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W.W. BOSWORTH

15 CHOIR, CAMPANILE AND CUPOLA OF THE CATHEDRAL, SIENA, ITALY

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ACOUSTICS OF AUDITORIUMS

CONCERNING THE THEORY OF REVERBERATION

Translated from the German of G. Jäger by F. R. Watson, Associate Professor of Experimental Physics at the University of Illinois.*

"THE questions which rise from time to time concerning the causes of the acoustical properties of rooms, halls and similarly closed spaces and the knowledge that the intensity of the reverberation in this connection is of essential importance, have given rise to the following investigation.

Consider a room closed on all sides. At one point in the room a sound of very short duration is generated. From this point the sound rays are propagated in all directions in straight lines until they strike the walls. Here a deflection takes place either by reflection alone or by reflection with diffraction. At the same time a part of the energy of the rays is absorbed. As a consequence, sound rays proceed from all parts of the walls with a total energy that is less than the original energy. The rays strike the walls again, are once more deflected in different directions and again lose a part of their energy and so it continues.

In order not to make the matter too complicated, we will assume that we have to deal with a reasonably large room whose dimensions in comparison with the velocity of sound are assumed to be small, say a room whose greatest linear dimensions do not much exceed 20 meters. In such rooms the sound even in the most unfavorable cases will experience 16 reflections per second and in general many more; that is, after a fraction of a second, an auditor in any part of the room will be able in general to perceive the same amount of reverberation; a fact which was established long ago.

If we restrict ourselves to the reverberation as described we may assume that at a certain time the whole interior of the room is filled with sound rays of equal intensity going in every direction and that equal volumes in the room will contain the same amount of energy. We may call the sound energy per unit volume the energy density and may consider this energy density as a measure of the prevailing intensity of the sound. The acuteness of hearing is also closely related to the energy density.

We characterize the reverberation by assuming that it changes with the time in the same way that the energy density does.

In order to formulate the previous suggestion we must answer the question as to how much the intensity of sound falls off at each reflection. Since the rays come from all directions of the room our question concerns itself not so much with a fixed portion of the wall as with the average absorbing power of all the boundaries of the room. We understand the absorbing power of the walls to be that fraction, a, which, when multiplied by the energy of the sound, will give us the loss in energy which a sound ray suffers on the average by one reflection.

Since for each sound ray, according to our assumption, all directions which it may take in the room appear to be equally probable, it follows that each sound ray on the average will experience the same number of reflec-

*"Zur Theorie des Nachhalls," by G. Jäger. Sitzungberichte der kaiserl. Akademie der Wissenschaften in Wien. Mathem.—naturw. Klasse; Bd. CXX, Abt. IIa, Mai, 1911.

Professor Jäger's article is so suggestive and comprehensive in the theory of reverberation that it is desirable to publish the translation in a journal easily accessible to American architects. The original article is largely mathematical but is well checked by references to well known facts and to experimental work. In this translation, the mathematical developments are omitted to a considerable extent, but the discussions follow very closely Professor Jäger's statements so that his original ideas may be preserved.

tions per second, and that this number will be given by the size and shape of the room.

We will designate the number of deflections per second with n. In the time dt the number of deflections will therefore be $n\,dt$. If the sound ray has the energy E at a certain time, it loses in the time dt the energy $Eandt$. If dE represents the increase of the energy in the time dt, then

$$dE = -Eandt,$$

which we can further transform into

$$dE/E = -andt$$

By integration we obtain

$$\log E = -ant + \log C$$

where by log C we understand an arbitrary constant. Out of the last equation follows

$$E = Ce^{-ant}$$

If we set the energy E at the time $t = o$ equal to E^{o}, then

$$E = E_0 e^{-ant}$$

For the reverberation exactly the same holds true. We need only by E^{o} to understand the energy density for the time $t = o$ and by E the same quantity at an arbitrary time t.

The reverberation is thus characterized by two quantities; by the absorbing power a and by the number, n, of deflections of sound rays.

This relation has already been obtained by Wallace C. Sabine[1], but in another form of statement. In his formula the average time between two successive deflections occurs instead of the number of deflections per second, but this makes no essential difference.

It is practically impossible to determine the quantity a theoretically. If we attempt to apply to acoustical problems the formulae which have been developed in optics for reflected light we experience difficulty in finding a room of similar simple conditions that will allow the same applications. In far higher measure does this apply to the diffraction of sound. However, it is not difficult to determine experimentally the absorption coefficients of walls and this has been done extensively by Sabine.

While Sabine determined experimentally the average length of the path of the sound, that is, the path which the sound traverses on the average between two deflections, we shall represent in the following this quantity, or what amounts to the same thing, the number n, by the measurement of easily determinable quantities. The calculation offers no difficulties, since similar problems—I mention only the number of impacts of a gas molecule — are frequently handled in physics."

By the application of the theory of probability Professor Jäger then develops the relation that

$$n = \frac{vS}{4W}$$

where n is the number of deflections of a sound ray per second, v is the velocity of sound, S the entire bounding surface of the interior of the auditorium and W is the volume of the interior.

"We may now write our formula for the reverberation:

$$E_t = E_0 e^{-ant} = E_0 e^{-avSt/4W}$$

We have assumed for our calculation the case of impulse of sound. We shall now assume that a sound, say a tone, is uniformly generated through a longer time and then suddenly stopped. If the energy sent out by the source in one second is A, then in the time dt the energy $A\,dt$ is sent out. The energy density in the volume W increases consequently according to the quantity $(A\ dt)/W$. The energy density will remain constant if in the entire volume in the same time just as much energy is absorbed as is generated. If this constant energy density has the value E_o and the tone is now suddenly stopped, the energy diminishes according to the formula

$$E = E_0 e^{-ant}$$

After the infinitely small time dt, we have

$$E = E_0 e^{-andt} = E_0 (1 - andt) = E_0 - E_0 andt.$$

If the energy density is to remain constant, the increase and decrease of the same must be held in equilibrium, therefore we must have

$$(A\ dt)/W = E_o andt$$

or

$$A = WE_0 an.$$

From this is obtained the energy density E_o, which a tone can generate in a room if maintained sufficiently long—practically this is always reached in a few seconds—by the equation

$$E_0 = A/(Wan)$$

([1]The American Architect and Building News, LXVIII, April 7, 1900.)

But according to earlier calculations

$$n = vS/4W$$

thereby

$$E_o = 4A/avS.$$

If we suddenly stop such a tone, it will diminish according to the law

$$E = E_o e^{-ant} = \frac{4A}{avS} e^{-\frac{avS}{4W}t}$$

This formula gives us now a series of conclusions concerning the reverberation in closed rooms, with the restriction that the rooms do not have too large openings such as windows and doors. There are two conditions that characterize the entire process of the reverberation, first, the factor $\frac{4A}{avS}$, and second, the exponent $\frac{avS}{4W}$.

The intensity to which a tone rises is fixed by the factor $4A/avS$. The average absorption coefficient a and the total surface S are fixed by the space in which the tone is generated. Therefore, if we call forth a tone under otherwise equal conditions in rooms of the same size, it will sound louder in the room with the smaller absorption coefficient. Naturally it should not be forgotten that our formula can only find an application when the sound intensity of the tone source is so produced that those sound waves which have already experienced many reflections contribute noticeably to the total intensity of the generated sound.

The changing of the absorption coefficient enables us to vary the intensity of sound within certain limits. As instances of this we have the damping of sound when the walls are clothed with tapestries and like material and, further, the smaller tone intensity obtained when the windows and doors are open compared with that obtained when they are closed. For the value of the absorption coefficients we naturally set equal to unity the openings that reflect no sound at all. For walls, on the other hand, the absorption coefficient is a small quantity, as is seen in the following table from Sabine:

	a
open window	1.000
pine wood sheathing	0.061
plaster on wood lath	0.034
plaster on wire lath	0.033
glass of single thickness	0.027
plaster on tile	0.025
bricks laid in Portland cement	0.025

The second feature of the reverberating room which is of influence on the original intensity of the tone is its surface S. By this is understood not only the surface of the walls, the floor and the ceiling in their essential dimensions, but the total surface to which belong not only the bounding surfaces of the room but also all the surfaces of the objects present in the room, and further, the extension of the surface by decorations, etc. If the average absorption coefficient remains constant with the change of surfaces, the initial tone intensity will decrease with increase in surface because it is inversely proportional to the absorption. For this reason the reverberation is greater in a room where few articles are present and also if the articles are made up of materials of small absorbing power.

The removal and addition respectively of furnishings in a room changes in general not only the surface but also the average absorption coefficient. Therefore, if we desire to determine the influence on the initial intensity of the various objects brought into the room, we have to observe the change in the quantity aS. It is obvious without further discussion that

$$aS = a_1S_1 + a_2S_2 + \ldots\ldots\ldots,$$

where the surfaces S_1, S_2 . . . . and likewise the absorption coefficients a_1, a_2 . . . . refer to the different parts of the room. The initial intensity of a tone is therefore always weakened by the introduction of articles, especially when they possess absorption coefficients which are essentially greater than the average coefficient of absorption of the room.

This holds also for people. If the average free surface of a person is σ and the absorption coefficient α, then one person adds to the quantity aS the value $\sigma\alpha$, and n persons the value $n\sigma\alpha$. Therefore, if the empty room possess the value a_1S_1, when n persons are present

$$aS = a_1S_1 + n\sigma\alpha.$$

In this it is assumed that the people do not touch each other. If this is the case, the free surface is less and the sound deadening consequently smaller.

Since $\sigma\alpha$ is determined essentially by the clothing, it is no wonder that women deaden sound somewhat more than men. If men were to appear in iron outfittings instead of soft woolen clothing, only a small deadening of sound would be perceived.

The decadence of the sound due to the reverberation is determined by the expression

$$e^{-\frac{avS}{4W}t}.$$

The quantity aS again appears. The greater the absolute value of the exponent, the quicker the tone intensity decreases and the shorter is the reverberation. The interpretation which the quantity aS had for the initial intensity of the sound is found again for the reverberation. Also here the reverberation is weaker with increasing aS and, in the same sense, we have a deadening of the tone.

For the reverberation an important quantity arises for consideration, namely, the total volume W of the room. With increasing volume the reverberation increases also. Since the volume W cannot be changed without altering the surface S, the ratio S/W plays an important role for the reverberation. The greater this ratio becomes the shorter becomes the reverberation. Therefore, we see how by extensive diversification of the walls, by bringing in ornaments with considerable surface area, luster and the like, that this ratio may be increased and the reverberation shortened. The reverberation is also greatly influenced by the number of people present at any time, since it rapidly decreases for an increasing number of people.

The smallest value of S/W for a fixed volume is given by a hollow sphere. For this case

$$\frac{S}{W} = \frac{4\pi r^2}{\frac{4}{3}\pi r^3} = \frac{3}{r}$$

if r is the radius of the sphere. With increasing radius S/W decreases and the reverberation increases. This holds good not only for spherical rooms but also for those with any arbitrary shape. For similar shapes the corresponding values of S/W are inversely proportional to corresponding linear dimensions.

Our equation for the reverberation

$$E = \frac{4A}{avS}e^{-\frac{avS}{4W}t}$$

allows it to be seen from the previous considerations that good acoustical rooms are restricted in their dimensions. What we demand is a fixed intensity of the sound. This is given by the factor

$$\frac{4A}{avS}.$$

The energy A which the source of the sound gives out in a second is fixed by this factor and is therefore a given quantity which has an upper limit. If with increasing volume and therefore increasing surface S, the sound intensity is not to sink below a given value, we must make the absorption coefficient a as small as possible, that is, we must choose materials for the walls that are good reflectors. A playhouse constructed in accordance with this consideration will not be unusually large since the best reflecting surfaces according to Sabine [2] have an absorption coefficient of 0.025. Practically the absorption coefficient must be assumed greater than the smallest value obtainable since the larger rooms serve almost exclusively to accommodate larger audiences and these raise the absorption coefficient considerably above the average. Since a cannot be made arbitrarily as small as desired, the surface S should not exceed a certain value; that is, the improvement of the acoustics by extensive diversification of the room has its limit. If this procedure is carried too far, the intensity of sound will be influenced too much.

The reverberation also should not exceed a certain value. Therefore the expression $avS/4W$ must be chosen correspondingly large; that is, it has a lower limit. Therefore, the volume W which, according to the previous considerations, is the only factor we can freely change, is thus limited in its value. Therefore, if a room is too large, it is impossible in principle to fashion it acoustically for sounds of limited strength, for instance, for chamber music. For this reason we can understand why chamber music is heard at a disadvantage in a concert hall which is admirably adapted for orchestra concerts, since in the latter case the generated tone A can be raised to the proper amount.

With rooms which are to be used only for speaking, it is much more important to see that they are not chosen too large. So is it certain, disregarding other causes, that the bad acoustics of the Austrian House of Deputies is determined in part by its large vol-

([2]loc. cit.)

ume. This amounts to about **11,000** cubic meters, while the volume of the auditorium of the German Reichstag with good acoustics is about **2,000** cubic meters smaller.

We will now investigate the manner in which the sound intensity increases to its final value because of the reverberation. We proceed from the consideration that the energy E in the time dt increases by the quantity $\frac{A}{W}dt$; on the other hand, it decreases by the amount $Eandt$, so that the total increase is given by the equation:

$$dE = \left(\frac{A}{W} - Ean\right) dt.$$

We can easily integrate this when it is brought into the form

$$\frac{WdE}{A - anWE} = dt$$

We obtain

$$\log (A - anWE) = -ant + \log C$$

where $\log C$ indicates an arbitrary constant.

If we set

$$\frac{A}{an\,W} = E_o$$

where E_o, according to the above, is the maximum tone intensity that can be reached, we get

$$E_o - E = \frac{c}{an\,W} e^{-ant}$$

If for $t = o$, $E = o$, then $\frac{c}{an\,W} = E_o$, and we obtain

$$E = E_o\,(1 - e^{-ant}).$$

If we introduce for E_o and n their known values, these give finally

$$E = \frac{4A}{avS}\left(1 - e^{-\frac{avS}{4W}t}\right).$$

The full intensity is then reached when the quantity $e^{-\frac{avS}{4W}t}$ may be neglected compared with unity. This must naturally not take too long a time. On this same ground $\frac{avS}{4W}$ must not sink below a certain value. The same condition holds here which we have previously discussed for the reverberation. In large rooms the final sound intensity will be reached in a longer time than in small rooms. This has its significance for speakers as well as for musicians. A clever speaker with a weak voice knows that he can be well understood before a large audience if he speaks slowly. Every musician agrees that in a large concert hall he must take the runs, trills, etc., considerably slower than in small halls. Heavy choruses and orchestra pieces can only develop their entire power in large halls. Light, graceful music has its best effect in small rooms, etc., etc.

Our investigation thus far refers always to a fixed tone. For such a tone the average reflecting power of the walls is a constant which, however, changes in general with the pitch. The dependence of the absorption coefficient on the pitch plays among other things an important role. To set forth the theory of this connection exhaustively would necessitate the introduction of complicated formulae in case the problem in general is capable of complete solution. We shall therefore confine ourselves to two special cases in which we shall somewhat closely consider

1 the behavior of thin walls,
2 the influence of padding.

Consider a plane wave of sound that strikes perpendicularly upon a wall. Part is reflected and part goes further on the other side of the wall. Let the wall be so thin that a displacement of the smallest particles with respect to each other in it may be neglected, so that its motion can be considered as that of a solid body. Consider a cylinder of unit cross section to lie perpendicular to the wall. The motion of the air in this cylinder may be conceived as the motion of sound in a cylindrical tube."

The applications of the usual equations of pressure, continuity and boundary conditions lead to the result that

$$B^2 = \frac{A^2}{\frac{c^2}{u^2n^2} + 1}$$

where A and B are the amplitudes respectively of the sound waves incident upon and reflected from the wall, c^2 is a constant, u is the mass of unit surface of the wall and n is the pitch of the sound.

Since the energy of a sound wave is proportional to the square of the amplitude, it is seen from the preceding relation that the energy of the reflected sound becomes more nearly equal to that of the incident sound the greater n, the pitch of the sound, becomes. The lower the pitch the less energy is reflected. "Likewise the sound will be so much the more reflected the greater the mass u of unit surface of the wall. For the energy passing through the walls these deductions are naturally reversed.

What we have deduced for thin walls appears to hold also for thicker walls since it is a general observation that the deeper tones penetrate walls more easily than high ones do.

That higher tones are more strongly reflected from thin walls than low ones was experimentally proven by O. N. Rood.[3] The quality of tones by such reflection becomes sharper and more metallic. Upon this rests also the difference in quality of a metal and a wooden wind instrument. The thin metal of a trumpet, for instance, is more reflective to the sound waves generated in it than the wooden walls of a flute, consequently, the strong appearance of overtones in the former and the lack in the latter.

We shall now consider the case where the air which produces the sound motion is confined in a porous body so that the motion can take place only in narrow canals and therefore experiences great resistance. The motion of sound in carpets and padding may take place in a similar way."

The mathematical development of this case leads to the resultant expression

$$c^2 = a^2 \left(1 - \frac{b^2}{4\pi^2 n^2}\right)$$

where c is the velocity of sound in the room and a the velocity of sound in the room and a the velocity in the pores of the material. The more nearly c equals a, the less hindrance does the porous wall exert on the incident sound and the smaller is the reflection.

"The greater, therefore, the vibration frequency n just so much less different will be the sound velocity from that in the free air. For deep tones, on the other hand, the sound velocity can be considerably smaller.

If we now adapt the Fresnel formula for reflection of light to the case of sound we can get the form

$$B = \frac{a - c}{a + c} A$$

where A and B are the amplitudes of the incident and reflected waves of sound and a and c have the values just noted. If c is nearly equal to a, which, as we just saw, is the case for high tones, no reflection appears since B is very small. The lower the tone, on the other hand, the stronger will it be reflected.

For the transmitted sound no such simple law exists since the absorption is again a function of the vibration frequency.

If we consider now—disregarding the two special cases investigated by us which show entirely opposite results for the dependence of the possibility of reflection with the vibration frequency—that many other possibilities of sound reflection exist, it is easily understood that an experimental investigation of the sound absorption for different rooms can give results that depart widely from one another, which has really been observed by Wallace C. Sabine.[4]

[3]Sill. Journn. (3), Vol. 19, p. 133 (1880).

([4]Proc. of the Amer. Acad. of Arts & Sciences, Vol. XLII, p. 49 (1906).

HOUSE OF MRS. M. C. RUSSELL, HOLLYWOOD, CAL.

MR. ELMER GREY, *ARCHITECT*

(For other illustrations of this house, see plate section)

A Commendable Undertaking

Under the direction of a committee of the Louisiana Chapter of the Institute, a series of measured drawings of the old St. Louis Hotel in New Orleans is being made prior to the demolition of the structure.

This is an example of practical and valuable effort that cannot be too highly commended. From time to time there has been noted the attitude of the members of the Louisiana Chapter towards their architectural heritage, and the means taken to preserve or where this is impossible, to make thorough and accurate records of valuable artistic and historical landmarks.

Similar action throughout the country would, in some degree, serve to compensate for the passing of many old and notable buildings. Photographs and sketches are, of course, valuable, but no record can be as truthful and satisfactory as one that includes measured drawings, as only by such means can we reconstruct with accuracy in other and newer work those characteristics of a building that made it famous.

Referring to the passing of the St. Louis Hotel, ***Building Review,*** of New Orleans, comments as follows:

"The dignified facade of this stately building will be sadly missed by lovers of the architecture of by-gone days. But there was no possibility of saving it. Already in a ruinous condition through many years of disuse and neglect, it could offer but feeble resistance to the racking of the great storm of a month ago, which left many parts tottering to their fall.

"Many discriminating visitors have paused to compare the old hotel with the pompous vulgarity of its modern neighbor across the street and have passed on with a doubt in their minds whether taste has after all much improved in the last half century. The latter building was evidently designed and set down amid its well mannered neighbors as an affront to their decayed aristocracy, and with the intent of 'modernizing' the architectural character of the locality. Curiously enough, until the hurricane came along, no appreciable change had been discernible."

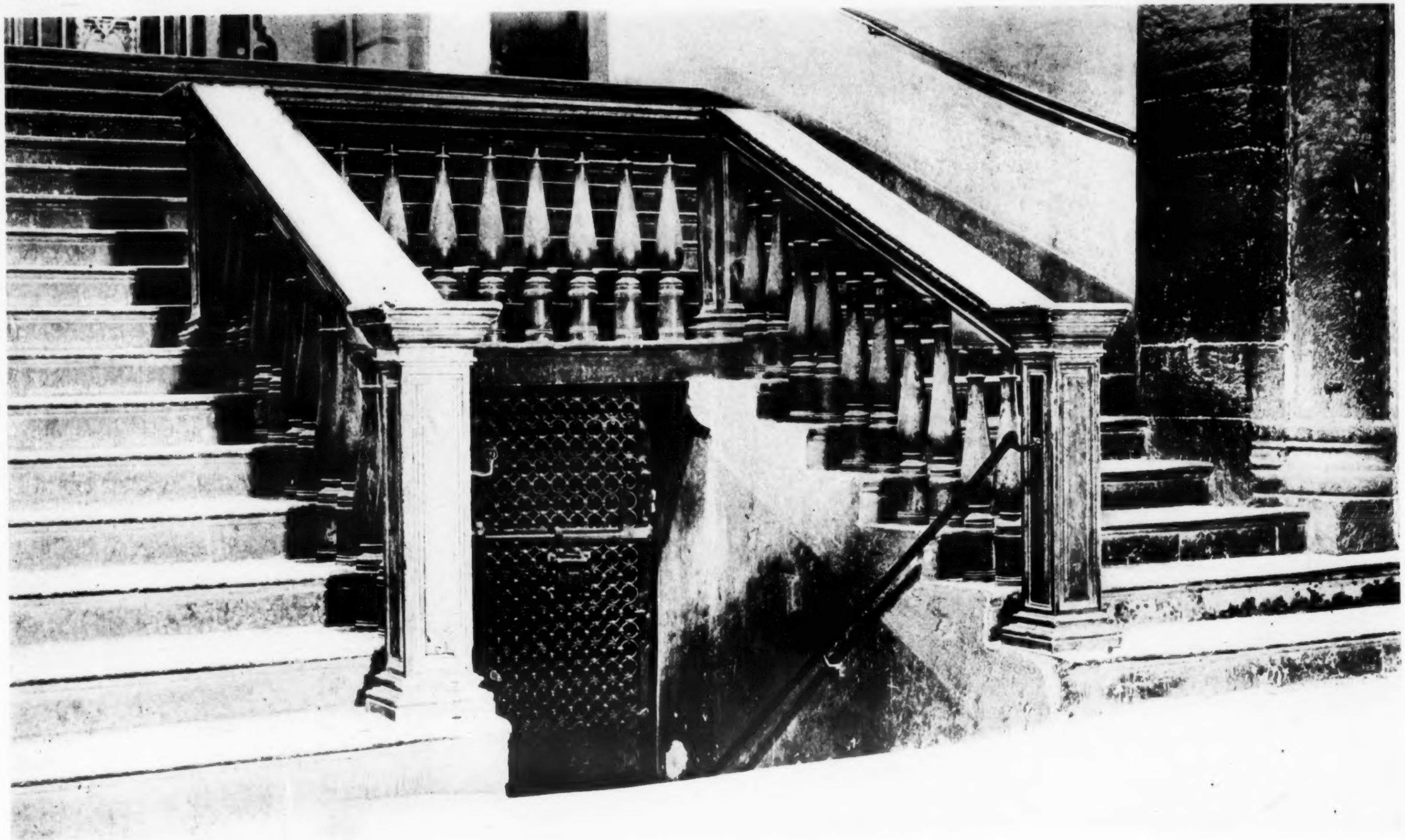
NORTHERN ITALIAN DETAILS

NO. 50—STAIRWAY, CATHEDRAL, PARMA

THE cathedral of Parma is a cruciform building, an admirable example of the Lombard Romanesque style. The handsome choir is somewhat raised above the crypt and it is the stairway leading from the floor of the nave down to the crypt and up to the choir that forms the subject illustrated.

The octagonal dome of the church is decorated by excellent frescoes by the hand of Corregio who lived in Parma. "It seems as if some mighty upward impulse had impelled the whole armies of Christendom to soar away from earth in joyful bliss. A striking feature of the work is that the figures seem to cleave the vaulting and to be in the act of forcing their way out of the church walls into bright ether. The masterly and almost playful manner in which the greatest difficulties in the work have been overcome had ever been an object of the highest admiration."

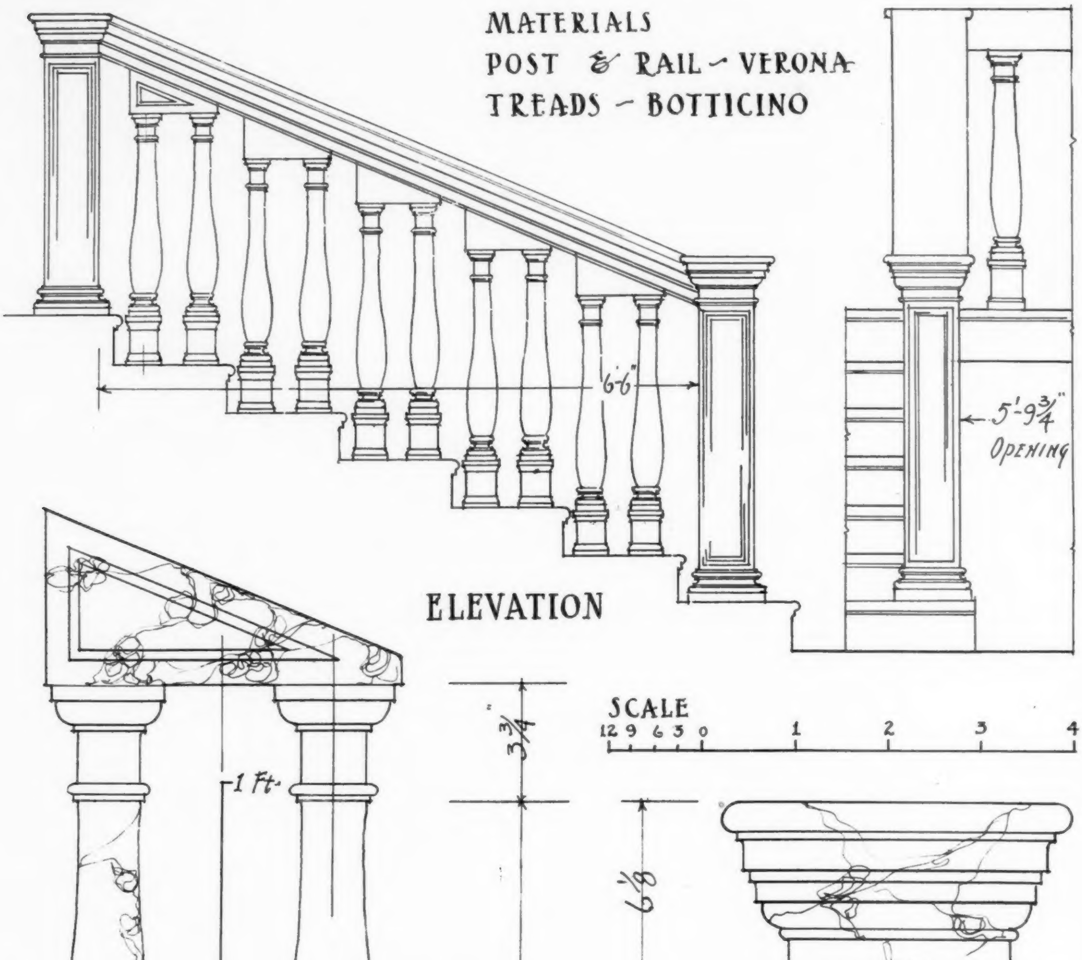
The balustrade of the stairway is novel in its arrangement while the details and profiles are designed with much feeling. The material used is a yellow Verona marble. The taking of the photographs of this subject involved unusual difficulty since the dim light of the interior of the cathedral was most unpropitious, but an exposure of more than half an hour gave results which are quite adequate.



STAIRWAY—CATHEDRAL, PARMA

PHOTOGRAPHS AND DRAWINGS
BY W. G. THOMAS AND J. T. FALLON

ARCHITECTURAL DETAILS
OF NORTHERN ITALY—PLATE NO. 104



STAIRWAY—CATHEDRAL, PARMA

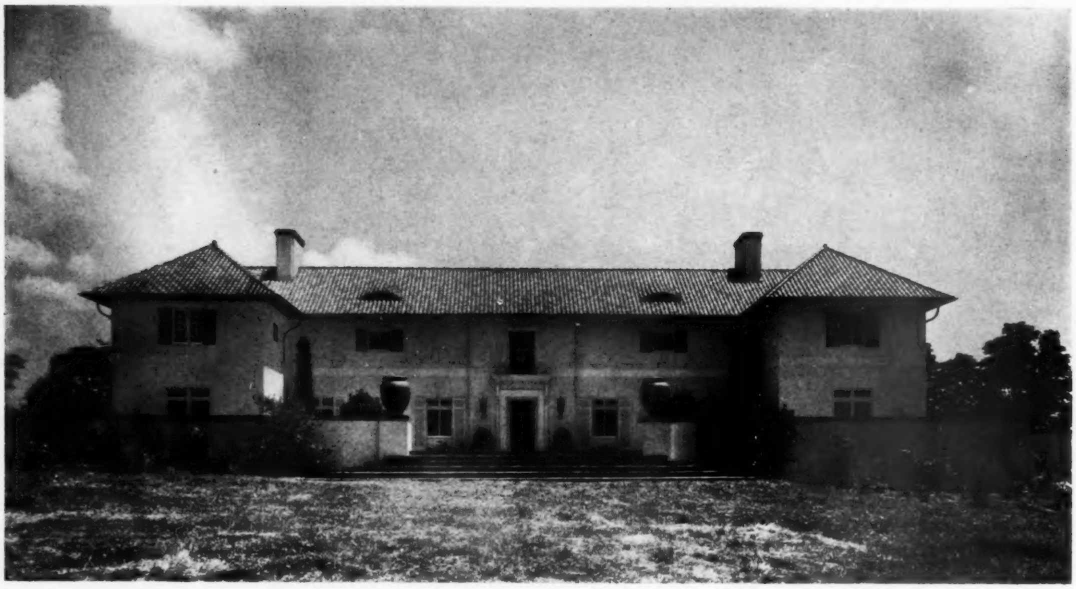
BY W. G. THOMAS AND J. T. FALLON
PHOTOGRAPHS AND DRAWINGS

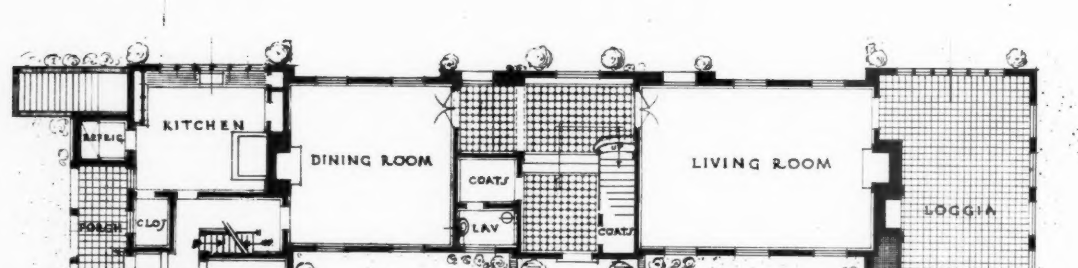
ARCHITECTURAL DETAILS
OF NORTHERN ITALY—PLATE NO. 105

HOUSE OF MRS. ERNEST ALLIS, LOUISVILLE, KY.

MR. LEWIS COLT ALBRO, *ARCHITECT*

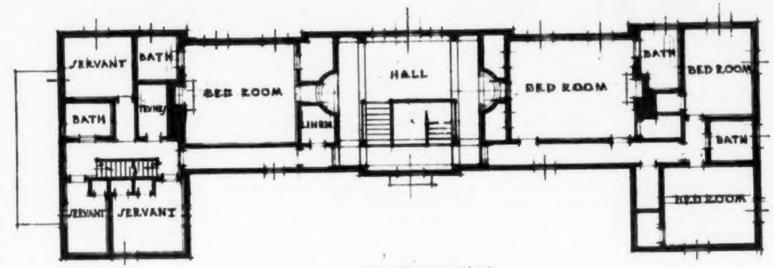
HOUSE OF MRS. ERNEST ALLIS, LOUISVILLE, KY.
MR. LEWIS COLT ALBRO, *ARCHITECT*





HOUSE OF MRS. ERNEST ALLIS, LOUISVILLE, KY.

MR. LEWIS COLT ALBRO, *ARCHITECT*



SECOND FLOOR PLAN

HOUSE OF MRS. ERNEST ALLIS, LOUISVILLE, KY.

MR. LEWIS COLT ALBRO, *ARCHITECT*

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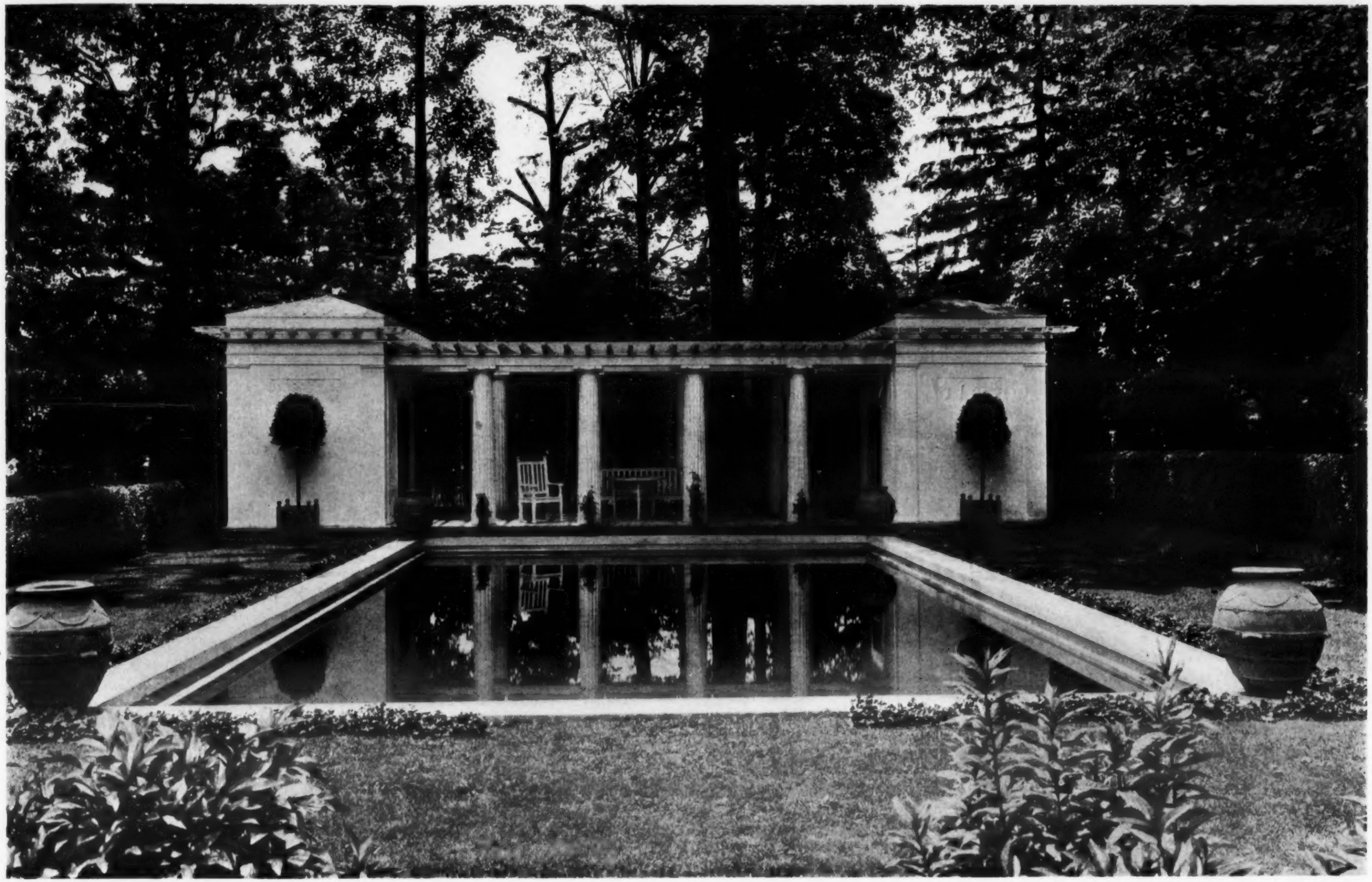


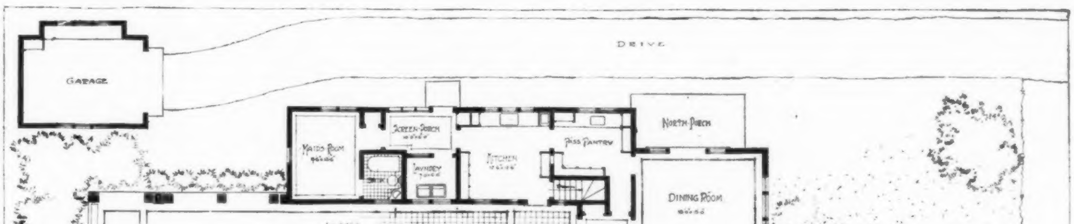
SWIMMING POOL, PERGOLA AND BATH HOUSE FOR EVERETT COLBY, ESQ., LLEWELLYN PARK, ORANGE, N. J.

MR. LEWIS COLT ALBRO, *ARCHITECT*

HOUSE OF MRS. M. C. RUSSELL, HOLLYWOOD, CAL.

MR. ELMER GREY, *ARCHITECT*

(For other illustrations of this house, see pages 375 and 379)



HOUSE OF MRS. M. C. RUSSELL, HOLLYWOOD, CAL.

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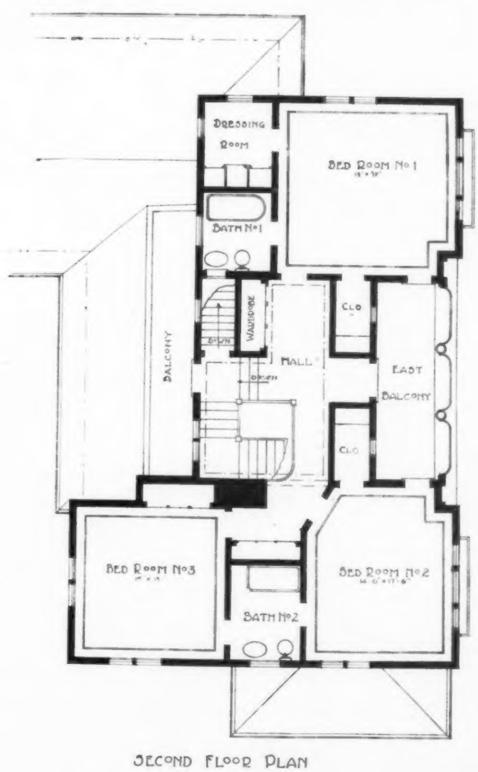
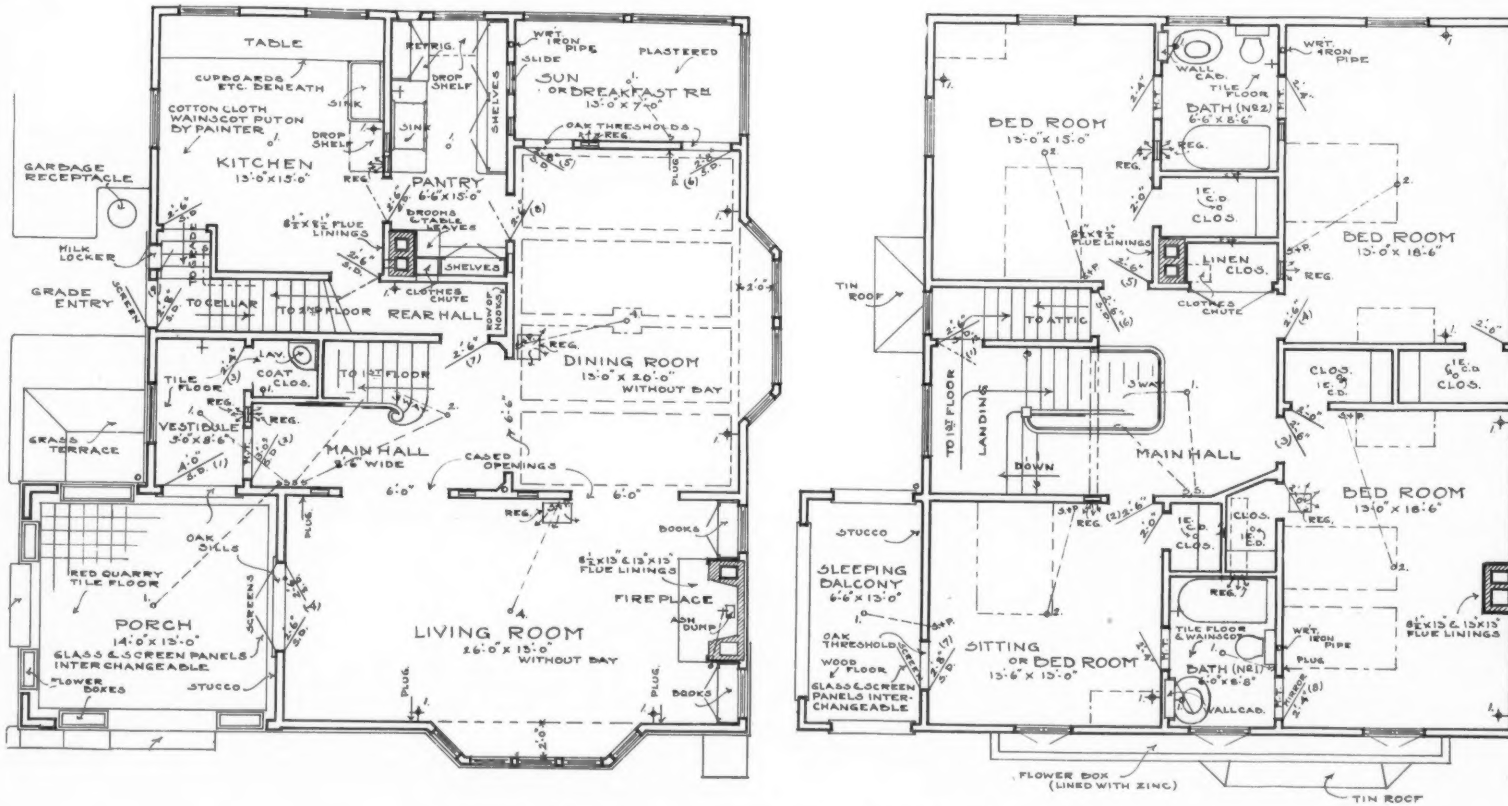


SECOND FLOOR PLAN

HOUSE OF DR. R. T. FRENCH, ROCHESTER, N. Y.

MESSRS. FOOTE, HEADLEY & CARPENTER, *ARCHITECTS*



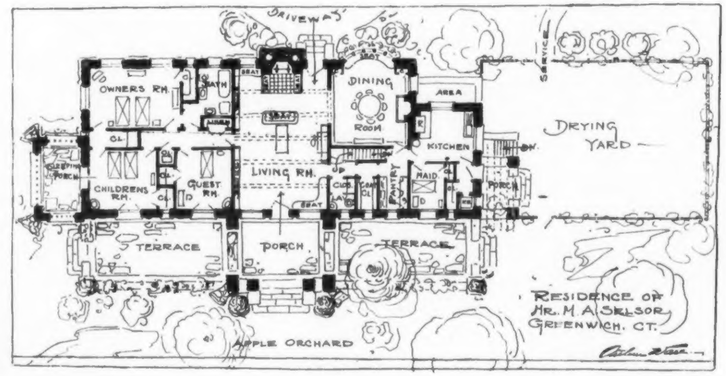
HOUSE OF DR. R. T. FRENCH, ROCHESTER, N. Y.

MESSRS. FOOTE, HEADLEY & CARPENTER, *ARCHITECTS*

Finish:—Kitchen, pantry, rear hall and stairs, plain red oak. Grade entry and stairs, white pine. Balance white wood, enameled. Posts, railings and treads on main staircase, birch, with mahogany finish. Doors, No. 1, 2¼" thick veneered with birch both sides; Nos. 2-6, 1¾" thick, same veneer; Nos. 7-8, 1¾", veneered one side birch and one side oak; No. 9, 1¾" thick, solid white pine. Balance 1½", oak both sides. House is non-fireproof construction, tile roof, concrete foundation. Exterior walls stucco on frame; interior walls and partitions, frame, doors are sanitary compound type with inlay strip of tulip wood. Hot air heating, gas and electric lighting.

HOUSE OF M. A. SELSOR, ESQ., GREENWICH, CONN.

MR. ARTHUR WARE, *ARCHITECT*



HOUSE OF M. A. SELSOR, ESQ.,
GREENWICH, CONN.

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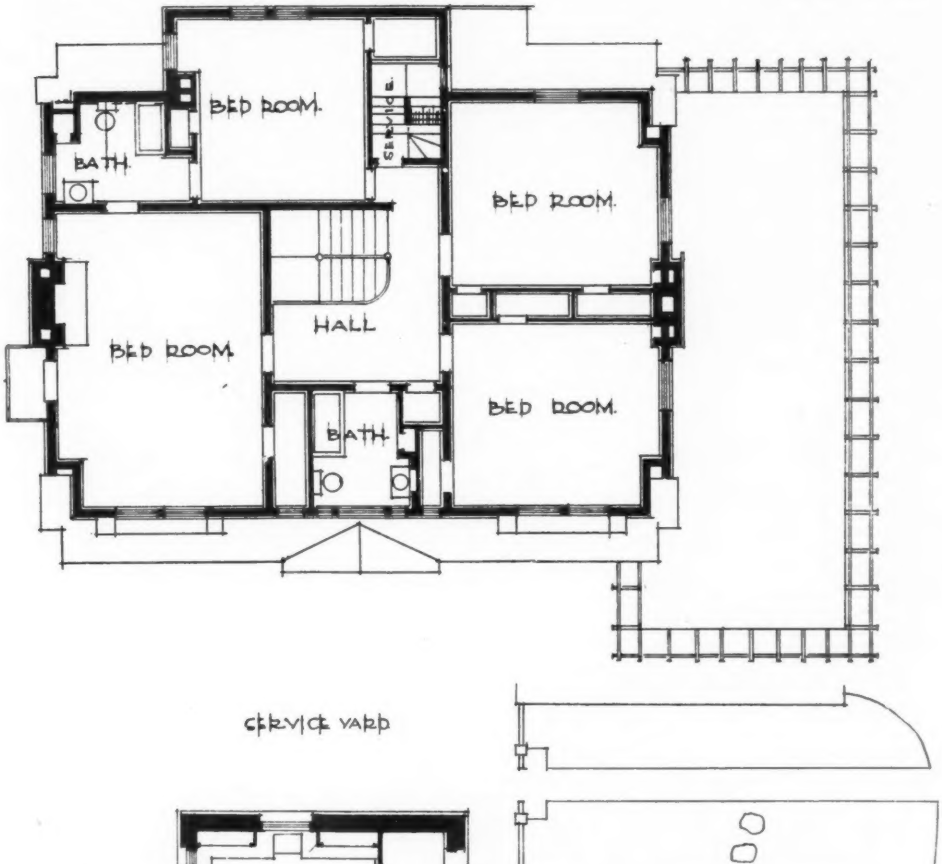
HOUSE OF W. G. ECKLES, NEW CASTLE, PA.

MR. W. G. ECKLES, *ARCHITECT*



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THE PRESERVATION OF ARCHITECTURAL MONUMENTS

THAT Americans as a nation place too slight a value on the early architecture of this country as represented by the comparatively few worthy examples still in existence is unfortunately true; but there are evidences that interest on the part of the cultured classes in structures that are typical of the art of colonial days, and have escaped the equally devastating hand of the wrecker and the restorer, is increasing annually. As a result societies, whose principal function it is to prevent the destruction of architectural monuments, have during recent years been formed with a considerable membership in the Eastern and New England states, where examples of early architecture are to be found in greatest numbers. Prominent among such organizations is the Society for the Preservation of New England Antiquities, which it appears has preserved more than a few notable structures from destruction. Noteworthy service of similar character has been performed by the architectural organizations of Philadelphia, and the hope seems justified that we are gradually becoming educated to the point where the beauty of much of the early art in this country will receive more general recognition. This is a work for which architects are peculiarly fitted, and as a consequence their participation in any movement to prevent the destruction of worthy examples of early architecture is much to be desired. Moreover, failure on their part to do anything possible to preserve a heritage of limited proportions originally, and already sadly reduced in value, would place them in an unenviable position before the art world. Even the possession of an artistic appreciation carries with it certain responsibilities.

A REVIVAL IN BUILDING

FROM numerous reports received from various widely separated sections of the country it now appears that confidence in the stability of economic conditions is returning and as a consequence building activity is increasing with each succeeding month. The improvement is particularly noticeable in the Middle West, while New York has been slower perhaps than any other section of the country to resume normal building operations. In New England greatly improved prospects for a revival of building work on a large scale are reported.

A general survey of the situation leads inevitably to the conclusion that this country is on the eve of a veritable building boom. Prices of building materials and supplies are, in general, low, labor is abundant, money is plentiful and to be had on favorable terms, and the demand for buildings of several differing classes is becoming insistent. Under these conditions it would seem to be the part of wisdom to anticipate a general movement by beginning any contemplated improvement at once and thus avail of a combination of favorable conditions not likely to be duplicated for years. Already some material increases in prices have been noted, and those owners who heeded the advice of their architects during the early months of the present year have had no reason for regretting their action. But, after all, there are but a chosen few who seem to possess an inherent good fortune that enables them to always buy at the low level and dispose of their holdings at the crest of the highest wave. To the great bulk of investors the opportunities now offered should prove sufficiently alluring, and there is every reason for expecting them to embrace them promptly.

INDIVIDUAL LIABILITY FOR FIRES

IF the campaign now well launched in this country having for its object the making of individuals liable for fires resulting from their carelessness or failure to observe the rules devised for fire prevention, succeeds to the extent which now seems probable, it will unquestionably result in an unprecedented demand for fireproof construction and fireproof materials for use in the finish and equipment of buildings. Further than that, if liability for fires in a given building is placed upon the owner of that building, the responsibility for proper construction and equipment to reduce that liability to its lowest terms will undoubtedly be placed by him upon his architect, who will then be selected for his knowledge of such matters as much as for his ability in design.

The committee on public information of the National Fire Protection Association has done much to crystallize the sentiment of the country in favor of assessing the expense of extinguishing fires upon individuals who ignore fire ordinances or fire department orders. Largely as a result of this propaganda agitation looking to legislation that will make owners liable for fires occurring on their premises has been started in a number of states. In Cleveland, O., this has taken form in a personal liability ordinance that became effective on July 12th of this year. This ordinance provides for a fine of $50 and a penalty of $3 per day while defects remain uncorrected after the date indicated by the fire warden; and the payment to the city of the total cost of extinguishing any fire resulting from such uncorrected defects. Of course, such an ordinance should be coupled with a building code of the highest character, in order to be thoroughly effective. If, however, the losses resulting from fires and the cost of extinguishing them are assessed against the owner of a building in which they originate, the tendency toward flimsy, unstable and non-fireproof construction will receive a decided check. In sections where building laws are at the present time incomplete, defective or non-existent, the responsibility for the selection of suitable structural materials falls almost entirely upon the architect, and it seems important that he should make such selection as would limit the liability of his client, in the event that at some future date his building is placed under the jurisdiction of state fire departments by the passage of state legislation of the character now earnestly demanded by organizations which have made the problems of reducing our national fire loss a subject of special inquiry and study for many years.

HOUSE OF MRS. M. C. RUSSELL, HOLLYWOOD, CAL.

MR. ELMER GREY, *ARCHITECT*

(For other illustrations of this house, see plate section)

The Current Architectural Press

THE November issue of *The Journal of the American Institute of Architects* is one of much interest and artistic excellence. The leading article, illustrated by reproduction of photographs taken en route, describes a pilgrimage to the Pacific Coast, journeying through the "Canadian Rockies" and down the coast to San Francisco. As the impressions of a man with finely trained perception of the beauty of nature, and with unusual ability to set them down for the benefit of others less fortunate, we commend this article. A symposium of impressions of the Panama-Pacific Exposition by members of the Institute who were of the group that journeyed to the coast is published, and interestingly sets forth the various viewpoints of competent critics.

Professor Kimball's series on Thomas Jefferson and the Classical Revival in America is continued. S. J. Vickers, de-

(From *The Architectural Record*)

VIEW FROM DRIVE—RESIDENCE OF CHARLES S. WALTON, ESQ., ST. DAVIDS, PA.
D. KNICKERBACKER BOYD, *ARCHITECT*

signing architect for the New York State Public Service Commission, has contributed an article on the architectural treatment of special elevated stations of the Dual System of subways, and Henry Read, president of the Denver Art Commission, writes entertainingly on city planning and civic center work in Denver.

The usual chapter notes and matters of interest to Institute members completes the issue.

In the leading article in *The Architectural Record* for November, Robert Dennis Murray describes a house in St. Davids, Pa., Mr. D. Knickerbacker Boyd, architect. There are many illustrations of this subject which fully merits the thorough presentation given it. The Parrish Museum, Southampton, Long Island, N. Y., designed by Mr. Grosvenor Atterbury, is also the subject of an article written by C. C. May. This museum is an interesting example of the artistic possibilities of modern brickwork,

(From *The Brickbuilder*)

GILMAN HALL, JOHNS HOPKINS UNIVERSITY, BALTIMORE, MD.
PARKER, THOMAS & RICE, *ARCHITECTS*

and with its surrounding well-planted garden it is an important architectural feature of this old Long Island town.

Mr. John J. Klaber writes of Planning Moving Picture Theatres. Mr. J. T.

(From *The Architectural Record*)

PART OF FORE COURT, SHOWING SIDE GATE—PARRISH MUSEUM, SOUTHAMPTON, L. I.
GROSVENOR ATTERBURY, *ARCHITECT*

Fallon has contributed an article on The Marquise and its design,—and the texture and color of the Panama Exposition buildings are described by Paul E. Denivelle. In the last-named article we have information "first hand," as Mr. Denivelle was supervisor of architectural modeling and tex-

(From *The Journal of the A. I. A.*)

THE ANGEL GABRIEL
REPRODUCED BY COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON

ture for the Exposition, and the things learned from his article are the facts in the case. For that reason his account is obviously of greater practical value than much of the theory that has found space in print.

Travertine is described by Mr. Denivelle as "the Volapuk of Materials," a very clever expression that exactly covers the use and handling of this simulation of stone.

Mr. Glenn Brown writes entertainingly of personal reminiscences of Charles Follen McKim, and a half dozen rather "edgy" etchings by Henri De Ville apparently provide the excuse for an article on the sky-scrapers and river front of New York, by Mildred Stapley.

* * * *

The Dominion Bank, Toronto, Canada, Messrs. Darling & Pearson, architects, is the principal subject of current interest illustrated in *Architecture* for November. Other subjects are the Extension of the Harvard Club, New York, McKim, Mead & White, architects, and the Garden of John D. Rockefeller at Pocantico Hills, by William Welles Bosworth.

The illustration of the Harvard Club presents little, if any, novelty over the original presentation some eight years ago, while the Garden at Pocantico Hills is substantially as fully illustrated in THE AMERICAN ARCHITECT, January 4, 1911, the difference being in the growth of the planting and the placement of some additional statuary.

Evidence is here furnished of the dearth of good illustrative material of recent construction.

A list of other subjects illustrated in this issue will be found in our index on another page.

(From *The International Studio*)

"L'YSER À DIXMUDE" BY VICTOR GILSOUL

The reprinting of the book on Spanish Regeria, recently published by the Hispania Society of America, is continued to the fifth month.

* * * *

The series on The Use of Native American Woods for Interior Finish, by C. Matlack Price, is continued in the October issue of ***The Brickbuilder,*** as is also Mr. Irving K. Pond's discussion of modern German architecture. Other articles treat of the Illumination of the Suburban House and the Acoustics of Auditoriums.

The plate illustrations are, as usual, confined entirely to brick buildings.

Further illustration is made in this issue of the group of interesting buildings at Johns Hopkins University, Messrs. Parker, Thomas & Rice and Joseph Evans Sperry, architects; a Y. W. C. A. building in Newark, N. J., Messrs. George B. Post & Sons, architects; and schools in Cleveland, Ohio, and Concord, N. H., by Messrs. Barnum & McCornack and H. T. Blanchard, respectively, complete the illustrations.

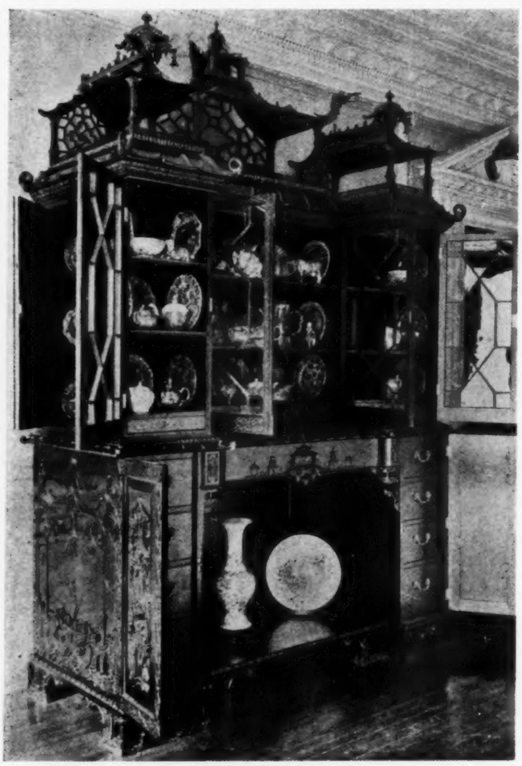
* * * *

Recent design in domestic architecture in England is shown by a number of excellent examples in the November issue of ***The International Studio.***

The use of rough cast cement and hand-made tiles is becoming quite general in the English country house, and from the examples shown it would appear that English architects are maintaining their high reputation for artistic application of building materials.

The feature of this issue is, perhaps, a series of etchings made in Flanders by Victor Gilsoul. These have the "crispness" that is always to be found in a well-made sketch direct from nature.

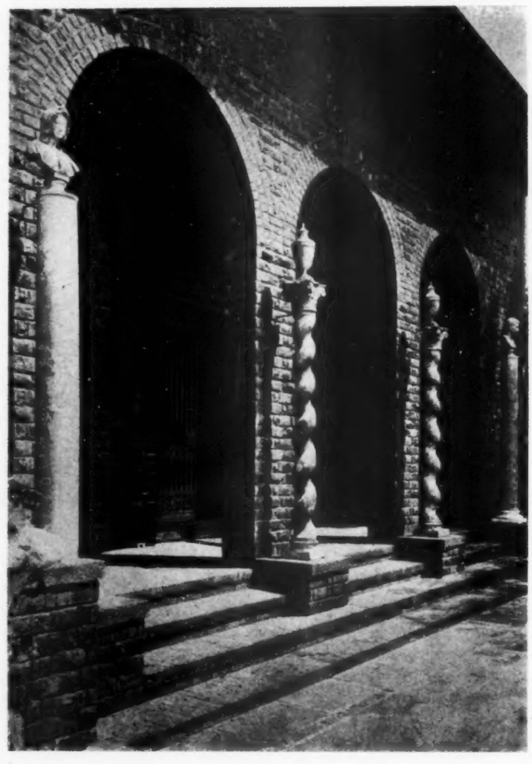
(From *Good Furniture*)



A FINE CHINESE CHIPPENDALE CABINET, FROM THE COLLECTION OF THE LATE R. A. CANFIELD, ESQ.

(Illustration by courtesy of J. B. Lippincott Co.)

(From *The Architectural Record*)



LOGGIA—PARRISH MUSEUM, SOUTHAMPTON, L. I.
GROSVENOR ATTERBURY, *ARCHITECT*

Henry Blackman Sell writes on Good Taste and the Mansion, illustrating his text by photographs of a house in Indianapolis, Messrs. Price & McLenahan, architects.

As an example of modern architectural criticism, for lay consumption, it may be acceptable, but the technical man will not regard the treatment of the subject as complete.

* * * *

The various serial articles appearing in *Good Furniture* are continued in the November issue. Under the classification of Art in the Home there are reproduced a number of well selected domestic interiors.

A thoughtful editorial, having for its subject "Industrial Education as the Backbone of Our Art Industries," points out the opportunity it is believed is presented in this country for the development of a higher grade of craftsmanship. This is a most important subject for consideration. Architects know from experience that, excepting in a very limited field, craftsmanship has not reached a satisfactory level of artistic development. Any efforts to arouse wider interest in the development of good craftsmanship should receive careful consideration and substantial support.

* * * *

Is American Architecture a Live Art? is a question asked by Mr. Frank E. Wallis and discussed by him at considerable length in the October issue of *The Architectural Review*. An entertaining writer at all times and a trained architect, Mr. Wallis succeeds in imparting to his discussion an interest that insures the respectful attention of his readers.

In considering the question, the author applies what he terms "the factory test," and illustrates his article with a profusion of factory buildings, among them a number of examples to be found in Germany, England and Scotland. The question used as the subject of the article is not definitely answered, but after considering it from the factory building viewpoint it is finally stated that "the searchlight should be turned inward on ourselves. Its rays will show nothing canting or superfluous about the question, 'Is architecture a live art or only a pedantic profession?' In the age of Peter the Hermit architecture was a live art. But that was an age of monasticism. Today America is a great manufacturing nation. We are practicing architecture today here in America. The use of fine arts in the market place, in the slaughter-houses and in the shoe factories, where steel beams are rolled and where vegetables are canned, is necessary and financially important, provided only that it is fine art, fit, proper and useful, with all of the essentials, including those of good form and color. Is architecture a live art or a pedantic profession? The burden of proof is ours. Can we bear it unless we have shown ourselves competent to prove that the abilities of our art include even this ill-considered and specific class of buildings known as factories?"

The article is one of the most interesting and useful that has appeared in an architectural magazine during recent months, and, although the more important examples of American factory buildings have been previously published, it is useful to have them gathered together for purposes of comparison and study.

Of the sixteen pages of plates shown in this number, four are of a house in England. Of the remaining twelve, nine are devoted to subjects previously shown in The American Architect, some as long ago as 1911. In view of this fact it is somewhat amusing to read in a review of current periodicals published, following the plates, that the special issue of The American Architect of September 15, devoted to schoolhouses, presents "little important *new* material." Another case of "the beam and the mote."

(From *The Brickbuilder*)

WALKER SCHOOL, CONCORD, N. H.

HUSE TEMPLETON BLANCHARD, *ARCHITECT*

Commercial Organizations and City Planning*

THE Board of Trade of the city of Newark, N. J., has been very active in inducing manufacturing and business concerns to locate in Newark, but about four or five years ago they gradually awoke to the fact that there were a lot of questions which were being asked them with regard to facilities in Newark, which they were unable to answer satisfactorily, and so they began to wonder why they shouldn't take it upon themselves to see that the local conditions of streets, transit, housing, etc., were better taken care of. This led to a strong city planning movement on the part of the Board of Trade, which resulted in the creation by the city of a city planning commission with sufficient appropriation to carry on scientific and comprehensive city planning work. As a result of the work of this Commission, backed up constantly by the Board of Trade, a number of urgent improvements have been recommended, and quite a number already carried into effect, not only in the improvement of the waterfront and in the cutting through of new streets and the widening of old streets, and in the control of all sub-division layouts, but also, with the aid of the Public Service Commission, a complete re-routing and re-scheduling of the transit lines of the city. The net result is that the Board of Trade can now answer with pride and satisfaction many of the questions which the prospective newcomer asks it, and say, "We have made those improvements."

A commercial organization, whether it be the Chamber of Commerce or the Board of Trade, or called by some other name, is created with the prime object of protecting and furthering the business and industrial interests of the community. Its function is to foster a healthy growth on the part of existing concerns and plants, and to induce new companies or corporations of good quality to locate in the community. It is their function also to see that the means of transporting in and out of the city of raw materials and finished product shall be as economical and as quick and convenient as possible, and see that corresponding facilities exist between the point of entry or departure of such goods and the manufacturing or business plant. It is furthermore their function to see that the labor market is adequate and that the employees are well taken care of so that they can get to and from their work easily, quickly and cheaply, and that they are happy and contented in settling down in the community, in other words, that they will make good citizens.

The commercial organization in inducing outsiders to locate in a community must make good the inducements which they have offered. More than that, they must be able to make a good impression on the newcomer the first time he enters the city. No matter how strong the general inducements may be, no matter how good the particular site for his factory plant may be, if he enters the city through a delapidated railroad station and comes out into an unkempt square and streets, rides in slovenly street cars, meets a traffic hold-up, due to narrow streets or bad paving, it is going to be very hard to overcome the first impression. We are all strongly influenced by it, no matter how sincerely we may try to discount it.

Now, all of these matters—the railway approach, character of streets, transit, the transportation of goods in and out of the city and to and from the plants, the providing of good manufacturing and business sites, the providing of adequate housing and recreation for the employees—are all matters of city planning. Whatever part the Chamber of Commerce takes in starting or carrying out work along any of these lines, it is doing city planning work. City planning is an integral part of the function of the commercial organization, far more so than it is of any other kind of organization in the community, and so the commercial organization is the natural leader in city planning.

Furthermore, it is often the only organization in the community that has money available to undertake the work as it needs must be done if it going to be worth anything. Almost everything that is worth while costs money, and city planning is no exception, but in the long run the money spent in making plans for the growth of the city, will return greater value for the money expended than almost anything else that the commercial organization can do.

*Address given before the Summer School for Commercial Executives in New York, August 5, 1915, by George B. Ford, Consultant to the Committee on the City Plan of the Board of Estimate and Apportionment of New York.