rental or purchase of land or premises, or for the building of premises to serve as offices, examination halls, libraries, museums, or for any other public purpose connected with architecture, i.e., it shall be the duty of the secretary to keep the register in accordance with the provisions of this Act, and the by-laws, orders, and regulations of

the Council.

All deeds of the Association shall be signed by the president and secretary
and sealed with the common seal of the Association.

20. This Act shall come into force on the day of its sanction.

SCHEDULE A

Date of Regis- tration.	Name.	Title or distinction if any.	Residence.
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HOT WATER WARMING IN DOMINION BUILDINGS DURING THE PAST TEN YEARS.

BY D. EWART AND WALTER R. BILLINGS

THE authors of this paper advance no claim for originality or novelty, it being prepared merely to attempt to convey to the Association an outline of some of the practice adopted in warming the various Dominion buildings with but water plants

some of the practice indopted in warming the various bounners with hot water plants.

The relative merits of hot water and steam as warming agents cannot be gone into here. They were fully considered by the chief architect who more than ten years ago satisfied himself on that point, and since then the Dominion buildings have almost invariably been heated with hot water, excepting when the intermittent use of the building or where the use of machinery therein rendered steam more advisable, and in such few buildings as the Smead-Dowd system or the use of wood stowes were preferable.

Nearly too buildings ranging in size from small village post offices to the Langevin block at Ottawa, have been successfully heated by warm-water, and we will at once proceed to give you an idea of the class of p'ant so far adopted.

Langewin block at Ottawa, fixe been succession reacted by warm water, and we will at once proceed to give you an idea of the class of pant so far adopted.

Among furnaces, the wrought iron pipe furnace, invented forty years ago by a veteran hot water heating engineer of Montreal, to whom the excellence of the modern direct hot water heating apparatus is mainly due, stands first for quick circulation, durability, and economy of fuel. The surcessful practice of the firm nanagurated by this engineer, shown throughout the breadth of Canada and the northermons States of the American Union in heating long, extended and rambling buildings, such as convents and asylums, satisfactorily, and with a lower expenditure of fuel than could be obtained from low-pressure steam plans in buildings of precisely the same character, at a time when steam heating engineers were wont to assert that how water could not be distributed throughout long, low buildings, evenly and economically, was largely due to the kind of furnace employed, and could not so readily have been obtained with the Cornish, the Tubular, the Saddle, or any of the cast iron sectional furnaces then hinche market.

Owing to prime cost of the pipe furnace and its need to be built in brickwork, the chief architect has used some of the excellent sectional heaters now the market of the pipe furnace and its need to be built in brickwork, the chief architect has used some of the excellent sectional heaters now the market of the pipe furnace and its need to be built in brickwork, the chief architect has used some of the excellent sectional heaters now the market of the state of the excellent sectional heaters now the market of the state of the pipe furnace and its need to be built in brickwork, the chief architect has used some of the excellent sectional heaters now the market of the state of the excellent sectional heaters now that the market of the state of the excellent sectional heaters now the case of the excellent sectional heaters now the case of the excellent secti

in the market for small and meanum sized outlenges of compact keyout; of its star flowers where anthractic coal is used, the wrought iron pipe furnace is first favorite. Where the use of bituminous coal is more economical than anthracite the pipe furnace chokes too rapidly, and the more sluggish or less rapidly circulating wrought iron tubular as well as the cast iron sectional furnaces are used for the large and small buildings respectively. The tubular furnace differs from the steam epiladrical boiler only in having the steam space as well as the water space filled with tubes. It is built in brickwork, the grate under the proximal end, the flame and gases of combustion passing backward under the shell to a chamber behind the distal end, returning from thenceto a second chamber at the proximal end, and passing finally either backward over the shell to the chimney, if the draught be good enough, or passing at once into the smoke pipe, in the case of the draught being a medium one. In these cylinders the tubes have usually been 3", but the experience of the Department wauld indicate that 4" tubes would not be too large.

The advantages of the cust iron sectional furnace is its relative small size and cost, and that it does for both bituminous and anthractic coal. In the smallest buildings no main larger than a" is required, so that these furnaces as manufactured are ready to set up, but in medium sized buildings where larger mains were required, and in those cases where twin furnaces were considered preferable to single ones, headers for the connection of the mains and to be provided.

iarger mains were required, and in those cases where twin intraces were considered preferable to single ones, headers for the connection of the mains had to be provided.

In some cases where a single furnace is used, its sudden failure in cold weather may be a serious matter, especially if the furnace become entirely disabled in a town where n duplicate furnace cannot be at once obtained. In the ense of a greenhouse, such a case is worse than its occurrence in an official building, but, in any cave, the want of heat even for a few days is a serious matter, besides the trouble to the officials. It would be a serious matter, besides the trouble to the officials. It would be a serious matter, besides the trouble to the officials. It would be a serious matter, besides the trouble to the officials. It would be a serious matter, besides the trouble to the officials. It would be a serious that it is necessary, until a filter can be had. To guard against the disagree-able probabilities referred to, twin furnaces are sometimes used with advantage—in which case the headers are connected with both furnaces, the connections having gate valves so arranged that one or both furnaces can be used as required, wought iroo pipe has been used throughout, even the stacks of 4° piping at the greenhouse of the Central Experimental Farm being of this kind. All pipe fittings and the furnace headers are; however.

ist from. In the arrangement and layout of the mains, what may be called the direct

system, i. e., that which offers the shortest distance and easiest flow to and from the heating surface, is used. The flow and return mains are ecunterparts, and go side by side. In no case has the system some architects adopt of having a separate flow and return from the furnace to each heating tract been used, although, in some cases, one or more mains are taken off the header exclusively for the use of the ground floor. When separate mains, as aforeaid, are used for supply of ground floor. When separate mains, as aforeaid, are used for supply of ground floor heating surface, they are always taken off midlength of the header, where the circulation is more lively, the mains of the upper floors taking the outside, and, in a 3-storey building of the ordinary departmental type, owing to the less rapid circulation of the water to and greater height of ceiling in the ground floor, the total sectional area of the main or mains of that floor at the header is equal to that the first and second floors combined, leaving all 1-storey annexes out of the question. In the cases referred to, where the ground floor mains are separate from those of other floors; the two upper floors are served from the same horizontal mains, but in all cases, whether the risers are all taken from one main, or whether the risers of the ground floor have a separate main, the first and second floors are taken from the same sets of risers. These risers are straight from bottom to top, the upper run being diminished in sectional area at the point where the connection of the lower tract of heating surface is never used. However, in nearly all cases the horizontal mains in the basement are trunks of which all the risers are branches, those serving the ground floor to the volve of the lower tract of heating surface is never used. However, in nearly all cases the horizontal mains in the basement are trunks of which all the risers are branches, those serving the ground floor to the sectional area of a branch pipe must equal the area of all branches. The

Bore of main or connection.	Quantity of heating surface based on a proportionate increase from 50' to a 1" connection.	Quantity used in good practice with well circulating plant.
t inch	so square feet	50 square feet
11/4 "	84 " "	84 " "
11/4 "	112 " "	200 " "
2 "	200 " " "	100 11 11
21/2 "	314 " "	833 ""
2 "	450 " "	1.000 " "

The foregoing list is not offered as a carefully worked out scheme, but as an indicator of the fallacy of direct proportions. In the early days, some of the public buildings were piped on the rule found in most manuals, but with disadvantage, and it became evident that no table could be exclusively

followed. A large heating firm has in one plant a six inch main supplying 30,000 lineal feet of t^a pipe (10,000) in heating surface, circulating well, whilst in another plant where the length of the main is greater, 7,000 lineal feet of t^a pipe (2,334) is all that can be circulated well on a main of that size. Another example by the same firm—the plant at the McGill University, Montreal, has a $2\frac{1}{2}$ inch main circulating 2,500 lineal feet of t^a pipe in heating surface.

Another example by the same and the many of the heating surface.

The intention in laying out an apparatus is to arrange the branches of the main in such a manner that all will circulate evenly, and if the rises for the supply of upper flats and the easily flowing wall coils could be taken from the distal end of the horizontal main, and those for the ground floor and the east into a could be placed at the proximal and, being careful in both cases to calculate the individual instances at their exact proportionate rate of circulation, the matter would be an easy one; but as the occurrence of such a case falls little short of a fairly average miracle we do not take it into account, and various shifts have in consequence to be made to get over the difficulties, in carrying out many of which we are dependent on the skill of the filter employed. For instance, when it can be helped we must not take off many branches in the same neighborhood, and on no occasion take off the main a quick circulating and a sluggish branch close together. In the latter case, where the two neighbors are flows, one will rob the other, and if they are returns, the one containing the warmer water returning will back up the other and thus obstruct the circulation of the heating tract connected with it.

and if they are returns, the one containing the warmer water returning arm, back up the other and thus obstruct the circulation of the heating tract connected with it.

The custom has been to take all branches off the top of the horizontal mains, but occasionally, as a check, a branch is taken off the side of the

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The practice is to allow a radiator valve both to the flow and the return of each radiator or coil. For all ground flow surface and for any riser which returns or feeds but one coil on any upper floor, only the flow valve is connected to the radiator, while the return valve is placed in the cellar with the draw off valve beside it, in order that the single heating intent may be conveniently emptied without disturbing others—a convenience which must be foregone in the case of one riser feeding or returning more than one radiator or coil, as in such a case, all the heating surface served by the return piper must be emptied at once. The ordinary peet valve is used on all mains, beaders and branches, and wherever a valve is needed, excepting on supply connections of ground floor and natic heating surface, and to any heating tractivalish the last on the riser, in all of which exceptions globe angle tractivalish the last on the riser, in all of which exceptions globe angle tractivalish the last on the riser, in all of which exceptions globe angle tractivalish the last on the riser, in all of which exceptions globe angle tractivalish the last on the riser, in all of which exceptions globe angle tractivalish the horizontal programment and sizes of piping and the quantity of heating surface can be decided on. In the public buildings it was a matter presenting some difficulties.

In steam heating practice, effective radiators such as the Nason, Walworth et al., which are attractive in appearance, economical of floor area, and rapid in returning the water to the boiler, were in the market at a figure which ensured their use in preference to box coils, the appearance of which has always been their only drawback. Ten years ago the so-called hot water radiator known to the profession was sluggish in action and possessed of but excellent circulators, were objected to in some

^{*} Paper read at the Third Annual Convention of the Ontario Association of