit, where several seams met. Here I observed a boy employed in putting down, on a slate, the number of baskets, as they came from the pitmen, who hewed the coal. By means of a lever, he placed the full baskets on the small waggons, and to a number of these put a galloway ; for the lowness of the seam, where the pitmen worked, would only admit of little boys to convey the baskets singly on a barrow. We set off again, and I found myself obliged to lay hold of the wrong end of the stick, in order to support myself. In this situation, nearly resembling that of a tailor on his shop-board, I crawled a considerable distance, and at length gained the extremity of the seam. Being very much exhausted, I stretched myself along the ground. My guide very naturally smiled, as I was lying with my eyes fixed on the pitman, who had no apparel on, with the exception of small-clothes. He was a young man, and handled his pickaxe with great activity ; his sooty countenance exhibited a degree of cheerfulness, which bore unerring testimony to the wonderful pliancy of the human mind. He tendered his pickaxe, and desired me to hew a piece of coal out of the seam ; this I declined, but gave him a shilling, which he thankfully accepted. I did not feel perfectly comfortable in this situation, and found it absolutely impossible to suppress such ideas as the awful ceiling naturally suggested. On our return, we stopped at one of the trap-doors, made in various parts of the pit, for the purpose of confining the air, which frequently becomes inflammable. Here the guide directed my attention to a boy between six and seven years of age, holding a cord in his hand, with which he drew the door open. The appearance of the little wretch was miserable indeed ; he had been sitting there since three o'clock in the morning, and was to be relieved at three in the afternoon. " And do you know, Sir," said my guide, with an unpleasant air of levity, " how much the little dog gets for that ?—Ten pence." " He will, of course, be brought up for a pitman ? " said I. " Certainly ! " was the answer. " Does his master in the meantime afford him any religious or moral instruction ? " " Oh ! no ! " replied the guide. I began to reflect on the immense sums which collieries yield ; and when I thought of one proprietor in particular, who is said to enjoy an annual income of eighty thousand pounds, and upwards, I felt an additional relish for the beauty and wit of Pope's lines on an inordinate pursuit of wealth, and the consequent punishment of avarice :—

" Damn'd to the mines, an equal fate besides
The slave that digs it, and the slave that hides."

J. A. ANDERSEN (*A Dane's Excursions in Britain*, 1809).

MARGINALIA

Economic Planning in Scotland

The economic planning of an entire area has been conceived and partially carried out in the Tennessee Valley and there is always a temptation to apply the principles and methods which governed this achievement to other areas which may not necessarily be suitable for experiment. In recent years the Highlands of Scotland have been so considered, but it is just as well to be clear about the difference in the fundamental problems which had to be tackled in Tennessee and in Scotland. The Tennessee Valley Authority had, as its principal function, the regulation and economic use of the waters of the Tennessee river and its tributaries : regulation meant flood control and with it river navigation and, as a concomitant of both, some planning of the land surface in or near the Tennessee Valley ; economic use, the building of water-power plants, industrial plants specialising in electro-metallurgical and chemical products and the erection of high tension transmission systems to widen the market for electrical energy. In the hands of the TVA executive, men of great ability inspired by courage and vision, the plan covered immensely more than the bare essentials of this function : it was expanded to include the economic and social life of a very extensive area. The issues here involved referred to the very existence of a people hitherto in the last extremes of poverty and social and communal decay. The TVA scheme became a vast experiment in human salvage.

A planning authority dealing with the Highlands of Scotland on the other hand would not find a semi-derelict population in a condition of social and communal misery and decrepitude. Apart from any other factor, the standard of living and the social legislation of this country would have precluded it, and it is generally agreed that the Highlands contributed some of the finest elements in our national life, not least during a period of war. The difficulty was rather to increase that contribution by bringing more population into the Highlands or make the area capable of supporting a greater number of inhabitants. In America the problem was one of human salvage; in Scotland, of land salvage—not at all the same thing.

The difficulties confronting the legislator are very much greater in the case of Scotland—they can be summarised like this : discover economic resources capable of human use, control them in the interests of a people still to be discovered and create a whole series of new communities living mainly on those resources.

Romanticists collecting nostalgic memories stigmatise the Highland clearances as a crime against the people and against history but, with the greater objectivity time allows, we are no longer in our hearts so critical. The Highland glens could not support a population as dense as that of the seventeenth and eighteenth centuries on a standard higher than that of bare existence, and modern standards require something better. To restore population means

not only restoration of the soil but also a very considerable increase in natural productivity and in human activity of economic value. If one were to ask any theorist or planner just how that object could be accomplished, he would be unable to give a satisfactory answer, and it is doubtful whether, in the present state of our knowledge, he could do so. The creation of a planning authority to open up the Highlands and bring new life to the glens would be in the nature of an experiment, the implications of which could not be entirely foreseen; but the TVA is just such an experiment and it has apparently the possibility at least of success. The difficulty is added that no real survey has been made of the Highlands at all comparable to that of the Tennessee Valley, and that after more than half a century of agitation there is still no body of information which would serve as a guide. No government has thought it fit to appoint a commission to answer the question: Granted the necessity to bring more population into the Highlands and widen the economic possibilities of the area in order to support that population, what resources are available and, in the light of modern research, what forms of agricultural and industrial activity should be encouraged—not necessarily by State action? If the State must intervene, what type of organisation should be elaborated? It is true that various committees have reported in recent years but their terms of reference were altogether too vague and their recommendations had little practical value.

Now, there must be an answer to those questions—particularly the first. The form of control or organisation is not so important if the objectives are clear. If the objectives are not known, then any organisation must be defective right from the beginning. The optimist soaked in the philosophy of the Encyclopedists might believe that human ingenuity would solve the problem and that a public board, the fashionable receptacle of men's hopes, would of its own inspiration carry out the task. Experience of the latter has cured us of that folly: anything less imaginative or less inspired in its operation and its policy than existing control boards could not be conceived. Our knowledge of the activities of an organisation like the Central Electricity Board should be such as to make us dread the multiplication of such a body.

The legislator might face up to his problem in three ways:—

(1) He might appoint a planning and investigation commission to discover the objectives and relate them to contemporary practice and, in the light of its investigation, work out a scheme of economic salvage.

(2) He might select certain objectives in advance about which there could be no doubt and create an organisation to carry them out, reserving the right to increase its responsibilities and powers until in time it would be coincident with a planning authority covering the entire area.

(3) He might work out general principles controlling State participation in economic, social and industrial activity and apply them to a specific case.

If he combined all three, he would lay at least the foundations for a considerable work of reconstruction which could not be upset by time or by the evolution of human knowledge.

The present Secretary of State for Scotland, a sincere and enlightened administrator far in advance of his predecessors, has not chosen to work out his revolution in that way: he has experimented in all three, only slightly, in turn. He has said in effect—I shall create and endow a planning department in terms of Town and Country Planning legislation soon to be elaborated with no wider powers. I shall appoint a series of committees to discover economic objectives and use other committees or individuals to give effect to them; I shall experiment with the public control board but confine its activities and duties to the production of hydro-electricity. All three proposals are admirable but they are no contribution, of a permanent nature, to a solution of the problem of Highland reconstruction.

To the argument that the economic resources of the Highlands should be controlled and developed in the interests of the community, not narrowly the Highland community (Isolationism is as much a crime in Inverness as it is in Council Bluffs), and that Highland water-power comes into this category there can be no answer. The new Hydro-Electric Board, although its powers are limited and its scope is restricted by a too tender consideration of interests which would not have been allowed to prosper in an enlightened country, will carry out a specific and valuable function but it is no closer to the task of economic and social reconstruction than a Highland Railway Board or an Agricultural Board or a Fisheries Commission or a Forestry Board. Without exact knowledge of what it can and ought to do with the energy under its control, it will be operating in a vacuum. The Central Electricity Board had its one function in the co-ordination of supplies of electricity to authorised undertakers and once that function had been completed, it became a mere automaton which

[continued on page xl

Little Snoring Church, Norfolk.

THE present church dates from Norman times, but the detached tower belonged to an earlier Saxon church, possibly destroyed by the invading Danes. Invasion is the penalty of weakness, and this is as true of buildings as it is of peoples. If you would be secure against the penetration of rain or flood, your buildings must be waterproofed with material that is not only impervious and imperishable, but is also strong enough to resist the severe pressures it may have to withstand. There is no other material that possesses all of these qualities in so high a degree as Portland cement when it is waterproofed by the addition of 'PUDLO' Brand cement waterproofer.

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continued from page xxxviii]

could be run by a caretaker and two apprentices. It could widen its conception of its function to cover economic progress but, after a period of uninspired and unhappy fumbling, it has given up the attempt. The Highland organisation has something much more positive and valuable to perform but it must have guidance, and that guidance has not been supplied by the Cooper Committee which suggested that the production of electricity from water-power could be distributed to electro-chemical and electro-metallurgical plant and the Central Electricity Board system with a small political allocation to the Highlands. The Cooper Committee was a most instructive example of what to avoid in investigation commissions: it showed no perception of the size, implications and urgency of the problem before it and made no attempt to discover the faults of the model in front of it.

The new Hydro-Electric Board, if inspired by an intelligent executive, should help the Secretary of State to solve his problem but it is no part itself of the solution: it provides the means to an end but is not the end.

The position in Scotland is now:—

(*a*) Legislation has been passed providing for the creation of a board to take over control of all future water-power production in Scotland and distribute electricity in areas in Northern Scotland outside existing franchises.

(*b*) A planning department has been surveying Scotland generally with a possibility of collaboration with the new Board in planning industrial and economic activity.

(*c*) Certain committees are unofficially considering new industrial possibilities which could be realised in the Highlands. Agricultural and geological departments are considering extensive surveys.

That is the total of economic planning in Scotland—not by any means a TVA or even a National Economic Resources Committee.

HUGH QUIGLEY

Planning Progress in England

While the Scottish Highlands scheme has focused attention on regional planning in Scotland, we have not heard much yet of regional projects in England. Work is, however, going on, and of one part of it, the one referring to the London region, preliminary results can now be seen. The Exhibition of the work of the Regional Reconstruction Committee opens at the National Gallery, while this number of THE ARCHITECTURAL REVIEW is going to press. The committee was appointed by the Council of the Royal Institute of British Architects. Its Chairman is Mr. A. W. Kenyon. Professor Abercrombie's and Mr. Forshaw's provisional schemes for the City of London will be before the L.C.C. on July 13. Both plans will be discussed in these pages in the near future.

Information from other centres is so far not very explicit. On Merseyside an advisory committee was formed early this year. Mr. F. Langstreth Thompson and Mr. C. H. James were appointed by the Ministry of Works and Planning to prepare a provisional outline plan. A survey of housing needs, and tenants' views regarding houses or flats, is in progress. Plans for the introduction of new industries are being examined. For the centre of the city new streets and new sites for public buildings are being considered. A route for civic processions from the town hall to the cathedral is amongst them. It is to be hoped that an exhibition will soon show the character in which these metropolitan improvements are visualized by the committee. The experience of the Royal Academy Exhibition of plans for London has shown how necessary it may be to start a discussion of planning schemes at a comparatively early stage.

It is therefore also to be hoped that Bristol and Portsmouth (not to say anything of the City of London) will disclose their outline projects. At Bristol there exists a Planning Advisory Committee organized by the Chamber of Commerce. It can base its work on the regional survey by Professor Abercrombie and Mr. B. F. Brueton which was started as early as 1923. Plymouth has also asked Professor Abercrombie to prepare (in co-operation with the city engineer, Mr. Paton) a plan for the future development of the city.

Comparative Figures of Dams

The following are the measurements of three dams. The first is the dam *par excellence* to us in Britain; the others have recently been in the news.

ASSUAN, 1898-1902, length 6,400 ft., height 88 ft., storage capacity of reservoir 2,300,000,000 cbm.

EDER, completed 1914, height 140 ft., storage capacity of reservoir 202,000,000 cbm.

MÖHNE, completed 1912, height 107 ft., storage capacity of reservoir 134,000,000 cbm.

The two German ones are incidentally not the largest in the country. The Saale dam at Bleiloch in Thuringia, which was completed in 1932, is 200 ft. high and forms a lake holding 215,000,000 cbm.

Acknowledgments

The following photographs are illustrated by the courtesy of *Pencil Points*: traffic crossing, on p. 164; and traffic light, on p. 157. The following by courtesy of *The Architectural Forum*: contour ploughing, pages 144–145; plan Wheeler Dam, p. 150; plan Big Ridge Park, p. 162.

IN THE SERENE SEVENTIES designers were under no hampering obligation to study " fitness for purpose ". Hence they achieved a wealth of decorative effects which are unknown to our own utilitarian age.

Consider, for instance, the delightful profusion of floral ornament on this porcelain vase — for such it is, *sub rosa*.

As a contemporary writer observed : " This is a genuine work of art. Note how beautifully it is proportioned, how equally it is divided into light and shade, and what an air of refinement marks even the smallest detail of its elaborate finish."

Having duly noted all this, one may speculate on the colours which added the final touch of perfection.

The above illustration is one of a series culled from publications of 1873, in which year The Silicate Paint Company was founded. The selection has been made with an eye to the lesser known, though more exuberant, decorative experiments of the period. In the matter of paint, of course, Duresco is eminently suitable for all periods — including the coming era of post-war reconstruction.

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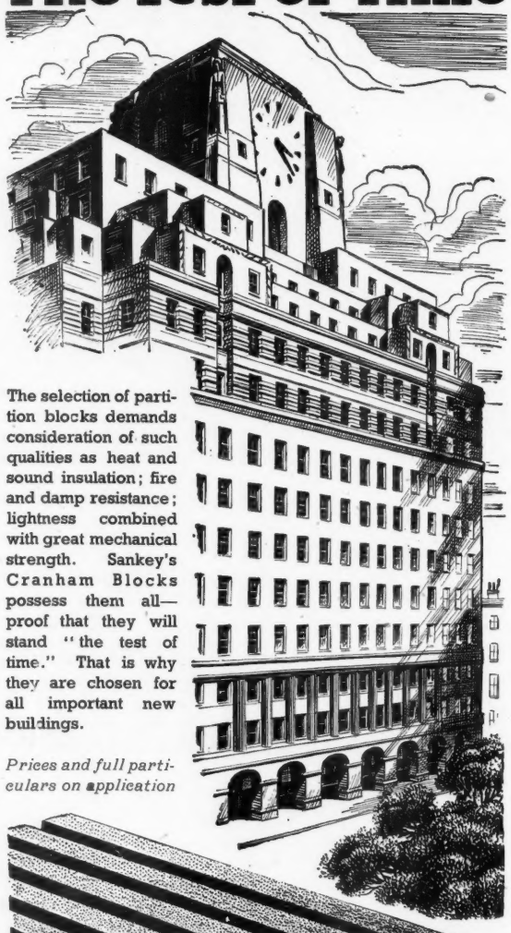
The Test of Time



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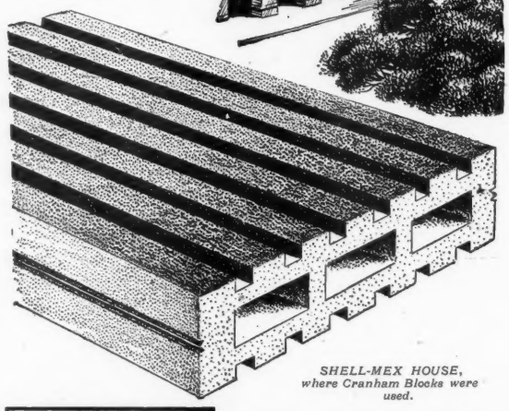

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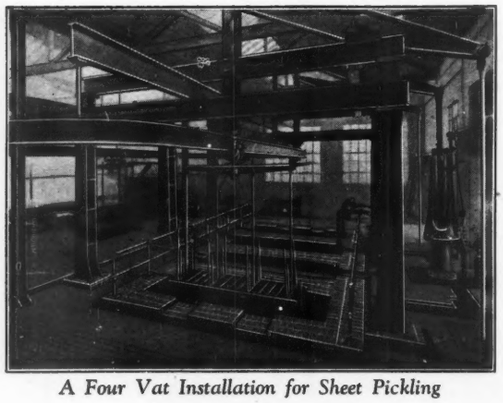
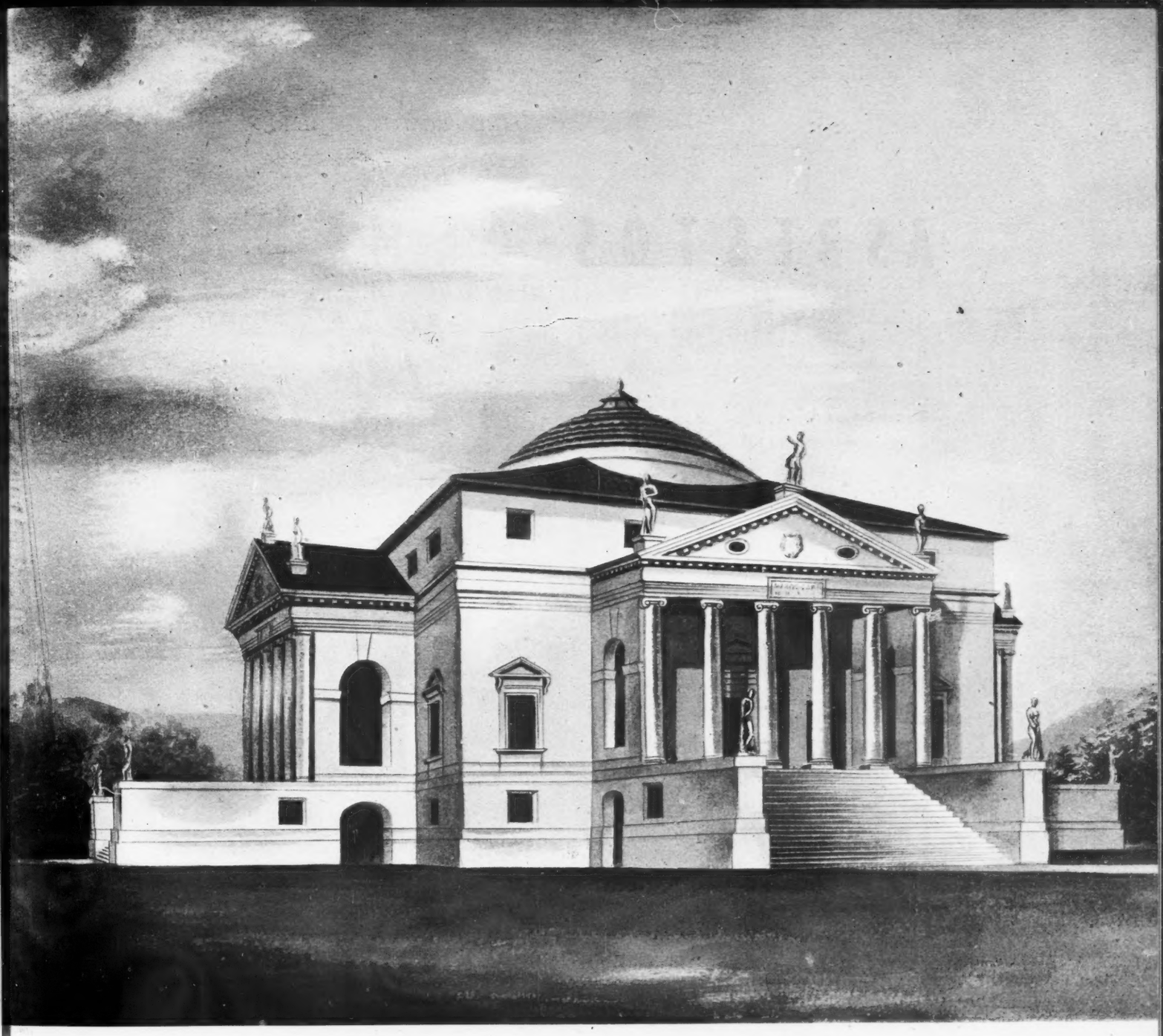


A Four Vat Installation for Sheet Pickling

A Three Vat Installation for Pickling Non-ferrous Metals



FONS ET ORIGO . . .

The famous Palladio was surely one who "builded better than he knew" — he who saw little beyond his Italian lakes and cypresses, and yet has been the father of innumerable of England's finest houses. But the astonishing vogue of his style in eighteenth century England is a tribute not only to him. It exemplifies the insight of his "discoverers" — they who recognised the wonderful rightness of his philosophy of architecture, with its three cardinal points — "L'Utile — La Perpetuita— La Bellazza." British architects have always shown themselves most ready to discern merit, both in material and style — and Celotex, makers of insulation and building boards, know they can trust their future safely to them.

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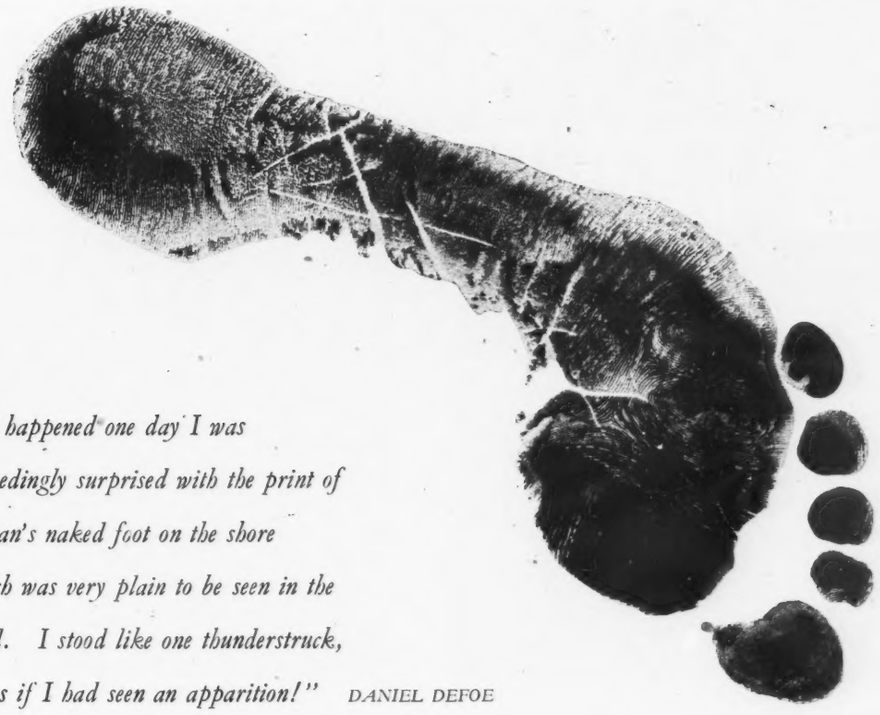

" It happened one day I was exceedingly surprised with the print of a man's naked foot on the shore which was very plain to be seen in the sand. I stood like one thunderstruck, or as if I had seen an apparition!" DANIEL DEFOE

Are you trying to solve a new kind of problem (you don't know quite what) by which your ideas for your product may be improved, or perhaps simplified, or even lowered in cost? Don't you wish that, like Crusoe, you could meet with some "exceeding surprise"? That like him you could see an imprint—not of a man's naked foot, but one which may solve your difficulty, as it may do, in the five-letter word—PAPER?

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THE PICTURE—HOW IT WAS DONE. *The background is a cardboard model, the lump of glass is Chance's optical glass (from which lenses and prisms are made) and the web is woven from 100% glass thread. The photograph was made by double exposure.*

THE WEB OF CHANCE

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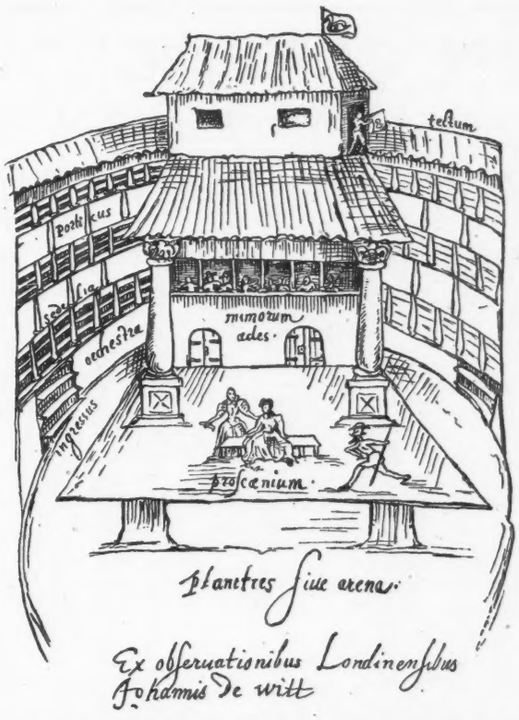


THE OLD "SWAN" THEATRE, BANKSIDE, LONDON

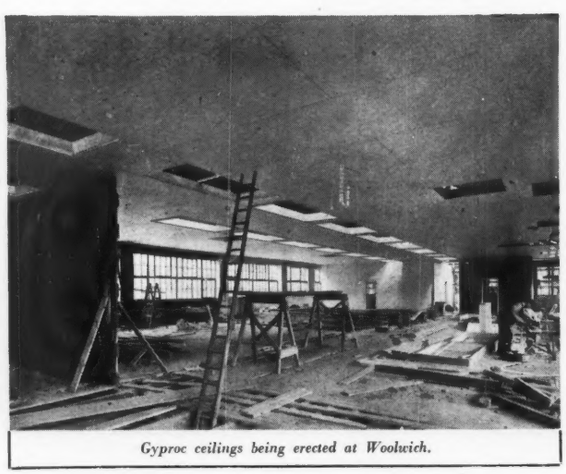
Towards the end of the 14th century, it is known that "performances and exhibitions" were given on crude wooden structures wheeled about the streets; but no theatres, as such, existed before 1576 when the "Theatre", Shoreditch, London, was opened. This, according to authorities, was the first theatre in Europe for the performance of secular plays.

London saw the opening of several theatres at this period, and by 1600 there were nine or ten compared with only two in Paris. These early theatres were small wooden imitations of the magnificent amphitheatres of Roman times. Stages for plays were movable wooden platforms wheeled into the arena between bear and bull-baiting and such popular amusement of the times.

A very good idea of the conditions under which Shakespeare's plays were first presented in this period can be formed from the illustration above. This is a copy of a drawing of the Swan Theatre, Bankside (1598), discovered in a London letter, *circa* 1600, from a traveller in England, Johannes de Witt.

STEPPING UP TO A BIG IDEA

Gyproc walls and ceilings in a works canteen.



Gyproc ceilings being erected at Woolwich.

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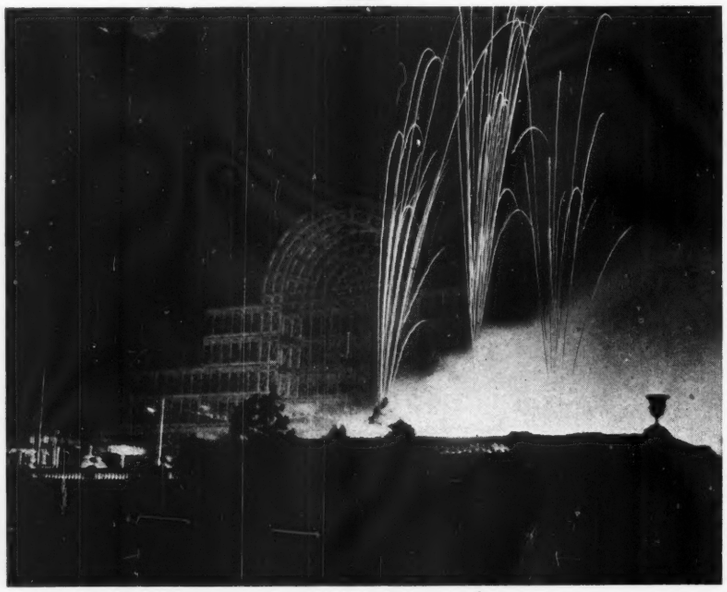

CRYSTAL PALACE. *"Times" photograph.*

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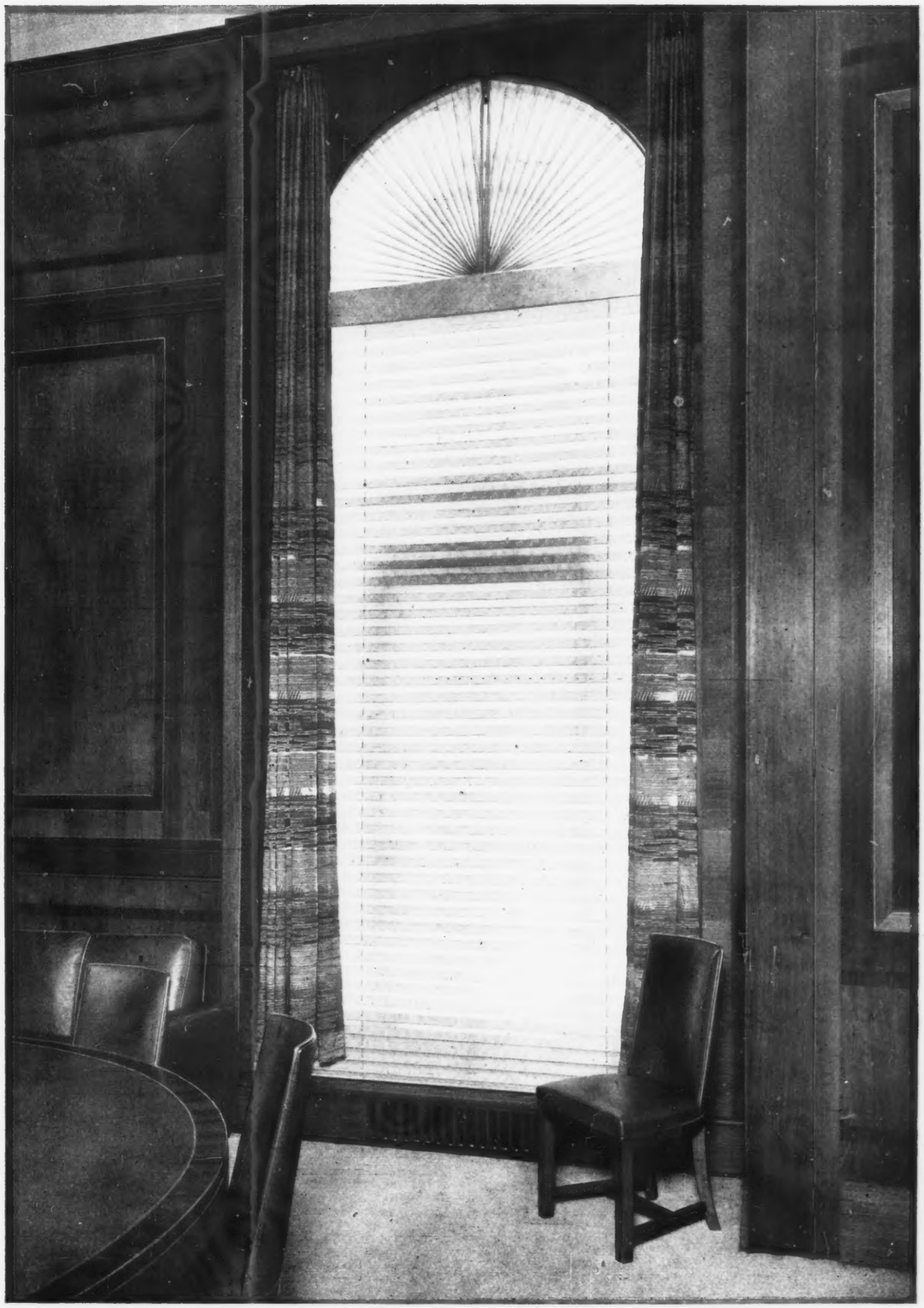

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