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A Practical Paper Devoted to all Branches of the Building Trades

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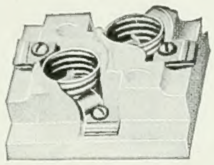

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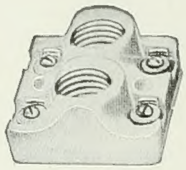

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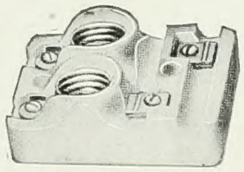

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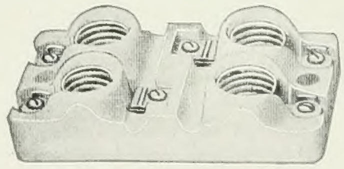

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Steel Square as an Aid to Roof Framing

How to Find the Lengths of Rafters

In our last chapter we took up the subject of splay cuts, and perhaps it may be remarked by some of our readers that our present mode of proceeding is not at all according to the usual routine.

The fact is that the subject matter is arranged with altogether a different object in view. For, instead of taking each kind of rafter and putting it through all the different processes to put the correct lines upon it, we are taking the different processes and describing them as applied to the different rafters.

The chief advantage in this classification compared with the usual method of taking each problem by itself is this:

There are only four absolute necessities in the laying out of ordinary rafters. Therefore, is it not best to lay hold of these four processes and be thoroughly acquainted with them in that light, and then apply them as action requires?

The main considerations may be looked upon as being:

Length,

Plumb and seat cuts,

Splay cut,

Projection.

At first it may seem hardly right to include plumb and seat cuts under one, but in practice it will be found that when you have one you have the other. To see this point, look at the end view of any roof. The level of the plate is always at right angles to the plumb cut of the rafter. Therefore, the seat cut of the rafter is always square from the plumb cut. So, in applying the square, it has been seen in former chapters it merely means that the other side of the square contains the angle required.

PLATE II
HIP RAFTERS

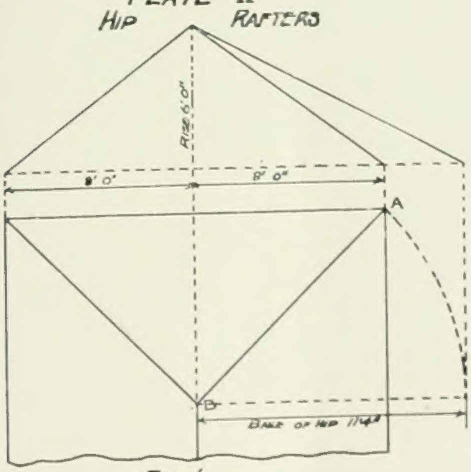


FIG. 1.

FIG. 2

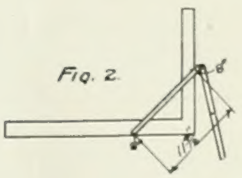
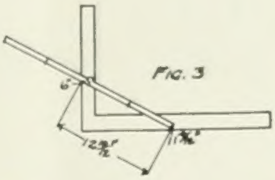


FIG. 3



Reproduced from June issue

Another remark as to classifying the operations of laying out rafters may not be out of place, and may be an aid in thinking out and remembering where and when the different operations take place:

First. The simplest kind of common rafter requires the first two of the necessary processes mentioned, namely, the length and the plumb and seat cuts. Such a rafter is seen in Fig. 1. The same can be said of all rafters.

Second. All hip, valley and hip jack rafters contain the first three of the above-mentioned necessities, namely, length, plumb and seat cuts, and splay cuts. Valley jacks have no seat cut. The last-mentioned projection is an extra which may come in common, hip, valley or hip jack rafters, but not in valley jacks, and often gives as much trouble as all the rest put together. What has passed has been in the form of an introduction to the real object of this chapter, which is to be devoted to finding the lengths of the various kinds of rafters.

How to find the length of common and hip rafters for even pitched roofs: This was thoroughly treated in numbers one and two. The principle made use of in No. 2, where the length is found by working in the two planes, is the one only system of finding lengths by the square, and that process applied in a few different ways, and with the assistance of proportion with square, includes all that we can do.

To make sure of the ground we are on, it may be well to mention the case we had in No. 2, as many of our readers will not have seen the June issue. In this we considered an even pitched hip roof with a span of 16 feet and a rise of 6 feet. To find the length of the common rafter we measured from the run to the rise, which in that case was 8 ft. to 6 ft., the rafter being 10 ft. For the length of the hip we first had to find its run.

To understand what the run is, drop a plumb line from the point of the ridge to the level of the plate. A horizontal line from this to the corner of the building will be the length of the run.

This length in No. 2 was found by measuring from 8 in. to 8 in. on the square, and was found to be 11 ft. 4 in. With this run and the rise 6 ft., the hip is 12 ft. 10 in. So in all cases of even pitched roofs and valleys, to find the run:

Take the run of the common rafter on the blade and the same on the tongue and measure across from one to the other, which will give the length of the run of the hip.

To do a few examples of this kind, taking various measurements, will be good practice, and will greatly help to insure a knowledge of the subject.

It often happens that a roof is entered by a smaller one of equal pitch, and therefore we want to know the length of the rafters for the narrower building. For this purpose we will employ a process of proportion by the steel square.

To demonstrate this, let us take the roof we have been considering, and enter it with a roof of 12-foot span, as shown in Fig. 3. We do not know the rise of this lesser roof, but we know the run to be 6 feet, and as 8 feet is to 6 feet, so 6 feet is to the lesser rafter. So to find this length by steel square proportion:

Apply the square to a board, as shown in Fig. 2, with

8 in. and 10 in. for the first case, showing the length and run of the rafter, then slide from 8 in. back to 6 in., and the other side will show the length of the rafter to be 7 ft. 6 in. for the smaller building. The same method can be used with the valley when it is a case of long and short valley, as shown in Fig. 3. This being an evenly pitched roof, the valley is the same length as a hip would be for the same span and rise.

The shorter valley must be shorter in proportion, so we just require to apply the square to a board with 8 in. and 12 10/12 in. See Fig. 1.

Then from 8 in. slide back to 6 in., and on the other side it wil show 9 ft. 7½ in. for the length of the short valley.

nicer way of working than by using the length. But before proceeding to it, just take notice that we are working at 16-inch spacing for the rafters. If the spacing is 20 in. or 24 in., just slide the square down to 20 in. or 24 in., or whatever the case may be.

For the example in question, however, we are using 16-inch spacing. It answers well before laying out the jacks to ascertain all their lengths, and to mark them all on a common rafter. This is done by using the square, as shown in Fig. 4, each time applying the square with the 16-inch base, and the figure found at the rise, as in Fig. 4, which, by the way, is the rise per 16 inches, as will be seen. And by this means the rise may be found per 12 in., 18 in., 24 in., or whatever may

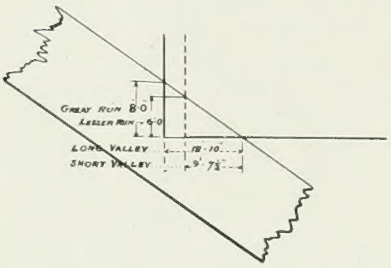


Fig. 1.

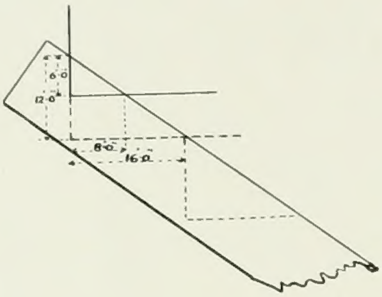


Fig. 4.

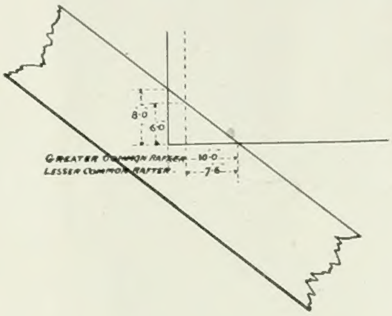


Fig. 2.

For the even pitched roof there now remains but one matter of length to be ascertained. This is the diminishing length of the jacks, or the difference in length of one jack compared to the one next to it. This is quite a simple matter, and the same rule answers with both hip and valley jacks. It is as follows: Apply the square to a board with the rise and run of the common rafter, as shown in Fig. 4, and mark the plumb cut. Then, keeping in touch with this rise line, slide the square down until the 16-in. mark touches the edge of the board; then observe what figure shows up at the rise side, which in this case is 12 in.

Now, if it is required to know the diminishing length, just measure from 16 in. to 12 in., but there is a much

be desired, as the same principle applies in all cases.

Lengths of Rafters for Unequal Pitched Roofs.

As a rule, when the student leaves the even pitched work and begins to consider the unequal pitches, he feels that he is entering upon a land of great mysteries. If he could bear one point in mind, he would soon get the upper hand of all the difficulties. The one point is

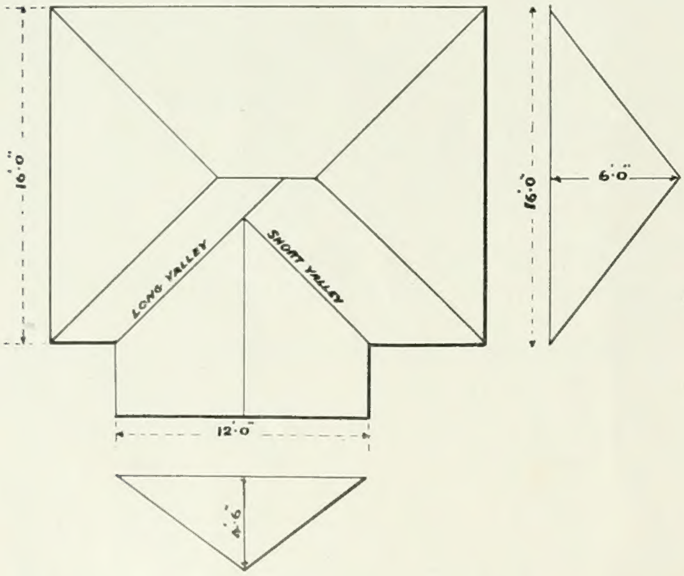


Fig. 3.

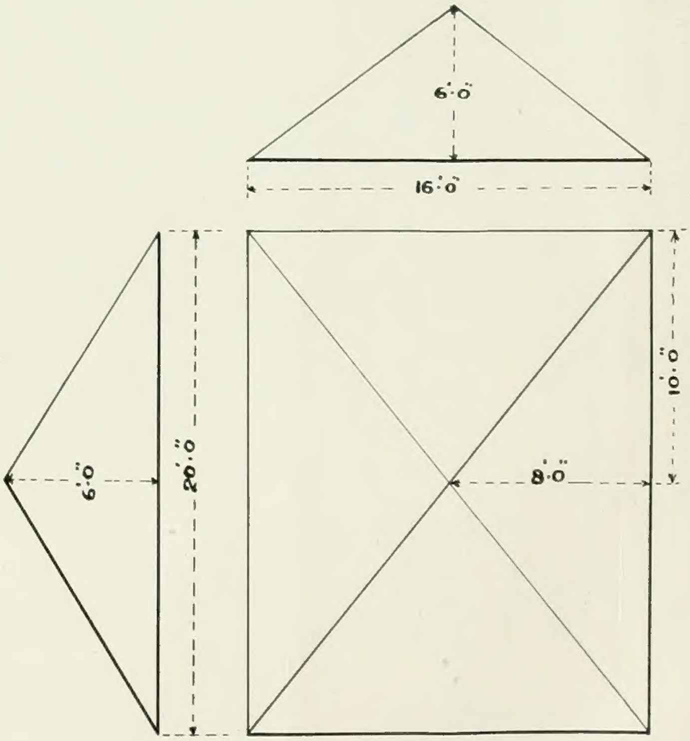


Fig. 6.

this: It is a rectangle, not a square, that contains the run of the hip or valley when the pitches are different. In the case in No. 2, the square was 8 ft. x 8 ft.; if the span was 18 ft., the square would be 9 ft. x 9 ft., and from corner to corner it would be 12 ft. 9 in., or a 20-ft. span would have a square of 10 ft. x 10 in., which would have a diagonal of 14 ft. 2 in.

So to show the nature of the difference between the square and the rectangle in this relation to the rafter, let us take, for example, a roof 16 ft. x 20 ft. (Fig. 6.)

This roof is hipped from the four corners to the centre in the form of an ordinary cottage roof, as shown in the elevations. This shows that the run of the hip is from the corner of the building to the centre, and its length is found by measuring the square from 8 to 10, as shown in Fig 7. Having found this run, let us find the length of the hip by measuring from it to the rise, as shown in Fig. 8.

The one thing for us to study now is the run of the rafter, for by this time the method of finding the length

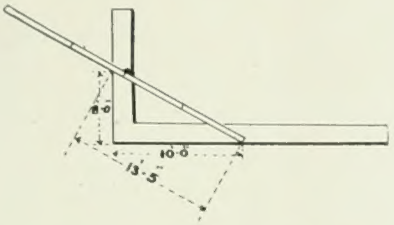


FIG. 7.

by the rise and run will be so familiar that it will not require mention. So in the case of the valley in Figs. 9 and 10, we have a valley roof; the main span is 18 ft., the less span 8 in. This shows the rectangle to be 4 ft. x 9 ft. Therefore, we measure the square from 4 in. to 9 in.

And so, in all cases, look for these two measurements, and measure between them on the square to find the run.

It can now be seen that we have passed over all the processes which are necessary in laying out rafters, and from this forward the most admirable way to acquire knowledge of the subject is to put into practice the ideas that have been received, although this course of instruction has been treated in but four chapters.

One fact regarding the study of this subject of the steel square will be well to bear in mind: There is no

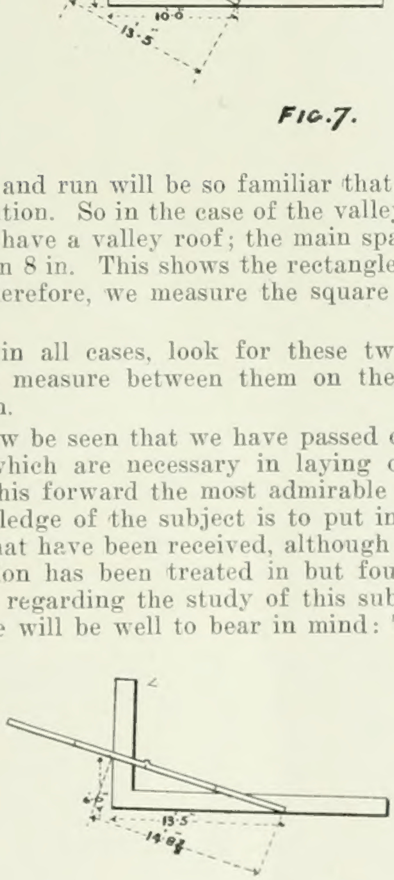


FIG. 8.

royal road to its mastery. Those who have reached the top have paid the price. Many men have worked hard all winter and have come far short of having this amount of knowledge at their command.

Of the few that excel, it is, as a rule, that pure love of the science causes them to spend perhaps not so much time in research, but many hours in thought, and applying bit by bit to their work until they build up a system of their own. This, of course, is done at the expense of infinite time and labor, but you will never hear one of those men say that it was wasted labor.

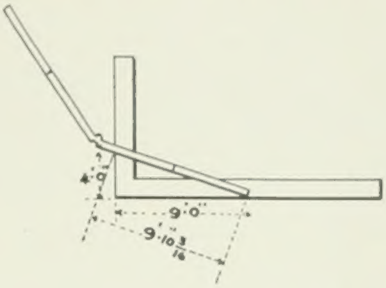


FIG. 10.

CEMENT HOUSES IN ENGLAND.

A number of cement-block cottages are being built at Plymouth, England, but Consul Joseph G. Stephens says that the blocks are made by hand in rough molds, which is more expensive than concrete walls. Two men and a boy earning a total of $2 a day make 125 of the blocks a day.

When some other wood is advertised as being as good as another, it is an unintentional admission that it is a substitute material, suggests the Hardwood Record. The world is prejudiced against substitutes. Every wood has particular merits for specific purposes. Find out what they are, and then exploit the lumber for its best use.

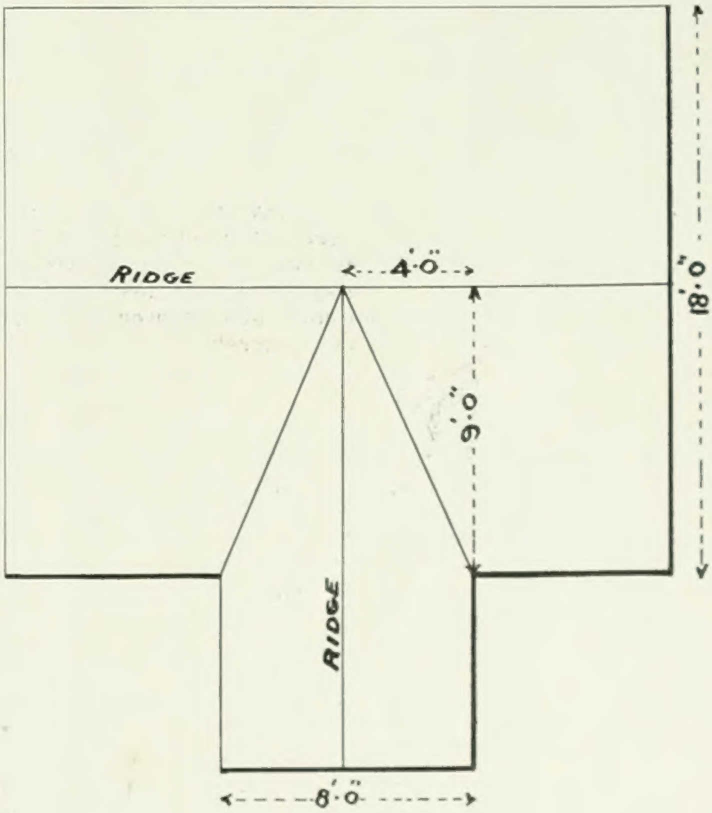


FIG. 9.

Reinforced Concrete

Report of British Joint Committee

The Joint Committee on Reinforced Concrete, formed under the auspices of the Royal Institute of British Architects, have issued their second report. It is explained that the section dealing with materials has been altered in some details, as compared with the 1907 report.

The following extracts from the report will interest our readers:

If the metal skeleton be properly coated with cement, and the concrete be solid and free from voids, there is no reason to fear decay of the reinforcement in concrete of suitable aggregate and made with clean fresh water.

Fire Resistance. (a) Floors, walls, and other constructions in steel and concrete formed of incombustible materials prevent the spread of fire in varying degrees according to the composition of the concrete, the thickness of the parts, and the amount of cover given to the metal.

Experiment and actual experience of fires show that concrete in which limestone is used for the aggregate is disintegrated, crumbles, and loses coherence when subjected to very fierce fires, and that concretes of gravel or sandstones also suffer, but in a rather less degree.* The metal reinforcement in such cases generally retains the mass in position, but the strength of the part is so much diminished that it must be renewed. Concrete in which coke-breeze, cinders, or slag forms the aggregate is only superficially injured, does not lose its strength, and in general may be repaired. Concrete of broken bricks suffers more than cinder concrete and less than gravel or stone concrete.

The material to be used in any given case should be governed by the amount of fire resistance required, as well as by the cheapness, or the facility of procuring the aggregate.

Rigidly attached web members, loose stirrups, bent-up rods, or similar means of connecting the metal in the lower or tension sides of beams or floor slabs (which sides suffer most injury in case of fire) with the upper or compression sides of beams or slabs not usually injured are very desirable.

In all ordinary cases a cover ½-inch on slabs and 1-inch on beams is sufficient. It is undesirable to make the covering thicker. All angles should be rounded or splayed to prevent spalling off under heat.

More perfect protection to the structure is required under very high temperature, and in the most severe conditions it is desirable to cover the concrete structure with fire-resisting plastering which may be easily renewed. Columns may be covered with coke-breeze, terra cotta, or other fire-resisting facing.

Materials.

Cement: Only Portland cement complying with the requirements of the specification adopted by the British Engineering Standards Committee should be employed; in general the slow-setting quality should be used. Every lot of cement delivered should be tested, and in addition the tests for soundness and time of setting, which can be made without expensive apparatus, should be applied frequently during construction.

Sand: The sand should be composed of hard grains of various sizes up to particles which will pass a ¼-inch square mesh, but of which at least 75 per cent. should pass ⅛-inch square mesh. Fine sand alone is not so suitable, but the finer the sand the greater is the quantity of cement required for equal strength of mortar. It should be clean and free from ligneous, organic, or earthy matter. The value of a sand cannot always be judged from its appearance, and tests of the mortar prepared with the cement and the sand proposed should always be made. Washing sand does not always improve it, as the finer particles which may be of value to the compactness and solidity of the mortar are carried away in the process.

Aggregate: The aggregate, consisting of gravel, hard stone, or other suitable material,* should be clean and preferably angular, varied in size as much as possible between the limits of size allowed for the work. In all cases material which passes a sieve of a ¼-inch square mesh should be reckoned as sand. The maximum allowable size is usually ¾-inch. The maximum limit must always be such that the aggregate can pass between the reinforcing bars and between these and the centering. The sand should be separated from the gravel or broken stone by screening before the materials are measured.

Proportions of the Concrete: In all cases the proportions of the cement, sand, and aggregate should be separately specified in volumes. The amount of cement added to the aggregate should be determined on the work by weight. The weight of a cubic foot of cement for the purpose of proportioning the amount of cement to be added may be taken at 90 lb. As the strength and durability of reinforced concrete structures depend mostly on the concrete being properly proportioned, it is desirable that in all important cases tests should be made as described herein with the actual materials that will be used in the work before the detailed designs for the work are prepared.

In no case should less dry cement be added to the sand when dry than will suffice to fill its interstices, but subject to that the proportions of the sand and cement should be settled with reference to the strength required, and the volume of mortar produced by the admixture of sand and cement in the proportions arranged should be ascertained.†

The interstices in the aggregate should be measured, and at least sufficient mortar allowed to each volume of aggregate to fill the interstices and leave at least 10 per cent. surplus.

For ordinary work a proportion of one part cement to two parts sand will be found to give a strong, practically watertight mortar, but where special watertightness or strength is required the proportion of cement must be increased.

*Coke-breeze, pan-breeze, or boiler ashes ought not to be used for reinforced concrete. It is advisable not to use clinker or slag, unless the material is selected with great care.

† For convenience on small works the following figures may be taken as a guide, and are probably approximately correct for medium siliceous sand:

Parts Cement		Parts Sand		Parts Mortar	Parts Cement		Parts Sand		Parts Mortar
1	+	[illegible]	=	1.20	1	+	2	=	2.35
1	+	1	=	1.50	1	+	2½	=	2.70
1	+	1¼	=	1.90		+	3	=	3.00

Metal: The metal used should be steel having the following qualities:

An ultimate strength of not less than 60,000 lb. per square inch.

A yield point of not less than 32,000 lb. per square inch.

It must stand bending cold 180 degrees to a diameter of the thickness of pieces tested without fracture on outside of bent portion.

In the case of round bars the elongation should not be less than 22 per cent., measured on a gauge length of eight diameters. In the case of bars over 1 inch in diameter the elongation may be measured on a gauge length of four diameters, and should then be not less than 27 per cent.

For other sectional material the tensile and elongation tests should be those prescribed in the British Standard Specification for Structural Steel. If hard or special steel is used, it must be on the architect's or engineer's responsibility and to his specification.

Before use in the work the metal must be clean and free from scale or loose rust. It should not be oiled, tarred, or painted.

Welding should in general be forbidden; if it is found necessary, it should be at points where the metal is least stressed, and it should never be allowed without the special sanction of the architect or engineer responsible for the design.

Mixing, General: In all cases the concrete should be mixed in small batches and in accurate proportions, and should be laid as rapidly as possible. No concrete which has begun to set should be used.

Hand-mixing: When the materials are mixed by hand they are to be turned over dry and thoroughly mixed on a clean platform until the color of the cement is uniformly distributed over the aggregate.

Machine-mixing: Whenever practicable, the concrete should be mixed by machinery.

Laying: The thickness of loose concrete that is to be punned should not exceed 3 inches before punning, especially in the vicinity of the reinforcing metal.

Striking of Centres: The time during which the centres should remain up depends on various circumstances, such as the dimensions or thickness of the parts of the work, the amount of water used in mixing, the state of the weather during laying and setting, etc., and must be left to the judgment of the person responsible for the work. The casing for columns, for the sides of beams, and for the soffits of floor slabs not more than 4 foot span must not be removed under eight days; soffits of beams and of floors of greater span should remain up for at least 14 days, and for large span large arches for at least 28 days. The centering of floors in buildings which are not loaded for some time after the removal of same may be removed in a short time; the centering for structures which are to be used as soon as completed must remain in place much longer. If frost occurs during setting, the time should be increased by the duration of the frost.

Testing: Before the detailed designs for an important work are prepared, and during the execution of such a work, test pieces of concrete should be made from the cement, sand, and aggregate to be used in the work, mixed in the proportions specified. These pieces should be either cubes of not less than 4 inches each way, or cylinders not less than 6 inches diameter, and of a length not less than the diameter. They should be prepared in molds, and punned as described for the work.

Methods of calculation, sheer reinforcements, pillars and pieces under direct thrust and pillars eccentrically loaded are also dealt with. Eight appendices to the report deal with beams, columns, slab and web reinforcement.

NEW BRICK PLANT NEAR TORONTO.

The Willcocks Lake Brick Company, 79 Adelaide Street West, Toronto, are erecting their new plant on Yonge Street, about 17 miles north of the city. Work on the foundations has already been commenced, and they expect to start manufacturing early in March.

Geo. B. Meadows, Limited, the well-known specialists in grilled iron work for banks, etc., are just completing an extensive addition to their plant at 479 Wellington Street West, Toronto.

For the eleven months ending November, 1911, the estimated cost of buildings for which permits have been issued at Nelson, B.C., is $160,050, compared with $116,580 for the corresponding period during 1910.

Four Ovens recently erected for C. W. Campbell, [illegible] by the [illegible] Oven Co. [illegible] an example of Bakeshop Construction.

Legal Decisions re Building

From The Canadian Labor Gazette

QUEBEC.

Building By-law—Dangerous Constructions—Order to Repair.

Appeal to the Supreme Court of Canada from the judgment of the Court of King's Bench, appeal side, affirming the judgment of the Superior Court, District of Montreal, by which the plaintiff's action was dismissed, except as to the amount of $394 awarded to him with costs.

The action was for damages for trespass to land. It was admitted that the servants of the corporation of the city of Montreal, entered upon the plaintiff's property against his will, and there, demolished a building in the course of erection. The forcible entry was justified, on the ground that the building was defectively constructed with improper materials, and by incompetent workmen; that the corporation had legal authority for what it did; and that it acted throughout in conformity with the directions or allowance of the legislature. Certain sections of the municipal charter of the city were invoked to justify the proceedings of the municipal employes.

It appeared that, in virtue of authority conferred by the legislature, the municipal council enacted "The Montreal Building By-law," making regulations in respect of dangerous structures, and providing that if, after notice by the inspector of buildings, the owner of any such structure should fail, as speedily as the nature of the case might require, to comply with the requisitions in such notice, the inspector might order its demolition, and, upon default of demolition within the time specified in the order, he might cause the structure to be demolished. The inspector gave notices to the plaintiff with respect to his buildings, alleged to be dangerous, but failed to give him definite orders with regard to the nature of the demolition required, and subsequently entered upon the plaintiff's property and demolished the buildings on his default to comply with the requisitions contained in the notices.

The Court held, Mr. Justice Davies dissenting, that the conditions prescribed as necessary before the exercise of the right of forcible entry and demolition of the structure, had not been fully observed, and that, in consequence of omission strictly to comply with the conditions, the municipal corporation was responsible for the damages sustained by the plaintiff through the unauthorized destruction of his property.

In the exercise of extraordinary powers conferred by legislation authorizing interference with private rights, all conditions precedent to the exercise of such powers must be strictly complied with, prior to the performance of acts which if done without special authority so conferred, would be wrongful.

(Riopelle vs. City of Montreal, 44 Sup. Ct., Repts., 579.)

MANITOBA.

Building Contract—Mechanics' Lien—Enforcement—Delay Caused by Strikes, etc.

In an action by the assignees of the contractors for the erection of a building against the owner and the mortgagees, to enforce a mechanics' lien, the plaintiffs claimed $2,767.84. The owner pleaded that the employment was under an agreement in writing, in which it was provided that the production of the architect's certificate and evidence that no other liens existed were, conditions precedent to payment, and that such certificate and evidence were not produced or tendered; that the agreement provided for a penalty if the work was not completed by July 1, 1909, and that the work was not completed by that date; that the work done and material used, were defective; and the owner counterclaimed for damages for delay and defective work and material. The plaintiffs replied that the delay, if any, was occasioned by the owner, and that, if the architect's certificate was a condition precedent, the condition had been waived and cancelled. The mortgagees claimed priority over the plaintiffs' lien. At the trial, the owner was allowed to amend by setting up that, since the action was at issue, the architect had issued his final certificate for $1,718.70, and stated her willingness to pay that amount into Court, on certain terms as to costs. The plaintiffs then said they would accept the $1,718.70 in full satisfaction, but with costs to date. This the owner declined, and the trial was proceeded with, but no money was paid into Court.

Mr. Justice Prendergast who tried the action, held upon the evidence, that the plaintiffs were entitled to recover for all work and material, including extras, $1,788.70, and also that the owner was not entitled to damages for delay, as the delay was caused by strikes.

The written contract provided that the work and material must be to the satisfaction of the architect; but under Article nine, when the contractors considered that they had completed the work, they were to notify the architect, and it then became his duty, within seventy-two hours, to issue either a final certificate that the work was completed, or a written statement showing in what respect it was incomplete; and the contract, after providing that payments should be made only upon the written certificate of the architect, added, "unless the architect is in default in issuing the same."

As to this the judge held, that "default" meant the omission to do something which the architect was called upon to do; that, upon the evidence, he had neglected to give a certificate within the proper time after notice from the plaintiffs; and that there was such prolonged inaction and default, as dispensed with the certificate as a condition precedent; and that the plaintiff's reply was sufficient to raise the point.

He also decided (1) that, as it appeared that the architect was satisfied by affidavits that there were no other liens, the plaintiffs were not barred by the want of a certificate as to that: (2) that the mortgagees were not entitled to priority over the plaintiff's lien, as they took their mortgage on the security of the house; and (3) that the plaintiffs were entitled to costs against both owner and mortgagees.

(Alsip vs. Robinson, 18 W.L.R. 39.)

Much of the artistic appearance of monolithic walls in concrete construction depends upon the skill and understanding with which the work is put in. "Keep the joints out of sight" and "keep them level" are injunctions worth remembering.

Characteristics and Construction of Shop Floors*

By Leonard C. Wason

President of the Aberthaw Construction Company, Boston, Ma

No floor space is perfect from every point of view. The question of what floor to adopt for a shop is therefore always a choice between different combinations of good and less good qualities.

Floor Cost and Choice.

While the factor of cost is apt to be considered the dominating one there are many situations in which cheapness is not the most important item in the choice of a floor; or to put the matter a little differently, it is sometimes economy to discard the floor that is cheapest in first cost for a different floor of higher cost which will justify this enhanced cost because of its better adaptation to the particular kind of service required of it.

Therefore, although I have been asked to speak particularly about granolithic floor surfaces for shops, I am not in the attitude of advising a granolithic floor for any and every service under any and all conditions. The granolithic surface has good qualities of great importance and I shall give these qualities due weight. But I shall also point out some of the circumstances under which it may be better in particular cases to put in wood floors.

In the first cost the granolithic floor surface has the advantage over a wood floor, the cost of such a surface laid in the best manner being about equal to the cost of seven-eighths maple flooring delivered at the work. Besides this advantage in cost, the granolithic surface is fire-proof and water-proof, and will not decay or disintegrate under washing with water, which is one of the weak points of the wood floor.

Granolithic and Wood Floors.

There are other considerations involved in a decision between granolithic and wood floors concerning which it is unsafe to be very dogmatic without first defining very precisely the conditions of each particular case. Taking first such a matter as the wear of these two types of floor, it is easy to see that a wood floor is more easily repaired than a granolithic surface, and that repairs to a wood floor can bring the floor to its original maximum efficiency. A granolithic surface also can be repaired so that the new patches will be quite as good as the original surface, but the time and care required is much greater than with a wood floor.

Repairing the Shop Floor.

In repairing a granolithic surface it is necessary for best results to cut out the broken or defective portion down to the slab, leaving the cut with vertical edges. Next, the slab must be cut with a sandblast or acid until the aggregate stands out sufficiently to give a good bond for the new surface. Then the slab, and edges of the cut, having first been well wetted, must be grouted with neat cement mortar, on which the new finish is laid before the grout has set. Finally, the patch must be kept wet, and protected from use for at least a week.

It is rarely possible to satisfy all these necessary conditions, and it is therefore true that under average practical conditions, the repaired portions of granolithic floors are inferior to the original surface in wearing quality.

In this contrast between the wood and granolithic floors we have to deal with the question of workmanship. With a maple top floor the difference in wearing quality between a floor laid by a first-class carpenter and the floor laid by a merely average carpenter, is comparatively slight; but with the granolithic finish, ignorant or hasty work is disastrous almost from the outset. The granolithic finish, to give good service, must be laid according to the right theory and every step in the workmanship must be first-class.

It is not at all difficult to get a first-class granolithic surface if one starts out with a determination to have it. Good work costs very little more than poor work. It must be admitted, however, that a great many granolithic floors have been unsatisfactory. Poor workmanship and wrongly chosen materials are the reasons.

Among objections which have been raised to the granolithic surface one of the most prominent is the bad effect of the concrete floor upon the health and comfort of the operatives who stand upon it. There seems to be little doubt that long standing in one position on a concrete floor is not good for the operative.

The reason for such ill effects as occur is not the excessive hardness of the concrete floor, as is generally supposed, but its great heat-absorbing power. Wood is a poor conductor, a poor radiator, and therefore in general a pretty effective insulator. But when an operative stands for hours on a concrete floor the heat of his body is conducted from his boot soles into the concrete rather rapidly.

Concrete Floors Must be Insulated.

In consequence of this drawing away of the body heat, feet and legs become more or less chilled, and circulation in the legs is slackened, and pressure on the skin of the feet, coupled with this sluggishness of circulation, due to the loss of heat, may easily give rise to sore feet and to various pains which are commonly classed under the head of "rheumatism." That these bad effects do occur has conclusively appeared in investigation of the whole question made by the Aberthaw Construction Company, about a year ago.

For operatives who are moving about while at their work, or who wear thick-soled boots, this excessive extraction of the body heat by the concrete floor is a negligible matter. For men working steadily at the machines in one position, some insulation is required. It is the practice in many machine-shops to give the men foot-boards or gratings of wood on which to stand. These do away altogether with any ill effects from the concrete floor.

Granolithic floors have been attacked as not sufficiently durable under the rough usage of machine-shops and foundries. Here again we have to take into consideration the all important item of materials, workmanship, and theory of construction.

Nothing but the hardest natural stone in the way of a masonry floor can long withstand the wear of heavy trucking. The usual form of truck is provided with small diameter wheels having a flat tread and sharp edges, and such wheels with the tilting or slewing of trucks that is always in evidence in turning corners, will gouge and dig into any kind of floor.

But the granolithic finish can be so made with such a high percentage of tough elastic aggregate that the wear of trucking is borne almost exclusively by the

*Read at the October Meeting of the Society of Mechanical Engineers held in New York.

aggregate itself. Nothing but steel and granite can outwear such a floor. It is the part of wisdom in laying granolithic floors over which there is heavy truck traffic along certain lines, to provide steel plates or gratings properly set in the concrete to form lanes or tracks for the heavy trucks.

Wood a Safety Material for Floors.

The nature of the tools, processes and products in a given shop bear on the decision between granolithic and wood floors. An edged tool dropped edge down on a granolithic floor would be damaged by the impact, while the same tool dropped edge down on a wood floor would dig into the wood and probably suffer no damage.

Also, a manufactured product consisting of delicate metal pieces would be much more damaged by falling on a cement floor than on a wood floor. Still further, the dust produced by the wear of some granolithic surfaces has proved harmful to delicate machinery in some shops.

The wood floor does not of itself produce a dust capable of any visible action as an abrasive. It is possible, however, by gluing battleship linoleum to a concrete floor to get many of the advantages of a wood surface. Tools and small manufactured articles are as little likely to break by falling on a linoleum surface as upon wood.

The linoleum is without the innumerable cracks of the wood floor and therefore is much more easily kept perfectly free from dust. Linoleum is also efficient insulation against loss of body heat to the concrete floor.

High resistance to wear of every sort and practically complete dustlessness, that is to say, freedom from the production of abrasive dust, can be secured in a granolithic surface properly made. It is always better that a granolithic finish should be laid on the floor slab while the latter is still green. A better bond between the finish and the slab can be obtained in this way than is possible after the slab has fully set.

Finishing the Floor.

Unfortunately, the conditions governing the erection of concrete buildings usually put off the laying of the floor finish until all the rest of the building is practically completed, and this involves the need of using great care in cleaning and roughening the slab surface so that the granolithic finish laid upon it will get the best possible bond with the slab. Ordinarily the finish need not be more than three-quarters of an inch thick. Both for wearing capacity and for the avoidance of dust through abrasion of the concrete, the granolithic finish should contain the highest possible proportion of tough stone aggregate.

For the most durable and most nearly dustless flow my rule is this: First, it is better to use no sand; sand grains are brittle, are early broken by the abrasion of feet, and cause dustiness. Use for an aggregate a stone suitable for macadam road, taking the sizes that pass through a half-inch round mesh screen, and nothing smaller than that passed by a 20-mesh screen. Mix the concrete dry of the consistency used in making blocks, so that considerable tamping will be required to bring to the surface enough water for troweling. Finally, do the troweling before the mortar sets.

It is practicable in this way to get a surface that is 90 per cent. hard stone; the mortar, of course, wears most quickly, but its small area makes the results of this wear unobjectionable. Prolonged troweling of a wet mixture brings to the top the "laitance" of the concrete, which is the part incapable of a true set. A top layer of laitance is therefore porous and wears down quickly. Even the fine particles of good cement should not be brought to the top, for they form a layer which is weakly bonded to the rest of the concrete, appearing in the air as dust.

WATERPROOFING BLUE PRINTS.

Waterproofing blue prints is accomplished by the following process, according to the Mining and Scientific Press. Immerse in melted paraffine until saturated a number of pieces of an absorbent cloth 1 foot or more square. When withdrawn and cooled they are ready for use at any time. To apply to a blue print, spread one of the saturated cloths on a smooth surface, place the dry print on it with a second waxed cloth on top, and iron with a moderately hot flatiron. The paper immediately absorbs paraffine until saturated and becomes translucent and completely waterproof.

PORCELAIN WALL COVERING.

W. H. Turner, an English pottery expert, has been working on a patent for many years and has finally invented a system whereby at a comparatively small cost, he is enabled to manufacture glazed slabs of pure porcelain so translucent that light can be seen through its half inch of thickness. These slabs are made in single pieces of any size up to that of the largest sheets of plate-glass, and are said to be so strong that an elephant could stand on one, without breaking it. These slabs are to be used for facing walls and are said to offer a means of using decorations which in color and brightness rival the painted wall decorations of Pompeii, for there may be printed on the slabs in its "biscuit' or porous stage of manufacture, designs in any desirable variation of coloring.

It is said that to line the walls of a room with this porcelain covering costs no more than with ordinary paneling, and architects believe that these plates will solve the problem of housing in the tropics, since a house built with walls, floors and roof of this porcelain will resist damp, heat, disease and insects.

It is said that a factory is to be built on the banks of the Thames for turning out these new porcelain slabs and panels.

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PAINTING and DECORATING PLASTERING

Paints, Stains, and Varnishes, Shingle Stains, Waterproofing, Wall Finishes, White Lead, Window Glass, Putty, Oils, Metal Laths and Plaster

PAINT AND THE PAINTER.

By A. Vaughan Wiggins

There is no branch of the building trade about which the builder or contractor knows so little from a practical standpoint as the painting branch, and yet the painting and finishing of walls and woodwork is of the greatest importance, whichever way you look at it.

The proper treatment of exterior wood and metal work to preserve it from the ravages of time is a serious problem for owner, builder and architect, apart from the question of color and color harmony.

The painting of all types of wood and metal requires a careful consideration on the part of the painter or builder. The paint mixture you would use for priming hard woods would not be good for soft woods. Again, the priming material for soft woods could not rightly be used for metal, and so on.

There are many kinds of woods and metals, also many kinds of paint and painters. What you ought to strive for is the right kind of paint, put on the right kind of wood or metal, by the right kind of painter. Sounds easy enough, doesn't it?

Builders and contractors, speaking generally, seem to forget that the painter is a "finisher." He finishes the carpenter's work, the plasterer's work, and the rest of it. He makes the ugly beautiful and at the same time does his best to preserve the material upon which he works.

Sometimes he fails to do these things.

Sometimes he "finishes" the walls and woodwork in another sense.

Sometimes the painter is not a painter.

It will therefore pay you to employ only a master painter who has a reputation for good, honest workmanship. You won't find him amongst the lowest tenderers. You will have to pay him a little more than the "cheap Jack." But look at the difference in the "finish."

If you have that popular little fallacy pasted at the back of your brain that "anybody can paint," you ought to add these words, "if they know how!"

We want to impress you with the importance of "Paint and the Painter."

Most of you have had trouble with paint blistering, balking, peeling, scaling and behaving badly in a general way.

The causes that produce bad results in the painting branch are many, but they can be summed up in a few words, "Cheapness and faulty specifications."

The cheap builder wants a "cheap" architect, who wants a "cheap" painter, who wants "cheap" material and "cheap" workmen.

Oh! ye builders and contractors, why in the name of common sense do you spend hundreds of dollars in fixing up panelled hardwood, employing the most skilful carpenters and woodworkers you can find, and then employ the cheapest "painter" you can discover to put the finishing touches to the work?

Is it any wonder you get "stung"?

Cheapness the Bugbear.

The great bugbear of the painting branch of the building trade to-day is "cheapness."

If the building cost has to be [illegible] you begin by cutting the painter's work. A coat of paint here, a coat of varnish there, and so on, until your specification calls for a cheap [illegible] job with which you are dissatisfied.

As a general rule, specifications for painter's work are made out by men who know little or nothing of the problem of paint.

Some specifications do not specify a sufficient number of coats to turn out a satisfactory job. Under such circumstances as these the painter and his paint should not be blamed.

Talking about specifications reminds me of a Toronto architect who specified Georgia pine to have one coat of stain, one coat of shellac and one coat of flat varnish, expecting to get a first-class job equal to a rubbed varnish finish. It was no use the poor painter protesting it could not be done.

> "His not to reason why,
> His but to do or die."

Next month the writer will publish a set of specifications for painters' work that will be a guide to the builder and contractor who is not too well informed on paint matters.

Make sure that your painter knows what good paint is and how to apply it. Good materials improperly applied will give poor results.

How many of you know that the first or priming coat is the most important feature in successful painting? "Anything will do for the first coat," seems to be the popular idea, and you allow a boy or a laborer, or anybody in fact, to apply it. As builders you know that if the foundations of a building are faulty the whole building is faulty.

Priming Coat the Foundation.

The priming coat is the foundation of the painting, and if that coat is not composed of the proper materials, correctly mixed and applied, then the foundation for a good job of painting is wrong, and no amount of labor afterwards can alter it.

Have you ever wondered why there is usually such a wide difference in the tenders for painting a new building? Suppose the job is worth approximately $400. If you call for tenders you may have prices sent in ranging from $[illegible] to $[illegible]. This is no exaggeration. Worse than this has happened. What is the reason?

There are many causes. [illegible] specifications are responsible for a great deal of uncertainty in the minds of the painters who figure on the work. Perhaps one or two of the contractors discover that the architect has omitted to specify some work that will amount to a large sum in "extras," and they will bring their prices down, hoping to recoup themselves out of the "extras."

Again, I have known architects to omit a whole floor, such as the basement, out of the painter's specifications, with the result that one conscientious painter will include the basement, while another will omit it, either by design or unwittingly. Again, plate glass may be marked on the plans but not called for in the specifications.

or named in the specifications and not shown on the plans. Result, confusion! Many architects dismiss the painter's specification in a few words, and force the painter to wade all through the specifications of the other trades to find out what he is expected to paint. This is neither fair nor honest. The architect should not begin the job by "scamping" or "shirking" his own work. This "scamping" or "shirking" on the part of the architect applies to other trades besides painting. The architect of to-day is being paid for a great deal of work he does not do.

Another cause of the difference in the prices on painting is the many different ways in which painting can be executed to produce the same result so far as the eye can see.

The writer, speaking from experience, has no hesitation in asserting that any painter who tenders on a job through an architect's office, intending to honestly carry out the work as per specification (presuming the specification is clear and calls for first-class work), will never land a contract unless he has "pull" with the architect or customer; but if he is dishonest and intends to beat the specification he stands a good chance of getting the job, because his price is the lowest, and the more "faking" he can do the better the chance of obtaining the contract. Verily, this is a funny world!

CARPENTRY AND WOOD-WORKING

Doors, Sashes, Flooring, Staircases, Fireplaces, Porch Columns, Floor Scrapers, Builders' Hardware, Carpenters' and Shop Tools and Equipment

THE ECONOMY OF HARDWOOD DOORS.

It is a fact generally recognized by the public at large, says "The Building Age," that one of the surest measures of the suitability of any article or commodity for the purpose intended is the extent of its popularity. Take hardwood doors for example. The fact that they are now insisted upon as a matter of course in the cities and towns where they have been introduced, and that architects, owners and builders alike unite in recommending them to their friends who are about to build, is certain proof that they are highly satisfactory and are considered a good investment. The hardwood veneered door is probably making more progress to-day than any other one article in the building line manufactured from wood.

The explanation of this remarkable progress is to be found in the fact that the builders of modest homes have taken to hardwood doors. They cost only a little more than the solid pine doors. When a prospective home builder goes into some newly finished home and sees hardwood doors, the pine doors are no longer attractive and he wants hardwood doors immediately.

Aim of Every Home Builder.

The aim of every home builder is to have the interior of his home rich, beautiful and harmonious at a small expense. These desirable requirements are determined by the kind of furniture and woodwork in the various rooms. Doors are the most conspicuous furniture in a room. If they are common, old-style, and poorly finished, no matter how beautiful and valuable the rest of the furniture may be, the room will lack harmony and have a cheap appearance.

The quality of the entrance and doorways of a home reflect the personal taste of the owner. When you choose doors substantially made by high-grade cabinet workers, designed correctly and adapted to the general style of architecture of your building, you create an effect which makes a favorable impression, strong, pleasing and lasting. The door looks well: "it is a source of beauty forever"; the door hangs true so that the opening and shutting of it is a real pleasure; the door shows no signs of wear or weather; it is solid and honest—an artistic and useful door which does credit to its surroundings and gives a tone of refinement by its satiny, rich finish.

Thus it comes about that the economy of modern hardwood doors arises first from the satisfaction and pleasure they produce which brings them into great demand by renters and buyers. As one speculative builder expressed it, "Yes, we use nothing but hardwood doors. If they were twice as expensive as they are we would still consider them a good investment; for the buyers will have 'em."

Cost of Hardwood Doors.

The nice part about it is, too, that they are not—compared with ordinary cheap doors expensive. The leading hardwood door manufacturers have developed the business on such an immense scale that they are able to turn out this high-grade hardwood product at practically the same cost as the poorer soft woods.

An example of the progressive, wide-awake business policy of these hardwood door manufacturers, which policy is now bringing their products within the reach of all, was recently in evidence. It appeared that the enormous demand for a certain well-known brand of veneered doors in large cities was not being duplicated in the country and small towns on account of the lack of confidence in the painters to properly stain and finish the hardwood doors and trim. This manufacturer accordingly announced to the trade that he would establish a complete finishing department and give to the rural and small city buyer an opportunity to secure his doors and all kinds of interior trim, stained and shellacked ready for varnish.

Millwork stained and shellacked ready for varnish can be handled in exactly the same manner as in the white, and requires no more labor or expense at the building. This manufacturer considered it a privilege and pleasure to extend, in this manner, to the small city and rural home builder an opportunity to beautify his residence or cottage on a par with the artistic interior of city dwellings at a cost easily within the reach of all.

The Standard Hardwood Door.

The hardwood door of to-day is usually a veneered door. Now and then may be found a solid door, but these are exceptions and are made to order to satisfy a sentimental rather than a structural requirement. There are doors with thin hardwood veneer, some with thick hardwood veneer, doors with plain hardwood veneer and doors with extremely fancy veneer very carefully matched and artistically finished.

The standard door is veneered with hardwood veneer one-eighth of an inch thick. In the fancy door, taking mahogany and other figured woods, thin veneer is used, because it is not practical to get it in the standard thickness of the door stock. Also, there is a disposition now in building doors for outside, to use a heavy veneer. Some of it is made as thick as one-fourth of an inch on the theory that it will resist the moisture better and there will not be any likelihood of veneer peeling off, a thing which sometimes happens when thin veneer is used and the door is exposed to the weather on the outside.

In the veneer door manufacturing world proper, birch is the first wood that became conspicuous in the making of the hardwood door. Then came oak, and now we have gum, and the rivalry among these three popular native woods promises to be quite lively in the future.

THE OPEN CORNICE.

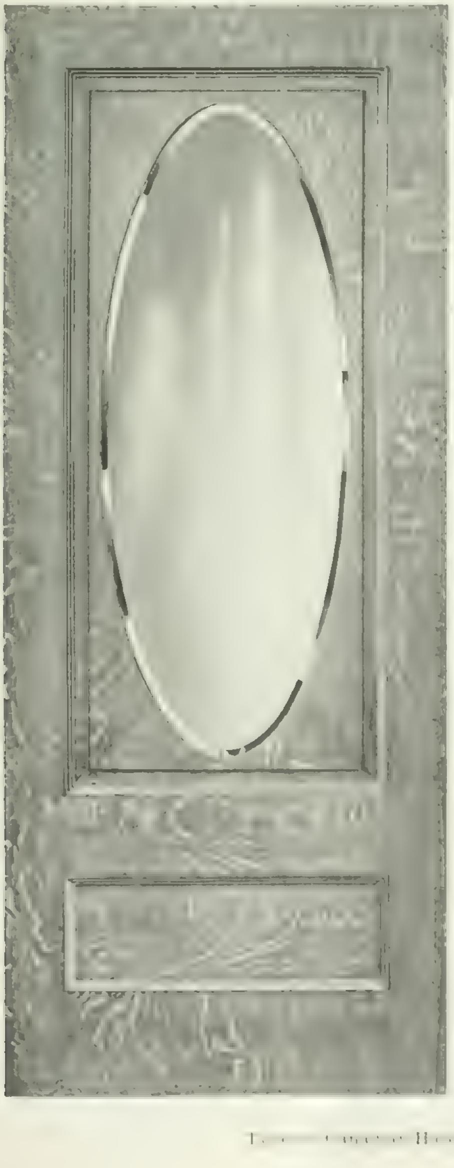
By John Upton in the Carpenter and Builder.

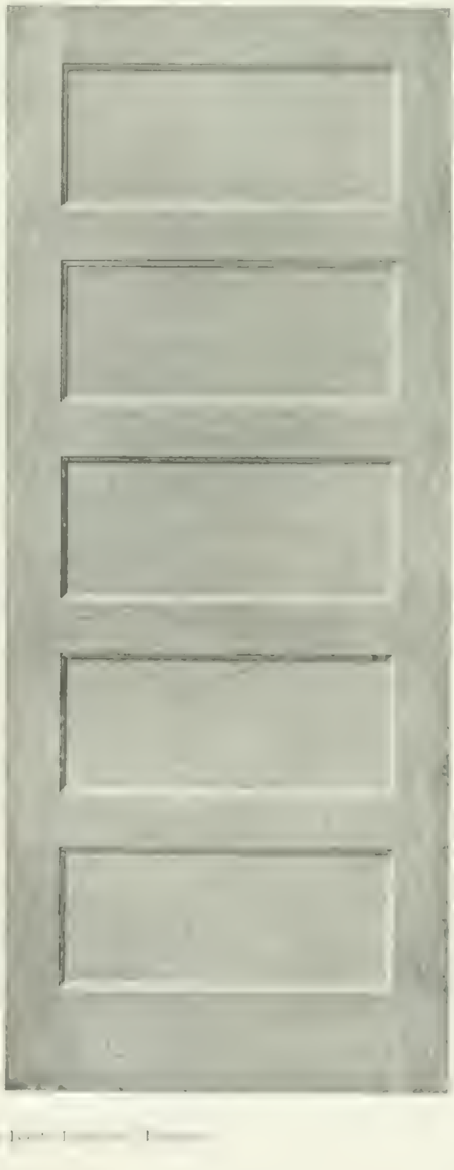
As commonly constructed, the cornice is generally either a quite expensive part of a building or else it approaches the other extreme and has a look of cheapness not in keeping with the rest of the structure. To solve this problem in a satisfactory manner and make a neat looking cornice one can make an open cornice, or, as it is sometimes called, "a railroad cornice," because of its being used on stations and other railroad buildings.

To make such a cornice, place the second pair of rafters at each end somewhat closer to the first ones than is customary. This is to save a little on material. As the ends of the rafters are to be exposed, they can be somewhat ornamental, if desired, or their ends can be of planed stuff, 2x4, and spiked to the sides of the rafters. There can be ornamental rafters placed at each end of the building at the end of the cornice, but for work where economy is desired it is not used.

The cornice consists of matched boards used in place of the roof boards. Those at the eaves can be the regular roof boards or can be matched. Those at the gable ends should be put on so that at least part of them extend to the second rafter, but part can stop on the first rafter.

At the ends of the boards the usual strip of 1x4 can be used. One great advantage of this kind of cornice is that there are more or less of short pieces of lumber which can be used in it so that about one-half of the





[illegible]

material can be figured to cost about one-half the price which would be paid for long stuff if bought purposely. Boards containing knots can be so placed that the knots come inside the first rafters, where they do not show, and thus a further saving can be made.

HARDWOOD FLOORING IS BEST.

Here is a little talk for those who want to use hardwood flooring:—

Carpets wear out; hardwood floors last a lifetime.

Carpets are not sanitary; hardwood floors conserve health.

Carpets soon fade and deteriorate; hardwood floors are an asset of increasing value.

Carpets cause the house-cleaning horror; hardwood floors emancipate the housewife.

Your customers will appreciate a talk on hardwood flooring.

PILING MIXED LENGTHS OF LUMBER.

As many of our readers run lumber yards, the following hints on piling mixed lengths, from the "Hardwood Record," will be interesting:—

Anyone in the lumber business will readily admit the importance of proper piling, and yet it is not an uncommon sight to see, in the yards of some up-to-date millmen, lumber piles with rear ends that are irregular and awry. There is more of this ragged piling of mixed lengths in hardwood than in pine, for the reason that pine dealers usually trim all their stock to two-foot lengths, so that there is not so much variety involved in sorting for length to make even piling. Among hardwood mills, however, more care is exercised in sorting, to have the longer length stock piled evenly.

In piling the shorter lengths, different sizes are often put in the same pile which causes some boards to project a foot or more. This not only gives the pile a bad appearance, but exposes the ends to the weather, and they become season-cracked, warped and twisted and will droop in drying until the boards are badly damaged beyond the inside piling strips.

It does not seem to occur to many manufacturers that it is practical to pile short lengths without making the back end of the pile uneven. Sometimes an effort at orderliness is attempted by piling the longer stock at the bottom and loading the shorter pieces on it. This may be some improvement over indiscriminate mixing, provided it is carefully carried out, and there are cross sticks and foundation sills enough to support the piles, so that the short lengths on the top will not cause the longer lengths underneath to sag between the supports.

It should be practical to pile short lengths, and even mix them in the pile, and keep both ends of the pile straight. It is simply a matter of care in building a pile foundation and using the crossers in placing the lumber. The best plan is to make the back a face end as well as the front and take the same care in making it even. The foundation should be large enough to carry the longest lengths in this mixed stock, and enough supports should be provided for one under every tier of piling strips. The best foundation would be concrete piers and substantial hardwood timbers for supports. Concrete foundations are practical and economical.

It costs a little more to build foundations for this kind of work, and takes a little more time to do the piling, but after looking at a few ragged piles, it will not be hard to convince one that the saving in lumber will more than offset the difference in cost.

SMILE-POWER.

By M. E. Yergin

A real power of life lies in smiles. You can hitch a smile to anything and it is bound to move.

Smiles are the only potentials known that move things whether they intend to move or not.

The old proposition, "If the irresistible should come in contact with the immovable, what would happen?" can have only one answer when the irresistible is a smile—the immovable will move.

A smile has a pulling power that cannot be calculated in foot pounds. A smile is the real-life locomotive. It is immensely more powerful than the iron and steam kind.

A smile with smiles inside of it is a type of engine that cannot be duplicated in capacity by any other make. It is the locomotive that does the real, worth-while business of life—a double-compound type of engine that pulls trainloads of success.

A person who has an equipment of these locomotives and knows how to use them—what to couple them to, and what tracks to run over, will pull with ease and speed loads that a thousand horse wagons would wear out and break down under.

Provinces, kingdoms and nations know the power of smiles and employ men who know how to smile, and who can and will smile with power, to do business for them with other states and nations.

You may not be in the habit of smiling, and may not know how to begin, but if you are determined to make the effort, you are on the right track.

INDIAN RELIC OF BAKED CLAY.

A head, made of baked clay, said to be the rarest find of an Indian relic ever made in New Jersey, has been unearthed on a farm near Trenton, in the vicinity of White Horse, and is now in possession of Dr. Charles C. Abbot, the naturalist, who already has brought together more than 100,000 Indian pieces.

The head is two and one-half inches long and an inch and a half wide. Shell ornaments, known to have been used by the Delaware Indians, are attached to the ears, while the lips and nose have been slightly abraded. The artistic ability shown in this relic is said to be altogether beyond what is supposed to have been the skill of the Indians. In the same field have been found many of the ordinary forms of Indian stone implements, and all of these are of the highest class of workmanship.

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M. L. Kemp	90 Liberty Street, New York

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A MERRY CHRISTMAS!

CONCRETE WORK ON FARMS.

On another page we print a special article on "Concrete Work in Freezing Weather." It is now demonstrated beyond all doubt that concrete work can be successfully accomplished in mid winter, and we have before us particulars of the erection of a large building while the temperature was at an average of 14 degrees below zero.

In the winter the farmer devotes a large portion of his time to carrying out improvements and extensions on his farm buildings, and during the same period the average builder often complains of the scarcity of work. Add to these conditions the fact that concrete is being used more and more, not only in cities and towns, but on farms, and you see a new avenue of possibilities for the builder, along which he may eliminate slack periods and keep busy all the time. Many farmers do practically all their own construction, but as the widespread use of concrete is a comparatively recent development, few of them would tackle elaborate work in a department with which even a number of builders are not yet very familiar. The farmer is learning from many sources the desirability of concrete as the material to be used in structures for agricultural purposes. Let the country builder be alive to his chances and specialize in concrete work on farms in the winter.

To illustrate our point take the question of the silo, which is yearly becoming a more important factor in farm development. One writer remarks: "A good dairy community can be judged by the number of silos on the horizon, just as an oil district may be known by the number of derricks in use." And the concrete silo is unquestionably the best. It is permanent, wind-proof, rodent-proof and fire-proof, fulfilling the conditions of efficiency in a silo. Out of 100 concrete silos recently inspected in the United States, 74 were built by contractors. This field is worthy of every attention from Canadian builders.

THE NEW C.P.R. SHOPS AT CALGARY

The magnitude of the new C.P.R. shops at Calgary will render the erection of them the biggest work of industrial construction in the Canadian West. The area to be covered by the new shops will include 120 acres of land. The large locomotive shop alone, to have stalls and pit for 35 engines, will cover six acres. This, with the rest of the 20 buildings and the extensive yardage, will make the Calgary shops among the largest and finest on the American continent. Apart from the existing yard trackage used for the regular traffic of the company, there will be twelve miles of trackage leading to the various buildings.

According to present plans the cost will be about $2,000,000, and after completion a little over a year hence, steady employment will be given to some 2,000 skilled artisans and mechanics.

In negotiating arrangements with the civic authorities for the extension of public utilities to the car shops, the company agrees to establish and maintain the shops for a period of 21 years.

What all this means to Calgary in general the active Canadian commercial imagination will readily conceive. What it means to the building trade of Calgary in particular is of keen interest to our readers. The big builder, the speculative builder, the steadygoing builder, the jobbing builder, the just-get-a-living builder, will all be there. The allied trades will receive an impetus rarely experienced even in western development, for housing accomodation for the two thousand new workers with their families and dependents will have to be provided.

THE TIME TO RAISE BUILDING STANDARD.

Canada is the land of opportunities, and in the foregoing article we give an exceptional example of the builder's opportunity. What use will he make of it? Will he regard it merely as a rare chance for the acquisition of the almighty dollar? Or will he listen to the call for "Better Building," the motto of every man who is zealous for the honor of the building trade and worthy of the name of Builder? In hard times, amid the pressure of poverty, there may be some excuse for scamped work, inferior materials and shady transactions. In a time of prosperity there is none, save the old ones that unfortunately still remain too popular. Now is the time to get fair prices—fair to both builder and customer, to insist on good workmanship and to elevate the standard of the trade.

Fraternal and educative effort for improved conditions and higher standards [illegible] one of the most hopeful characteristics of the age, and it would be difficult to name any trade [illegible] the result of such effort is more beneficial and lasting than the building trade. But in the last analysis it depends upon the individual.

We started by speaking of one particular city, but what is true of Calgary applies to most of Canada's towns and cities, the expansion and development of which are the talk of the civilized world. The watchword of "Better Building" should ring through every community in our great Dominion. We are not only house building, store building, factory building; we are nation building. "Some people," said a man of wide experience, "spend one-half of their lives correcting the mistakes of the other half." That saying is equally true of nations. May it never be said of Canada.

NOTE AND COMMENT.

Montreal needs more building inspectors. Mr. Alcide Chausse, building inspector, is laying his plans for next year and asking for a larger staff of inspectors. At present he has four building and eight plumbing inspectors. Last year he asked for twenty more and obtained only one. Blessed is he that expecteth, etc.

During the month of October there were throughout Canada ten fatal and thirty-nine non-fatal accidents recorded in connection with the building trades, compared with six fatal and seventeen non-fatal accidents in September, and six fatal and thirty-one non-fatal accidents in October, 1910. Of the fatal accidents, four were caused by falls, four by falling materials, one each by the collapse of a scaffold and electrocution. Why the great increase in the number of accidents during October?

* * *

Halifax is to have a brand new group of University buildings, for Dalhousie University has started a campaign to raise $350,000 for development and improvement. Forty acres are to be purchased in Halifax on which it is proposed to begin construction work in the spring. Among other public structures to be erected in Halifax are a Market House and Masonic Temple. Who said that the Maritime Provinces are slow?

* * *

During 1910 nearly one-half of the entire shingle production of Canada was manufactured in British Columbia. They do things on a large scale in the Pacific Coast province, but this record seems big, even for B. C.

HEATING, LIGHTING, AND PLUMBING

Boilers, Radiators, Furnaces, Lighting Fixtures, Bathroom Equipment, Hot Water Boilers, Kitchen Sinks, Laundry Tubs, etc.

TYPES OF WATER HEATER FOR RESIDENCES.

Paper read by H. D. Gillingham at the Second Annual Meeting of the Pennsylvania Gas Association, Easton, Pa.

The selection of a water heater for residence work is a very broad subject, as the various types of water heaters for this purpose have increased rapidly during the past few years, and a description of each would be almost an endless task. I will therefore only briefly mention some of the smaller heaters and devote the greater part of this paper to the larger ones.

We are all familiar with the ordinary tank heater of either the copper coil or brass section type, which is connected to our regular 30-gallon kitchen boiler and gives a fair supply of hot water for domestic purposes. These heaters burn about 35 feet of gas per hour and heat the water at the rate of one-half gallon per minute. The heaters themselves usually show a good efficiency when tested under favorable conditions, but in actual practice this is not maintained, due to the fact that the uninsulated boilers radiate considerable heat from hot water. It is usually a fact that more hot water is heated than is actually used, the balance being allowed to cool. The slowness with which the water is heated by this method is vexing to the consumer who desires a quantity of hot water at short notice. However, the selling price of the heater is low and therefore they are quite popular.

A variation of this type of heater has lately been introduced by a manufacturer of kitchen boilers who makes a combination of boiler and water heater in one, the boiler having in the lower part a circular chamber which becomes smaller and continues to the top as a flue. In this chamber is placed the water heater and in this position is surrounded by the water in the boiler. This method tends to utilize more of the heat given out by the gas, with the result that good results are obtained.

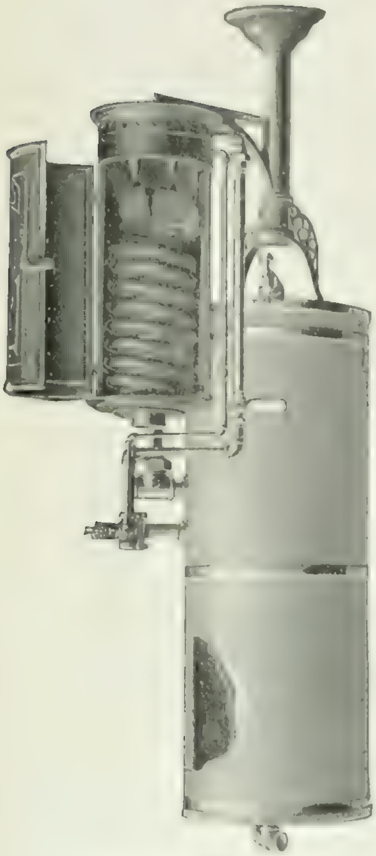
This heater is also fitted with a thermostat, which, after the contents of the boiler is sufficiently heated, cuts the gas supply down to a small flame, which continues to burn under the boiler and aids in keeping the water warm. In my judgment water is heated most efficiently when the burner is going at its full capacity, and when the supply of gas is cut down the operation is more wasteful than useful. I also think that, should a gust of wind from an open door or window blow out this small flame the result would be that the water cools and the thermostat liberates the full supply of gas, with no pilot light to ignite the same. It is only fair to state here, in behalf of this system, that no report of accident has come to my knowledge, but the possibility, however, still remains.

Next in mind are the instantaneous heaters, which are designed for bathroom use and do not aspire to the supplying of hot water for the general household uses. These heaters are placed in the bathroom usually having an outlet to the wash basin and one to the tub. They are nickel-plated and therefore ornamental as well as useful. Their supply of hot water varies from one to one and one-half gallons per minute, according to size of heater, and are most useful as an auxiliary to the hot water system in winter and indispensable in summer for the comfort of any of the family who may have to keep house alone.

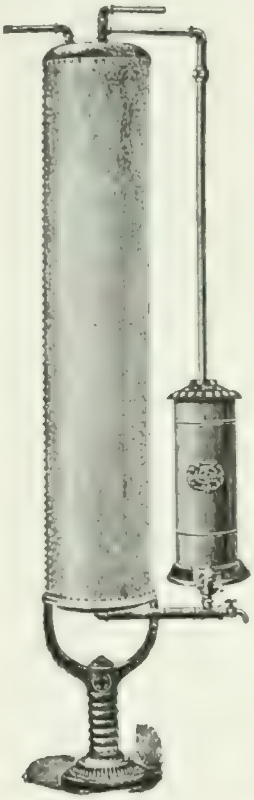
We now come to the point as to the best hot water system to install for the customer who is anxious for hot water—a lot of it, and quick. He is willing to pay for the appliance which will produce this result. The problem has been solved by the perfecting of the instantaneous automatic water heater and the automatic storage system.

The first of these two heaters consists of a long cop-

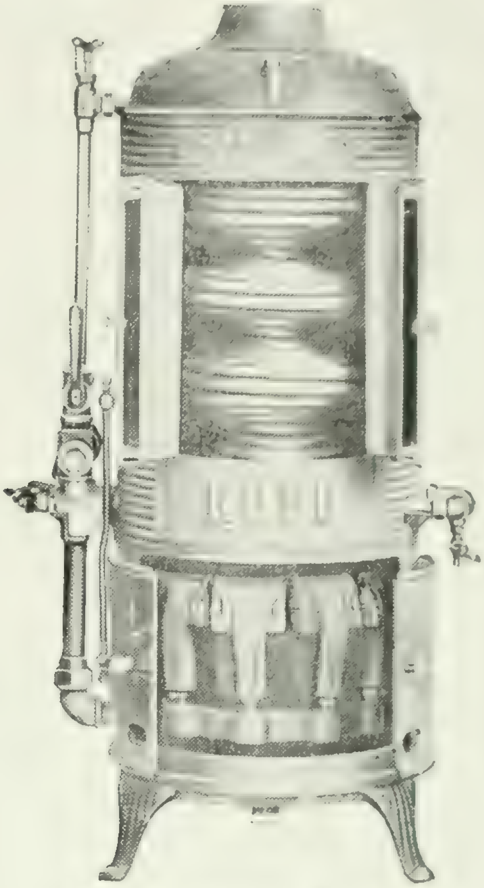
Types of Water Heaters sold by leading Canadian Gas Companies



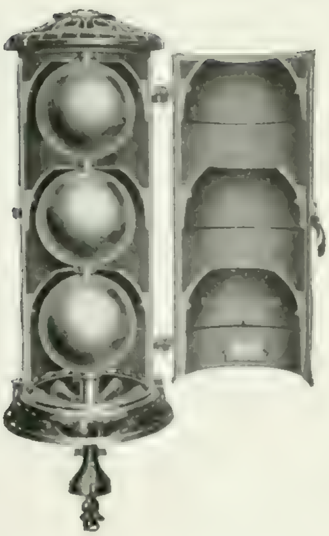
Automatic Storage System



Small Tank Heater connected to Kitchen Boiler



[illegible] gal. a minute Automatic Water Heater



Small Ordinary Water Heater

Another type of [illegible] Water Heater per coil encased in a cast-iron shell, under which is a set of powerful bunsen burners. The heater is provided with a water valve working directly against the gas valve, so that as water passes through the heater the gas valve is opened, the gas ignited from a pilot light and the water heated. This continues only so long as water passes through the heater, therefore if a hot water faucet is opened in a few seconds hot water is pouring forth, and the closing of the faucet also shuts off the gas at the heater. This means that the consumer only pays for the heating of such water as is used. This fact, in connection with the high efficiency of this type of heater, makes it the most economical method of heating water.

The thermostat, which is the secret of success in water heating, as employed on these heaters acts as a governor, only allowing the proper amount of gas to be consumed in proportion to the amount of water passing through the heater, and can be regulated so as to keep the hot water very close to the temperature desired, and for which the thermostat is adjusted.

These heaters are made in sizes to deliver three, four, six or eight gallons of water per minute, using one foot of gas of 650 B.t.u. to heat each gallon of water, raising the temperature 65 degrees and showing an efficiency of over 80 per cent.

There are two methods of installing these heaters: The first, or direct connected, is simply to admit cold water direct to the inlet of the heater and deliver the hot water to the house fixtures. The second, or reheating system, which is preferable, is to connect the heater in the hot water line between the kitchen boiler and the hot water fixtures, thus giving the heater the advantage of any heat that may be imparted to the water while in the boiler, but insuring the consumer of unlimited hot water at the fixture.

Should the water from the boiler be sufficiently hot, the thermostat in the water heater checks the flow of gas until the temperature of the water passing through the heater lowers to such a degree as to allow the thermostat to open up the gas supply and additional heat is then imparted to the water. By this method gas is saved and the consumer is assured of hot water at all times and also insures the heater being kept in operation all year around. This is especially true of such climates as have very cold water during the winter months.

These water heaters have their limit of capacity, however, and the mistake should not be made to put too small a heater on too large a job, as the customer is disappointed and the gas of company has the trouble and expense of installing a larger size heater. Heaters of this type need a plentiful supply of gas during their operation, and when one is installed care should be taken to have service, meter and supply pipe to heater of sufficient size; also to have a flue connection with a steady draft.

The following table will aid in determining this:

Rated Gallons of Water Delivered Per Minute.

Heater (gallons)	3	4	6	8
Gas per hour (cu. ft.)	180	240	360	480
Meter (number lights)	30	45	60	80
Gas pipe (inches diam.)	1	1¼	1½	2
Water pipe (inches diam.)	½	½	¾	¾
Flue pipe (inches diam.)	6	6	7	8

As to the size heater to be installed in any residence, the maximum amount of hot water desired at any particular time should be determined, but for an off-hand rule the following will usually fulfill the demand:—

Four-gallon heater—Residence of one bathroom.

Six-gallon heater—Residence of two bathrooms.

Eight-gallon heater—Residence of three bathrooms.

This will also take care of the usual kitchen equipment of sinks, laundry tubs, etc., which are usually supplied with houses having the above number of bathrooms. Consideration must be given, however, whether the heaters are to be used all winter or only for summer use, and in the latter case the heaters may be overloaded.

To accommodate larger users of hot water, the automatic storage system has been designed and is suitable for residences and apartment houses. This system consists of a horizontal boiler of 80 to 1,000 gallons capacity, erected above a multi-copper coil storage heater, which is constructed much the same as the automatic heater. It differs, however, in the arrangement of the coil and thermostat. The coil of this heater is composed of seven separate coils, each connected into manifolds located on opposite sides of the heater; thus the cold water leaves the tank by way of the circulating pipe to the inlet manifold, crosses the heater through the copper coils to the outlet manifold and is returned to the top of the tank. This creates a circulation through the tank, and all the water is heated.

The thermostat in this system is in the tank, and when the required temperature lowers, causing the thermostat to again operate the "moment valve," which opens the gas supply to its full capacity, which remains so until again shut off. The thermostat may be regulated to operate at any desired degree of temperature, and is usually adjusted to open up on a drop of temperature of about 25 degrees Fahr.

With this system, the tank and all hot water piping should be well insulated. This, together with the positive action of the "moment valve," makes it a most efficient storage system.

The tank may also be equipped with a steam coil to heat the water during the winter from the steam heating plant of the building.

These heaters are usually rated by the hot water delivery per hour to the tank and are made in sizes of 100, 200, 300 and 400 gallons per hour. The following table will give the proper size meter, piping, etc., to be used:—

Gallons of Water Heated Per Hour.

Size of Heater	100	200	300	400
Size meter (No. lights)	20	30	45	60
Circulating pipes (inches) ..	1½	2	2	2½
Gas supply (inches)	1	1	1¼	1½
Cold water pipe (inches) ..	1	1	1½	1½
Flue pipe (inches)	4	6	6	7

To arrive at the proper size system to install, the following may be used as a guide: There should be a water-heating capacity at a minimum of 20 gallons per hour per apartment in buildings of less than eight apartments and 15 gallons capacity per hour for buildings of 8 to 20 apartments. If it is desired to figure various fixtures separately, estimate for bathtubs 20 gallons, washstands ½ gallon, laundry tubs 20 gallons, each time used.

This system admits of various combinations of heaters and boilers, according to the storage desired and the rapidity with which the heater must work to replenish the hot water. In the case of some of the very large boilers two heaters are connected to it in parallel, thus giving a capacity of 800 gallons per hour.

In comparison to this, a unique storage system was exhibited at the Madison Square Garden Show, which consisted of a 50-gallon boiler sheathed in wood, and the storage heater attached to same being capable of delivering 50 gallons of hot water per hour. The system, being equipped with thermostat and "moment valve," made the outfit a very desirable one for moderate-sized residences.

Plans for Six-Room $2,800 Shingled Cottage

A Set of Architect's Drawings from the American Carpenter and Builder That is Bound to Please Hundreds of Home Hunters

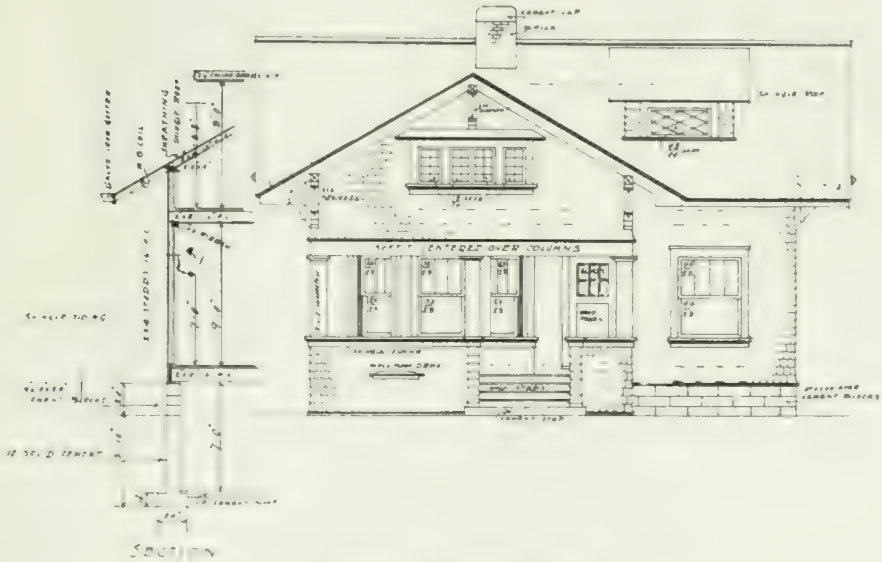
The little bungalow cottage illustrated by the attached drawings is 31 feet wide over all by 28 feet from front to back excluding porches.

The exterior is typically "bungalow" with low roof, wide extended eaves and open rafter cornice bracketed at the gable ends.

The first floor plan shows four fine rooms. The living room is especially attractive, being 20 feet long by 12 feet wide. It is very attractive with large bay window, fireplace, colonnade, etc. The dining room at the right hand is well placed, both with reference to the living room and to the kitchen. The downstairs bedroom will be appreciated by many.

On the second floor are two additional bedrooms besides a large amount of closet and storage space. The basement is finished very nicely in cement with set laundry tubs, provision for central heating plant, cast iron fuel chute, etc.

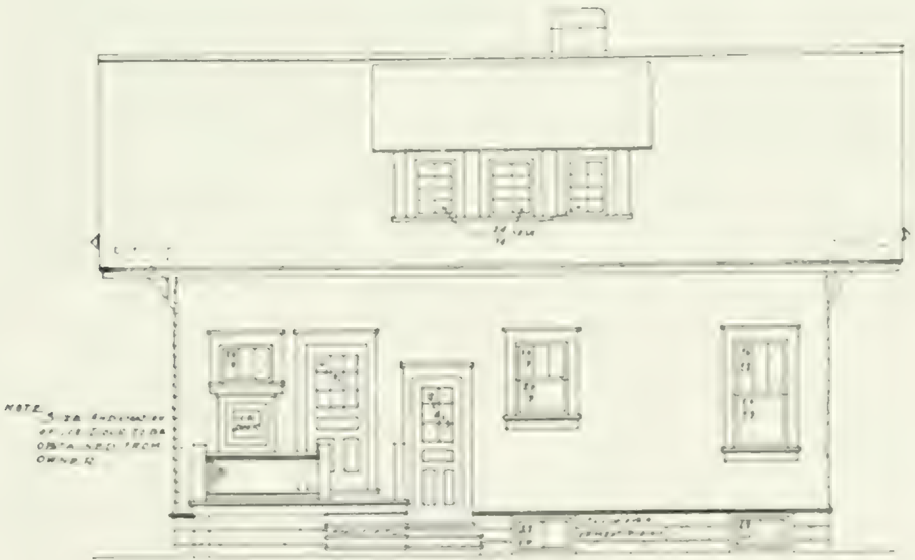
The estimated cost of the bungalow is $2,800.



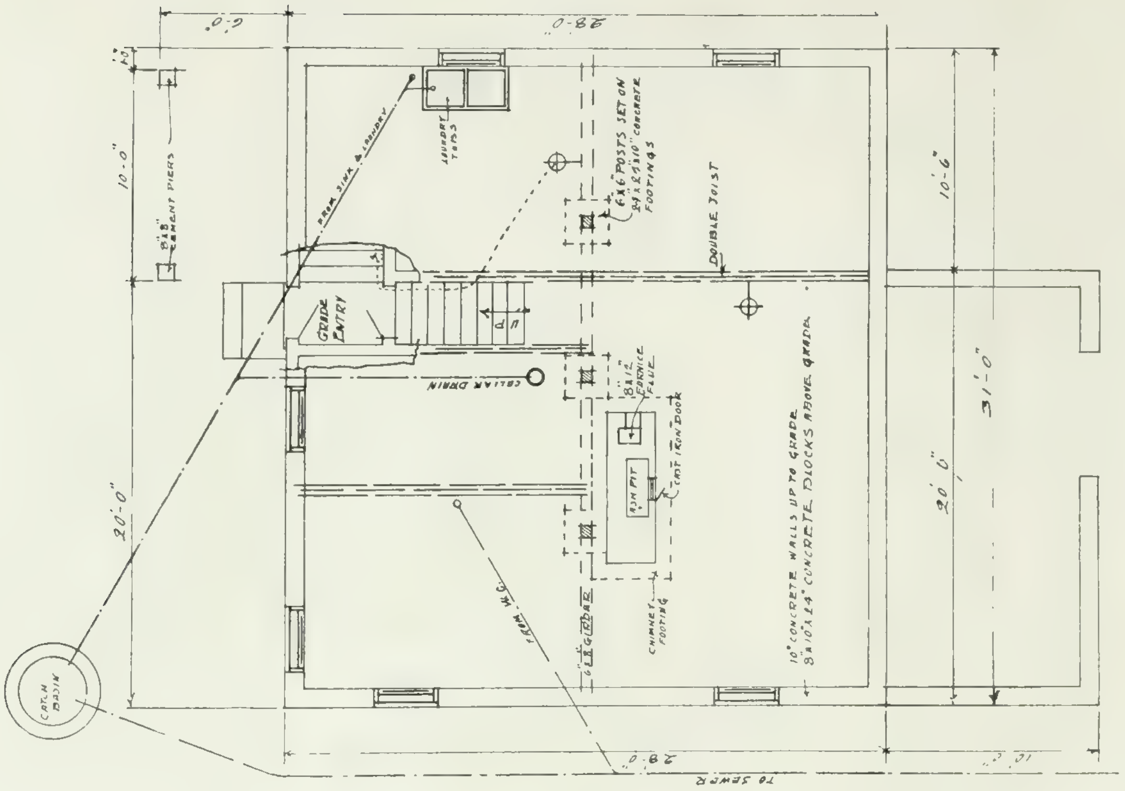
FRONT ELEVATION

That the [illegible] type of "bungalow" [illegible] is evidenced by the [illegible] drawing

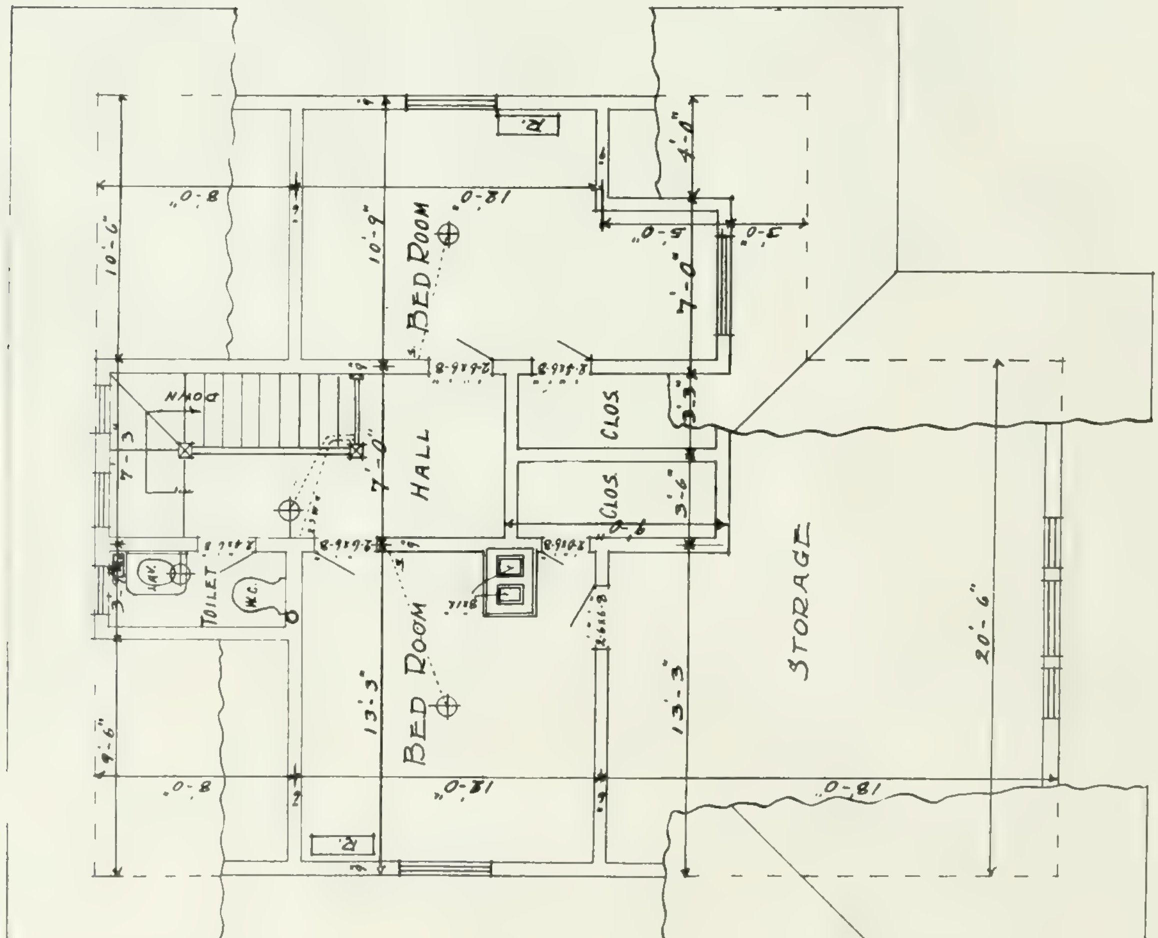
The rear [illegible] of the house is [illegible] pleasant



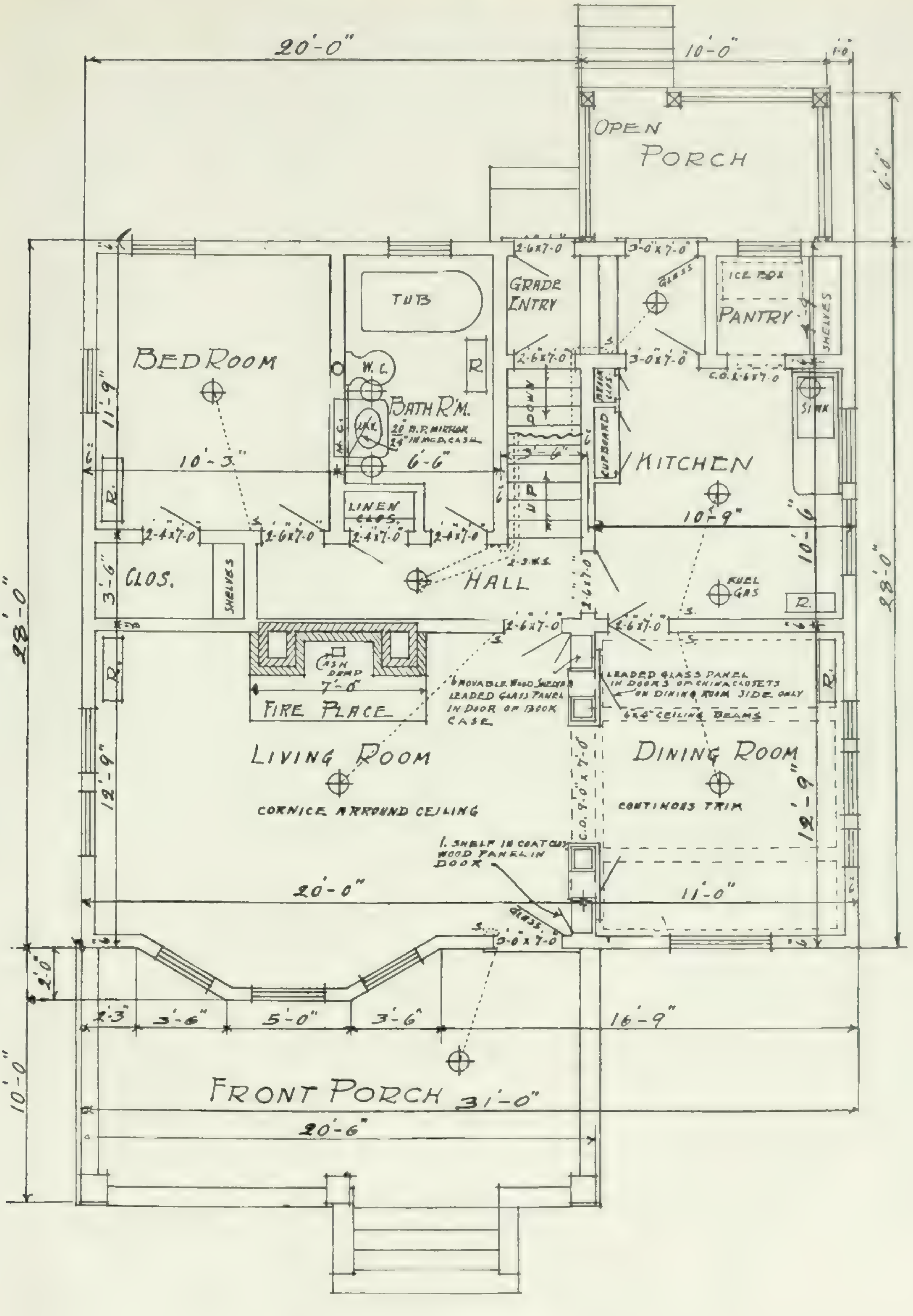
REAR ELEVATION



BASEMENT AND FOUNDATION PLAN



SECOND FLOOR PLAN



FIRST FLOOR PLAN

BRICK WORK, CONCRETE WORK, AND MASONRY

Brick, Fireproofing, Tile and Terra Cotta, Cement Blocks, Reinforced Concrete, Cut and Crushed Stone, Concrete Mixers

CONCRETE WORK IN FREEZING WEATHER.

Until a few years ago, although concrete had already been generally adopted throughout the country by contractors and farmers for almost all structural work, it was the practice to stop all work on this form of construction as soon as the cold weather set in.

It has been found, however, that concrete work may be carried on in cold weather successfully, and with but very little more trouble than under ordinary circumstances.

This fact is of great benefit to the farmer, as it is in the colder period of the year that he is able to find time for building and making the many articles around the farm to which concrete so readily adapts itself.

With a few simple precautions it has been found that concrete can be used, not only in freezing weather, but when the thermometer has been actually below zero.

If the concrete freezes before it starts to "set," it will not be injured, but if the freezing takes place after the "setting" action has started up, the concrete is likely to be damaged when it thaws, owing to the expansion of the melting water forcing the particles apart and making the concrete crumbly. On the other hand, if the concrete has a chance to become thoroughly "set" before freezing, no harm will be done. To give it this chance you must first of all prepare the materials as described below, and secondly, you must protect the concrete after it has been placed in the "forms."

Preparation of Materials.

Concrete will, on its own account, develop a certain amount of heat in the "setting" process. But in cold weather, some outside assistance, in the form of artificial heat is necessary. The best way to develop this artificial heat is to warm the materials before mixing. This shortens the time that it takes the concrete to "set" and lengthens the time necessary to bring it to the freezing point. Bear in mind that the less water used, the quicker concrete "sets." Therefore, it is advisable to use as little water as possible in the mixing during cold weather.

Heating Water.

A simple and easily made vessel for heating water is shown in the accompanying drawing. (See Fig. 1). A coil is made of one-inch pipe with the ends fastened in the barrel and made water-tight. A small fire built under the coil will heat the water rapidly and will keep it in circulation, thus keeping all the water heated.

For this purpose it is wise to use a length of malleable iron gas-pipe, because it is easily bent into the required coil. This is done by taking a log or fence-post about the size of the coil and bending the pipe around it. This method prevents the pipe from "buckling" and makes the coils more regular in size.

Where concrete work is being done on a large scale, it is advisable to use the two-barrel heater shown in Fig. 2. This allows the water to be constantly replenished without reducing the heat of the water in the barrel from which the hot water is taken.

Most farmers, however, possess large boiling kettles, used during butchering time, or for making soft soap, etc. One of these will do equally well.

Sand and stone may be very easily heated by making use of two pieces of stove pipe, one piece for the sand and the other for the stone. The pipes are laid on the ground in such a position as to allow the wind to make a good draft. The fire is then built in one end. The flames pass through, heating the whole pipe, and as fresh fuel is added, the cinders are pushed along the pipe and gradually work out at the other end. The sand and stone should be piled on top of the stove pipes, and will soon thaw out and become heated.

In very cold weather, the cement may be heated by laying the bags on top of the sand, but this is not absolutely necessary, as the cement itself must be kept dry until used, whether the weather be hot or cold.

Temperature Required.

Materials should not be heated to too high a temperature. A good way to judge the proper amount of heat is to make them just hot enough to be comfortable to touch. Care should be taken not to use any frozen lumps of sand.

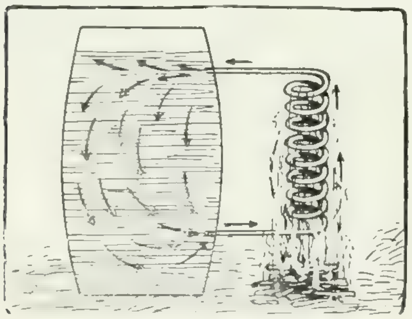


Fig. 1 Showing Simple Method of Water Heating

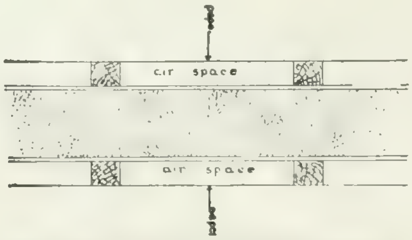


Fig. 4 Paper Tacked to Wooden Supports to Prevent Concrete from Frost

Fig. 3 Showing How Materials may be Heated by Means of a Fire in an Old Stove Pipe

Protecting Concrete in Position.

After the concrete has been placed in "forms" it should be protected so as to keep the heat in as long as possible. This is more essential in thin structures than in massive walls and foundations; for the latter will hold their own heat longer on account of their thickness.

Wooden "forms" are non-conductors, and will retain the heat in the concrete up to a certain point, but the concrete should be protected on top by a covering of canvas or heavy paper, with a layer of ten or twelve inches of manure on top of this. Straw will also answer the purpose. If manure is used, care should be taken to prevent it from coming in contact with the concrete, as it will discolor it, and possibly even seep through sufficiently to weaken the structure.

Protecting Thin Structures.

In the case of thin walls where extra cold weather calls for additional protection, heavy paper should be nailed to the vertical posts of the forms, (see Figure 4), thus leaving an enclosed air space between each pair of posts. These air spaces will have about fifteen degrees higher temperature than the outside air. The "forms" should always be left on longer in cold weather, as it takes longer for the concrete to harden.

There is no reason why concrete cannot be used with complete success in cold weather if these simple precautions be followed.

REINFORCED CONCRETE RAFT TO SUPPORT TOWER.

In connection with the rebuilding of Holy Trinity Church, Kingsway, London, a reinforced concrete raft was constructed to support the main tower, which is described in detail in a recent issue of Concrete and Constructional Engineering, London.

The total weight of the church tower when completed will be about 2,500 tons, but at present this portion will not be carried beyond the level of the church roof, which represents a weight of about 1,200 tons.

Owing to the settlement which must necessarily take place when the remaining 1,300 tons is added at some future date, the tower foundation has been designed to be entirely independent of that of the front or entrance portion of the church, or of the body of the church itself, and intentional lines of weakness are arranged on each side of the tower. Any such settlement of the tower will not interfere with the remainder of the building, and will then involve very slight repairs.

The reinforced concrete raft itself measures 50 feet by 53 feet, and consists essentially of a lower slab supporting two main beams on which the four corners and intermediate walls of the tower rest, the lower slab itself being stiffened by means of small cross-beams running between the main beams and beyond same to the edge of the slab. The slab is 12 inches thick, the two main beams on the top of the same are 4 feet wide by 4 feet 3 inches deep, and the seven cross-beams are 2 feet wide by 2 feet 9 inches deep.

BOOK REVIEWS

"Notes on Heating and Ventilation," by John R. Allen, is now in its third edition. This is a popular text book on heating and ventilation, the author being Professor of Mechanical Engineering in the University of Michigan, and a leading authority in his particular field of research. The work, which deals in a comprehensive way with the problem of heating and ventilation, is considerably enlarged, the new features including a resume of the results of the German experiments and methods of determining heat losses from buildings. The book is published by Domestic Engineering, 443 South Dearborn Street, Chicago, and the price is $2.50.

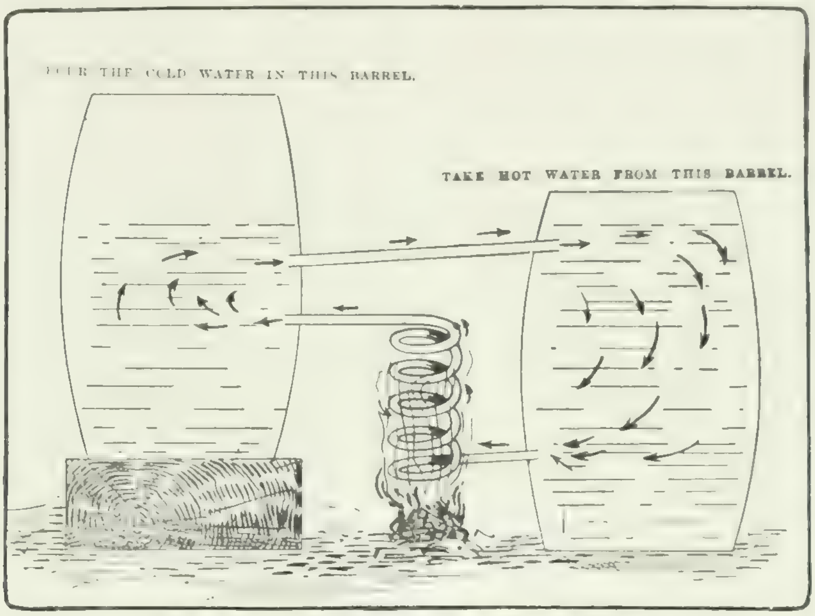


Fig. 2—Showing Two Barrel Method of Heating Water

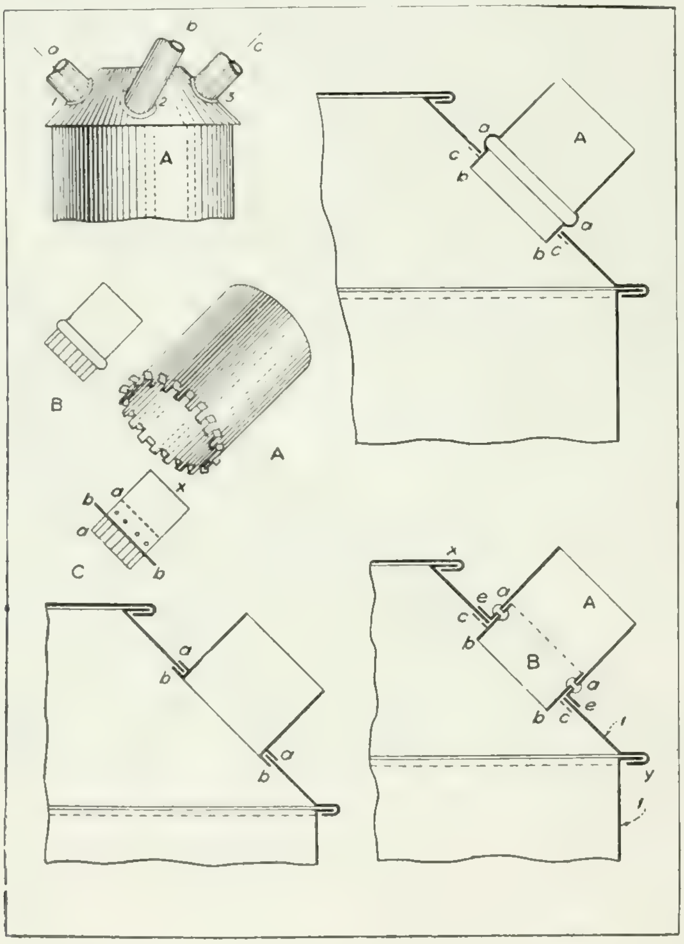
ROOFING AND METAL WORKING

Asbestos, Cedar, Metal and Slate Roofings, Skylights, Cornices, Metal Walls and Ceilings, Expanded Metal, Ornamental Iron and Brass Work, Fireproof Doors and Windows, Galvanized Iron Work

CONNECTING FURNACE PIPES TO FURNACE TOPS.

When furnace warm-air pipes are to be connected to furnace hoods, as shown in A in the accompanying illustration, it is well to know the different methods which are used, so that the one best adapted can be employed in making the connections, writes William Neubecker in The Metal Worker. As every collar in most cases has a different angle, the collars are usually trimmed at the job as follows: Run a line or spool wire from the register box on the first floor, or from the stacks leading to the upper floors, to the bonnet or hood, as indicated by the dotted lines, a, b and c, which gives the proper angle at which the collars are to be cut to fit against the hood.

After the collar has been fitted accurately it is held tightly against the hood and a pencil mark made on the hood and carefully cut out with the circular shears. Each collar is marked to correspond to the opening in the hood, as shown by 1, 2, 3, etc., as shown. The collars can now be joined to the hood by either one of the methods shown, A showing a notched or dovetailed collar; B, a beaded notched collar and C, a flanged and notched collar.



SUGGESTIONS ON CONNECTING FURNACE PIPES TO TOPS

Note in the collar A the alternate flanges are turned out at right angles, as shown, so that when the collar is joined to the hood, as shown in the diagram below C in the accompanying illustration, the edges just turned lie tight against the outside of the hood at a a, while the unturned edges are turned on the inside of the bonnet at b b. These edges are dressed down firmly, which secures the collar ready to connect with the warm-air pipe.

When the collar is beaded and notched, as shown by B, this collar is secured to the hood, as shown in the diagram in the upper right-hand corner of the illustration at A. The collar is set in the opening in the hood, with the bead snugly against the hood, as shown by a a, after which the flange b b, which is already notched, is turned over as shown by c c. The flanging and notching of the collar C is accomplished by first flanging the collar x at b and b until this flange fits snugly against the hood. A separate collar a a is now riveted to the main collar x as shown and notched at a.

When connecting this collar to the hood as shown in the diagram in the lower left-hand corner of the illustration, the main collar A is set tightly against the hood as shown by e e and the notched portion b b of the collar B which had previously been riveted to the collar A at a and a is then turned against the inside of the hood at c and c. Of course it is understood that the seaming at x and y is not done until the collars have been joined to the hood. After the collars were all fitted a mark was made at 1 on the hood and 1 on the casing as shown, after which the hood was removed from the casing, the collars secured and the hood set back again on the casing in its proper position as shown by the marks 1 and 1 and then seams x and y closed.

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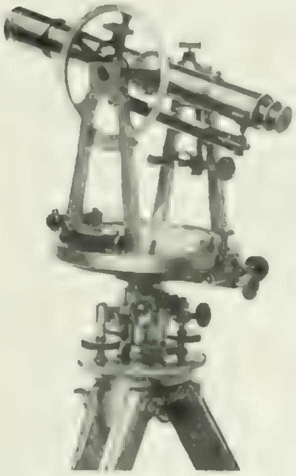

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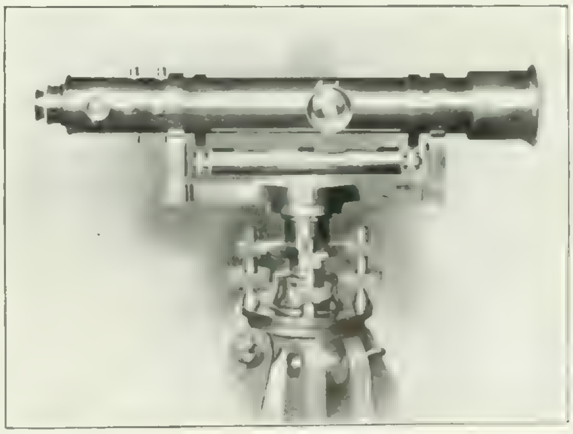

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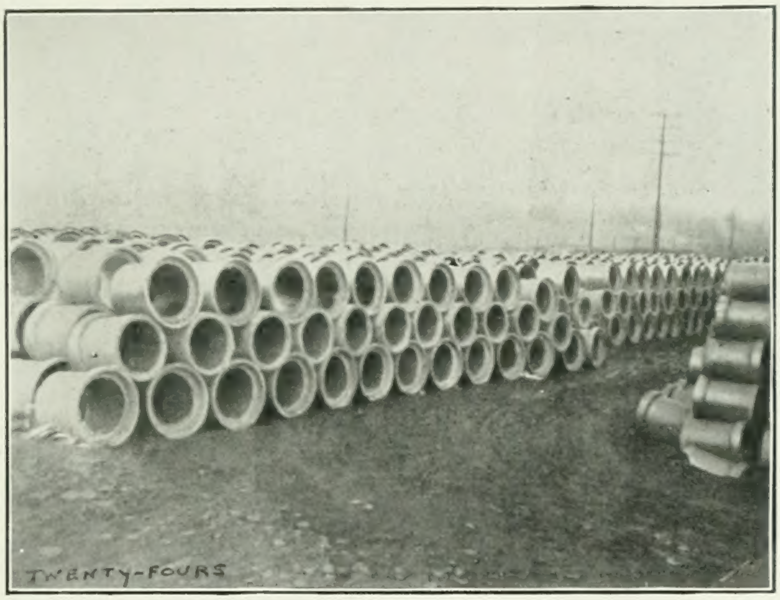

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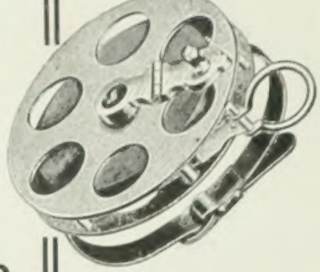

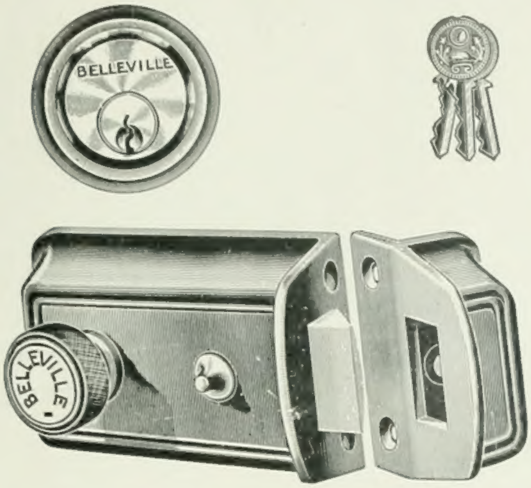

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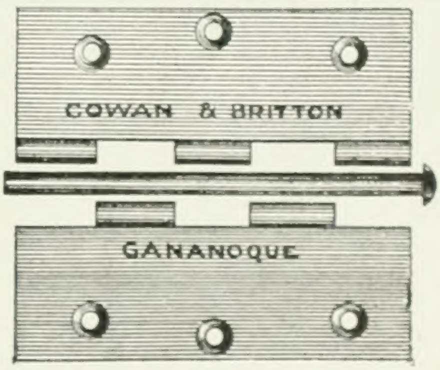

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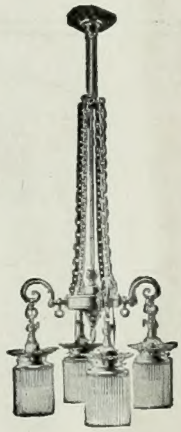

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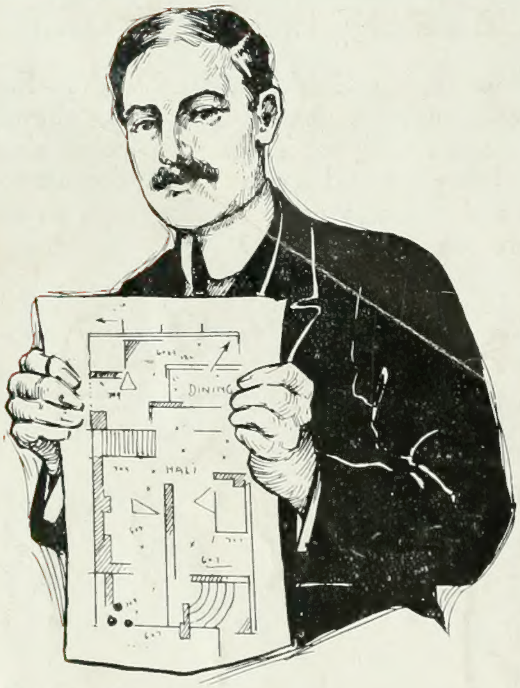

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