between Bay and Pearl streets, cost $2,000.

TORONTO, ONT.—Mr. F. H. Herbert, architect, 24 Toronto Arcade, will receive tenders until 5 p. m. on Saturday, the 25th inst., for the mason and brickwork, carpenter work and structural iron work required in remodelling Messes. Guinane Bros. shoe store, 214 Yonge street. Plans may be seen at the store.—The Lorne Park Company report that several persons are negotiating for the purchase of lots at the Park on which to erect summer cottages next season.—A permanent sidewalk will be constructed on Carlton street, from Yonge street to Seaton street. —The Sheppard Publishing Company have purchased property at No. 22 and 24 Adelaide street west as a site on which to erect their proposed building.—At a meeting of the York County Council held last week the Engineer recommended that immediate steps be taken to erect a new bridge at Woodbridge. The cost is estimated at $3,000.—Tenders are wanted at No. 193 Church street, until Saturday, the 25th inst., for remodelling two houses on Shuter street.—The City Engineer has been instructed to prepare complete plans of all the work proposed to be done on the water front, and submit the same to the Property Committee.—At a meeting of the Public Library Board held last week, it was decided to ask for tenders for fittings for the art-room and two rooms on the first floor, the cost to be in the neighborhood of $850.—Building permits have been granted as follows: John Stark, det. 2 story and attic bk. residence, n. w. cor. Park Rd. and Woodland ave., Rosedale, cost $8,500; Reinhardt & Co., 2 story bk. and stone office and boiler room, Mark st., cost $3,000; Widmer Hawke, 2 story bk. stable, rear s. w. cor. Wilton ave., and Jarvis st., cost $2,000.

OTTAWA, ONT.—At the last meeting of the Board of Works, the City Engineer presented his report on the proposed trunk sewer. The total length of the sewer is estimated at over six miles, to be built of brick. From Concession st. to the Rideau Canal, it will be three feet six inches deep, by two feet four inches wide. After crossing the canal these dimensions will be increased to four feet six inches by three feet. The total number of brick necessary is estimated at $4,000,000 from Concession street eastward. The total cost of the trunk sewer through the entire district including $4,000 which is recommended for the enlargement of the present main sewer and a new iron discharge pipe with piers is estimated at $360,750. To meet this expenditure it is proposed to issue debentures if the by-law for the sewer is adopted by the ratepayers at the January election.—Plans have been prepared by Mr. G. F. Stalker, architect, for a concert hall and assembly room, to be erected on Wellington street. Tenders will be called for shortly.—A company with a capital stock of $95,000 is applying for incorporation to build a new opera house in this city. The promoters of the company are Messrs. Thos. Askwith, John B. Brouse, Wm. Johnstone, Wm. Stewart, Andrew Mills, R. P. Harris, T. F. Nellis, S. J. Davis, Henry Burgess and Henry C. Monk. Their solicitors are Messrs. Nellis and Monk. Options have been secured on several properties, and work will be commenced in the spring.—Mr. F. J. Alexander, architect, has the following work in hand, to be executed next spring: summer cottage at Lake Temiscamingue, Que., for Mr. M. Brown, of Philadelphia, U. S. A., cost, $3,000; two detached villa residences for Sanford Fleming, C. E., C. M. G., to be built on Daly avenue, this city; two semi-detached residences for Mr. W. Burland, to be erected on Slater street.—E. F. E. Roy, Secretary Department of Public Works invites tenders until Thursday, the 30th inst. for the construction of a hot water heating apparatus in the public building at West Farnham, Que.

Stamp & Frank, painters, of Hamilton, have assigned to W. Anderson.

FIRES.

Two residences at Moncton, N. B., owned by G. H. Barnes, of Sussex, and Daniel White, were destroyed by fire a few days ago.—A saw mill at Ethel, Ont., owned by Wm. Milne was burned on the 18th inst. Insurance on building and machinery $1,800.—The Dominion hotel at Campbellford, Ont., owned by Mr. Mahoney, and occupied by Messrs. White & Dewey, was damaged by fire last week to the extent of $1,000.—The Carveli residence, at the corner of Waterloo and Cliff streets, St. John, N. B., was burned on the 16th inst. Loss, $45,000, insurance $10,000.—Humphrey & Trites' large saw mill at Petitcodiac, N. B., was destroyed by fire recently. Loss, $15,000, covered by insurance.—The Christian Brothers' school on Sussex street, Ottawa, a fine cut stone structure, was destroyed by fire on Thursday of last week. Loss $50,000; insurance $11,000.—A business block on Rideau street, owned by Sheriff Sweetland, was damaged to the extent of $2,500 on the same date.—The store and dwelling of Mr. Jos. Tully at Springville, Ont., were destroyed by fire on Monday last.

CONTRACTS AWARDED.

OTTAWA, ONT.—G. M. Bayly, architect, has awarded contracts as follows for a residence for Mr. Jos. Foster, to be erected on Concession street: John Robertson, masonry and brickwork; Thos. Shore, carpentry; Thos. Cleary, plastering; plumbing and painting not let.

ANCHORING BOLTS IN STONE.

To a paper read before the Washburn Mechanical Engineering Society of Worcester, Mass., by Mr. E. F. Miner, we are indebted for the following facts regarding the holding power of anchor bolts in stone:

The tests were made on a Fairbanks testing machine in the mechanical laboratory of the Worcester Polytechnic Institute, for the purpose of determining the strength of the fastening of a cast-iron journal plate to a stone column. The materials tested were babbit metal, lead and sulphur.

It was necessary that the bolts should not enter the stone over 6 inches and that they should be capable of easy removal without injuring the stone. For the purpose of the test a tap bolt was prepared, 1¼ inches in diameter, 9 inches long, with a thread 6¾ inches long. The thread was V shape ⅓ inch pitch, cut nearly sharp on top, and about three-sixteenths of an inch wide at the root, thus leaving a wide space between threads to allow the setting to fill easily about the screw. In all the tests, with one exception, the bolt was set in stone 6 inches; in the test with lead pipe, 6¼ inches. The stones were prepared in 10 inch cubes, faced on three adjacent sides and were of dark Brandford granite from Stoney Creek, Conn. The holes in the stones were as nearly as possible two inches in diameter, 6½ inches deep, and in three of the tests tapered, so that at the bottom the diameter was 2¼ inches.

The loads were applied slowly, and measurements for extension made at each 500 pounds increment. At every additional 5,000 pounds the setting was allowed to remain five minutes with the load applied. Measurements for extension were taken by calipering the distance between the iron clamp straps.

TEST NO. 1—Babbit metal setting, an inferior grade of metal, quite hard and brittle. Up to 10,000 pounds there was an extension of 3-128ths of an inch, due to the babbit metal and stone coming to a firm bearing. After remaining five minutes under the load of 10,000 pounds no change was apparent. Between 10,000 and 15,000 pounds there was no extension, but after the five-minute period at 15,000 pounds the bolt had drawn out 1 inch. At 16,000 pounds the stone split. It had previously been used with a lead setting, and no doubt been weakened thereby.

TEST NO. 2—Lead setting, lead melted and poured in about the bolt. Hole in the stone tapered. Up to 2,500 pounds there was an extension of 1 inch. From 2,500 to 5,000 pounds there was no change; but after standing five minutes under 5,000 pounds the bolt had drawn out 1-64th of an inch. Above 6,000 pounds and up to 13,000 pounds, at each additional load of 1,000 pounds there was an extension of 1-128th of an inch, after which measurements were not taken. At 13,000 pounds, power from the engine was applied and an attempt made to pull out the bolt; the tension ran up to 33,000 pounds, when the lead gave way rapidly and the load fell off.

TEST NO. 3—Lead pipe setting in a straight hole. The internal diameter of the pipe was 1½ inches and the external two inches. The pipe was made to fit nicely in the stone, the last inch in length being driven. The bolt was then screwed into the pipe and made to cut its own way, thus forming a thread in the pipe ⅛ inch deep and forcing the lead out into all the irregularities in the sides of the hole. Up to 4,000 pounds there was an extension of 1-32nd of an inch, but between that and 10,500 pounds there was no change. Between 10,500 and 13,000 pounds there was an extension of 1-128th of an inch. Above this latter point each additional load produced its proportional amount of extension. In applying the power from the engine the tension rose to 25,000 pounds, and then fell rapidly from that point.

TEST NO. 4—Sulphur setting, in tapered hole. Up to 10,000 pounds there was no perceptible change in the bolt or setting. Above this point the extension became a measureable quantity, but at a load of 19,000 pounds it had become only 3-64ths of an inch. Beyond this no measurements were taken. At a load of 31,125 pounds the stone split. It was thought that at this point the sulphur setting showed signs of movement, though it is difficult to say anything definite. The fragments of sulphur from the broken stone showed no signs of crushing.

TEST NO. 5—Sulphur setting in a straight hole. Up to 20,000 pounds there was no measureable movement in either bolt or setting; at the end of the five minute period at 20,000 pounds there was an inch but beyond this there was no further accumulated extension of 1-128th of an extension through the remainder of the experiment. At 29,000 pounds the pressure of the iron clamps cracked off a corner of the stone and the load dropped 1,000 pounds; otherwise nothing was affected; at a load of 31,515 pounds, one of the iron straps holding the stone broke and ended the experiment.

The tests with sulphur were the most satisfactory in every way, and that was the material selected for use. In the experiments with lead and babbit metal, there was a very perceptible movement under a slight load or until the metal and stone had come to a firm bearing. This would seem to be due to the contraction of the metal on cooling. In both experiments with lead the failure was between the lead and the stone.

BUSINESS NOTES.

Mr. J. Courtney, plumber, Queen street east, Toronto, has assigned to W. A. Campbell.

A statement of the affairs of John Sims & Co., plumbers, 145 Church st., Toronto, showed the liabilities to be $10,827 and the assets, $26,452. It is likely that a settlement will be effected at 30 cents on the dollar.

The following items are reported in the *Legal and Commercial Exchange*: E. Lacasse & Co., plumbers, St. Henri, Que., have dissolved partnership.—Fortin & Son, sash and door factory, Vancouver, B. C., have sold out.—Wencelas Brunet has registered to carry on business as plumbers in Montreal, under the style of Hetu & Brunet.—Rochon, & Frere, contractors, Montreal, are offering to compromise at 35 cents on the dollar.—Gillard & Rufus, builders, and John C. Reid, painter, of St. John, Nfld., are applying for insolvency declaration.—Andrews & Stevenson, contractors, Glencoe, Ont., have dissolved partnership, Mr. James Stevenson, continuing the business.

MUNICIPAL DEPARTMENT.

THE MANUFACTURE AND USE OF PAVING BRICK.*

The generic term brick includes within its meaning classes of material of such wide variations in their particular qualities as to need a more definite classification when considering the adaptability of such classes to particular purposes.

So when we consider a certain class of this material for street paving it must not be confused with other classes manufactured for other purposes and perhaps entirely unfit for this particular use. These manifold qualities of brick are due partially to methods of manufacture, but more largely to greatly diversified qualities of the clay from which the brick are made.

Clays may be classed as to their origin and occurrence as follows:—Residuary clays result from the disintegration of rocks in place. The soluble and binding materials are leached out and was washed away and leave the insoluble materials in a more or less divided form, as clay. This takes its character from the character of the rock from which it is derived, modified by the action of water. Some of the purest clays are derived in this way from feldspathic rocks from which the alkalies have been leached, leaving a clay closely resembling kaolin (puree lay). Other less pure clays are derived from the disintegration of limestone, sandstone, &c. In each case, however, soluble constituents are almost entirely gone, leaving the insoluble silicates, quartz grains, alumina and ferric oxide. 2. Drift clays are the result of the mechanical action of the ice during the glacial period, by which the various formations were ground up and mechanically transported and redeposited largely without the aid of water. These clays represent the character of the mother rock much more accurately than those of class 1. as in this case the soluble matter is largely retained and not leached out, except by the action of the water, since their deposition. 3. Alluvial clays reworought and redeposited by fluvial agencies. 4. Indurated clays, or argillaceous rocks and shades, are formations resulting from the disintegration of the earlier rocks by various influences and their re-formation into new strata. They have usually been subjected to great pressure from the superincumbent rocks, to which pressure they owe their physial character to a large extent.

Of the deposits of clay above named the clays from the carboniferous period are most widely utilized for the manufacture of paving brick. At Columbus, O., the Devonian shales or the product of their disintegration, is untilised, while at Syracuse the Salina shale is found available. Some few drift clays are also successfully used for the manufacture of a fair quality of paving brick, notably at Decature, Jacksonville, and Urbana, in Illinois. A mixture of drift clay and carboniferous clay is utilized at Brazil, Ind., for the manufacture of paving brick. The accompanying map shows the distribution of the carboniferous deposits east of the Rocky Mountains and also the outline of the drift area. It also shows the location of the principal paving brick factories and the principal cities which are now using this material for paving within the territory shown.

As may be judged from its wide occurrence and manifold compositions, clay varies widely in its extreme characters, but all material to be classed as clays must have certain constituents in common. The essential ingredient is a hydrous silicate of alumina, known as kaolin, which, according to Professor G. H. Cook, is composed of

Silica	46·3
Alumina	39·8
Water	13·9

This may be considered a pure clay, and is rarely, if ever, found in nature. To this is commonly added in varying quantities, silica, lime, magnesia, ferric oxide, potash and soda. The presence of these substances, which may be regarded as the impurities of clay, and the physical conditions under which they exist, caused the wide variation of the clays themselves, and to a great extent in the manufactured product made therefrom.

Pure alumina will resist the highest temperature of the blast furnace, in which crystalline quartz (silica) will be only slightly affected, both being practically infusible. Alumina shrinks, warps and cracks greatly in drying, but gives plasticity and adhesiveness to the clay and strength to the product. Silica prevents cracking and disterting, the more silica being present the less shrinkage. But the more silica the less plasticity and adhesiveness of the clay and the less strength and greater brittleness. Lime and magnisa, while infusible in themselves or with alumina, fuse in the presence of an excess of silica, as do also several other common ingredients of clay, and form a "vitrified brick."

It is found that potash has the most active fluxing effect on clay, after which follow soda, lime, magnesia and iron in the order named. To "vitrify" a clay should contain at least 3 per cent. potash, 3½ per cent. of soda, or 5 per cent. of lime or magnesia, or 8 per cent. of iron, or a combined proportion of any of all these fluxes equal to these amounts. An appreciable less amount of these fluxing elements will leave all the product more of the nature of a firebrick, unvitrified and porous

* From a paper by Mr. D. W. Mead, read before the International Engineering Congress at Chicago Exhibition.