

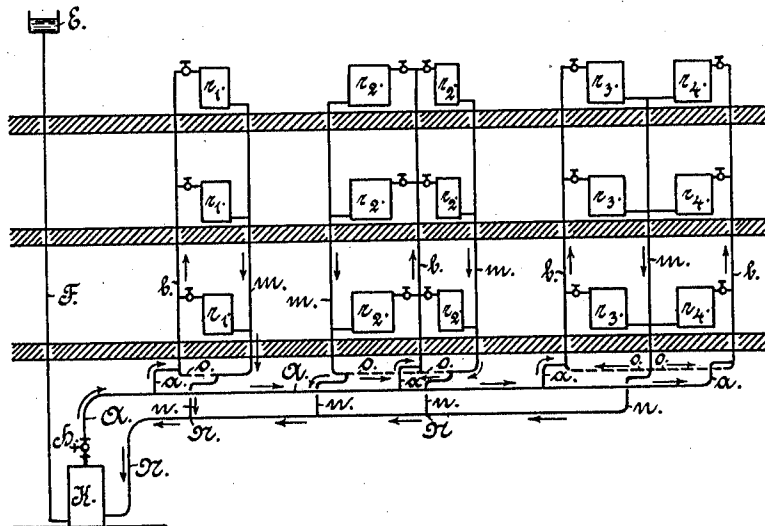
A. B. RECK.
HOT WATER HEATING INSTALLATION.
APPLICATION FILED APR. 14, 1908.

1,031,290.

Patented July 2, 1912.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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Edwin D. Spring.

INVENTOR

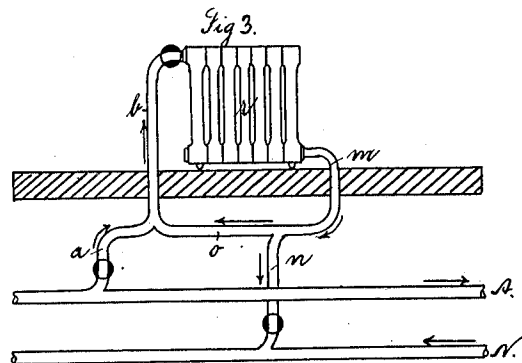
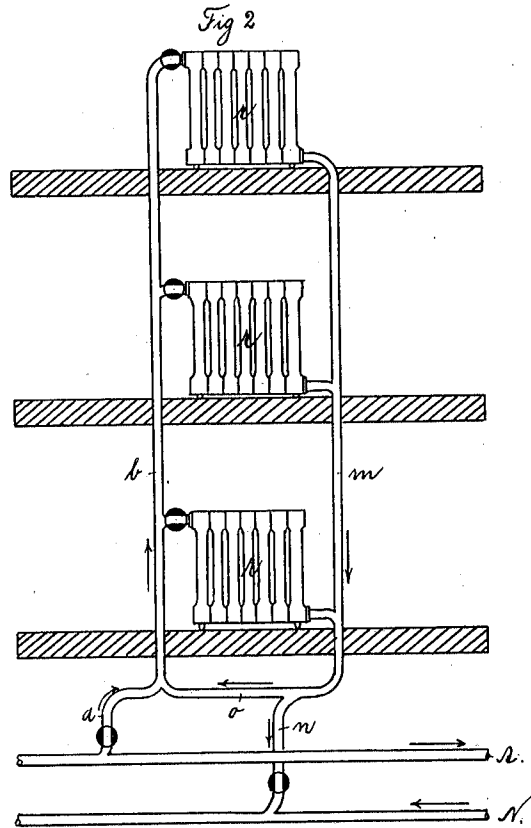
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ATTY.

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2 SHEETS—SHEET 2.



WITNESSES

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HOT-WATER HEATING INSTALLATION.

1,031,290.

Specification of Letters Patent.

Patented July 2, 1912.

Application filed April 14, 1908. Serial No. 426,973.

To all whom it may concern:

Be it known that I, ANDERS BORCH RECK, captain, subject of Denmark, residing at Christiansvej 16, Hellerup, in the Kingdom of Denmark, have invented new and useful Improvements in Hot-Water Heating Installations, of which the following is a specification.

In hot water heating installations with an open expansion reservoir the pressure of the liquid in the upper part of the system is so small that large quantities of steam are easily formed as soon as the temperature of the water in the open reservoir rises only a very little above the boiling point of water under atmospheric pressure. The production of steam in such a low pressure heating installation does not have to be very great to cause the expulsion of so large a quantity of water from the expansion reservoir that the working of the system is deranged if nothing worse happens.

Since the temperature of the water in a boiler rises occasionally for a short time considerably above that which is normal for the boiler and since the water in the ordinary systems rises to the upper part with almost the same temperature as that with which it leaves the boiler, it has hitherto been necessary in order to prevent boiling over to make both the radiators and the pipes of such dimensions that the desired effect of the system can be obtained with a boiler temperature considerably below the boiling point at atmospheric pressure.

Next to the boiler the main pipes are the most important part of a hot water installation. Through one of these pipes, the main flow pipe, the heated water passes from the boiler to the building to be heated, distributing itself through the radiators, and through the other, the main return pipe, the cooled water coming from the radiators is returned to the boiler to be heated again. The cost of these two main pipes constitutes a large part of the total cost of the installation, so that any thing that diminishes their dimensions without disadvantages is of greatest importance. Since generally these two pipes have usually to be placed outside the rooms to be heated and since the heat radiated from their outer surfaces represents a useless loss of heat, the dimensions of the pipe also play a great part in the fuel economy of the installation. The dimensions of these pipes depend first of all on the

quantity of water to be conveyed per unit of time. This quantity of water can be the smaller, the greater the difference of temperature of the water in the two pipes, and with the same temperature of the water in the return pipe the quantity of water can be smaller, the higher the temperature that can be attained in the main flow pipe. From this is derived the importance of the present invention, since the latter renders it possible to keep a higher temperature in the main flow pipe than was previously thought advisable owing to the danger of the formation of steam.

If not only the main return pipe but also the main flow pipe are arranged in the basement of the building to be heated, which is nearly always possible, there is no danger of steam being generated either in the boiler or in the main flow pipe so long as the temperature in the boiler is kept a suitable number of degrees below the boiling point of the water at the pressure in the main flow pipe. This boiling point varies in buildings of usual height between 250° F. and 290° F. and in order that water may be used at a temperature of between 220° F. and 260° F., in the main flow pipe without danger, care must be taken that the water in this pipe is cooled to about 180°–190° F., that being the temperature generally used in hot water heating plants, by suitable means, before it passes to the upper parts of the building, where the pressure is less and the danger of steam formation greater. How this result is obtained in a simple manner can be understood from the accompanying drawing in which—

Figure 1 is a diagrammatic view of the invention. Fig. 2 is a diagrammatic view of a portion of Fig. 1, and Fig. 3 shows the invention applied to a single radiator.

The continuous lines in the drawing show a low pressure hot water heating plant of known construction.

The present invention consists in the pipe connections shown by dotted lines.

K is the boiler of the installation wherein the water is heated, r_1 , r_2 , r_3 , and r_4 are the radiators wherein the water is again cooled.

E is the open expansion reservoir of the plant, F the pipe connecting it with the lower part of the boiler, so that only the coldest water can rise from the boiler to the reservoir when the water expands from rise of temperature. The other pipes shown in

continuous lines connect the boiler and radiators in the usual way, so that the heat imparted to the boiler is transmitted to the radiators.

- 5 As with every hot water heating installation, so the one shown in the drawing may be considered as consisting of two main parts. The one main part of the plant consists of the boiler with the expansion reservoir, the two main pipes connected with the boiler, the main flow pipe A and the main return pipe N together with pipes *a*, *n*, through which the main pipes are connected with the vertical branch pipes or risers of the system. The other main part consists of the rest of the plant and is to be considered as a number of groups of radiators with inlet and outlet pipes *b* and *m*, each group receiving hot water from the same pipe, which leads either direct from the boiler or from the main flow pipe.

- In the example shown in the drawing four groups of radiators are shown, namely, r_1 r_2 r_3 r_4 . The pipes which lead the hot water to these four groups are marked *a* and *b*. The pipes through which the water cooled in the radiators finds its way to the main return pipe are all marked *m* and *n*. In the group r_2 there are two pipes from the radiators to the return pipe N. On the other hand the two groups r_3 and r_4 have only one exit pipe *m* and *n* from the radiators to the pipe N, the exit pipe being common to both groups. Thus it will be seen that in the drawing the basis for the division of the radiators into groups has been the inlet pipes only and not the exit pipes *m*, *n*.

- In order to explain the present invention there may be considered first of all a heating installation consisting only of the parts above mentioned well known to those skilled in the art, which are shown in the accompanying drawing in continuous lines; the alteration in such an installation involved by the invention will be described. It is supposed that the cross sections of the various pipes in the system are such as conduce to a good result, namely so that the dimensions of the main pipes A and N with the connecting pipes *a* and *n* are calculated on the basis of the driving pressure created in these particular pipes which pressure is due to the difference in the specific gravity of the water, while the dimensions of the pipes *b* and *m* in the groups of the radiators are independently calculated on the basis of the pressure created in these particular pipes themselves.

- 60 Now the present invention consists in so altering the installation that, as shown in dotted lines in the drawing, in each of some of or in all, of the groups of radiators the part *m* *n* N of the pipe system through which flows the cooled water from the ra-

diators in the group is put into direct connection, as by pipes *o*, with any point of the lower part of the branch pipe *a* leading from the main flow pipe A to the group. In the drawing the pipes *o* shown in dotted lines are indicated as connected with the point from where the pipe *m* from the radiators meets the branch pipe *n* which leads to the main return pipe N, but they can be connected with any other points of the branch pipe *n* or with points of the main return pipe itself, near the branching off of the pipes *n*. The addition of the pipe O to the usual pipe systems for heating installations of this sort enables the dimensions of the main pipes A and N to be considerably reduced as well as those of the pipes *a* and *n* leading therefrom, without detriment to the efficiency of the system.

To understand the matter it can be supposed that the resistance against the motion of water in such an installation as shown in the drawing is increased by the throttling of valves inserted on all the pipes A, N, *a* and *n*. If during this the firing of the boiler is continued as before and if the system has no connecting pipes *o*, this increase of resistance in the pipes mentioned would reduce the quantity of the circulating water while on the other hand the temperature of the water coming from the boiler would rise with the result that steam would be liable to be formed in the upper parts of the system with the danger that the expansion reservoir would boil over. This is not so when the pipes *o* of suitable dimensions are added. Of course in this case also a throttling of the valves that may be inserted in the pipes of the main circuit A, N, *a* and *n* diminishes the quantity of the water circulating in the said pipes in unit time, so that the water with undiminished firing of the boiler, leaves the latter with a higher temperature than before. The local circuit in the pipes *b* and *m* of the groups of radiators produced by introducing the pipes *o* will not, however, have to overcome an increased resistance. And even if the alteration in the supply of heat to any group occurs so that the quantity of water passing through the pipe *a* is lessened, then the quantity of heat itself supplied remains unaltered and the temperature of the inflowing water increases as the quantity decreases.

Under the above mentioned conditions the case for the local circuit of each group of radiators is such that not only the resistance in the circuit but also the supply of heat so to speak, remains unaltered, and this supply of heat occurs uninterruptedly at the place in the circuit where the pipe *a* enters it, just as if there were an ordinary small hot water boiler at this point. Now it is a well known fact that in a circuit with a certain difference in level between boiler and

radiator and with certain resistances in the
 pipes, there can only be certain velocities
 and certain temperatures for each particular
 supply of heat to the boiler. From this it
 results that if the increase of resistance in
 the main pipes A, N, *a* and *n*, causes the water
 flowing into a local circuit through the pipe
a to diminish then a quantity of water cor-
 responding with this decrease in *a* flows
 from pipe *o* to pipe *b* and by the mixing of
 this water cooled in the radiators, the tem-
 perature of the water from *a* sinks just so
 much that the temperature in pipe *b* remains
 the same as before the increase of resistance
 in the main circuit. From this it will be
 further seen that it is immaterial whether
 the inflow of warm water to the point of
 union of pipes *o* and *a* is caused by heating
 the boiler K or from any other cause, as for
 example by leading in steam or air in the
 main circuit or by pumps or the like. The
 circulation caused only by the difference of
 temperature of the water in pipes *b* and *m*
 in the local circuit remains in all cases the
 same. Take for example a heating plant in
 a building where the expansion reservoir
 is 33 feet above the main pipe A but
 only 3 feet above the highest radiator of
 the system. With these conditions and a
 temperature of about 215° F. steam would
 form in the radiators while in the main
 pipe A steam would not form until a tem-
 perature of 250° F. was attained. If the
 pipes of the installation are of such dimen-
 sions that the water when the system is in
 full operation, rises to a temperature of 185°
 F. in the radiators and 220° F. in the main
 pipe A, there is the same margin of safety
 against formation of steam at both places,
 namely 30° F. If now the size of the radi-
 ators is such that the amount of heat re-
 quired for the building is supplied when
 the water enters the radiators with a tem-
 perature of 185° F., and leaves them 35° F.
 cooler, that is, at a temperature of 150° F.
 then the water both in pipes *m* and *n* and in
 the main return pipe N will also have this
 last mentioned temperature. Since there is
 no objection to the temperature in the main
 pipe A being as already mentioned, 220° F.
i. e. 70° F. higher than in pipe N, the same
 transference of heat occurs in the main cir-
 cuit as in the groups of radiators, even if
 in unit of time only half the quantity of
 water circulating in all the pipes of the
 groups of radiators, circulates in the main
 circuit. If therefore the dimensions of the
 main pipes are calculated for half
 the hourly flow of water in comparison
 with the quantity of water necessary for
 circulating in the radiators, then under the
 above conditions each pound of water which
 at a temperature of 220° F. passes from one
 of the pipes *a* to one of the pipes *b* mixes
 here with another pound of water which

enters from the pipe *o* of the group and
 since the temperature of this last pound is
 150° F. both pounds will pass mixed through
 pipe *b* at a temperature of

$$\frac{220 + 150}{2} = 185^{\circ} \text{ F.},$$

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that is at the temperature desired.

While in a heating installation without
 the connecting pipes *o* it would be necessary
 to use the same quantity of water in the main
 pipes as in the groups of radiators, in the
 above example it is possible to adjust the
 dimensions of the main pipes for only half
 the quantity of water, so that the pipes may
 be considerably smaller. In this manner, by
 diminishing the cross section of the main
 pipes, there is utilized the possibility afford-
 ed by the invention of using without disad-
 vantages main pipes having greater resist-
 ance to the motion of the water than has
 formerly been possible. By decreasing the
 dimensions of the main pipes not only is a
 smaller capital outlay required but on ac-
 count of the smaller surface of the pipes
 loss of heat by radiation is lessened so that
 the annual working costs are diminished.
 It is advantageous for the motion of the
 water in the local circuit of the groups of
 radiators through pipe *o* to arrange at the
 place where this pipe and pipe *a* meet and
 connect with pipe *b*, T pieces of any well
 known form in which the two inflowing cur-
 rents meet at an acute angle.

The addition of pipes *o* to the hitherto
 known pipe system of hot water heating does
 not lessen the possibility of central regula-
 tion of the heat given off by the radiators
 of the installation by altering the tempera-
 ture of the water in the boiler, by influencing
 the combustion. Central regulation can also
 be obtained by keeping the temperature of
 the water in the boiler constant and by ad-
 justing a valve as shown at H on the main
 flow pipe A until the quantity of water pass-
 ing through pipe A to the pipes *a* and
 through these to the groups of radiators is
 exactly what is required to heat the build-
 ing. This method of regulation is especially
 of use where the pressure effecting the cir-
 culation of the water in the main pipes A and
 N is caused not only by differences in spe-
 cific gravity of the water in these pipes, but
 also by other means as for example, by the
 introducing of steam or air into the main
 circuit or by pumps or the like.

In Fig. 1 of the drawings no valves are
 shown in pipes *a* and *n* between the mains
 and the groups of radiators since such valves
 are not absolutely necessary in an installa-
 tion using this invention. In practice how-
 ever a valve is generally placed in pipes *a*
 and *n* as shown in Figs. 2 and 3 so that each
 group can be independently cut off from the
 mains and emptied. Such valves can also

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be useful in one or both of the following ways. Since only pipes of certain fixed diameters can be obtained, it is often necessary to choose the pipes a and n of larger diameter than actually necessary. By partly throttling a valve inserted on one of the pipes a or n this can be remedied. Further sometimes it is desirable in a building that the temperature at certain times and in certain groups of radiators should be kept lower than in others. This is also obtained by partly throttling the valve on the pipes a and n of the groups in question.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A hot water heating system comprising a main circulating pipe system, a heater inserted in said main pipe system, a plurality of complete local hot water heating circuits and branch pipes forming connections between the said local circuits and the mains in the said main circulating pipe system, said local circuits being each formed by a flow riser and a return riser, heat radiating surfaces connected to the upper portions of the said risers, and a local main connecting pipe making communication between the lower end of the said flow riser and the lower end of the said return riser, the said main connecting pipes in the said local cir-

cuits being positioned on about the same level as the horizontal mains in the said main circulating pipe system.

2. A hot water heating system comprising a main circulating pipe system, a heater inserted in said main pipe system, a plurality of complete local hot water heating circuits and branch pipes forming connections between the said local circuits and the mains in the said main circulating pipe system, said local circuits being each formed by a flow riser and a return riser, heat radiating surfaces connected to the upper portions of the said risers, and a local main connecting pipe making communication between the lower end of the said flow riser and the lower end of the said return riser, the said main connecting pipes in the said local circuits being positioned on about the same level as the horizontal mains in the said main circulating pipe system, and means for regulating the quantity of water circulating in the said main circulating pipe system.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ANDERS BORCH RECK.

Witnesses:

A. M. CARLSEN,
OSKAR NIELSEN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."