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FEATURES—THE CANADA CEMENT COMPANY, LIMITED—NEW METHODS OF REINFORCING CONCRETE

CANADIAN CEMENT AND CONCRETE REVIEW

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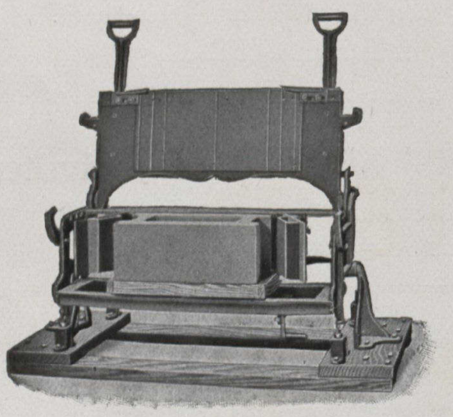

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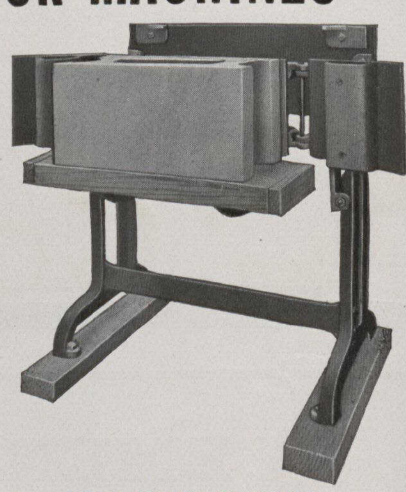

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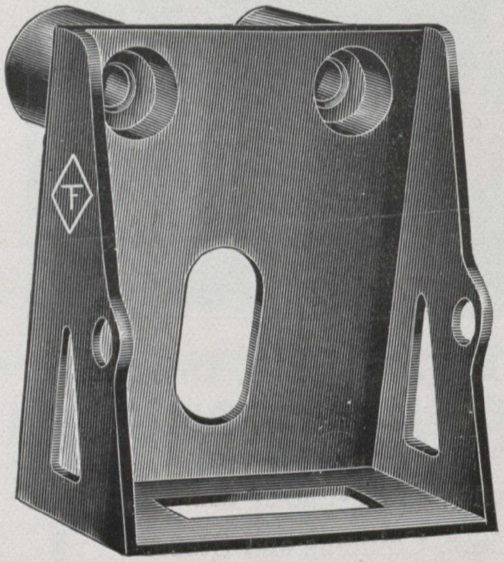

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Canadian Cement and Concrete Review

Vol. 3. TORONTO, SEPTEMBER, 1909 No. 9

A Splendid Example of Concrete Block Construction.

RESIDENCE OF MR. T. L. DATES, RECENTLY ERECTED AT OWEN SOUND, ONT.—CONCRETE BLOCK INDUSTRY RECEIVES AN IMPETUS IN THAT TOWN—OTHER LARGE CONCRETE BLOCK BUILDINGS TO BE ERECTED SHORTLY.

One of the finest examples of concrete block construction that has come to our notice is that of the residence of Mr. T. L. Dates, Owen Sound, Ont., manager of the Sun Portland Cement Company of that city. This residence, which has just been completed, is a splendid example of what may be accomplished through the use of carefully constructed concrete blocks. It is to be regretted that more structures of this standard have not been erected in the past. It is buildings of this kind, carefully planned, well constructed, with every consideration in workmanship, that will place concrete blocks before the public in their proper light, and educate the general public as to the adaptability of concrete blocks for building purposes and the difference between what is good and what is bad construction. Some months ago we called attention editorially to the attitude of the general public toward concrete blocks and the desire to see it demonstrated in buildings before adopting it. Actual demonstrations where careful workmanship has been employed, have had the desired effect, in almost every instance.

Take the case of the handsome concrete block residence described herewith. Since its completion the management of the Owen Sound Clubhouse have decided to build of concrete blocks, an opera house, and two churches will be erected of this construction, all the outcome of one good, thorough and consistent demonstration. This concrete work was not accomplished, however, without strong and aggressive opposition on the part of brick, stone and opposing interests.

The total cost of the cement work of this residence was $1,450. This figure included everything in which cement entered, including the cellar floors and cellar division walls as well as an outside cistern for water. As a comparison of the cost of this construction with that of brick it is interesting to note that the bid for the same work in brick was $1,725.

Residence of Mr. T. L. Dates, Owen Sonnd, Ontario.

A Carefully Planned and Well Constructed Concrete Block Building.

The cellar walls up to the first joists were built of 10-inch Ideal hollow blocks. These were the only walls in which rock-faced blocks were used. From the first storey to the second storey joists 10-inch vertical tool hollow blocks were used. These had a 9-inch—3-inch high plain face block. The setting faces of these were one inch from the line of the tool face. The second storey was built of 8-inch hollow blocks or smooth face. All blocks were faced with a mixture of 3 to 1 white sand

and Portland cement. The faces of all the blocks were made absolutely waterproof by the application of a waterproofing compound.

This residence is 31 feet square. The porches extend 10 feet wide both front and back. It is worthy of special notice that all the work was performed on the job, all columns, steps, etc., being made on the ground. All the concrete work was made of a 5 to 1 mixture with the exception of the face of blocks as stated above. A particular feature of the cellar was the making of all outside and division walls of smooth hollow blocks. This produced a wall surface practically equal to plastered work. Another feature of this building is its perfect dryness. There is absolutely no trace of dampness whatever. It is much superior in this respect to either a solid brick or a stone house. The first storey is finished in plain oak with birch floors. The second storey of Norway pine of natural finish. No. 1 cedar shingles dipped in creosote red stain were used. One walk six feet wide extends to the street, a distance of 52 feet, while another concrete walk two feet wide extends from the street to the rear. Among the other interesting features of this building is the arrangement of the cellar windows. A cement areaway has been built for the cellar windows in order to allow the maximum amount of light. With this arrangement seven windows have been placed in the cellar 5 feet six inches in length. These windows are 32 inches wide. The chimneys from the foundation to the top have been constructed of concrete blocks with no other lining whatever.

The first floor consists of a sitting room 13 feet 9 inches by 17 feet; vestibule and hall 7 feet 6 inches wide; parlor 13 ft. 9 ins. by 15 ft. 3 ins.; kitchen 14 feet 3 inches by 12 feet 9 inches, together with china pantry, rear verandah, grade entrance. The second floor is composed of four bedrooms, hall, drawing-room, together with a front and back balcony. The attic contains two storerooms and studio and hall.

The entire cement work was completed in sixty days. The building being started about the 15th of May of the present year. Only two men were employed in the erection of the concrete work. The entire structure presents an appearance of stability. No imitation of other materials has been attempted. It is concrete pure and simple and is the more pleasing for this reason. The builder has tried in every way to make it appear as concrete and his success in this undertaking is proven by the splendid results which have been secured. There is just sufficient ornamentation to be in keeping with the general design, a feature which is sometimes overdone in this class of dwelling. The object of the builder was to erect a substantial, attractive and economical building.

He has undoubtedly been successful in all these particulars, and the fact that other large buildings have been started in Owen Sound, as the direct outcome of this work is the best criterion that we could give as to the manner in which this work was caried out. The concrete work was carried out under the direct supervision of Mr. Dates himself, whose own ideas were carried out throughout.

"Monster, your heart is of stone!" shrieked the leading lady in "Tillie, the Threshing Machine Girl." "No, indeed," scoffed the cold, cruel villain. "It is of reinforced concrete, which is just twenty-nine times as hard as common stone," and the curtain went down.—Puck.

CHANGES IN CEMENT SPECIFICATIONS.

The Committee on Specifications for Cement of the American Society for Testing Materials recommended the following changes in the standard specifications for cement:—

1.—To amend the requirements for specific gravity for Portland cement to read as follows:—"The specific gravity of cement shall not be less than 3.10. Should the test of cement as received fall below these requirements a second test may be made upon a second sample ignited at a low red heat. The loss in weight of the ignited cement shall not exceed 4 per cent."

2.—To amend the requirements for tensile strength for both natural and Portland cement as follows:—

Natural Cement.—The minimum requirements for tensile strength for briquettes one square inch in cross section shall be as follows, and shall show no retrogression in strength within the periods specified:—

Age.	Neat Cement.	Strength, Lbs.
24 hours—in moist air		75
7 days—1 day in moist air, 6 days in water		150
28 days—1 day in moist air, 27 days in water		250

1 Part Cement, 3 Parts Standard Ottawa Sand.

Age.	Strength, Lbs.
7 days—1 day in moist air, 6 days in water	50
28 days—1 day in moist air, 27 days in water	125

Portland Cement.—The minimum requirements for the tensile strength for briquettes one square inch in section shall be as follows, and the cement shall show no retrogression in strength within the periods specified:

Age.	Neat Cement.	Strength, Lbs.
24 hours—in moist air		175
7 days—1 day in moist air, 6 days in water		500
28 days—1 day in moist air, 27 days in water		600

1 Part Cement, 3 Parts Standard Ottawa Sand.

Age.	Strength, Lbs.
7 days—1 day in moist air, 6 days in water	200
28 days—1 day in moist air, 27 days in water	275

SILO FORMS USED IN CONCRETE CHIMNEY CONSTRUCTION.

Mr. Ira Peer, contractor, Belmont, Ont., recently built a concrete chimney for Mr. W. F. Hamlyn, of that place, in an unusual manner. It was built with silo forms made especially for the work, as regular silo curbs could not be made to work in the case of so small a diameter. This stack is 60 feet high, with 40-in. flue, The wall is 15 inches thick at the ground, tapering on the outside to 4 inches at the top. The footing is 10 ft. square, 3 feet thick, and is 4 feet below the level of the ground. The structure was completed in less than three weeks. The cost of labor was $3.25 per foot of height. The materials required were Portland cement, 45 barrels; reinforcing material, 35 cwt.; sand and gravel, 12 cords. Mr. Peer is to build another this fall at Strathroy, Ont., which will be 80 feet in height.

New Types of Concrete Construction.

INTERESTING METHODS OF REINFORCING—THE WAGNER SYSTEM, A NEW DEPARTURE FROM PRESENT METHODS OF BUILDING—OTHER METHODS OF REINFORCING AT PRESENT BEING TRIED OUT.

The advance that has been made in recent years in concrete construction is remarkable, and the future promises even greater strides in the use of cement. Complicated and expensive form work has figured extensively in the past in some classes of concrete work. Many attempts have been made to make a satisfactory concrete construction without the use of cumbersome forms.

It is the object of this article to describe an entirely new departure from present methods of building. It is claimed that this method of construction offers all the advantages of a solid concrete structure for practically the same cost as a wooden building.

By the Wagner system as shown in Fig. 1, buildings are constructed along the same lines as the ordinary so-called balloon frame buildings in wood; concrete slabs reinforced with poultry netting being used in place of wooden boards, and are tied to concrete studs by wires projecting from the ends of the slabs. Concrete studs between the slabs and carrying all the loads take the place of wooden studs.

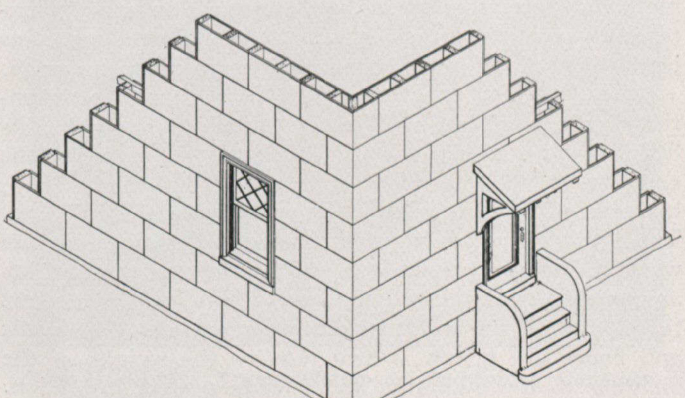


Fig. 1 WAGNER SYSTEM OF CONCRETE CONSTRUCTION

The advantages claimed for this system are, the absence of wooden forms and the minimum amount of material used, with the consequent low cost of construction; the hard impenetrable face, due to a wet mix and trowelling which does not allow the absorption of moisture; and the large air spaces which will make the building cool and dry in summer and warm in winter, and which make it perfectly safe to plaster inside without the use of lathing. For many purposes the smooth finish of the slabs on the inside, will answer without any extra white plaster coat.

Fig. 2 shows a slab with a portion of the surface removed to expose the poultry netting reinforcement and the bond wires. There are two or more of these bond wires in each slab, which project from the ends of the slab, and serve to hold it in place till the stud is poured and then to bond the slab to the studs.

Very little space is required for making the slabs as they can be made one on top of the other with a sheet of building paper between. In fact this is advisable, as it is more economical, and the slabs are kept damp and away from the air, which removes the danger of hair cracks.

Slabs can be made in multiple using a form as in Fig. 3. The steel plates on the form rest on the finished slabs, and hold the form in place till the concrete is poured, and gets its initial set, then the forms are disconnected at the corners and drawn out. The forms are then connected together again and placed on top ready for making a new set of slabs. It is advisable to use

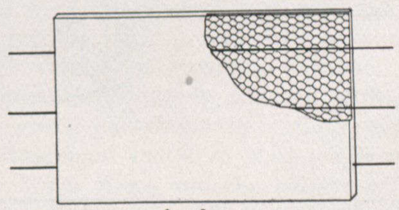


fig. 2

three or four forms, so as to leave them on longer and protect the corners from being broken until they are well hardened.

The slabs can be made either straight, or curved for bay windows, and the surface may be finished in various ways. The surface may be floated off, or trowelled to a smooth finish, and if a facing coat of marble dust and white cement is used, will closely resemble marble.

A very pleasing appearance is obtained by mixing a facing coat of red or grey granite chips, marble or any other stone or combination of stones that may be desired, and after the initial set, scrubbing the surface and washing with a hose at the same time, to remove entirely the cement and sand from the surface and expose the stones. The surface is finally washed with dilute acid, which removes all traces of cement from the surface of stones, leaving them clean and bright.

For special effects in decorating, slabs may be colored red, blue, grey or almost any color by the introduction of coloring matter into the cement mortar,

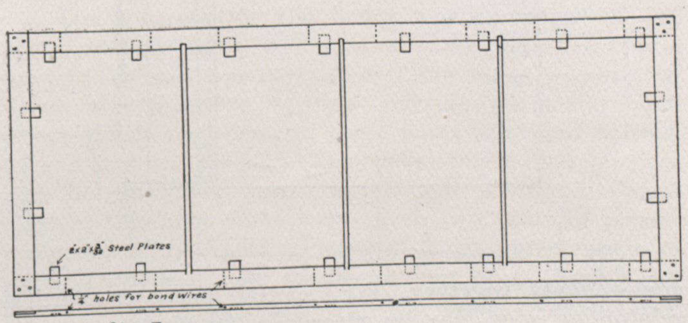


fig. 3

but this is not generally advisable as concrete should stand for what it is, and not be made to imitate any other material.

In the most pleasing cement buildings the architects have departed entirely from the old ideas of decoration, and have created a new style of architecture, using straight lines and long curves, which give the structure a massive and durable appearance, which is distinct from any other form of construction.

The method of constructing the wall by the Wagner system is shown in Fig. 4. Form boards marked "A" of a wedge shape, to be easily removed, are used to gauge the thickness of the wall and keep the slabs in line until the stubs are poured and set, and these boards also serve to hold the concrete poured in to form the

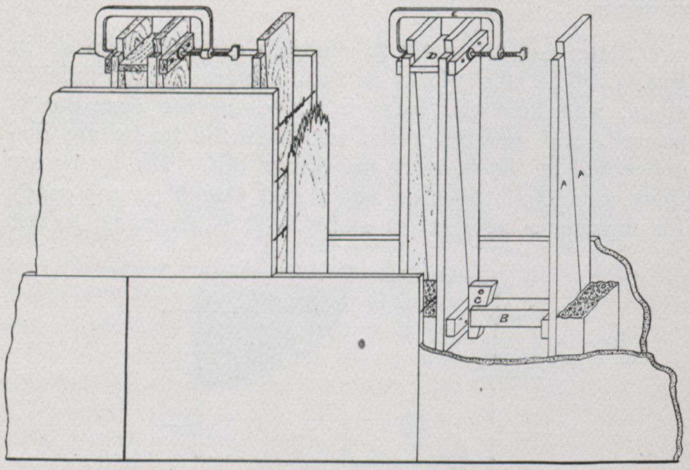


fig. 4

studs. Above the first course these form boards are clamped to the finished stud by means of struts "B" and wedges "C," and the tops are held in place by separating blocks "D" and clamps "E."

After the form boards are in place the horizontal joints are spread with mortar and the slabs are laid in place against the form boards and the projecting wires are connected across the wall, holding the slabs firmly in place. Concrete is then poured between the form boards and around the wires to form the studs. The studs are poured only to a point below the top wires, leaving the top part of the stud to be made continuous with the stud in the course above and thus tie the hori-

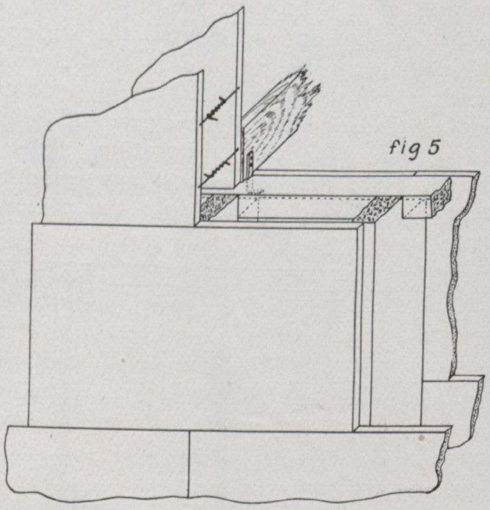


fig 5

zontal joints together. For special purposes vertical reinforcing rods may be placed in the studs.

When the studs are sufficiently set, the form boards are loosened and moved up, and another course of slabs are set and grouted.

The thickness of the wall, and the size of the studs, will, of course, depend on the kind of building and the loads to be carried. For very heavy loads the studs can be made very thick, or taking an extreme case, where a solid wall is desired the studs can be made to fill the whole space between the slabs. In this case the concrete would be poured to fill the bulk of the space, leaving only a small space occupied by the form boards, which would be filled when pouring concrete in the course above, after raising the form boards.

Working in this way solid walls can be built without any outside form work whatever, and at the same time have a veneering of very hard close grained concrete of pleasing appearance.

No weight at all is carried on the slabs. The load of the joists is transferred to the studs by decreasing the thickness of the wall at each story and bolting angle or channel irons to the tops of the studs which project, or by joining the tops of the studs together with concrete to form a concrete beam as shown in Fig. 5.

Door and window frames are grouted in solid.

Patents have been applied for by the patentee, Mr. W. E. Wagner, 19 Gerrard Street East, Toronto.

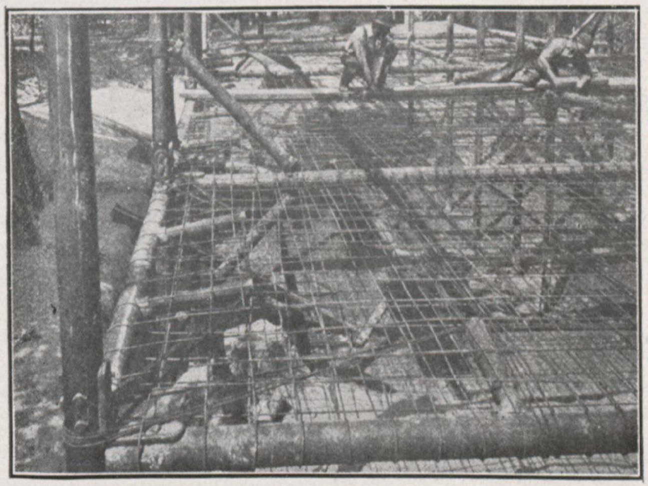
A CONCRETE HOUSE BUILT BY A NEW METHOD.

Owing to the growth of our cities and the massing together of people, the demand for fireproof buildings has been steadily increasing. Engineers and builders realize that every owner wants his building to be fireproof, but up to the advent of concrete all methods of fireproof construction have been expensive and almost prohibitive except for the highest type of building where excessive rentals can be obtained. The more common methods of reinforced concrete construction are not extensively applied to residences. Some of the advantages claimed for this form of construction are given herewith.

The building invented by G. M. Graham is an entirely new combination of steel tubing, wire, malleable fittings and concrete. With the exception of piers, the concrete is not depended on to carry any of the load, but is used only as a stiffener or body to the building. The entire frame work can be erected before the concrete work is started, making it possible to inspect the position and quality of steel and to erect a building in a short time. No forms or centering are required. The walls and floors are hollow, which reduces the weight of the building to the minimum and affords perfect insulation. The strain on the floors is carried by wire in tension. The walls, floors and partitions form one integral mass, so that the building is vermin proof and indestructible. As every partition, floor and ceiling is interwoven with wire, it is impossible for cracks to develop. The building is absolutely fireproof and costs very little more than the present form of brick walls, wood floors and partitions, which are so highly inflammable. All steel and wire is encased in cement, which prevents corrosion or rust. The exterior is of cement mortar which permits of any finish or form of ornamentation desired.

The projectors of this construction have been working on it for several years. Tests have been made of the strength of each part of the structure and excellent results have been obtained. A floor slab fourteen feet square between supports and only three inches thick was loaded with six hundred pounds to the square foot and showed practically no deflection. Another slab was loaded until it deflected several inches and when the load was removed the slab went back to its original position.

The first building in which this construction was used has just been completed in Glencoe, Illinois, at the corner of Sheridan Road and Central Avenue. M. J. Moorehouse, No. 2117 Fisher Building, Chicago, was the architect of this residence, and the construction was carried out by G. A. E. Kohler, of Kohler Brothers, Fisher Building, Chicago. A complete skeleton of steel tubing was first erected, all the pipe being cut to length and drilled in the shop. The columns extend down to the basement floor and rest on concrete piers or footings which were the only foundation required. None of the pipes were threaded, but were put together with a special malleable fitting which was bolted through the column and girder. A number of different fittings have been devised, but in the construction of this building only one type of fitting was required and this was an angle cast in malleable iron concave on the side next the pipe. These fittings were bolted onto the girders in the shop and the girders were then poured full of concrete, and after the frame was erected the columns were filled with concrete, so that all bolts are cemented in position and the interior of the pipe is protected against corrosion. A frame of this kind can be set up with common labor and in a remarkably short time, as the only work is to hoist the pipe into position and bolt it together. The strength of the pipe is greatly increased by being filled with concrete, and in the construction of this building it



The Horizontal Truss System of Reinforced Concrete.

was found that the frame was so rigid that no bracing was required, although a system of diagonal bracing was originally planned.

After the pipe frame was completed, a system of horizontal trusses was constructed around the outside of the building on a level with the floors (see illustration), which formed an incompressible frame work upon which to draw the floor wires. These trusses were constructed by wrapping the wire around the columns and driving in short pieces of pipes for struts. The same method of trussing is used under the girders where especially heavy loads occur, and any desired strength can be obtained by using a sufficient number of wires.

After the truss wires were in place, wire was drawn around the girders in both directions, either the entire length of the structure or in such sections as desired, and these wires attached end to end with a specially devised coupler. This process gives a continuous wire stretched around the girders, drawn under a tension of nearly one thousand pounds, and left free to adjust itself to the strain as applied. For this purpose No. 0 to No. 3 wire was used, wound as close as required for the strength of the floor. The side walls were wound in the same manner and the window frames were attached to the wires with the same couplers used for joining the floor wires. The walls of each story were wound separately, so that it is impossible for a girder to deflect, as each girder hangs from the girder above, and is supported its entire length. Expanded metal or wire cloth was placed under the top wires of the floor and was tied to these wires with specially designed clips; this wire cloth served only as a medium to hold the concrete until it had hardened. The wires at this stage of the construction were very stiff and the floor could be walked on and for wheeling the concrete only a single plank was required. The concrete was dumped or shoveled onto this floor mattress and leveled off to an even surface. As the fresh concrete was placed the weight deflected the floor wires and, as they were wound continuous, they slipped over the girders and drew the under wires to a high tension with practically the same strain on every wire. When the concrete hardened each of the upper wires was thoroughly covered with concrete and the under wires, carrying the ceiling, were perfectly straight. Expanded metal or wire cloth was then applied to the under wires and the plaster was put on the ceiling in the usual way. Floors three inches thick and with spans from 14 to 16 feet were successfully constructed in this manner.

The outside walls were formed by applying wire cloth to the vertical wires, as above mentioned, and the plaster was put on the same as in any other form of cement plaster finish. Where hollow inside partitions were used, they were formed similar to the outside walls, but slight, solid partitions can be constructed with this method. Where partitions were to run, a horizontal wire was stretched in the floor before the concrete was placed and vertical wires were suspended from this one about 10 inches on centres. After the concrete was placed on the upper floor, these wires were attached to the wires in the lower floor, so that when the concrete was put on this floor the weight of the floor stretched the partition wires; wire cloth was then attached to these vertical wires and the partition was plastered in the usual way. The roof was constructed in the same manner as the floors and the finished cement surface was left exposed. This roof was finished with a float and has stood throughout the entire winter and spring and no leaks have developed.

The concrete for the floors was composed of one part cement, three parts lake sand, and five parts gravel; the roof was composed of the same concrete, on which was placed a ¾-inch covering of mortar composed of one part cement, three parts sand and finished with a wooden trowel. The walls, inside and outside, and the partitions were covered with Portland cement plaster; the outer walls were given two coats of plaster composed of one part cement (1 bag), three parts of sand (3 cu. ft.), hair to the amount of ½ bushel per barrel cement was mixed with the sand. The exterior was finished with a pebble-dash composed of one part cement and two and one-half parts coarse sand and gravel which passed a ⅜-inch screen and was retained on a ⅛-inch screen.

The residence is complete with plumbing, hot water heating and electric wiring all of which were installed without difficulty. With the exception of interior trim, no wood was used in the construction, as all exterior mouldings and ornament were formed of cement, cast on the ground and wired in place before the plastering was done.

AGGREGATES FOR CONCRETE AND METHODS OF REINFORCING.

An important point in connection with reinforced concrete frequently presents itself, namely, as to the nearest place where the materials, such as sand and gravel or chippings, can be obtained, and it is a question well worth close consideration because in nearly all instances the cost of the proposed structure will be of course affected by the cost of its constituents, and these are in turn much influenced by the cost of freight and carriage.

In many places the Eastern Counties flint is practically the only stone locally obtainable, but though this makes good, tough concrete, it is unreliable for fire-resisting purposes owing to its tendency to crack and "fly" under heat.

The same remarks apply to limestone, but it has not the redeeming feature of being more fire-resisting after being broken; in fact, it is not advisable to be used at all where fire-resistance is an important consideration, as it is very apt to disintegrate to powder under the action of heat, but it is not to be condemned entirely as it is quite a serviceable material apart from increased fire risk.

Sandstone can be obtained in many parts of the country in almost unlimited quantities, but, as a rule, it is too soft, too porous and too absorbent for use in reinforced concrete work. Samples should always be taken and tested by crushing, and if it is found that it will stand about 1½ tons per square inch, and that the difference in weight, when clean and dry and after being two days under water, does not exceed 8 per cent., it may be safely used.

Quartzite stone is fairly good if not too soft and open in texture, in which case the same precautions apply as for sandstone.

With reference to what may be called artificially-produced aggregates, broken earthenware and stoneware from the potteries district make quite a good aggregate, but those who have not had experience with this material for reinforced concrete will be disappointed to learn that the same must be unglazed, thus preventing the use of the many hundreds of tons of broken crockery now existing in some of the older Pottery towns, as the glaze prevents the proper adhesion of the cement; but doubtless this difficulty will be surmounted in time.

Burnt clay and gault are quite permissible materials, provided that they are tough and hard and do not soften or "crumble" after being left in water for two or three days.

Speaking generally, broken bricks are not a good aggregate for reinforced concrete, although they have given excellent results in mass concrete. They are usually too soft and yield too much blunt dust, and have frequently old mortar adhering to them; if, however, they are hard and close in texture and free from mortar they may be safely used.

It is well known that coke breeze makes an excellent class of concrete, but it must be remembered that such cannot be regarded as being really fireproof.

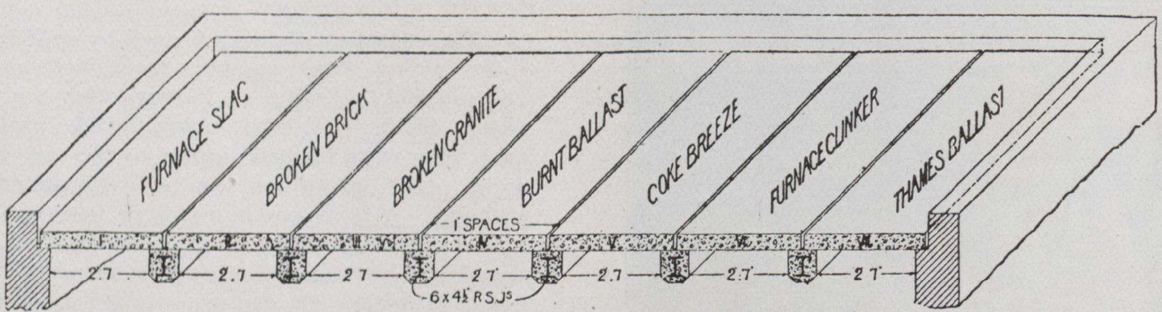
In the case of ashes, only those that will float in water and which are of a uniform color and texture, and quite free from adhering pieces of coal and dirt, should be used, while with clinker only that which is really hard and clean is serviceable. In both cases if the washing and riddling or screening are carried out as one process, a more reliable result will be obtained. The question of sulphur must, however, be carefully watched.

Slag from furnaces, whether blast or cupola, makes also quite a good aggregate, provided it is hard and tough and free from dust, and its sulphur contents carefully noted.

As is well known, all clinkers, breeze, slags, etc., contain a certain amount of sulphur which is apt to attack the reinforcing steel with disastrous results. The maximum allowable percentage of sulphur in reinforced concrete aggregates is now being made the subject of tests and experiments. There is an important point in connection with the presence of sulphur, namely, that if it is in the form of "sulphate" it is practically harmless, but if in the form of "sulphide" it is very deleterious, and anything more than a very small amount indeed should not be allowed.

Care should also be taken with all artificial aggregates that no free lime is present; but, as in the case of sulphur, there are two forms of this material present, one the free lime referred to, which is dangerous and the other carbonate of lime which is practically harmless.

Before leaving the subject of aggregates, the author would draw attention to the recent important fire tests, made by the British Fire Prevention Committee, of concrete composed of various descriptions of material, the proportion of cement, sand and aggregate being identical in each case, i.e., 1: 2: 3, except with the burnt clay and coke breeze where there was no sand, the proportion being 1 : 0 : 5. The illustration, Fig. 1, kindly supplied by the British Fire Prevention Committee, shows diagrammatically the arrangement of the test, which was simultaneous, and exactly the



No. I.	No. II.	No III	No. IV.	No V	No. VI	No. VII.
Top: Slab cracked across in two places.	Top: Slab cracked across in three places; slight curve downwards.	Top. Slab cracked across in three places, curved downward about ¼ in	Top No cracks; not curved downwards.	Top No cracks: not curved downwards.	Top Slab cracked across in two places, curved downwards about ⅜ in	Top Slab cracked across in very many places; curved downward about 2 in
Underside: Curved downwards ½ in.; slight cracks visible.	Underside: Curved downwards ¼ in.; slight cracks visible.	Underside. Curved downwards ¼ in.: no cracks visible; about 1 in. washed off by water	Underside: Not curved downwards; no cracks visible; about 3 in. washed off underside (in parts) by water	Underside: Not curved; no cracks visible; about 1 in. washed off underside (in parts) by water.	Underside: Not curved, one slight crack visible, pitted in places about 1 in. deep by water	Underside: Curved downward 1¼ in., and bad cracks all over in all directions, mainly longitudinally; much washed off by water

Fig 1.—Arrangement and results of Experiments by the British Fire Protection Committee with Concretes composed of various aggregates.

By A. C. Auden.

same for all the slabs, which were all uniformly loaded to 224 lbs. per foot super. The remarks printed beneath each slab are of much interest as showing the behaviour of each material after being quenched with water when practically red-hot. The slabs were all 10 ft. by 2 ft. 7 in. clear span. Engineers will be interested to know that the furnace clinker mentioned was obtained from off the bars of an ordinary steam boiler, not from destructors.

Sand.

Sand is, in some parts of the country, more difficult to obtain than any other constituent of reinforced concrete. A certain amount is absolutely necessary, and nothing up to the present is known which really and entirely supplies its

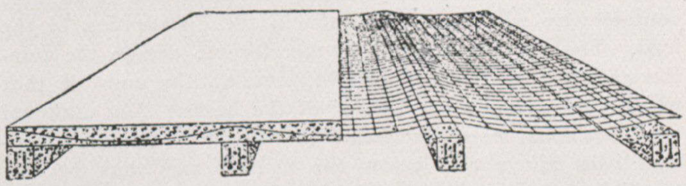


Fig. 2.—Reinforcement of Flat Surfaces; Wires or Rods held in place by Weaving.

place. Engineers having foundries will have a ready means of judging sand for reinforced concrete if they remember that, generally speaking, the better sand is for moulding, the worse it is for reinforced concrete. For instance, it must not "bind," that is, retain any shape when compressed, and it must be incapable of being smoothed with a trowel to a bright surface, or of "standing up" by itself when cut with a shovel; these being "rough-and-ready" methods of ascertaining that the sand has what is required, namely, large sharp grains. Dirt in the form of slime, mud, or vegetable refuse is distinctly bad.

If sand is scarce or costly, some economy may be effected by regarding the very small pieces of the stone or other aggregate, below ⅛-in. mesh, as sand, and mixing them with some real sand. The economy is not so apparent as appears at first because the small pieces must be screened out from the larger aggregate, and in most instances washed to remove the floury dust before being mixed with the real sand, ready for putting in the gauge boxes.

Reinforcement.

It is important that all reinforcement should be so designed as to possess a considerable amount of initial rigidity, so that it does not "sag" or "warp" or "twist" when placed in position in the mould boxes. Many illustrations regarding this could be quoted, but that of compression bars intended to be above the neutral axis in a beam, sagging down by their own weight till a portion of their length is below the said axis, where it is worse than useless, is not by any means as rare as it should be. The same remarks apply to lateral misplacement, particularly in the case of columns and struts, as well as to the pitching and spacing of reinforced bars or metal on flat surfaces such as floors, walls, etc. In these last-mentioned it is practically essential to have the bars or metal so designed that they cannot be knocked out of place, as it is almost impossible to keep a number of separate loose bars in proper pitch; it is advisable therefore that all reinforcements for this form of work be woven together, as shown in Fig. 2.

Punching or slitting solid plates into strips or bars is another efficient form of reinforcement for flat surfaces, particularly for those which are approximately square in plan, viz., where the strains are practically equal all over; but for flats where the length is considerably greater than the span, a wire meshing is cheaper, as the cross-span wires take the load, the longitudinal ones being only necessary to keep the others in pitch, and it is not advisable to pay for metal and strength in the longitudinal directions where it is not wanted.

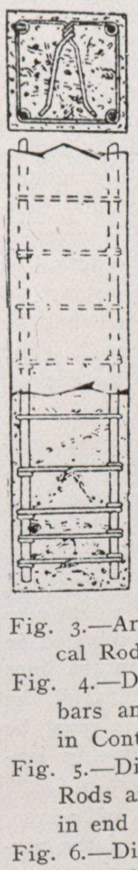
Auxiliary Tension Members in Beams and Slabs.

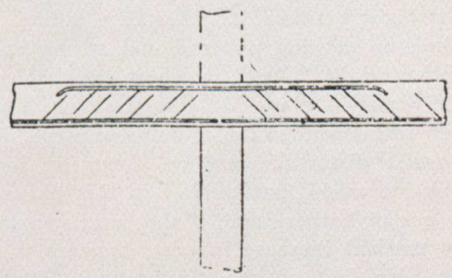
An examination of all the accepted specifications, for the last ten years, dealing with reinforcements will show that it is almost universally acknowledged that these important accessories must be inclined to the main tension bars and not be at right angles thereto, and also that such bars must be so designed as to retain absolutely their positions where they are connected to the main tension bars and cannot be slipped or moved along the same when ramming the concrete or otherwise.

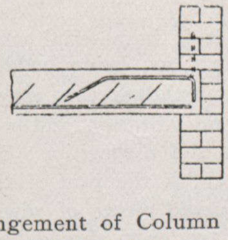
Reinforcements of Struts and Columns.

There are two very distinct methods of reinforcement in use for these—one being that in which the vertical bars are prevented from spreading by being spirally wound with rods of wire, and the other where the same end is obtained by means of rings or loops of wire tying the vertical bars together, such loops or rings being arranged at various distances apart to suit the design and strength desired. Both these methods have good and bad points, each one being the best under appropriate conditions.

The spiral winding has given most excellent results, and is considered by many to be the best for columns, etc., as it permits the use of lighter and fewer vertical rods, but it has the disadvantage of being somewhat difficult to make it a "good mechanical job," that is, so that the spirals shall all be the same diameter and parallel in bore, otherwise some will clasp the group of vertical bars too closely and others hardly touch them, which results in unequal stresses.







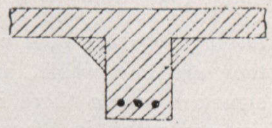


Fig. 3.—Arrangement of Column Reinforcement with vertical Rods and Loop-pieces.

Fig. 4.—Diagram showing Arrangement of Reinforcing bars and Shear Members to resist "Reverse Flexure" in Continuous Beam.

Fig. 5.—Diagram showing arrangement of Reinforcing Rods and Shear Members to resist "Reverse Flexure" in end of beam.

Fig. 6.—Diagram of Section of Beam and Floor showing increased area of Concrete in Compression.

This is, however, generally made much easier by using bands of flat rectangular section which bend readily, and by first winding the spirals on a cylinder and then slipping them over the vertical bars when made. Great care must be taken when using spiral reinforcement in vertical columns that it is not made in too long lengths, as all the concrete has to be put in from the top of each length, and it is well known that when concrete is dropped from even a small height the mixture of its constituents becomes very uncertain. Care must also be taken that each length of spiral is "corkscrewed" well into the one below it, or otherwise there is a plane of weakness between each length of spiral. This form of reinforcement must be so designed that the required strength is obtained without the pitch of the spiral being closer together than the size of the largest pieces of aggregate used, as if it is so, the stones become jammed between the coils and a lack of homogeneity is the result.

The second method of column and strut reinforcement above-mentioned, namely, loops or rings slipped over the vertical bars and held at the proper distance apart, as shown in Fig. 3, is also an excellent one, especially when the loops are carefully made mechanically on hard metal formers, so that each one is an exact replica of its neighbour; the result being that each one equally clasps the group of vertical bars, otherwise should one be tight and the other slack the bursting strains will not be taken up by all the loops in equal proportions. As the first desiratum of this design of column and strut reinforcement is the prevention of the vertical rods spreading apart under the load (the loops themselves, being further apart, do not resist the bursting strains on the concrete to the same extent as the spiral windings), it is not good practice to allow the loops to be curved in between the points where they touch the vertical bars. Unless the wire or rodding forming the loop is straight between its resistance points, it does not get a chance to develop its tensional strength, as it must "pull itself straight" first, which it does at a low stress. For this reason the use of comparatively high-carbon steel is often recommended for columns or strut loops, as it is stiffer to resist distortion, and as distortion is one of the main things to avoid, particularly in this phase of reinforcement, the use of harder steel, if the same can be obtained without any marked increase in cost, appears to be certainly indicated; in fact, as the elastic limit of all reinforcement is almost of as great importance as its ultimate strength, the use of bars and rods possessing considerable resistance to stretching is certainly to be recommended, provided that the said ultimate strength is not appreciably decreased. The use of high-carbon steels has been recommended for various other reasons.

It is often said that it is immaterial whether the reinforcing rods are bent or not, as, being bedded in concrete, they are immovable, and doubtless this may be true in a structure where there is no vibration and where the loads are unvarying in amount and disposition; but where it is not so, there is a tendency on the part of the concrete on the concave side of the curved pieces of wire or rodding to become friable, and this tendency should be eliminated in the design by working the reinforcement in straight lines whenever possible. It should also be noted that all the joints of the vertical rods in columns and struts must be in close fitting sleeves—preferably of good quality lap-welded steam barrel.

When designing reinforcement there are, of course, many points for consideration quite irrespective of the particular method of constructing or attaching the various parts or members, one of the principal being that all beams or floors running continuously over the tops of columns or stanchions or walls must be reinforced above their neutral axis where they pass over the said columns, in exactly the same way as they are reinforced below that axis in their clear span, as the parts in tension and compression are reversed in these circumstances. In one well-known system the bars are run along both top and bottom surfaces from end to end, but these rods or bars in the compression area are only provided as a means of keeping the shear-members or loops or stirrups in position, not as reinforcement against reverse flexure, nor as such in compression, this last not being needed unless the area above the neutral axis is such that it cannot stand the allowable crushing stress.

The exact position of this neutral transverse—or, more correctly speaking, diagonal—plane of "reverse flexure" has not so far been very exactly located, and it will, of course, vary with every variation in the distribution of the load. The present practice is therefore to design the reinforcement, over the supports, to overlap the ends of that which runs along the "belly" of the beam. The diagonal auxiliary shear-members connected to each of the main tension bars above and below the neutral axis thus become parallel to each other, as shown diagrammatically in Fig. 4, in the same way as the tension members in a lattice girder. The same arrangement must be carried out where the ends of beams rest on and in walls, and the diagram, Fig. 5, shows the reinforcements against tension due to the same reverse flexure above the neutral axis under these conditions. As will be noted, the ends of the bars are bent downwards into the beam itself when only the beam is reinforced concrete, but, should the whole structure be of this material, the beams and walls consequently being all monolithic, it is better practice to bend the bars upwards, as shown in the dotted lines, this being also handier as the men can readily see, and, if necessary, adjust, any bar which may have been displaced by punning or otherwise.

When designing long and deep beams or girders such as for a railway bridge with flat (not arched) spans, it will also, not infrequently, be found that the available area of concrete in compression above the neutral axis is such that the stress per square inch is more than the concrete will safely stand, that is, more than 550 to 750 lbs. per square inch. according to the class of concrete and the nature of the aggregate used; but this is easily overcome by using reinforcement in the compression area. always remembering that the value of steel in compression is 50 per cent. less than that of the same in tension. Here also the question of rigidity to resist deformation under compression is important, exactly as it is in columns and struts, and care must be taken that all the separate members in compression are properly braced together to avoid the tendency to spread in any direction, but particularly sideways and downwards. Even with ordinary beams supporting floors this question of the available area of concrete in compression demands consideration, but, the floor and beam being all in one solid piece, not only does the part of the floor immediately over the beam contribute to the desired area, but portions of the floor on each side of this are available also, thus enabling us to regard the beams as of T section, as shown in Fig. 6, but except under special conditions of loading, the breadth of floor which we can consider for the purpose of this calculation should not exceed four to six times the breadth of the beam itself, according to the class of concrete and the nature of the aggregate used. But even with this reservations this fact of the beams and floors being solid together enables a wonderfully strong and light structure to be obtained. The same diagram also shows in closer section an additional means of obtaining this larger area of concrete in compression, namely, that of making fillets at the junction of the beam with the floor.

Another point to be remembered is that temperature stresses must be carefully guarded against and that extra reinforcement, in fact, increased scantlings over all, must frequently be adopted for this purpose, as the co-efficient of expansion of steel and of concrete is practically the same. In structures such as bridges these variations due to the temperature can be arranged for the ordinary hinges or expansion joints (of which the latter can be very rapidly and effectively made with thick sheet-lead, the area being such that no pressure it will experience will cause it to "squeeze out"), but in the case of structures where such are impossible, as for instance, in an exposed tank or bunker or silo, the only remedy appears to be a general increase in strength, particularly by means of increased reinforcement, and, although perhaps contrary to theory, this method has proved perfectly successful.

Centring.

With reference to the design and erection of forms or centring for keeping the soft wet concrete in place till it is properly set, there are two main conditions which must always be fulfilled. Firstly, it must be so supported and stayed that neither the weight of the concrete, nor the ramming of it, can make the centring bulge or sag; and secondly, it must be as close-jointed as possible, otherwise the water will leak out and carry with it an appreciable amount

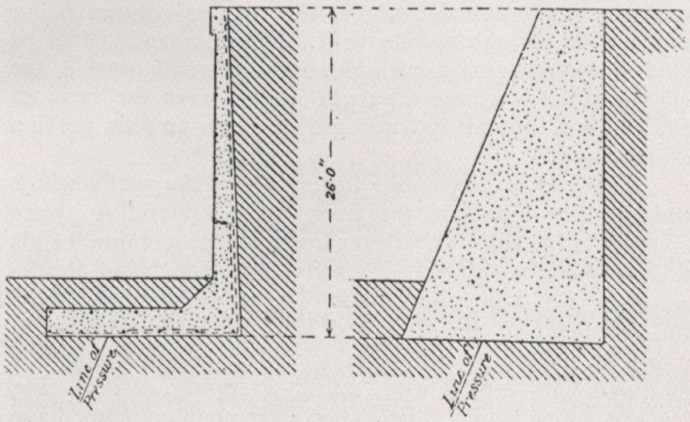


Fig. 7.—Comparison between Amount of Material required and useful space occupied in Mass Concrete and Reinforced Concrete Dock or Retaining Walls.

of cement, which will weaken the structure. There are many methods of obtaining a smooth face on the finished concrete, such as painting the boards with oil or whitewash, or any material to prevent the concrete adhering to them, but, given fair flush joints in the woodwork, the passing of a thin piece of sheet steel (an old hand-saw with the teeth ground off is excellent for this purpose), between the concrete and the boards gives perhaps the best result whenever the general arrangement permits of its use. When work is to be floated or rendered, a rough surface is, of course, desirable.

The question of centring leads naturally to that of the length of time it should remain in place. The author is frequently asked to state his opinion on this in general, but no general or hard-and fast rule is possible—on some jobs or portions of them, 24 hours is ample, on others six weeks is too short. Much depends on the weather, particularly on frost, and much on the over-all scantlings of the various pieces, but, most of all and beyond everything, on experience; in fact, there is no material where experience on the part of the constructors is more important than in all matters connected with reinforced concrete or where more disastrous consequences are likely to follow the lack of such experience.

A contractor with considerable resources in the way of plant and materials is also very advisable. It is not long ago since a somewhat serious collapse occurred in a job where the concrete was put in on a Friday and the centring struck on the Monday, as the contractor had not, and could not get, any more timber.

Methods of Using.

Buildings in General.—All buildings should be of skeleton framework construction. The spaces or panels between the columns and beams can be ⅛ in., filled in with reinforced concrete or with brickwork, or the whole frame covered with a skin of stone or brick; but as the main strength is in the frame, such panels can be quite thin, in fact, only of such thickness as is needed for dryness, not for strength, which results in a large increase in floor area, particularly in the lower storeys, where, otherwise, the walls would have to be of considerable thickness.

Boats and Barges.—These have been successfully built for several years, and, provided several are ordered of one size, that is, made off the same moulds, they are very much cheaper than steel.

Chimneys.—From current quotations these certainly appear to be cheaper than the same in brickwork, and, of course, do not need pointing; but there may be a difficulty when one needs to be felled, as at present it is not known how to bring one down in a small area. It is, however, a simple matter if there is space available for the chimney to fall in one length.

Drain and Sewer Pipes.—Many miles of these have now been laid and are giving great satisfaction both as regards first cost and upkeep. Great care is, however, necessary in their manufacture to ensure the reinforcement, both longitudinal and circular, being exactly in its correct position, otherwise there is a great risk if the sewage or water reaching some of the metal and the life of the pipes being therefore very short. One of the great advantages of reinforced concrete sewer pipes—particularly in bad ground, for instance, over old mine workings—is that they do not cost any more per yard when made in long lengths, up to, say, 18 ft. if required; thus about 75 per cent. in the number of joints is saved, and they are able to carry the weight of themselves and contents over spans practically equal to their own lengths. The same remarks also apply to water pipes.

Dock, Retaining and Reservoir Walls.—The author has already noted the saving in space in buildings due to the use of reinforced concrete, and the illustrations in Fig. 7 show that such is even more the case with these walls, the one being in reinforced, and the other in mass concrete. Both are drawn to the same scale and calculated for the same strength with the same factor of safety.

Engine and Dynamo Beds. — Probably many readers will remember the case of a large and important hotel in London having its own electric installation, where the vibration from its large turbo-alternator sets was a cause of serious complaint, notwithstanding the use of many different forms of soft anti-vibration materials beneath the beds. Finally, reinforced concrete bedplates were tried, the same being practically replicas (in plan) of the cast-iron ones, which rested on them, but only about 8 in. thick. These reinforced concrete bedplates are very carefully reinforced, and are only supported at points, that is, they do not rest directly on the old solid stone beds. The result has been very satisfactory, the difficulty of the vibration having been entirely eliminated.

Fence Posts.—The use of these is increasing very rapidly, but up to the present they are rather handicapped by the want of a cheaper method of attaching the wires to them, the ordinary hooks or staples being practically inadmissible, as they get bent and broken when the posts are bundled for carriage, and clips and bands or screw-plates are costly.

Magazines for Explosives, etc.—Owing to its practically absolute fireproofness, reinforced concrete is particularly suitable for these structures, and recent large and costly experiments in Germany have proved that even the explosion of huts containing 1½ to 2 tons of gelatine dynamite did no damage to their surroundings other than from the air blast. It was found that the reinforcement was only rent, but not scattered, and the concrete blown away in the form of coarse dust.

Piles, Piers and Jetties.—One of the principal points to bear in mind when considering the use of reinforced concrete piles is that they will safely carry about three times the load of such in wood of the same cross-sectional area; also, that they are no more difficult to drive; and, with reference to piers and jetties, the use of a material which does not deteriorate " 'twixt wind and water" is a matter worthy of very careful consideration.

Pithead Gears and Pit Props.—These being fireproof is their strongest recommendation, and the latter, if made hollow, are, strength for strength, but very little heavier than ordinary wooden props.

Railway Sleepers.—As the most important question in relation to these is their life, not their strength, nothing but time will prove whether the use of reinforced concrete at a somewhat higher cost than wood will be the more economical in the end, but about five and a half to six years' experience of sleepers in continuous service under heavy traffic and rolling stock so far show no appreciable difference from the day they were laid down, and a recent order for over 100,000 of such shows that they are being extensively adopted.

Painting.

The question of painting, although only now referred to, is one of vital importance with all reinforced concrete structures (other than buildings such as houses, offices, etc., which are usually plastered and papered), as it is well known that all naked steel and iron work deteriorates rapidly from rust and corrosion unless it is periodically very carefully scraped and painted. Even when this is done, the amount which is, rightly, deducted for depreciation in the case of a valuation for sale, transfer, mortgage or similar, is very marked, in addition to the actual cost of such scraping and painting. This is particularly the case with bridges, owing to their exposed position, and the expense of painting them is frequently considerably increased by the extra cost of the necessary cradling and scaffolding. All this is eliminated in the case of reinforced concrete, which increases in strength with age, and is not subject to depreciation, nor are painting or scraping or other methods of preservation necessary. In fact, when comparing the cost of a reinforced concrete structure with that of a similar one in other materials, it is quite a good rule to work out the cost of the painting and upkeep, and, having capitalized the same at a rate per annum (say, 1 per cent. over the current bank rate), to deduct this sum from the estimated cost of the reinforced concrete in order to place both propositions on an equal basis for purposes of comparison.

Since going to press we have learned that Mr. W. E. Wagner, Toronto, Ont., has been granted a Canadian patent on his System of Concrete Construction, described elsewhere in this issue. The patent No. is 120530.

A REINFORCED CONCRETE BUILDING OF UNIQUE DESIGN.

A reinforced concrete building of unique construction, appropriately called a cantilever system, now under construction at East Third Street, Los Angeles, Cal., is described in a recent issue of "Concrete."

The floors of this building are supported on columns dividing the floor area in 18-in. panels; the columns are supported on reinforced footings, which are almost flat. The top of each footing, however, is cast in an inverted hopper 8 x 8-in. and 18-in. deep. These inverted hoppers are turned upright and used at the neck of each column just under the floor slab, forming the footing for the corresponding column above. This differs from the several "mushroom" types in that in the latter the reinforcing rods are bent into the head and neck of the column, while in the system described here the base of the column is made in the ordinary way with circular wrapped reinforcing and rods started from dowels secured in the top of the footing, while the head of the column has reinforcing projecting through the column from either side, making cantilever arms in six directions, and the floor slab is supported on these cantilever brackets, which are, as stated, 8-in. square and 18-in. deep. Over the cantilever arms the floor slab reinforcing extends in all directions, the head of the column being made wide enough to receive it. The floors may thus be said to have beams 8-in. wide, since the slab steel is the strongest as it passes at right angles over the head of the column, but no extra depth is given to this portion of the floor.

There is a continuous batter along the walls which reduces the span of the floor slabs extending from columns to walls. Cantilever rods in the column heads are formed with 20¾-in. rods and the steel in the columns is of 1-in. round rods. The columns extend from the basement to the roof, and have the rods retained in wrought iron bands. The circular column steel is wrapped with No. 3 wire, spiral wrapping, the spacing for the wires being 2 ins. The basement columns have 20 1-in. rods; the first and second storey columns have 16 1-in. rods. These rods are joined near the floor line in each case by using pipe sleeves in the ordinary manner. Reinforcement for floor slabs is of ⅜-in. twisted steel rods rising at right angles to the column heads and American steel wire mesh of No. 3 wire, spaced 4-in., running diagonally across the column head.

The walls are 12-in. thick for all side and rear walls, and 16-in. for front walls. The reinforcement for the wall is ⅜-in. rods forming rectangles 18-in. square. Column rods 1-in. in diameter are placed in the wall, making reinforced piers directly opposite each row of columns supporting the floor slabs. The stairways are all of reinforced concrete, and are formed on slabs 5-in. thick, and the treads and risers project above the slab. The reinforcement in the stair slab consists of ⅜-in. twisted rods 6-in. apart in each direction; the same applies to each floor. The balustrade is 4-in. thick and 2½-in. in height, and the reinforcement extends into the floor slab. The reinforcement in the building comprises about 400 tons of steel. The outline of construction in this building considerably simplified the forms and made a saving in lumber, since the column hopper forms forming the heads of the columns could be moved from floor to floor as the building proceeded, and the forms supporting the slabs were made in panels of uniform size and moved up for the pouring on each floor.

The forms for the stairways were made of a flat wooden panel for the under side of the slab and inverted wooden risers for the treads. The front of the building was marked into blocks by using beveled strips ½-in. thick by 1½-in. wide, these strips being nailed to the forms, dividing the blocks into rectangles 14 x 21-in. When the forms for the front of the building were stripped, the walls were cleaned and brushed with a thick coating of neat cement applied with a stiff wire brush. Cement used on the building totalled about 5,000 barrels. There are 37 columns, forming 18-ft. bays on each floor, the columns in the basement being 22-in. in diameter and on the other floors 20-in. The heights of the stories vary, that of the basement being 10-ft. floor to ceiling, first floor 16-ft., second and third 14-ft. high. This lack of uniformity, however, lengthened the time of construction, which was ninety days.

The various floors are shut off at the stairways by iron doors, closed by a system of weights and pulleys, utilizing pockets in the walls on side of the stairways. The concrete floors have been thoroughly tested. They showed a test of 500 pounds per square foot, which gave a deflection of ¼-in. only in the centre of an 18-in. panel. All work was done by day labor under the direct supervision of Architect W. J. Saunders, who was also the supervising engineer; A. J. Roberts was superintending foreman in charge of labor. The contract price is calculated at $50,000, and the methods of construction adopted have proven entirely satisfactory in all respects.

RECENT PATENTS.

The following are patents concerning cement machinery, products and appliances recently issued in the United States:—

Method and Apparatus for Making Culverts of Concrete. Henry Noah Baxter, Iowa.

Method of Manufacturing Concrete Reinforcing Frames and the Product Thereof. Paul E. Bertin and Rene L. Bertin, New York, N.Y., assignors to Reinforcement Supply Company, New York, N.Y.

Cement Cistern Mold. Newman Bronhard, Toledo, Ohio.

Burial Vault. John D. Fowler, Junction City, Ohio, assignor of one-half to John H. Kuhlman, Springfield, Ohio.

Mold. John R. Haldeman, Springfield, Mo.

Permanent Concrete Form. Michael D. Murray, West Homestead, Pa., assignor of one-half to Patrick O. Gara, Pittsburg, Pa.

Reinforced Concrete Post. Jacob H. Carpenter, Reading, Pa., assignor of one-third to James R. Yost, Wyomissing, Pa., and one-third to Rufus R. Yost, Sinking Spring, Pa.

Apparatus for Making Concrete, Mortar, and the Like. Lemon M. Reed, Cleveland, Ohio.

Process of Making Concrete or Cementitious Compounds. Lemon M. Reed, Cleveland, Ohio.

Fireproof Structure. Charles W. Denny, Philadelphia, Pa.

Metal Lath. Elmer A. Wilson, Niles, Ohio.

Wall Tie. Jacob H. Coffman, Philadelphia, Pa.

Centering Mold. James E. Moody, Essex, Ill.

Expanded Metal Fabric. Norris E. Clark, Plainville, Conn.

Fence Post, Telegraph Pole, and the Like. Herbert L. Stillman, Westerly, R.I.

Cement Block-Making Machine. Herman Besser and Jesse H. Besser, Alpena, Mich.

Building Construction. John C. Pelton, San Francisco, Cal.

Construction Member. John C. Pelton, San Francisco, Cal.

Apparatus for Constructing Concrete Pipes. Frank Teichman, San Francisco, Cal.

Concrete Mixer. James W. Stuart, Freeport, Ill.

Fitting for Concrete Casings. Frederick A. Koetitz, San Francisco, Cal.

CONCRETE BLOCK COTTAGE.

The cottage building shown was built by T. Lewis & Son, contractors, Hamilton, Ont., at that city. It is 36 feet by 24 feet 8 inches, and is built entirely of con-

A Hamilton, Ont., Block Cottage

crete blocks, with verandah columns of concrete 10 inches in diameter. It contains six rooms, and is of a particularly pleasing appearance and design.

THE INDEPENDENT PORTLAND CEMENT CO.

The application for charter by the Independent Portland Cement Company is at the present time being made. The capitalization will be $10,000,000, and will take in the remaining ten plants in Ontario. These are all marl plants, and include the following:—The Brant Portland Cement Company, Brantford, $500,000; Colonial Portland Cement Company, Wiarton, $800,000; Hanover Portland Cement Company, Hanover, Ont., $500,000; Imperial Portland Cement Company, Owen Sound, $300,000; Sun Portland Cement Company, Owen Sound, $500,000; Grey and Bruce, (St. Mary's Company), Portland Cement Company, Owen Sound, $500,000; Western Ontario Portland Cement Company, Atwood, $500,000; Superior Portland Cement Company, Orangeville, $500,000; Bell's Lake Portland Cement Company, Markdale, $500,000; Ontario Portland Cement Company, Paris, $450,000. Mr. J. R. Roaf, Toronto, is solicitor for the new company. The head office will be at Toronto. As soon as the charter has been obtained officers will be elected and operations commenced. Future developments will be watched with great interest by all, as the future of the cement industry in Canada will be entirely in the hands of those two consolidated companies.

Canada's Largest Industrial Consolidation.

CANADA CEMENT COMPANY, LIMITED, WILL CONTROL TWELVE PLANTS SITUATED IN DIFFERENT PARTS OF CANADA—TOTAL OUTPUT OF OVER 4,500,000 BARRELS PER YEAR.

An indication of how rapidly the industries of Canada are developing is afforded by the announcement of the completion of The Canada Cement Company, which will represent the largest industrial consolidation that has ever been effected in Canada. Within the past couple of years it has been apparent that there were decided advantages to be gained through the consolidation of the different properties and for some months past the leading financial interests of Montreal and Toronto have been trying to arrange terms with the different companies to enter into the merger. A few weeks ago it became apparent that their efforts would be successful when a number of the leading plants were either absorbed or contracts made by which the controlling interest in the stock was secured. It was not, however, until the last few days that it was known that practically all the largest concerns had been secured and that the merger would thus be rendered a very complete one.

The ten companies that have been secured are as follows: The International Portland Cement Company, Ltd., Hull, Que.; The Vulcan Portland Cement Company, Montreal, Que.; The Lehigh Portland Cement Company, Belleville, Ont.; The Canadian Portland Cement Company, Marlbank, Ont.; The Canadian Portland Cement Company, Ltd., Port Colborne, Ont.; The Lakefield Portland Cement Company, Montreal, Que.; The Lakefield Portland Cement Company, Lakefield, Ont.; The Owen Sound Portland Cement Company, Shallow Lake, Ont.; The Alberta Portland Cement Company, Calgary, Alta.; The Belleville Portland Cement Company, Belleville, Ont. In addition, The Canada Cement Company, Ltd., by means of contracts already made, proposes to acquire the majority of the shares of the capital stock of The Western Canada Cement and Coal Company, Ltd., Exshaw, Alta., and the Eastern Canada Portland Cement Company, Quebec, Que.

The plants which are owned and controlled by the new company are regarded as being among the best constructed and most efficiently equipped on the continent, and it is expected that on account of central management not only will a uniform standard of quality be secured in the combined product but an equitable standard of prices will be maintained throughout the whole country. Of the output the various plants are showing at the present time it is expected that the whole capacity of all the plants for the year 1909 will be in excess of 4,500,000 barrels.

According to the returns made to the Dominion Government by the cement manufacturers the average price obtained by them in 1908 was $1.39 a barrel. In 1906 the average price was from $1.65 to $1.70, and in 1907 about $1.60. At the beginning of the present year it was realized by a number of the manufacturers that even without any increase in price the business could be rendered much more profitable by the merger. Of several of the large competing companies on a conservative basis The Canada Cement Co., Ltd., is the outcome. The new company will own or control cement-producing plants at the central points of distribution from the St. Lawrence River west to the Rocky Mountains, and will be able to regulate the distribution of the manufactured product from these central points to the centres of consumption, while economy in the present cost of freight will undoubtedly be effected. The establishment of one executive office in the city of Montreal and the elimination of competing salesmen, middlemen and brokers should also enable the company to effect a considerable saving in the costs of the sales department.

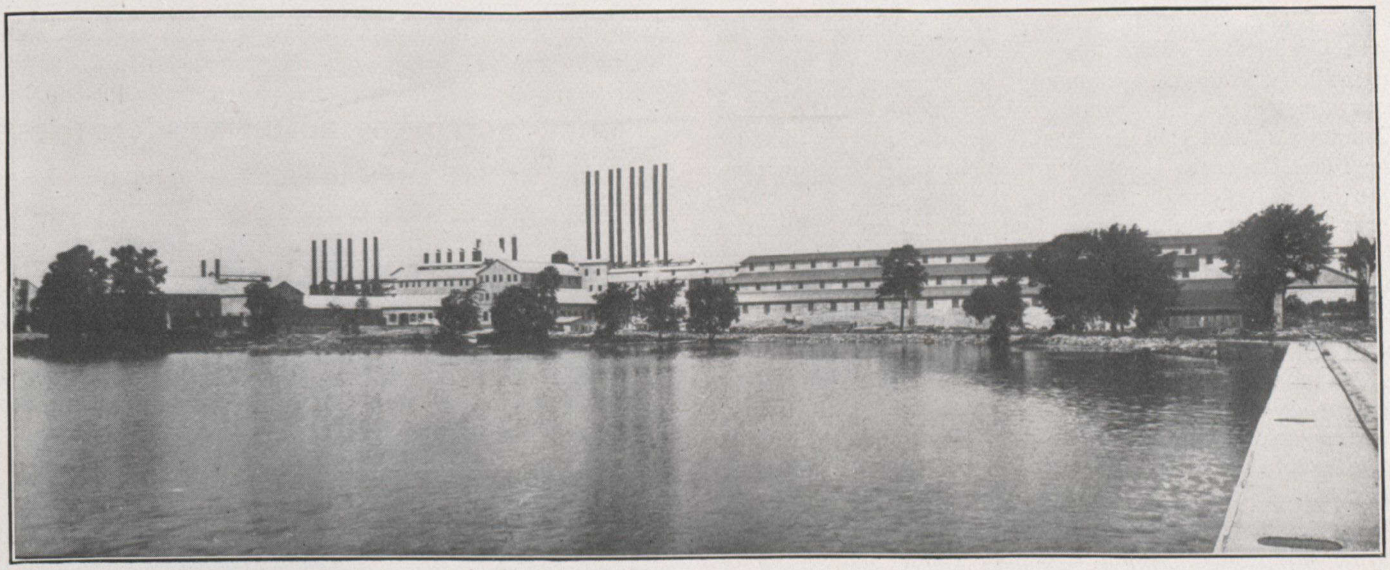
The Vulcan Portland Cement Company's Plant, Montreal, Que., included in the Consolidation.

Some idea of the way in which the demand for Portland cement has increased in Canada during the past five years may be obtained from the statistics of the Dominion Government. They show that in 1904 the whole consumption of Portland cement in the Dominion was 1,694,988 barrels of which 784,634 barrels were imported. In 1908 the consumption, notwithstanding the general industrial depression, was 3,134,338 barrels, and no less than 3,495,361 barrels were manufactured in Canada. Existing trade companies indicate that the trade for 1909 will largely exceed that of 1908. The increase is not abnormal nor due to local causes. In the year 1888 it is estimated that less than 200,000 barrels of cement were manufactured on the North American continent, and the enormous growth of the business is shown by the fact that in 1908 approximately 55,000,000 barrels were there produced. The manufacture of Portland cement commenced in Canada in 1888, but until 1904 the importation in Canada of the foreign product exceeded the Canadian production. The report of Mr. John McLeish, B.A., Chief of the Division of Mineral Resources and Statistics of the Department of Mines, Ottawa, on the production of cement in Canada during the calendar year 1908 furnishes the following comparative statement: In 1904 the number of barrels manufactured in Canada was 908,990, and the amount imported into Canada was

784,630, while the whole consumption in the same year was 1,694,988 barrels. In the year 1908 the number of barrels manufactured in Canada was 3,495,961 and the number of barrels imported was 469,049, while the whole consumption was 3,134,338 barrels.

Great as has been the development of the Portland cement industry in Canada since 1904 it is only reasonable to assume that this growth will be largely exceeded in the immediate future and for many years to come. The enormous public works in progress and in contemplation including railways, canals, bridges, harbour improvements, piers, wharves, docks, pavements, building foundations and buildings, etc., will all require proportionately large quantities of the manufactured products. The hydro-electric development throughout the country will increase the demand, while the rapid substitution of concrete for other materials in the building trades will render necessary an increase in production on the part of the new company. The board of directors of the new company is most representative. It is one of the most representative that has ever been gathered in Canada, representing as it does interests not only from all the important financial centres but also from the men who have been identified with the cement industry in Canada ever since its inception. In this way Toronto and Montreal gains its right to representation on the board by the part played by other leading financiers while other centres obtained representation because of the active part they have played with different plants that are now included in the consolidation. The board of directors is as follows:—

Sir Sandford Fleming, K.C.M.G., Ottawa, Director of The International Portland Cement Company, Ltd., and of The Canadian Pacific Railway Company; J. M. Kilbourn, Montreal, President of Lakefield Portland Cement Company, Limited; J. R. Booth, Ottawa, Director of the Grand Trunk Pacific Railway Company; George E. Drummond, Director of The Molsons Bank; J. S. Irvin, Ottawa, Managing Director of The International Portland Cement Company, Ltd.; Hon. W. C. Edwards, Ottawa, Director of The Canadian Bank of Commerce; W. D. Matthews, Toronto, Director of The Canadian Pacific Railway; R. W. Kelly, New York, President of The Vulcan Portland Cement Company, Ltd.; Hon. Robert Mackay, Montreal, Director of The Canadian Pacific Railway; W. R. Warren, New York, Director of The Vulcan Portland Cement Company, Ltd.; W. H. E. Bravender, Calgary, Vice-President, The Alberta Portland Cement Company, Ltd.; E. M. Young, Allentown, Pa., Vice-President The Lehigh Portland Cement Company; Hon. George A. Cox, Toronto, Director of The Grand Trunk Pacific Railway; W. M. Aitken, Montreal, Director, The Montreal Trust Company; Charles H. Cahan, K.C., Montreal, President, The Western Canada Power Company, Ltd.. The Bank of Montreal are the bankers for the new consolidation and The Royal Trust Company, transfer agents, and The Montreal Trust Company, registrar.



The Plant of The Lehigh Portland Cement Company, Belleville, Ont., also included in the merger.

CONCRETE MEN AT TORONTO INDUSTRIAL EXHIBITION.

Contrary to expectations, concrete men at Toronto's annual Industrial Exhibition were not entirely pleased with the arrangement accorded them by the management. An effort was made some time ago to have these interests concentrated at one portion of the grounds or in a section of one of the larger buildings. Consideration was promised by the management and concrete men were hopeful of making better displays throughout, as well as presenting a united front. There were eight or nine companies in all making exhibits. The Ideal Concrete Machinery Company, Wettlaufer Bros., and Gustiana Bros. were located under the main grand stand. The remainder occupied outside positions in the northern portion of the grounds. All the exhibits were of a high order. All the latest machines and improvements were demonstrated, and many new and interesting ones were shown. Among the firms making an exhibit at the Industrial for the first time were the Cement Tile Machinery Company, who have a large plant at Chatham, Ont.; The Peerless Brick Machine Company, of Minneapolis, who are manufacturing in Toronto.

Messrs. Wettlaufer Bros., with Toronto office at rear 262 Yonge Street, found their inside space inadequate for the demonstration of their mixers, and so took up outside space as well, where they demonstrated their sidewalk mixer, run by gas-engine and equipped with automatic lift hopper. Their main exhibit consisted of their mixers of all grades from hand to traction mixers, as well as concrete, brick and block machines.

The application of concrete construction to meet the demands of the beautiful in architecture was strikingly shown in the excellent exhibit of the Ideal Concrete Machinery Company, Ltd., of 211 King Street, London. A concrete verandah formed the principal part of the display. The verandah, which was of imposing design, with Corinthian pillars, heavy rubble-faced piers and a magnificent staircase ornamented by Grecian lawn vases, was constructed entirely of concrete made at the Ideal Company's works in London from machinery made by the Ideal Concrete Machinery Company. The main portion of the verandah, including the staircase, was made from imported white facing sand and cement, while the fine ornamental work, including the columns, caps, rail pillars and bases, had an admixture of white cement. The finish was as smooth and perfect as if it came direct from the mason's chisel.

Gustiana Bros., Hamilton, Ont., exhibited their cement tile flooring, in plain colors as well as in various color designs. These tiles are claimed to be waterproof, fireproof, antiseptic, and to posses the hardness of marble. The Cement Tile Machinery Co. had in operation a cement tile machine driven by gas-engine, which demonstrated the manufacture of cement tile. This company recently erected a large factory at Chatham, Ont., for the Canadian trade. The main factory at Waterloo, Iowa, has been taxed to its capacity in order to supply the demand throughout the States during the past few months. The Peerless Brick Machine Company, of Minneapolis, who recently commenced the manufacture in Toronto, demonstrated their Peerless Brick Machines. This exhibit was in charge of Mr. T. V. Thayer, president of the company. They intend to establish their Canadian office at Toronto; meantime all Canadian business should be directed to Minneapolis, Minn. The London Concrete Machinery Company had on exhibition their usual large line of concrete machinery for all purposes, including mixers, block, brick and tile machines, side moulds, etc. The exhibit was in charge of Mr. Henry Pocock, president of the company.

W. D. Beath & Son, Limited, Toronto, exhibited a sample of their triangle mesh concrete reinforcement. During the last five weeks they have sold over 500,000 square feet of this material. It is being used at the transformer stations at Niagara Falls, Dundas, St. Thomas, Woodstock, Paris and Preston. This mesh is made in two hundred different styles and widths. The company showed their new overhead carrying system, in the manufacture of which are included the most up-to-date devices for transportation.

The Roman Stone Co., Marlborough Ave., Toronto, had their usual interesting exhibit of Roman Stone for all classes of ornamentation and building purposes. John T. Hepburn, Yonge Street North, Toronto, made an interesting display of concrete block and brick machines, as well as concrete moulds for special work. This company also carry and manufacture a large line of contractors' supplies, such as cranes, stone hooks, wire rope, stone cutting tools, etc. Mr. John Hepburn was in charge. Clarence W. Noble had a particularly pleasing and interesting exhibit of builders supplies, etc. This exhibit was situated under the main grand stand. In numbers the concrete exhibits were about equal to those of a year ago, and reports would indicate that business transacted compared quite favorably with that of past years. There will doubtless be a move in the near future on the part of cement men towards concentration of these interests at Toronto's Industrial Exhibition. In order to present a united front it will be necessary for all to work together. There was no noticeable change in arrangement this year over other years in spite of the desire expressed by the management to arrange matters satisfactorily.

BRICK BUILDINGS SOMETIMES COLLAPSE.

The six-storey brick warehouse owned by the J. C. Wilson Paper Company, of Montreal, on McDermot Avenue, Winnipeg, was wrecked July 26th, under the weight of an 88-ton fire tank, which was placed on the roof six months ago. The damage will amount to about $30,000.

The building was of mill construction design, the outside walls of brick, two bricks thick, and the partitions, floors, posts and stringers of wood.

A Six-storey Brick Warehouse, Winnipeg. Manitoba, which Collapsed on July 26th.

The walls were 21 inches thick at the basement, tapering to 17 inches in the centre, and 13 inches at the top. The weight of the tank filled was 175,000 pounds.

The water tank on the top of the building was supported on four legs resting on steel girders, and was directly over the corner of the building which fell. Three of the legs rested upon the walls and the fourth on a column which still remains standing. Persons who witnessed the accident, state that the huge tank dropped through two floors before breaking.

The Setting of Portland Cement.

A PAPER PRESENTED BEFORE THE CONCRETE INSTITUTE—RESULTS OF RESEARCH WORK—PRACTICAL RESULTS OF COMPETENT INVESTIGATORS.

(Concluded from August Issue.)

Aeration Methods.—In view of the fact that this simple method of aeration in bulk could not be successfully applied to cement manufactured on the new system, many attempts were made to accomplish the most important part of natural aeration—i.e., the absorption of water, by artificial means, such as passing the ground cement through a moist atmosphere, or by blowing moist air through the cement in bulk. These methods, however, were not found to be wholly successful—firstly, from the physical and mechanical difficulties which presented themselves by reason of the partial setting of the finest portions of the cement, with the consequent blocking of any apparatus used for the purpose, such as revolving drums, distributing discs, conveyor screws, and scrapers, and the like; and, secondly, in the author's opinion, for the much more important reason that, in order to accomplish the desired result in a short space of time, it was necessary to submit the cement manufactured by the rotary process (all of which consisted of finely reduced particles of the pure calcined clinker) to a moist atmosphere at a comparatively high temperature, as distinct from the normal temperatures under which all the previous attempts at artificial aeration had been carried out.

"Tube Mills."—In order that this might be accomplished, and the cement submitted to a moist atmosphere at a high temperature, in which the action of the water vapour upon the particles of clinker might be rapid and effective, a process was introduced in which advantage was taken of the peculiar construction of the mills chiefly used for completing the reduction of the cement to a fine powder in enclosed revolving cylinders, known in the trade as "tube mills," which contained as their grinding media a heavy charge of steel balls or flint pebbles.

Tube Mill Experiments.—The cement introduced into these mills for the purpose of finishing was in a coarsely ground condition, having previously been dealt with by some form of preliminary grinder, during which process, owing to the friction entailed, the temperature of the material was raised to a point ranging between 140° and 160° Fahr. The friction due to the action of the attrition of the steel balls or flint pebbles against themselves, the sides of the mill, and the pasing cement, caused the temperature in the tube mill to be still further increased, and it was at this point where moisture was introduced in the form of a regulated supply of steam, which still further increased the temperature and enabled it to be maintained at a point above 180° Fahr., at or above which temperature the operation is most successfully conducted, and the cement operated upon was made to take up uniformly throughout an amount of water, in practice about 1 per cent. or a little under, with which it combined chemically, and which could not be expelled except by ignition.

The thoroughness of the process will be realised when it was understood that the time of passage through the tube mill was about two hours, and that each particle of cement was being continuously submitted for that period of time to a moist atmosphere acting upon its surface, which latter was removed by the attrition of the balls or pebbles, exposing a fresh surface upon which a similar action took place, until the whole left the mill at a temperature which had been gradually increasing until the operation was complete. In this way the operation of exposure to moisture was accomplished at a temperature above the critical point necessary for the purpose, and in such a manner that no mechanical difficulties presented themselves in the blocking of the machinery or apparatus.

The facts mentioned in reference to the importance of carrying out the process at or above a certain temperature were not generally known.

Adding Gypsum.—Now let them return to the other method of retarding the setting time known to the ancients—i.e., the addition of gypsum to the product of the intermittent kiln during or after the process of grinding.

With this class of cement, containing already sulphates equivalent to about 1.5 per cent. SO_3, derived, as previously stated, from the sulphur compounds in the fuel, it was generally sufficient to add 1½ per cent. of gypsum to obtain a slow-setting cement; the effect, however, in most cases was only transient, as it was well known that the effect of aeration, even when the cement was packed, almost invariably resulted in such cement returning first to its original quick-setting condition before subsequently becoming slow-setting, and largely inert through excessive exposure to the atmosphere. This peculiarity of cements slowed by gypsum had been the cause of much difficulty to the manufacturer, and many conflicting theories were propounded as to the cause of such reflex action.

Slow-setting Cement.—A hydrated slow-setting cement containing 0.95 per cent. of SO_3, of which only 0.35 per cent. was added, retained this property of slow setting for long periods in commercial packages, as it was also known to do when stored in bulk.

It was difficult to give any definite chemical or physical explanation of the fact that the presence of as little as 1 per cent. of combined water in cement, which had been taken up at a high temperature, should not only in itself have the effect of appreciably slowing the setting time, but that when present in conjunction with even small percentages of gypsum the slowing effect of the combination was maintained.

The presence of 1 per cent. of combined water had also an enormous influence on the action of cement when tested for soundness under the boiling test, more particularly under the method invented by Le Chatelier and now usually adopted, by which method and with which apparatus it was thought the actual expansion of the cement could be measured.

By means of the steaming process described the proportion of gypsum required to be added to produce a slow-setting cement was much reduced, and if advantage were taken of the greater solubility of plaster of Paris ($CaOSO_3$ $\frac{1}{2}H_2O$) over that of raw gypsum ($CaOSO_3$ $2H_2O$) the quantity of SO_3 introduced into a cement might be reduced to a minimum.

Gypsum Effects.—The author had referred to this subject on former occasions. Inasmuch as the effect of gypsum in retarding the initial set of cement depended upon the rapidity of solubility in the period immediately after the addition of water, and the quantity that could quickly be brought into solution (in which condition it was alone active), it followed that the form of gypsum having this property most developed would be the most effective. The quantity required to produce like results when plaster was used might be one-third less than with gypsum, and this was important in view of the known defects produced by the addition of gypsum to cement, more especially if the cement was to be deposited under water (more particularly sea water) before setting commenced.

Le Chatelier's Test.—Le Chatelier, in a paper read at the meeting of the International Testing Association at Brussels, describing the behaviour of cements in sea water, said: "By introducing important quantities of calcium sulphate into hydraulic cements, it is possible to bring about their disintegration at more or less rapid speed; and, as a rule, destruction proceeds faster when the material is in the sea than when it lies under fresh water.

It was important, in view of the chemical action which was said to take place between the added sulphate of lime (gypsum) or the soluble constituents of sea water, with the aluminate of lime in the cement, forming a compound said to be sulpho-aluminate of lime, that the amount of added gypsum should be kept as low as possible.

The action referred to by Le Chatelier was continually in evidence with all cements to which more than 2 per cent. of gypsum had been added to retard the setting time, when such cements were tested by the accelerated methods for determining the ultimate soundness, more particularly when they were subjected to the primary stages of that quantitative boiling test which appeared in most specifications, introduced by Le Chatelier himself, and which bore his name.

This test was designed with the object of detecting rapidly any inherent unsoundness in cement, so that a knowledge as to the constancy of volume of any cement might be obtained previous to its use in the work.

To those who had much experience in the orthodox working of this apparatus it was apparent that the conclusions drawn might frequently be entirely fallacious, and many perfectly sound cements thereby rejected, while others of doubtful quality for certain conditions of work were not detected.

Expansion.—In adopting this test the fact seemed to have been entirely overlooked that many cements, more especially those containing over or about 2 per cent. of gypsum, were found to expand considerably during the primary immersion in cold water, and might show but a slight further expansion during the second, or boiling, stage of the operation. Such cements would be passed as satisfactory by this test, and no doubt many would prove to be so, if allowed to harden before immersion in water. It would seem, however, that as at present conducted the test entirely failed to detect (unless a record of the expansion during the cold water immersion was included) a cement containing an unsafe percentage of gypsum, which cement might be required for work where the concrete was of necessity deposited under water immediately after gauging.

The period of immersion before boiling stipulated in the Le Chatelier test was a very important factor in affecting the results, and appeared to be entirely arbitrary. It might be that certain cements, perfectly sound in cold and in boiling water, and especially those of a very slow-setting character, would fail to pass if boiled twenty-four hours after gauging, whereas at thirty-six or forty-eight hours, or even longer, the results might be perfectly satisfactory.

Causes of Expansion.—Now as to the causes of expansion of certain cements when boiled, this might be due to (1) an insufficient reduction and amalgamation of the raw materials; (2) incomplete or irregular calcination; or (3) a predominance of small unground particles of clinker in the finished cement. The Le Chatelier test was designed to guard against the results of such irregularities in the course of manufacture, and as regards points 1 and 2, was useful and effective, as unsoundness due to either of these causes might subsequently develop, causing disintegration. The expansion under these circumstances was probably due entirely to chemical causes, resulting either from unbalanced proportions of the raw materials, possibly also in an unsuitable mechanical condition, refusing to form during calcination a chemical combination of the same uniform character as would be the case if chemically balanced and thoroughly amalgamated; or, given a satisfactory raw material in all respects, the expansion or boiling might be due to the fact that during calcination the raw material, either wholly or in part, might not have been brought up to the requisite temperature at which the principal compounds constituting Portland cement were formed.

Unground Particles.—The expansion, however, due to the third cause—i.e., the presence of unground particles of well manufactured clinker, came under a different category, for the material causing expansion was of identical composition, and had the same chemical and physical properties as the finer-ground portions of the cement, which latter, per se, were entirely free from expansion when boiled. The cause in this case was rather more of a physical character than a chemical one, although it must be admitted that the hydration of the particles of clinker at the high temperature, which in the author's opinion was the cause of the expansion in this case, was a chemical process.

It was evident that the mere reduction of the clinker to a fine powder did not in any way change the chemical composition of the cement, and if any difference was noticeable under the Le Chatelier boiling test between a finely ground and the same coarsely ground clinker, the former being perfectly sound and the latter showing expansion, this expansion must be due to the action of water at a high temperature on these particles.

Conclusions.—In the author's opinion the conclusions drawn from the results of tests under the Le Chatelier method, brought about through this latter cause, might be misleading, because it was assumed that these particles causing expansion consequent upon hydration at a high temperature would equally expand at normal temperatures, which had yet to be proved.

From experiments it would appear that the larger particles of clinker remaining even in a commercially finely ground cement, which were hydrated with expansion when in contact with boiling water under the Le Chatelier test, were also hydrated, and perhaps also with expansion, by contact with steam at a high temperature, although in a comparatively dry condition, during the process of grinding.

This would seem to be the logical reason of the fact tnat while cement manufactured from clinker chemically well balanced and thoroughly calcined would expand when submitted to the Le Chatelier test, it would not expand under the same conditions if it had been previously treated by the hydrating process.

Futile Methods.—Attempts had been made to use other materials for regulating the setting time, such as calcium chloride, sodium carbonate, etc., etc. but as far as the author was aware these methods have not proved commercially successful. At the present time the processes employed were practically confined to watering the clinker hydrating by means of steam during grinding, and the addition of gypsum. With these methods individually, or with a combination of same, cement could be produced having setting times suitable for all requirements.

Although the methods described made it possible to produce cement with definite setting properties, it must be remembered that the activity of the chemical process of setting was dependent upon the hygroscopic condition and temperature of the atmosphere or surrounding conditions under which concrete work was being carried out, a high temperature and a dry atmosphere tending to increase the rapidity of the set, and vice versa.

Conclusion.—Some tests indicating the change in the character of the setting time of cement due to temperature and atmospheric conditions, over which the manufacturer had no control, and which will always exist, were then referred to by the author, who thought their results should induce the engineer, architect, contractor, or other users of cement to supply the manufacturer with the fullest possible detail of the prevailing conditions under which the cement he purchased is likely to be used, so that the experience of those who have made this question a special study might be utilized to the full, and by the avoidance of failures thereby creating even greater confidence in the method of concrete construction, which, although developed of recent years to an enormous extent, was yet in its infancy.

THE LIMITATIONS OF CONCRETE.

It is time that the position of concrete in the field of building construction should be clearly recognized. Like most good and relatively new things, concrete was at first embraced as a superior substitute for almost everything built of wood or brick, but sober consideration in the light of experience shows that it, too, has its limits, although they are by no means as great as some would have us suppose—says Mr. M. C. Tuttle, in an exchange. It has already proved itself such a valuable addition to the building arts as to necessitate its consideration under all practical conditions.

First of all the selection of concrete as a building material must be based on its ultimate efficiency. It is clearly recognized that a well-built concrete mill will usually cost from 10 to 15 per cent. more than one of ordinary mill construction which is capable of supporting the same loads on floors and columns. Of course where the material and labor entering into concrete are exceptionally cheap, and where on the other hand the cost of heavy lumber and brick are exceptionally high, the concrete building may prove the cheaper. This condition is, however, so rare that general statements to the effect that a concrete building is cheaper than an equivalent brick building with wooden floors should, as a rule, be discounted or at least should be accepted only after careful investigation.

Not upon the basis of its first cost, but upon its endurance, its low maintenance charges, its fireproof features, and the rapidity of its erection, should the decision in favor of concrete be made. That these factors outweigh the slight excess of cost in the minds of progressive manufacturers is evidenced in the increasing use of reinforced concrete for manufacturing buildings. It was early objected that in the case of such buildings it would be difficult to attach shafting to the ceilings or machinery to the floors, and that the skeleton pier and window construction would add materially to the cost of heating in northern climates. Experience has shown these objections to be more imaginary than real. As an offset to the slight and usually immaterial increased cost of heating there will be a greater amount of daylight and decreased requirements in the way of artificial lighting.

It is a simple matter to provide in the construction for the easy attachment of shafting to walls or ceilings, and for adjustment thereon. Although there may be a little more difficulty in attaching machines to the concrete than to the wooden floor, but it should be recognized that this process is seldom repeated, and that a machine once set generally remains there.

CONCRETE SEWER.

The main sewer on Princess Street, Hamilton, Ont., from Sherman Avenue to Wentworth Street, is 24 inches diameter, and it was proposed to build this with fire clay pipe. All the other main sewers, being of larger diameter, were built of concrete. Before finally deciding on fire clay pipe in that section, 100 feet of 24-inch sewer was laid, composed of concrete, mixed 1:2:4, four inches thick, two-thirds of the sewer being constructed in the trench, the upper one-third was moulded on the surface and placed in the sewer after being properly set. The cost of this section of sewer was carefully kept in detail, with the result that the concrete sewer was found to be much cheaper than the fire clay pipe. Therefore, it was decided to construct a concrete sewer in this section.

Cost of 24-inch Diameter Concrete Sewer—Labor and Materials—100 Lineal Feet.

Labor.

Bottom, 2:3, 9 men 9 hours at 20c	$16 20
Bottom, 2:3, setting moulds, 3 men 9 hours at 20c	6 21
Top, 1:3, moulding, 2 men 18 hours at 20c	7 20
Setting tops	10 00

Material.

70 bags cement	$35 00
5 loads gravel (10 cubic yards)	10 80
Coal for mixer	1 00
Total cost for 100 feet	$86 41

Cost per lineal foot of concrete pipe sewer 24-inch diameter, 86 4-10c.

A Reinforced Concrete Elevator.

A NEW STRUCTURE RECENTLY ERECTED FOR THE BALTIMORE AND OHIO RAILROAD CO., AT BALTIMORE, MD.—PARTICULARS FURNISHED BY H. PRIME KIEFFER, C.E., 42 BROADWAY, NEW YORK.

The Baltimore and Ohio Railroad has just completed a large reinforced concrete storage elevator at their Mt. Clare Station, a suburb of Baltimore. This elevator embodies some interesting concrete work, and the structure contains a number of new features. It is interesting not only from its size but for the progress that it marks in the growing tendency to use concrete for mammoth structures.

The elevator was built for the Baltimore and Ohio Railroad Company by James Stewart & Company, contractors. It is a concrete and steel structure, and, therefore, fire-resisting, there being no wood whatever employed. As an elevator, it presents several unusual features, there having been no elevator ever built or designed on just the lines of this one.

The total capacity of the elevator is 250,000 bushels, divided up into 130 bins, varying in size from 1,000 to 3,000 bushels, but most of them are of the smaller capacity. The bins are rectangular and have concrete walls varying in thickness. The thickest ones are 8 inches and the thinnest are 6 inches. All are reinforced, both horizontally and vertically, by open-hearth, round steel bars, the horizontal bars being placed one and one-half inches from each side of the wall and are figured to resist the bending stresses of the grain pressure. The corners of the bins are reinforced with large fillets, which provide for the concentrated loads on the cupola. The bin bottoms are hoppered above the concrete slab, which, in turn, rests upon the concrete girders, the larger ones being three feet wide by six feet deep. The main columns of the basement, first and second storey, are 42-inch octagons and are reinforced by means of spiral, steel hoops and vertical steel bars.

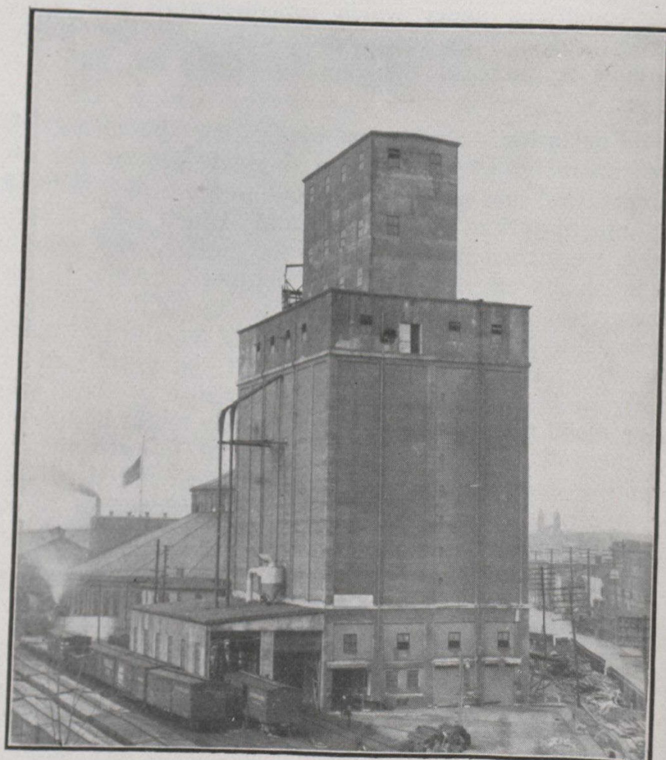
The concrete mixture was as follows: All walls 1:3:5; floor slabs, 1:2:5:4; cornice and projections, 1:2:3. A Smith mixer (No. 2½) was used, and Northampton, Dexter, Universal and Dragon cements were employed. The concrete was not waterproofed.

The foundation consists of a single, enormous concrete slab, extending over the entire area and projecting over several feet beyond the building line of the elevator. In order to get upon firm ground, which runs in strata on an incline, it was necessary to step the footings off from one corner to the diagonally opposite corner, increasing the thickness from about 6 feet to nearly 15 feet. This footing is reinforced by steel bars running in both directions under the columns on the top and bottom planes.

Wooden forms were used in all the work, and these were very heavy and well braced, owing to the heavy monolithic construction throughout. They were wet well before the concrete was poured. A set of movable forms were used in moulding the bins, and they formed an interesting feature of the construction. These forms were so constructed that they could be raised as the work progressed, and the four sides of each of the square bin forms, therefore, comprised four interior sides of one bin. A large number of these forms were employed, and, as they were always placed at the same level, they thus formed the walls of the bins.

The architectural effect of the outside of the elevator is improved over that of the usual plain elevator design by means of concrete pillasters, corners, gables, and mouldings. The enclosing wall of the cupola and train shed were made with Bnapp Bros. Manufacturing Company trusett metal lath, plastered inside and out with a two-inch coat of Portland cement. The framework of the cupola and train shed is of structural steel. The windows are galvanized-iron framed, with one-quarter-inch wire-ribbed glass. The interior doors are kalsomined and the exterior doors are corrugated galvanized steel of the roller type, provided with chain mechanism.

The elevator machinery is driven by Westinghouse, 60-cycle, 440 volt, A.C. electric motors, and the elevator is lighted by electricity. All machinery is of first-class



Reinforced Concrete Elevator, Baltimore, Md.

design and workmanship, being made for receiving, weighing in and out, handling and cleaning the grain, in addition to which there is a dust-collecting system and complete lines of steel spouting.

As previously stated, there are a number of unusual features to the elevator in its layout. The Baltimore and Ohio Railroad Company unload the cars, elevate the grain, weigh it and deposit it in bins. These bins are leased to numerous local dealers in Baltimore, who operate the bins just as if they were their own, sending in their teams and unloading them with grain sacked out from the bins.

For receiving purposes there are two tracks, each having two unloading pits of carload size, underneath; after the grain is unloaded by means of power shovels, the operator pulls a lever, thus opening the gate which allows the grain to be discharged on to a 30-inch rubber belt conveyor, below the car pits, and the conveyor belts transfer the grain to the bottom of the elevator legs which lift it to the top of the cupola. These belts are four-ply, Rob Roy, made by B. F. Goodrich & Company. From the head of the legs it is discharged into the garner and held until the weighman is ready. At the proper time he pulls a slide and allows the grain to drop into the scales from the garner.

There are two large Fairbanks hopper scales, each of a thousand bushels capacity, with printing attachment on recording beams.

After the grain is weighed it is discharged into any one of the bins directly from the scales, through spouts. Underneath the bins are two storeys, the upper one being the sacker floor where the grain is drawn off from the bins and sacked by means of eight, three-bushel automatic bagging scales. These scales are arranged two in a row on steel tracks which run under the bins. By means of these automatic scales, the operator may bag seven bags of three bushels each, every minute.

On the sacking floor there are three 24-inch belt bag-conveyors for carrying the sacks across the building and discharging to the teams underneath.

There are three driveways under the elevator and one along the side under the awning to accomodate teams. The elevator was built by James Stewart & Company, who also designed and made the plans, under the supervision of M. A. Long, architect, Baltimore and Ohio Railroad, and the entire work was executed under the general supervision of A. M. Kinsman, Engineer of Construction, Baltimore and Ohio Railroad.

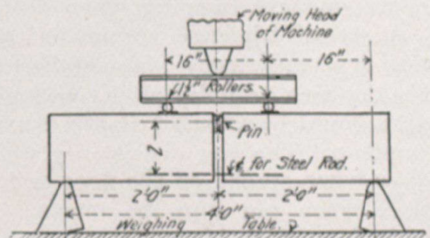
TESTS OF BOND OF STEEL BARS EMBEDDED IN CONCRETE BY THREE METHODS.*

Most tests of bond have been made by pulling a bar of steel out of a cylindrical block of concrete. Another method is to push the bar out of the block. Neither of these approximate the conditions existing in a reinforced concrete beam, for the design of which the results are desired. By the first method the concrete is in compression and the steel in tension at time of failure, by the second both are in compression. In the case of a loaded beam, however, both materials are in tension. It has been found that the bond between the concrete and the steel is very much less under these conditions than is indicated by pull or thrust tests. This may be accounted for in part by the effect of the lateral deformation of the two materials under axial stress. This deformation would tend to make the concrete grip the steel when in compression and separate from it when in tension.

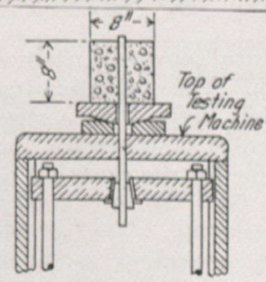
A practical objection to the results based on pull out and push out tests as a safe guide in the design of beams is the method of molding the test specimen as usually made in comparison with the method of casting a beam. It is usual in making a specimen to set the steel vertical and run the concrete around it, while in casting a beam the steel is laid horizontal and concrete rammed on the upper side only. The contact on the lower side is often imperfect, especially is this true for those types of deformed bars that have depressions on the surface which may occur on the lower side and not be filled with ordinary care in ramming.

A third method of making bond tests was described by Mr. Withey in a paper before this society last year. Page 469, Vol. VIII. of the Proceedings. It consists essentially of a bending test on a small reinforced concrete beam in which a part of the length of the rod on which the bond is to be determined is left exposed to allow the attachment of an extensometer. When the beam is loaded the elongation of the rod is measured and the pull on it computed at the time of bond failure. The results from this method were from one-third to two-thirds of the values obtained from cylinder tests, all other conditions being the same.

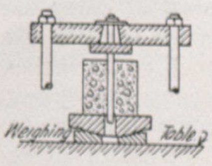
The tests herewith described were undertaken under the direction of the author by Messrs. E. B. Callow and A. H. Moorshead, to whom acknowledgement is hereby made, as a senior thesis in the department of



Beam Test



Pull-out Test



Push-out Test

civil engineering, University of Pennsylvania. The purpose was to compare the results obtained by the three methods and to try out a modification of the third method by which it was desired to avoid the use of the extensometer and makes possible the use of smaller specimens and greater rapidity in testing. This modification consisted in dividing the beam transversely at the middle by a 1-in. board at the time of molding and in the use of a hinge in testing. The hinge was placed near the top of the opening left on the removal of the board and served to fix the position of the compressive force.

The materials used in making the concrete were Giant Portland cement furnished by the American Company, bar sand and trap rock 1½-in. crusher run purchased in the Philadelphia markets. A 1:2:4 mixture, based on loose measurement, was used. The cement passed the standard specification of this society, the tensile strength neat at seven days was 500 lbs. per sq. inch, and at 28 days 600 lbs. The sand was clean and fine, all passed a No. 10 sieve and 40 per cent. passed a No. 50 sieve. About 15 per cent. of the stone passed a ¼-in. sieve. The weight per cu. ft. of the sand and stone was carefully determined and the quantities for the different batches were weighed out instead of making volumetric measurements each time. Only two sizes of

*A paper read before the American Society for Testing Materials, Atlantic City, 1909, by H. C. Berry.

steel bars were used, ¾-in. round and ¾-in. square. The embedment was small enough that the elastic limit was not developed in any test.

The usual procedure in mixing the concrete was to spread the required weight of sand over the cement and turn them together until the mixture was of uniform color. Water was then added and the mortar well mixed. The required weight of stone, which had been previously dampened, was then added by throwing alternate shovelfuls together. It was then turned four times. Water equal to about 20 per cent. of the combined weight of the cement and sand was used, though the quantity varied somewhat, the appearance of the concrete being the criterion of the amount needed rather than a predetermined percentage.

Medium consistency was used for the greater number of specimens. If it was wet enough the water would rise to the surface on light tamping when placing it in 4-in. layers. A set of triplicate specimens was made with concrete of dry consistency and another very wet consistency. The dry was granular after thorough mixing and moisture could be brought to the surface only by thorough tamping. The wet consistency was so wet that it would flow when spread on the floor and could be stirred into place when put into the molds. Six-inch cubes were made from each kind of concrete and from nearly all batches.

The specimens are shown in position for testing in illustration herewith. The cylinders were 8 inches in diameter and 8 inches high, with a steel rod 18 inches long through the centre of those for the pull-out tests, and one 9 inches long for the push-out tests. A special jig was arranged to hold the rods vertical during molding so as to avoid bending. The spherical compression block was of further assistance in obtaining axial pull. The cylinders were stored in damp sawdust and tested at 28 days. The specimens for the test in bending were 4 feet 6 inches long and 8 by 11 inches in section. The centre line of the steel was 1 inch from the bottom of the concrete. It extended about 8 inches to either side of the transverse division of the beam at the middle. The wooden partition was left in position until the time of testing and removed when the hinge was placed. The beams were stored in air at about 70 degrees Fahrenheit and tested at 28 days.

The 6-inch cubes were stored in damp sawdust and tested at 28 days. The ultimate strength for those from the dry consistency was 3,520 lbs. per square inch, based on six tests. These received a thorough tamping when molded. Those from medium consistency gave 2,650 lbs. per square inch as an average from 12 tests, and the wet ones 2,000 lbs. per square inch also from 12 tests.

The mounting for the pull-out test is shown in figure. In early tests the short projection of the rod was covered with plaster of paris, which was trimmed down to the surface of the steel so the edge of the latter would appear as a fine line. During the application of the load this line was watched and the reading taken when it was appreciably widened. After a few tests it was found that this occurred at the maximum load when there was a marked "drop of the beam." Throughout the greater number of the tests the load as noted by the drop of the beam was taken as the bond strength.

The arrangement for making a beam test is shown in figure. The beam was loaded at two points symmetrically placed about the middle of the span, giving uniform bending moment throughout the middle part of the beam. Short reinforcing rods bent up at the ends of the beam and extending into the concrete along the test bar served to distribute the stress to the specimen and prevent failure of the beam in diagonal tension. The accuracy of the determination of the bond from a test arranged in this manner depends on the precision of the measurements of the lever arm of the pull in the steel about the centre of the hinge and the horizontal distance between the line of action of the load and the reaction on each side. To expedite setting up a special frame a jig was devised with notches for the upper rollers and pointers for placing the supports. The jig was clamped to the side of the beam and the setting quickly made. Another simple frame with a slide on the bottom was made for quick measurements of the lever arm of the steel.

The hinge was made of two steel bars 2½ x ⅜ x 9 inches, with a groove milled to the slope of a standard taper pin extending from each end toward the middle. On the removal of the upper part of the board the sides of the hinge were set in place and the pins driven to a tight bearing. After measurement of the lever arm the load was applied at lowest speed. The deflection was noted for increments of 1,000 lbs., and if it became greater than about 0.07 in. the load was released and the pins driven tighter and the test begun again. In this way undue bending of the specimen was avoided.

Five beams were tested with sufficient length of steel exposed to permit the application of the Ewing extensometer. This made it possible to check the pull in the bar by a measurement of the elongations. The results checked with those based on the load and measurements of the lever arms within less than 2½ per cent. This is less than the variation to be expected among the specimens of a set taken from the same batch of concrete and shows that with ordinary care the method is sufficiently accurate and possesses the advantage of smaller specimens and greater speed in testing without any risk to delicate apparatus from unexpected failures.

Two beams with deformed bars were tested but they failed by pulling out the concrete at the bottom of the beam rather than by a failure in bond.

Bond Between Concrete and Steel.

(Lbs. per sq. in. of surface in contact.)

Consistency	Square bars, ¾-inch	No. tests	Round bars, ¾-inch	No. tests	Average of both	Ultimate strength of cubes
Pull Out Tests—						
Dry	694	3	741	3	718	3,500
Medium	589	10	638	10	614	2,650
Wet	591	3	475	3	533	2,000
					618	
Push Out Tests—						
Dry	672	3	469	3	570	3,500
Medium	444	9	666	6	453	2,650
Wet	498	3	531	3	514	2,000
					497	
Beam Tests—						
Dry	140	3	230	3	185	3,500
Medium	268	7	280	7	274	2,650
Wet	184	3	240	3	212	2,000
					237	

In the table it is seen that the average value of the bond, including the different consistencies and both forms of rods, is 237 lbs. per square inch, while for the pull-out tests it is 618 lbs. per square inch, about 2.6 times as much. For the push-out tests it is 497 lbs. per square inch of surface in contact or about 2.3 times that for beams. It is also to be noted that the round bars gave the higher average for seven of the nine series.

From these values it is evident, as was shown in the paper referred to above, that the maximum value of the bond between concrete and plain steel in reinforced concrete is between 200 and 250 lbs. per square inch, and that this value instead of the higher values usually quoted should be taken for guidance in reinforced concrete design.

From these tests it is also evident that pull-out and push-out tests give approximately the same results. The modified form of the specimen for beam tests gives the same values of the bond as that requiring the use of the extensometer and with as great a degree of accuracy, this depending only on the precision with which the lever arms are measured, and makes possible much greater speed in testing, which may be increased still further if the hinge be replaced by two or more short rods set in a plane near the top of the beam at the time of molding. This would avoid any loss of time in setting the hinge and make the beams more rigid and less liable to accident in handling, but make the position of the centre of the compressive force slightly uncertain.

THE USE OF NAILS IN CONCRETE REINFORCING.

M. S. Moissieff, a well-known engineer, in a paper read by him recently at an engineering conference at Atlantic City, stated that little attention had been paid to the methods of reinforcing concrete with nails, because on its face it would appear to be very uneconomical and would not promise to be a commercial success. He recounted some interesting observations made with reinforcement of this character. This occurred through the necessity of filling the compartments of a large steel casting with a material of that character. The casting formed a pedestal of an important bridge in New York City and it was suggested that concrete reinforced with wire nails, or cut wire, be used and tests of the material followed. The results of these tests were so satisfactory that concrete reinforced by wire nails was adopted for the filling of the casting. A table of results were also given. Aside from the practical considerations of utilization, the tests have a theoretical bearing, and illustrated how the compressive strength of a material may be increased by reinforcing its shearing resistance. The nails reinforce the shearing planes in all possible directions and thereby develop the high compressive resistance of the material, thus throwing some light on the internal stresses of a body in compression. The high cost would preclude the use of concrete so reinforced to any considerable extent.

Another day will be added to the Sixth Annual Convention of the National Association of Cement Users, which will be held at Chicago, Ill., February 21-25 inclusive.

AMERICA'S FIRE WASTE AND RECOMMENDATIONS OF FIRE UNDERWRITERS.

Until the Monetary Times inaugurated its monthly compilation of Canada's fire losses, no reliable Canadian newspaper published a record of the Dominion's fire waste. Under the Review of the Month Section has been printed Canada's fire story for each month. Hitherto, those interested have been compelled to turn to New York sources of information where Canada's figures have been lumped together with those of the United States. From our Canadian statistics it is seen that fire waste is a subject of great import to this country President Hare, of the National Board of Fire Underwriters, has shown that the average annual loss by fire in America has been more than a quarter of a billion, the total for that period having been $1,346,002,059, or a daily destruction of nearly three-quarters of a million dollars. The San Francisco and Baltimore fires considerably augmented the heavy average for the period. But the past two years alone have shown a loss of $215,004,709 in 1907, and of $217,885,850 in 1908. The indication is therefore, that the annual destruction is likely to continue above the two hundred millions mark.

These statistics do not include the loss from forest destruction, which, as is known, amounted to several million dollars in Canada last year. Then there is the indirect cost of fires, such as the expense of maintaining fire departments and waterworks. This item in Canada and the United States probably accounts for twenty million dollars beyond the direct cost. In addition must be reckoned losses resulting from business interruption following fires. Even an approximate estimation of these cannot be made.

The carelessness of the Canadian and United States public is to blame most for these conditions. At least one-half of the fires which occur probably can be properly ascribed to carelessness in one shape or another. There we may take a leaf out of Europe's book.

The National Fire Underwriters have made some excellent recommendations with a view to reducing these losses:—

First—That the public be brought to understand that property destroyed by fire is gone forever and is not replaced by the distribution of insurance, which is a tax collected for the purpose.

Second—That the States severally adopt and enforce a building code which shall require a high type of safe construction, essentially following the code of the National Board of Fire Underwriters, which has been prepared under the advice of experts in construction and engineering.

Third—That the States severally establish, and maintain at the expense of the State, an official or officials who shall be required to investigate the cause and origin of all fires, and who, when crime has been committed, shall submit the facts to the Grand Jury or proper indicting body. Such officials should have conferred upon them the lawful right and power to enter premises, to examine under oath, and to make arrests.

Fourth—That municipalities adopt ordinances governing the use and keeping of explosives, especially inflammable commodities and other special hazards, such as electric wiring, the storing of refuse, waste, packing material, etc., in buildings, yards, or areaways, and that proper and regular inspections of premises by the police and members of the fire departments be made with a view to the enforcement of such ordinances and removing dangerous conditions.

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THE CONSOLIDATED CEMENT COMPANIES.

The opinion has been generally expressed during the past year that some understanding would shortly be reached among the largest cement-producing mills in Canada with a view to steadying the price and equalizing the distribution of cement. Frequent announcements have appeared in the daily press indicating that an agitation of this nature was in progress, but not until the last few weeks have the public become aware of its real character or the magnitude of the undertaking. The outcome is the Canada Cement Company, Limited, a merger of twelve of the largest plants in Canada—the largest industrial consolidation ever effected in Canada. Hardly had details of this first merger been received before announcement was made of the formation of the Independent Cement Company, Limited, involving the remaining ten Ontario plants. While details of the latter are not yet available, there is every reason to believe that it will reach a successful issue, and that Canada's Portland cement industry will shortly be in the hands of two consolidated companies. We are unable to see in either of these combines anything that should prove a menace to the industry. A price-cutting war like that which has been in existence for upwards of a year would eventually be ruinous. The smaller mills have been hard pressed by close prices. Few have been in continuous operation, and even some of the larger plants at one time signified their intention of closing until price-cutting had been abandoned. In view of existing conditions it has been almost a certainty that some concerted action would be taken by manufacturers to avoid a repetition. Just what the future policy of these two companies will be is a matter for conjecture; at all events we can see no cause for alarm. Judging from similar large combines, reduction in administration expenses, larger buying and improved opportunities generally should effect a big saving in the cost of production. It does not seem probable that an endeavor will be made to command an artificially high price, but rather to establish more uniformity in the cost to the consumer, to equalize the distribution and elevate the standard of the output. The Canada Cement Company, Limited, has all the ear marks of an organization of wide influence.

MORE TRIUMPHS FOR THE CONCRETE BLOCK.

The concrete block is fast coming into favor, and new triumphs are reported almost daily. The day when the architect could afford to ignore this material is now past. The industry nevertheless has had a hard fight, and only those who have made a life study of the subject and have given their best for its betterment deserve the credit for the victories won. Of the many difficulties to which the industry has been subjected, those due to the disastrous effects of inferior workmanship by indifferent or incompetent builders stand alone. The prejudiced architect has many times been won over and the anti-concrete man often convinced, but the lasting, disastrous influence of the careless builder remains with us still. The casual observer is not aware that there is such a vast difference between good and bad concrete block work. Consequently, the intelligent builder has had to fight the battles of the good and bad alike. The one has faith in his business and the industry at large. The other is here to-day and away to-morrow. What the industry needs is more men who exercise care and discretion and think for themselves. Wherever well-constructed concrete building blocks have been employed they have proven their worth and their right to a foremost place among the building materials of the day. One carefully-planned and constructed building will do more to convince the conservative public as to the possibilities of this material than endless submitted proof of successes elsewhere. Each municipality must fight its own battles on behalf of the concrete block. Once correctly understood, there need be no fear as to the eventual outcome. What is needed in Canada to-day is representative concrete block structures in all our larger towns and cities. Take the case of the city of Owen Sound, Ont. There has just been completed there a concrete block residence embodying the best that a careful builder could turn out. While erected at a cost much below that of brick construction, every care was taken both as to general design and detail. The result has not only been a structure of particularly pleasing appearance, but an absolutely dry, durable, and serviceable one. As a direct outcome there is now under way in that city the Owen Sound club house, an opera house and two churches, all of which will be constructed of concrete blocks. The residence referred to is that of Mr. T. L. Dates, to whom is entitled the credit of having stood firm for concrete in spite of strenuous opposition on the part of brick and stone interests and prejudiced city officials. He is not only to be congratulated for setting an example to the industry at large, but also for the influence which his efforts have had upon the Owen Sound public. Such achievements could undoubtedly be accomplished in a like manner in other towns and cities if the campaign were to be conducted along similar lines. It is hard to estimate the real influence for good of one well-built structure or the harm resulting from one of inferior build.

NEWS IN GENERAL.

Galveston, Texas, is now assured of its practical immunity from another disaster like that of 1900. A general feeling of confidence has resulted from the splendid action of the sea wall, which resisted the onslaught of the sea, backed by the hurricane which beat in vain on the concrete wall seventeen feet high surrounding the city at the gulf side of the island several weeks ago.

An economical retainer in which to ship products such as cement, lime and plaster is described thus: Halves of a barrel are separable and can be nested in a compact form for the return journey. The cost of the barrel is about $1, which is a little more than twice that of a wooden barrel, but they are said to be good for at least fifteen round trips, and the room they occupy when empty cuts down the shipping bill one-half.

An idea of what the Panama Canal construction means to one industry in this country may be gleaned from the fact that almost a million tons of cement will be used in the gigantic work. Shipments have already begun in steamers owned by the Government, which will carry about eight thousand tons at a trip. It is estimated that it will take about four years to deliver the 4,800,000 barrels of cement contracted for at the present rate of shipment. The Government will profit by using its own vessels instead of chartered ships, as there will be no charges for demurrage in case loading or unloading is delayed.

In a Washington town of forty-eight buildings, every one of them, down to the smallest outbuilding, is made either from moulded cement and concrete or from concrete blocks. The building of the town began last March with the erection of a store of concrete. The materials were easily and cheaply obtained, and as fast as new settlers arrived concrete buildings sprang up. A new schoolhouse is made from concrete. Two churches are being constructed, and the town's water supply is enclosed in a tank made of concrete blocks, standing on solid concrete piles. The building up of a solid concrete community in a State where the heaviest stand of virgin timber abounds is a novelty.

The cause of the disappearance of rust from iron bars, etc., used in the erection of reinforced concrete structures, says the Mining Journal, has been traced by Rohland, in "Stahl und Eisen," March 17, 1909, to the presence of acid carbonates and sulphates in the cement, these salts dissolving the iron oxide and leaving the metal bright. The cement in setting absorbs carbonic acid from the air, thus forming the necessary acid carbonates; and experience has shown that the de-rusting process is effected while the concrete is setting and commencing to harden. This discovery affords an additional guarantee for the safety of reinforced concrete structures, inasmuch as the metal is protected from rusting by the alkaline reaction of the cement during the mixing process, and any rust on the bars is removed by the acid carbonates at an early stage in the erection of the structures.

Considerable interest is being shown in Winnipeg among the cement dealers in regard to the merger of Canadian Cement Companies and what effect it will have on the cement business.

There has evidently been very large quantities of cement shipped into the West this year, as there seems to be plenty of it still on hand. The West is using more and more cement every year, and many fireproof buildings have gone up this season.

The business in cement, while fairly good, has not been anything to brag about. All other lines of building material are brisk, and the dealers, on the whole, have experienced an excellent season.

The Union carpenters are out on strike in Winnipeg, and have been for some weeks; and to some extent are holding up work on a good many buildings.

The Executive Committee of the North-Western Cement Products Association, convened at the Commercial Club at 12.30 p.m., in the City of St. Paul, on Wednesday, September 1st, and unanimously agreed to open the Sixth Annual Convention, Tuesday evening, March 1, and close Saturday night, March 5, 1910. The meeting was attended by practically all the cement men and cement machinery men of the Twin Cities and representative contractors. The City of Minneapolis and St. Paul are both anxious to entertain the convention, and made flattering offers and inducements to secure the cement show. President Martin T. Roche appointed George J. Grant, St. Paul, Minn.; Harvey B. Smith, Minneapolis; Daniel L. Bell, St. Paul; O. U. Miracle, Minneapolis, and Wm. Stewart, St. Paul, as a committee to investigate the buildings offered by both cities, and empowered them to make final selection for the next place of meeting. President Roche in calling the meeting to order stated that the purpose of the meeting was to promote the concrete industry, and to give wide publicity to concrete in all its forms. The city in which the convention will be held will be announced as soon as the committee reports.

The demand for space at the Third Annual Cement Show in the Coliseum, Chicago, February 18-26, 1910, is brick, according to reports from the offices of the Cement Products Exhibition Company, 115 Adams Street, Chicago. The general floor arrangement at the next show will be somewhat similar to that of the Second Annual Show last February. The scheme of furnishing uniform equipment and decoration for all exhibitors will again be followed. The main feature of the decorative scheme at the next show will be a large ornamental centrepiece, 30 feet in diameter and placed in the centre of the Coliseum floor. A competition is being held by the Cement Products Exhibition Company, for a design for this centrepiece. It is to be constructed of concrete and may take any form the artist may suggest; some are designing pergolas, others fountains, band stands, etc. Three hundred and fifty dollars in prizes are being offered for the best design for a centrepiece. There will be a number of new features in connection with the next cement show. The space rates have been only slightly increased over those which prevailed last year, the purpose being to provide more funds for advertising the coming show.

The National Association of Cement Users, the American Society of Engineering Contractors and the Illinois Association of Municipal Contractors will all hold their conventions in Chicago during the show. It is expected that the annual meeting of the National Builders' Supply Association will also be held there. All these conventions, together with the elaborate preparations for the show should mean a big gathering of building material interests in Chicago next February. President Humphrey, of the National Association of Cement Users, is busily arranging for the programme of addresses. He anticipates a banner convention next February, and expects to add largely to the membership of the N.A.C.U.

RELATIVE STRENGTH OF CONCRETE.

It is ordinarily assumed, at least by the inexperienced, that the strength of concrete is measured by the proportion of cement in a given mixture relatively to the amount of the other materials—sand and stone. But the fallacy of this assumption is shown by the fact that the total volume of concrete is always less than the sum of the volumes of its ingredients. This is due to the ability of the smaller particles—the cement in a semi-liquid condition and the fine sand—to fill all interstices or "voids" between the larger pieces of stone. More compact concrete can be secured by the use of gravel than broken stone—the angular pieces of the latter frequently arch together, allowing voids to form beneath. In a technical, yet very practical, way this subject is discussed in a recent paper by Mr. Leonard C. Wason, president of the Aberthaw Construction Company, Boston, Mass. He shows that for watertight work gravel is always to be preferred as compared with broken stone.

There is little difference in strength between concrete made by broken stone or by gravel. Mr. Wason has proved by actual test that broken stone having a rough surface with angular fractures will give an increase in strength over rough bank gravel of about 15 per cent. in most cases. In some, however, the gravel has given the greatest strength. This is always true if the stone has a glossy surface such as is found in some trap rocks.

In the first instance, if the specifications required one-three-six broken stone concrete, and there is a difference in cost between broken stone and gravel screenings of two cents per cubic foot, it will be cheaper to use a mixture of one-two and one-half-five with gravel and still obtain an equal strength with the broken stone. Mr. Wason makes the rule never to allow the size of stone in its greatest dimensions to be more than half the thickness of the work into which the concrete is to be placed. In large size work very much larger stone can be used than is ordinarily done with very good results, the only limitation being that of convenience in handling. In regard to placing, it is much easier to obtain dense concrete, that is, without voids, using gravel than using broken stone, as angular pieces will sometimes arch together, allowing a void to form underneath. Therefore, for watertight work gravel is to be preferred every time. For nearly all classes of work the best results will be obtained by using such an amount of water that the concrete when placed will just barely quake, but is not sufficiently soft to flow.

Trade Topics

The Canadian Cement Casket Company, Prescott, Ont., with a capital of $99,950, is to be incorporated. Mr. H. E. Whitney, of Prescott, is a director.

The Manitoba Gypsum Company, Winnipeg, Man., are erecting an entirely fireproof plant, which will be up-to-date and modern in every particular. Particulars of this plant will be furnished our readers at a later date.

Owing to the announcement of the recent merger in the cement industry there has been practically no progress made of late in the erection of the St. Mary's Cement Company's factory, St. Mary's, towards which that town recently voted a loan of $40,000.

It is the intention of Messrs. Wettlaufer Bros., Mitchell, Toronto and Buffalo, to erect a large building in Toronto for manufacturing purposes in the near future. The present Toronto office and warehouse of this company is at the rear of 202 Yonge Street, Toronto.

The Canadian Concrete Vault Company, rear 503 Queen Street West, Toronto, report business as improving steadily in concrete burial vaults. The general public are showing more interest in these products, and are being educated as to the suitability of concrete for this class of work.

The National Cement Company of Durham has secured an option on the Horse Shoe quarry, St. Mary's. The lease of the present operators of the stone quarry, Messrs. Leslie and McNeill, expires the last of the present year, when there is a probability of the National Company taking it over.

Owing to increased business the firm of Eadie-Douglas Company, Montreal and Toronto, has been incorporated under the name of Eadie-Douglas, Limited. The officers and directors are as follows:—H. P. Douglas, president; Shirley Ogilvie, vice-president; H. G. Eadie, secretary-treasurer, all of Montreal.

Karl A. A. Bracher, of Toronto, has discovered a new use for concrete. He substitutes a concrete slab, reinforced with wire mesh, for the slate that forms the principal feature of the billiard table. A great proportion of the cost of billiard tables is occasioned by the expense in preparing slates that will be absolutely level. The use of concrete should cut down this expense materially.

Among the new plants to be erected in the States mention may be made that the Ogden Portland Cement Company (in which Grand Rapids and Chicago capital is largely enlisted) is building a plant on its property in Box Elder County, Utah. This is to cost $300,000 and will be of modern type as to construction and equipment. The plant will be producing October 1st, and have a capacity of 600 barrels daily. W. J. Bell, general superintendent for the Newaygo Portland Cement Company, is the president and general manager of the Ogden Company. Officers of the Partland Cement Company, 608 Lumbermen's Building, Portland, Ore., expect soon to make an important announcement concerning the installation of a large plant at Oswego, Oregon, for the manufacture of cement.

The names of the companies that are included in the cement merger are the following:—Vulcan Portland Cement Co., Montreal; Belleville and Lehigh Cement Company; Canadian Portland Cement Company, of Marlbank and Port Colborne; International Portland Cement Company, Hull; Western Canada Portland

Cement Company, Exshaw, Alta.; Lakefield Portland Cement Company, Montreal; Lakefield Portland Cement Company, Lakefield; Owen Sound Portland Cement Company, Shallow Lake, Ont.; Alberta Portland Cement Company, Calgary. Those not included are the three Owen Sound plants, the Imperial, Sun, and Grey and Bruce. Also the National at Durham, Superior at Orangeville, Colonial at Wiarton, Ontario at Brantford, Hanover at Hanover, Ont., and the Raven Lake Company.

The Peerless Cement Brick Machine Company, of Minneapolis, Minn., have made final plans for opening up a branch in Canada. Arrangements have been completed with the Polson Iron Works, Toronto, in regard to the manufacture of these machines. Within a short time a local office will be established at Toronto, particulars of which will be announced in due time. Toronto will be made the headquarters of the Canadian branch, and until such time as the local office is established communications should be addressed to the head office at Minneapolis. The above company have five manufacturing plants in the United States, and are represented in all the States as well as the various European countries. Mr. L. V. Thayer, president and treasurer of the company, and Mr. J. J. Palmer were in charge of the Peerless Exhibit at the Toronto Industrial Exhibition. This company make a specialty and manufacture cement brick machines only.

Building News

Some concrete work is to be done in connection with the La Fontaine Park pond, Montreal.

A large amount of concrete pavement will be laid in the town of Georgetown during the fall season.

Mr. C. H. Conery, Guelph, has accepted contracts for three concrete bridges in the County of Halton.

A. T. Chapnon has secured a contract for cementing the wading pool in Lafontaine Park, Montreal, at $1,975.

A $600,000 by-law to cover the cost of building three new schools has been passed by the Winnipeg city council.

Mr. D. D. McPherson, Sec. S. S. No. 14, Dunwich, Wallacetown, desires tenders for the erection of two concrete schoolhouses.

J. S. McCracken, Niagara Falls, has secured a contract from the School Board of that place for concrete walks at 11½c. a foot.

E. A. Hay, city engineer, Peterborough, invites tenders for the erection of a reinforced concrete bridge over the River Otonabee.

A new concrete reservoir will shortly be built for the town of Limoilou, Que., by Messrs. Ouimet and Lesage, engineers, Montreal.

Bids are invited for the construction of a reinforced concrete bridge at Three Rivers, 16 feet wide, by L. T. Desauliners, secretary-treasurer.

A new bridge with concrete floor will be erected at Baden by the Hamilton Bridge Company, for $2,297. H. J. Bowman is county engineer.

After calling for tenders for five miles of concrete walks the city of Vancouver has decided to do the work by day labor. Two firms bid 14c. a square foot.

Mr. L. Malcolm, city engineer, Guelph, recently called for tenders for the construction of three concrete bridges, approximating 700 cubic yards of concrete.

Whether or not the construction of numerous concrete walks will be commenced this year is to be decided by the council of St. Catharines at a meeting shortly.

Concrete will be the material used for the piers of a bridge at River Beaudette, for whose construction tenders are now invited by Fabien Bissonette, secretary-treasurer.

Considerable cement will be used in the construction of new buildings to be erected at Sherbrooke, Que., by the C.P.R. The Sherbrooke Construction Company have the contract.

The contract for material for a 11,000-ton floating pontoon dry-dock, which is to be built on Burrard Inlet, Vancouver, has been awarded to Swan & Hunter, Wallsend-on-Tyne, England.

Messrs. George A. Begg & Company, of St. Catharines, have been awarded the contract for a large reinforced concrete bridge at Peterborough. They propose to start the work immediately.

A contract for a concrete bridge, at Moose Jaw, to cost $7,490 has been given to the Parsons Construction & Engineering Company, and one for walks to cost $13,495 has been awarded to Navin Bros.

A bridge 100 feet long with concrete floor and reinforced concrete abutments will be erected at Wilbey, Waterloo County, Ont. The concrete work will be in charge of Eichler & Huehn, at $3.97 per cubic yard.

The contract for a reinforced concrete bridge over the Humber River between Purpleville and Kleinburg, has been awarded by the Vaughan Council to Contractor Hicks, at $3,600. The structure will be 16 feet above the water and will have a span of 50 feet.

Tenders will be received for all the various trades required in the erection and completion of an 8-storey fireproof building on the south-east corner of King and Jordan Streets, Toronto, for the Standard Bank. Darling & Pearson, 2 Leader Lane, Toronto, architects.

A contract for the construction of a concrete culvert over Mill Creek, St. Thomas, on the L. & P. S. Gravel road was awarded to Scoyne & Ramey, of Talbotville, for $810. The other tenders were G. A. Ponsford, $899; H. F. Woodry, $1,185, and Powell & Gunning, $1,184.

The contract for the concrete piling and footings of the warehouse to be erected for the Buhl heirs, at 115-119 West Woodbridge Street, Detroit, has been awarded to the Raymond Concrete Pile Company, of New York and Chicago. John Scott & Company are the architects of the building.

Tenders will be received up to the 16th Sept., for the construction of a reinforced concrete or iron bridge, of 16 feet wide, on Ste. Marguerite Road, Three Rivers, to be finished before the 16th November. Each tenderer must furnish his plans and specifications. L. T. Desaulniers, secretary-treasurer, Three Rivers.

Machinery and Supplies.

Medusa White Portland Cement of the Sandusky Portland Cement Company has been used on the following work:—University Building, Evanston, Ill.; First National Bank Building, San Francisco, Cal.; Whitney Building, San Francisco, Cal.; High School, Everett, Wash. Specified by the following architects in England: James Hartley, and Runton & Barry. For imitation terra cotta trimmings on Tremo Hotel, Spokane, Wash.; for exterior, cement finish Dormitory for Pomona College, Claremont, Cal.

The efforts on the part of the management of the Toronto Industrial Exhibition to place exhibits of concrete machinery and products by themselves were far from being successful. Some were located under the Grand Stand, others in tents at the north of the grounds. Those making exhibits included the following. The Cement Tile Machinery Company, Chatham, Ont.; the Peerless Brick Machine Company, Toronto and Minneapolis; the London Concrete Machinery Company, London, Ont.; the Roman Stone Company, Toronto, Ont.; John T. Hepburn, Toronto; Wettlaufer Bros., Toronto; Ideal Concrete Machinery Company, London, Ont.; Gustiana Bros., Hamilton, Ont.

An attractive and complete catalogue has been published by the Cement Tile Machinery Company, 85 Rath Street, Waterloo, Iowa, and Chatham, Ont. These machines make from 3,000 to 5,000 four, five, six, seven, eight, ten, twelve, fourteen, fifteen or sixteen-inch tile in ten hours, with the aid of six men and a ten-horse power engine. Excellent views are shown of the large and modern plants of this firm, also interior scenes of the offices, together with the officials of the company. The attachment for making block or building tile on the "Schenk" machine enables the operator to make a block six inches square and twelve inches in length, with a four and one-half inch round hole through the centre, at the rate of 2,000 blocks or building tile per day. The "Easy" tile and sewer molds, made by this company, are fully illustrated and described, as is also their "Perfection" mixer, their "S" and "S" Revolving Screen, for screening and grading sand and gravel, their "Ideal" tile, block and brick and transfer car and improved truck. An excellent view is also shown of their "S" and "S" Gasoline Engine, from two to ten horse-power.

In the work on the tunnel and aqueduct which is to supply the City of New York with water, a machine had to be constructed so as to operate inside of the tunnel, which is only 6 feet 6 inches in diameter, and still turn out a maximum amount of concrete. The Standard Scale and Supply Company, of Pittsburg, New York, and Montreal, were successful in meeting the requirements. The mixing drum is mounted for rear discharge on a special car or truck having inclined track extending from regular track on to the car platform. The material to be mixed is loaded in a charging car at the entrance of the tunnel and then run through the tunnel right up the incline on to platform in front of mixer. The car is then tilted and the whole batch of unmixed material is unloaded into the mixer at once. The drum revolves all the time as the charging end is entirely open and fitted with an intake chute which permits the charging car to clear the drum while mixer is being loaded. The discharge is so arranged that it may be operated from either the front or rear, thus allowing plenty of room for the operator to work. The truck upon which the outfit is mounted is so arranged that the special wheels and axles can be removed and replaced with regular ones, thus permitting the same outfit to be used on all classes and conditions of work. Power for operating the mixer is supplied by a compressed-air motor of the latest type placed right beside and partially under the mixer drum. This motor can also be operated by steam. The whole outfit is very compact, durable and portable, and turns out the highest grade of concrete and cement mortar. It is said that this is one of the first batch mixers that has been designed to meet the requirements of mixing concrete inside of a tunnel, and accomplishes in a simple manner the supplying of concrete just as required.

AN OMISSION.

Through an oversight several omissions were made in the Trade Directory of the August issue of the Review. Messrs. F. H. Hopkins & Company, Montreal, were listed only under the heading of concrete mixers. As is well known this company are dealers in all lines of railway and contractors' supplies, including building supplies of all kinds, dump cars, crushers, cement and concrete machinery, concrete reinforcing, wire rope, tools of all kinds, etc. These omissions have been corrected in this issue, so that prospective buyers will find our Trade Directory complete in this respect. It will be the object of the Review to make this Directory more complete each month. Those desiring insertions under new headings will kindly advise us by the fifth of each month.

Publications Reviewed

The Medina Concrete Company, Medina, Ohio, U.S.A., have an interesting booklet which describes their concrete building-block machinery, tools, walls, etc. It is well illustrated. A copy of this catalogue may be obtained for the asking.

Wrought-Iron Cement-Lined Water Pipe.—By Leonard Metcalf, civil engineer, Boston, Mass., 90 pp., 6 x 9.

Tungsten Ores of Canada: A Report by T. L. Walker, M.A., PhD.., containing 60 pages, 6 x 9; Pub. Doc., Mines Branch, Ottawa. Hon. W. Templeman, Minister.

Canadian Annual Review of Public Affairs, 1908.—By J. Castell Hopkins, 669 pp., 6 x 9, cloth, $5. (?)—Annual Review Publishing Company, 2 College Street, Toronto.

The Fire-Resistive Properties of Various Building Materials.—By Richard L. Humphrey, 100 pp., 6 x 9. Bulletin 370, Dept. of the Interior, N.S., Geological Survey, Technologic Branch, Washington, D.C.

Waterproofing.—By Myron H. Lewis, C.E., 260 pp., 6 x 9, reprinted from paper read before the municipal engineers of the city of New York. Engineering News, Book Department, 220 Broadway, New York City.

Concrete and Constructional Engineering, of London, Eng., which during the last three years has appeared as a bi-monthly, namely every two months, will, from this on, be published as a monthly.

Fine Cement Porch Work.—This is the title of a pamphlet issued by W. A. McLenaghan, Box 86, Perth, Ont. It contains several splendid illustrations of verandah columns, also gateway and wall designs.

Journal of the American Society of Engineering-Contractors:—June 1, 1909, Vol. 1, containing constitution and list of members:—Daniel J. Haner, Secretary, Consulting Engineer, Park Row Building, New York City.

Hydroelectric Developments and Engineering.—By Frank Koester. Assoc. Mem. Am. Inst. E.E., 454 pp., 500 illustrations, price, $5. D. Van Nostrand Company, publishers, 23 Murray, and 27 Warren Streets, New York, U.S.A.

Simplified Methods of Calculating Reinforced Concrete Beams. — By W. Noble Twelvetrees, M.I. Mech. E. A.M.I.E.E., M.R.S.I., 25 pp., pocket size; 15 cents. Whittaker & Company, publishers, 2 White Hart St., Paternoster Square, London, E.C., and 64-66 Fifth Avenue, New York, U.S.A.

Riveting Machines for structural, bridge and railroad work, boiler, tank and stack construction, which are manufactured by John F. Allen, 370-372 Gerrard Avenue, New York City, are dealt with in an interesting fashion by this old-established manufacturer. Copies of this pamphlet will be cheerfully sent upon application.

Blueprints:—Several kinds of blueprint paper and a price list are dealt with by the Keuffel & Esser Company, Hoboken, N.J., in a pamphlet which has just been prepared for them. The directions given for obtaining the best results will undoubtedly be appreciated by men who have to do with blueprints and blueprinting.

Concrete Molds.—The Dayton Concrete Mold Company, 20-21 Patterson Building, Dayton, Ohio, send us a booklet devoted to machines for the manufacture of molded semi-circular concrete blocks. This book shows briefly to the prospective buyer, the many uses the product of these machines are adapted.

Supplies:—The Brydges Engineering & Supply Company, of Winnipeg, have issued a very handy catalogue cover, by which separate sheets of any line desired can be sent out to those desiring same. The device saves the expense of supplying anyone with the large amount of material in the ordinary catalogue, the majority of which they are not interested in.

Pumps:—A complete power driven outfit for use of contractors, builders, railroads, or on public works, where it is necessary to raise large quantities of water, or to handle water containing mud, sand, grit, gravel, coal, grain or chips, sewage, or any liquid that will flow, is described in Bulletin No. 500, which the Fuller and Johnson Manufacturing Company, of Madison, Wis., are just distributing. A price list is included.

A Brief Course in Elementary Dynamics for Students of Engineering.—By Erwin S. Ferry. Published by MacMillan Company, New York, pages 182, illustrations and diagrams, 121. Price, $1.25 net.

A text book for students, presenting a clear and consistent development of the laws of dynamics, discussing statics or the laws of equilibrium, friction between solids, kinetics, or the laws of connecting force and motion, statics of fluids, motion of bodies under variable forces, etc., with numerous problems collected by the author over a number of years, which are made more practical than usual. The book is well written and will prove of value to the engineering student. The principles and fundamental laws are thoroughly taken up without discussing a vast range of different phenomena, and the illustrations are chosen from familiar subjects.—F. A. G.

"Kahn System Standards." The third edition of "Kahn System Standards" has recently been issued. This 128-page handbook is full of valuable tables and information on the design of reinforced concrete. Complete theoretical discussions on the principles of design, as well as practical tables, are given in convenient form. Other tables useful in designing more generally, such as bins, bridges, sewers, etc., are also given. The third edition of "Kahn System Standards" contains all the matter of the previous one and in addition many new tables. All data has been strictly revised to date. This handbook is something very much more than an ordinary trade catalogue and is generally recognized as a standard handbook on designing. "Kahn Standard System" will be furnished free to engineers, architects, and builders of standing, and to others at a nominal charge, on request to the Trussed Concrete Steel Company, Toronto or Detroit.

Hy-Rib.—This is the title of a fifty-page catalogue issued by The Trussed Concrete Steel Company of Canada, Ltd. It describes the construction of Hy-Rib metal, its many advantages and its application for floors, roof, walls and sidings partitions, ceilings, furring, arched floors, conduits, sewers, and culverts, silos, tanks, reservoirs, cisterns, chimneys, etc., and construction work of all kinds. Its many uses on the farm, its use for industrial and business buildings, also for houses, garages and small buildings are all described in this interesting catalogue. In short, it deals with the application of Hy-Rib metal for nearly every class of construction work. It also contains specifications for the use of Hy-Rib, many testimonials, tests, information for purchasers in making out orders, etc. It is fully illustrated throughout and splendidly prepared. A copy of this interesting and instructive catalogue may be obtained by writing the above company at any of the offices. They are represented at Toronto, Winnipeg, Vancouver, Montreal, Halifax and St. John.

Electric Smelting of Iron Ores.—As a sequence to the reports on Electric Smelting of Iron Ores, published in 1904, 1906, and 1907, the Mines Branch of the Department of Mines of Canada has just issued the results of "An Investigation of an Electric Shaft Furnace" in operation at Domnarfvet, Sweden. The investigation was made by Dr. Eugene Haanel, in December, 1908, on the invitation of the inventors, and the results given represent the latest developments of the electric smelting of iron ores.

The report contains 38 pages and is divided into four parts.—Part 1 deals with the Domnarfvet furnace, the trial runs witnessed by the writer of the report and the comparative costs of production of pig-iron by the furnace. The other three parts which are more of the nature of appendices, describe:—(1) A new electric furnace for the manufacture of steel, (2) the manufacture of electrodes, (3) methods of manufacturing wood-charcoal, this material being used to supply the carbon which enters into the composition of pig-iron manufactured by electric smelting.

Three full page plates, from photographs, and numerous drawings, illustrate clearly the descriptive matter of the book, which, taken in conjunction with the reports previously published by the Mines Branch on the subject of electric smelting, brings up to date the literature on the electro-metallurgy of iron.

The "Report on the Investigation of an Electric Shaft Furnace" at Domnarfvet, Sweden, may be obtained on application to Dr. Eugene Haanel, Director of Mines, Department of Mines of Canada, Ottawa.

The Economy Factor in Steam Power Plants.—By Geo. W. Hawkens, published by Hill Publishing Company, 505 Pearl Street, New York; pp. 133, with 50 diagrams. Price, $3 net.

The material embodied in this book covers a most valuable lot of data and diagrams bearing on the efficiency of apparatus and economy of steam power plants. It is divided into four parts:—Part I. treating of the individual pieces of apparatus forming a steam power plant; discussing briefly their economy and the conditions which tend to vary it. A number of valuable curves on boiler and engine economy are given.

Part II. deals with the factors of evaporation discussing feed water temperatures, and the comparative efficiencies of auxiliary apparatus.

In Part III., under complete plant economy the authors discuss three types of plants, viz.; (1) non-condensing, (2) surface condensing, (3) jet condensing, developing formulae in each case for obtaining the economy of the plant, with tables and graphic representation of these formulae. Examples of their use are appended.

Part IV. contains a discussion of the economy of a plant working under variable load, with numerous load curves and diagrams, illustrating deduced formulae by examples.

The book forms a most valuable treatise on plant economy, illustrating the importance of the fuel economy factor in the design of the power-station. It will prove a most useful book to the designing engineer and the student, containing specific information which cannot be obtained in such complete form elsewhere.

Market Conditions

Toronto, September 15th, 1909.

Accounts from all parts of Ontario indicate a moderate degree of activity in the building trade. In Toronto, the Industrial Exhibition has given an impetus to business generally. Concrete machinery men making a display are well pleased with the results of their exhibits, and in some cases a large amount of business was transacted. Following close upon the formation of the first cement merger taking in some ten of the larger plants, comes the news of the formation of the Independent Portland Cement Company with a capital stock of $10,000,000. This includes the remaining ten Ontario cement plants. Some important developments along cement lines may be looked for from this. Toronto quotations are as follows:—

Broken Stone.—Broken stone in mixed sizes for making concrete vary from $1.25 to $1.50, f.o.b. Toronto, with a slight increase for smaller sizes and screenings. Gravel suitable for roofing purposes sells at $1.60 to $1.70 per yard.

Canadian and American Cement.—Cement is quoted by certain Toronto dealers at $1.90, including bags, or $1.50, exclusive of package. Canadian cement manufacturers' price to the dealer in thousand barrel lots and up is $1.30 to $1.65 in cotton bags, excluding cost of packages, on car, Toronto. For quantities up to carload lots, ex-package, dealers' prices range accordingly, and range up to $1.75 per barrel, in cotton bags and $2.10 in wood, weight in each case 350 pounds. Bags are repurchased at 10 cents each if in good condition, there being four to the barrel; weight of bags, 87½ pounds each, net.

Concrete Blocks.—Prices for concrete blocks vary according to the quality, style, amount of material per block, etc. The following complete list of different size cores for both faced and unfaced blocks gives the prices, f.o.b. Toronto, local conditions regulating the prices to some extent: 8 x 8 x 16-inch blocks, faced, with 4-inch core opening, 22c.; 3-inch core, 23c.; 2-inch core, 24c.; corner or angle blocks, 1c. higher in each size; opening, 20c.; 3-inch core, 21c.; 2-inch core, 22c.; corner blocks same price, the proportions being 1 part cement to 5 parts gravel, and facing 1 part cement to 1½ parts sand.

English and European Cement.—Prices for English and European cements remain fairly constant at $2.50 per barrel, in wood, per 350 pounds gross.

Firebrick.—American firebricks sell at from $28 to $35 per 1,000, while Scotch and English prices are quoted at $32.50 to $35.

Lumber.—The following are the quotations for lumber suitable for making forms for concrete per 1,000 feet, f.o.b. shipping points: Hemlock, 2-in. plank, $16; 2 x 4 scantling, $12; spruce, good mill culls, 2-in., $14. For dressing one or two sides the prices will be about $1.25 in advance of quoted prices, and for dressing and matching about $1.75.

Sand.—Sharp river sand of best quality, laid down at Toronto, and suitable for concrete work, is quoted at about $1.35 per cubic yard. The prices vary according to the quality, and range from 95 cents to $1.35 for other purposes.

Montreal, September 15th, 1909.

The recent formation of the Canadian Consolidated Cement Company and the present announcement of the incorporation of the Independent Portland Cement Company, Ltd., with a capital stock of $10,000,000, taking in the remaining ten Ontario cement plants has made the cement dealers more at sea than ever. Other prices are steady and the demand active. Montreal quotations are as follows:—

Broken Stone.—Crushed stone, one-inch size and over, $1 per ton, and smaller than one inch, $1.50 per ton at the quarry, Montreal. For ½-inch silica, gravel or crushed stone for concrete or roofing work, $2 per ton, Montreal, is quoted.

Canadian and American Cement.—Prices range from $1.35 to $1.65 per barrel, in cotton bags, and up to $2.05 in wood, weights in both cases 350 pounds, in carload lots at Montreal. There are four bags of 87½ pounds each, net, to a barrel.

Cement Hollow Blocks.—Those measuring 18 inches long by 8 inches high or one square foot, are quoted at 27 to 35 cents per block, the thickness being 8 inches. The cement used is 1:2:5, the face being one of cement and two of sand.

English and European Cement.—English cement is quoted at $1.65 to $1.90 per barrel in jute sacks of 87½ pounds each (including price of sacks), and $2 to $2.20 in wood, per 350 pounds gross. Belgian cement is $1.60 to $1.65 per barrel, in bags, and $2.05 to $2.20

Firebrick.—American firebricks sell at from $40 to $45 per 1,000, while Scotch and English prices are quoted at $40 to $50.

Lime.—Lump lime, $8 to $10 per ton, delivered in Montreal. Hydrated lime, $13 to $14 per ton, bags extra.

Lumber (for Moulds).—Quotations per 1,000 feet in carload lots, f.o.b. shipping points, at mills in vicinity of Montreal: Hemlock, 2 x 4 scantling, and 2-in. plank, dressed on one side, $15 to $18. Spruce, good mill culls, 2-in., tongued and grooved and dressed on one side, $15 to $18; rough, $1 less in each case.

Plaster.—Hard wall plaster, sanded and ready for use, $7 to $8.50 per ton, delivered in Montreal; bags extra.

Sand.—Shippers of sand, such as is suitable for mixing with cement and crushed stone, quote $1.35 per cubic yard, laid down at Montreal. This is for good, sharp river sand, washed and screened. Other qualities of sand used by builders, not suitable for concrete work, may be had as low as 90 cents per cubic yard.

Winnipeg, September 14th, 1909.

The carpenters strike is still interfering with building operations in Winnipeg to some extent, and there are still 500 carpenters out, a large majority of whom it is said have gone out to the harvest field. Local market conditions are becoming more active and orders are coming in better from the country as large buyers realize that their chances for getting orders filled when the grain rush commences are slim, as every available car will be drawn into service for moving the crop. Building material continues to be very active and there seems to be no let up yet especially in house building. All large buildings are making good progress. Cement is said to be a little more active and considerable is being said about the big cement merger. Quotations are unchanged, however, and all lines quoted remain steady at usual figures, which are as follows:—

Broken Stone.—Broken stone in mixed sizes for making concrete, $1.75, f.o.b. Winnipeg, with a slight increase for smaller sizes and screenings. Gravel suitable for roofing purposes sells at $2.25.

Canadian and American Cement.—Canadian cement manufacturers' price to the dealer in 1,000-barrel lots and up is $2.25 to $2.40 in cotton bags, excluding cost of packages, on car, Winnipeg. For quantities up to carload lots, ex-package, dealers' prices range accordingly, and are general at about $2.55 per barrel, in cotton bags, the weight in each case 350 pounds. Bags are repurchased at 10 cents each if in good condition, there being four to the barrel; weight of bags, 87½ pounds each, net.

Concrete Blocks.—Local conditions control the price of concrete blocks to a large extent, although the following prices will be found to be fairly general for blocks, 8 x 8 x 18 inches: Common blocks, 24 to 28 cents; faced, 30 to 35 cents per block.

Lumber.—The following are the quotations for lumber suitable for making forms for concrete per 1,000 feet f.o.b. shipping points; hemlock, 2-in. plank, $16; 2 x 4 scantling, $12; spruce, good mill culls, 2-in., $14. For dressing one or two sides the prices will be about $1.25 in advance of quoted prices, and for dressing and matching about $1.75.

Sand.—Sharp river sand of best quality, laid down at Winnipeg, and suitable for concrete work, is quoted at about $1.35 per cubic yard. The prices vary according to the quality, and range from $1.25 to $2 for other purposes.

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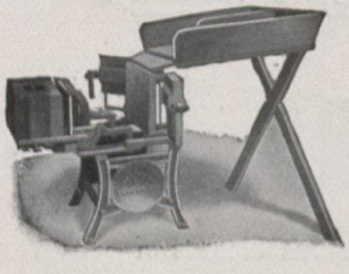
The LONDON

Face-down, Adjustable Concrete Block Machine



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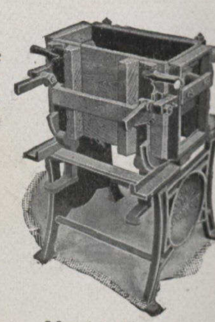
makes every kind, size and design of block. **All sizes of blocks made in the one adjustable mould. All sizes of blocks made on the one size pallet. Any size core desired can be used** which is withdrawn vertically and thus allowing all blocks to be made by the wet process, or with crushed stone in the block. Machine fully **covered by patents.**



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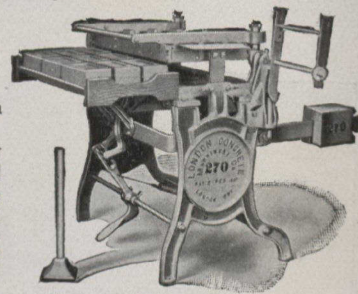

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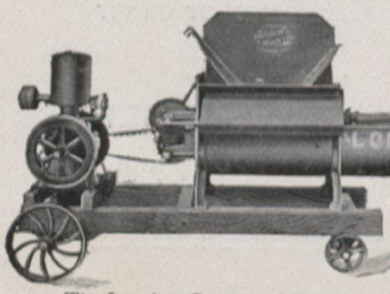

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Why does it save you money? Simply because the **materials only have to be handled once. No extra shovelling, no wheeling, no measuring.** Just **keep the hoppers full** and the **machine will do the rest.** Will give **any desired proportion, will mix any kind of material** with any consistency of moisture. **Measurements absolutely perfect.**

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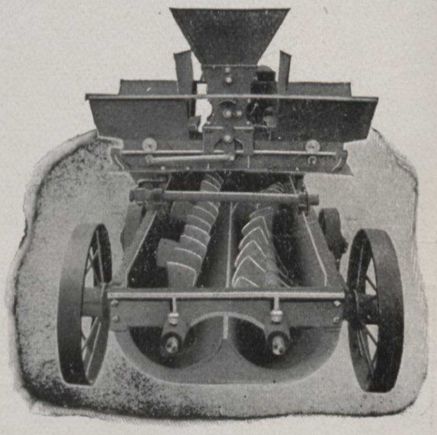

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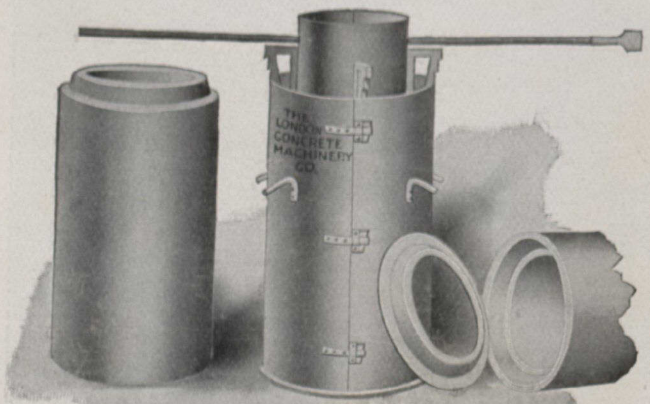

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