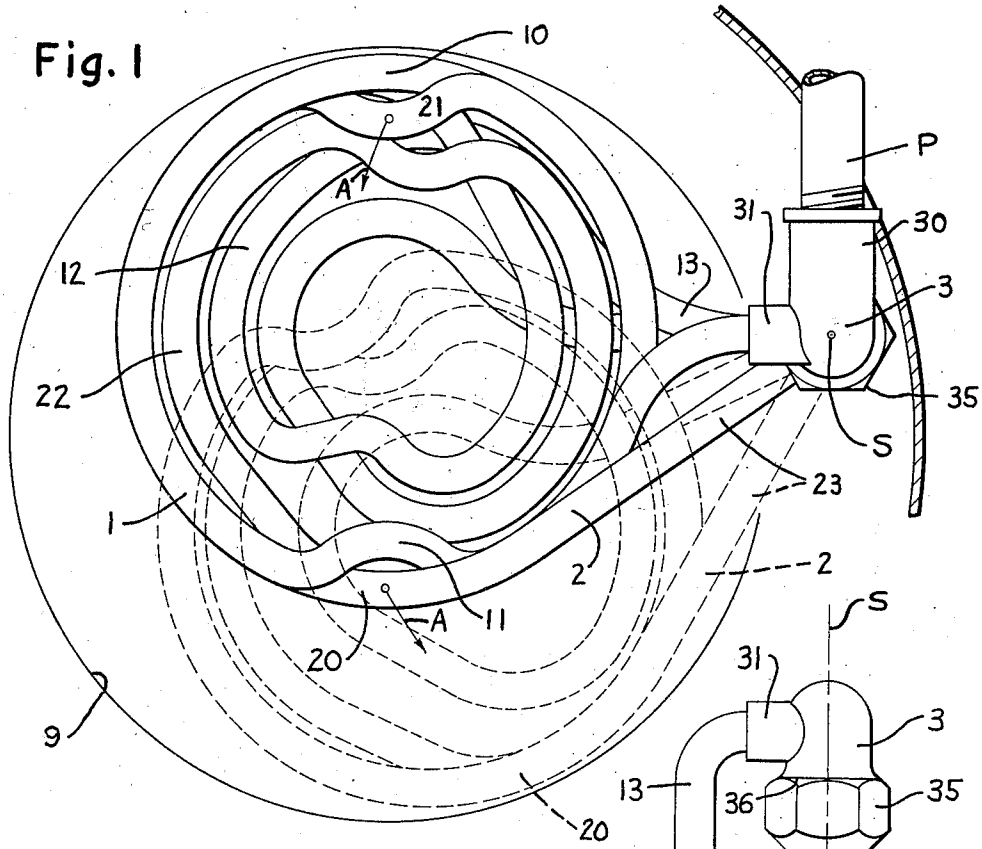
June 22, 1943. H. A. BECKSTROM 2,322,502

WATER HEATER

Filed March 6, 1940

Fig. 1



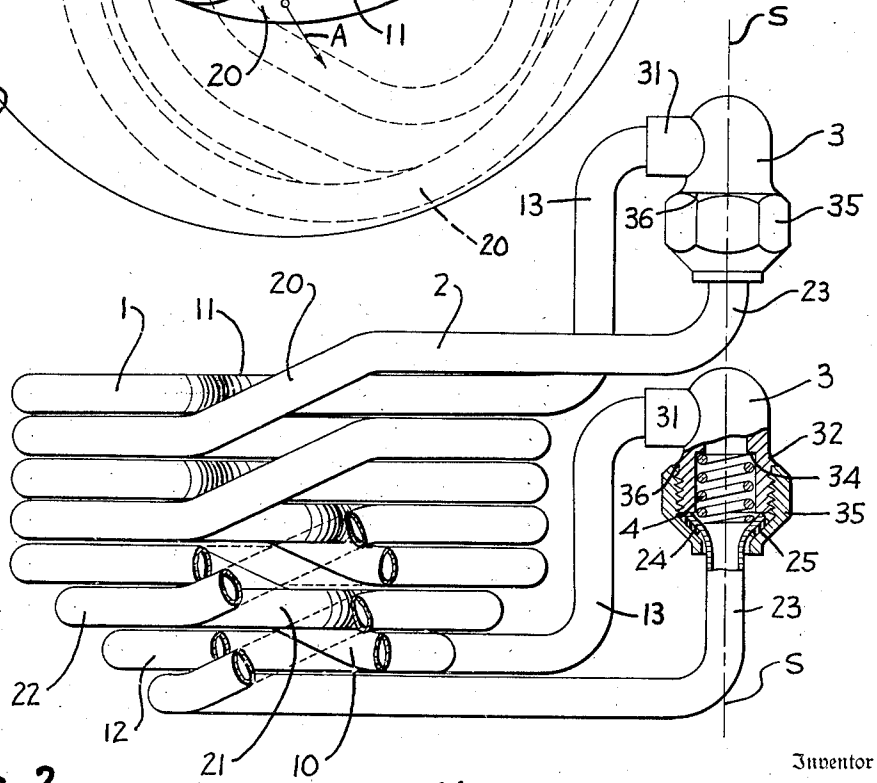


Fig. 2

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WATER HEATER

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13 Claims. (Cl. 257—248)

It is common practice to dispose a tubular coil within a furnace or like chamber, where it is subject to the flow of hot gas or other application of heat, and to circulate water through such a coil, to the end that a supply of hot water may be obtained for domestic purposes, heated by the fire in the furnace, by means of which the house itself is heated. Such coils, however, are generally fixedly located, and their location and disposition with respect to the source of heat must be a compromise. During the winter months, when the furnace is being fired more nearly continuously and usually with a high fire, the coil, if located where it would be adequately heated during the months when the fire is less frequently active, and active to a lesser degree, would produce overheating of the water. Conversely, if the coil were located in a position and at such disposition with respect to the source of heat that there is not excessive heating during the winter months, there would be greatly inadequate heating during the warmer months, when the furnace is less frequently used. Its arrangement and location must therefore be a compromise between the two objectives, in the normal installation.

It has been proposed heretofore to adjust the position of the coil with respect to the source of heat, as is suggested in the patents to Howard No. 498,057 and to Vrba No. 1,669,794, but in each such arrangement it is necessary to provide and to pack, in the water inlet and discharge pipes, a sliding joint or the like, or in some manner to make provision for the required movement between the water supply ports at the heater, and the fixedly installed water pipes leading to and from the furnace; at best such adjustment can be of only limited extent.

It has also been proposed, in the patent to Steele, No. 2,092,658, to adjust a shield member relative to or along a water heater to vary the surface of the heater which is impinged by the hot gas, but in such an arrangement the water heater body must be itself a specially formed body, and it is not practicable to employ a coil form of water heater, which is simply constructed and which affords the maximum of area exposed to the gases when maximum heating is desired.

It is a principal object of the present invention to provide a water heater, preferably in coil form, so constructed and arranged that of two or more complementary coils one at least is movable, relative to another, between a position wherein the turns of the coils are interleaved and mutually shield one another from the hot gas, and other positions wherein no coil materially shields another, and the turns constituting the coils have their axes spaced apart. The first position above is the condition obtaining when the minimum of heating of the water heater is desired, and the second condition is that obtaining when a greater or maximum heating is desired.

More specifically it is an object to provide a heater in coil form, formed of at least two coils, one of which is movable relatively to the other, and wherein in the interleaved position, whatever may be the peripheral form defined by the interleaved coils, the individual turns of each coil are spaced apart only sufficiently to permit the interleaving of the turns of the other section or sections, to the end that the peripheral form of the heater as a whole is a substantially unbroken continuous wall, whereby few, if any, interstices are afforded for the circulation through the walls thus constituted of hot gases. The heating is then almost entirely produced by the hot gases that flow outside and inside of the space thus enclosed.

It is a further object, in connection with a heater of the type just described, to provide means, preferably formed by restricting the peripheral extent of the terminal turns at the lower end of the heater coils, whereby to close in the entrance to the enclosed space to a greater or less degree, thereby to restrict entrance of hot gases to the interior of the enclosed space, particularly when parts are in the high fire but low heating condition.

With these and other objects in mind, as will appear from a study of the disclosure as a whole, my invention comprises the novel heater, the novel arrangement of the several parts thereof and their specific form, and the novel arrangement of such a heater, so constructed, relative to the combustion chamber of a furnace or similar chamber wherein such a heater is installed, to be heated by the flow of hot gas or otherwise.

In the accompanying drawing I have shown my invention embodied in a typical form. It will be understood, of course, that the form, arrangement, and particular characteristics of a given heater will vary in accordance with the requirements of individual installations, and that the arrangement shown is typical only.

Figure 1 is a plan view of such a coil heater, installed within a furnace combustion chamber, and Figure 2 is a side elevation of the heater, parts being broken away for better illustration.

The furnace, in the combustion chamber of which such a heater is generally installed, is

represented at 9 in Figure 1. The heater, at least the fixed portion thereof, is preferably located somewhat eccentric to the furnace 9, as is seen in Figure 1, so that upon relative lateral movement of the movable section there may be afforded space for the latter to move, as is shown in dash lines in Figure 1.

Such a heater is formed of preferably two tubular complementary coils 1 and 2, of which 1 may be considered the fixed section and 2 the movable section. In form these may be substantially helical coils, although it is immaterial whether their plan form be circular or otherwise. The peripheral extent of each generally corresponds to that of the other, and the turns of each are sufficiently spaced apart, slightly in excess of the tubular diameter of the turns of the other coil, that the levels of the turns in the two coils are staggered. Thus the turns of one coil may interleave with or be alternately interposed between the turns of the other coil, to bring the two coils into substantial axial coincidence, and to form of their interleaved turns a substantially unbroken peripheral wall defining the intra-coil space of the heater.

It is obvious that the tubes 1 and 2, if precisely helically coiled, can not become exactly axially coincident, since there would be interference at the opposite sides of the two coils. Provision is made whereby they can become axially coincident by offsetting the respective turns. Preferably also a further expedient is provided to prevent interference in that each turn, throughout the greater part of its 360 degrees extent, lies in and defines one single plane perpendicular to the coil axis, as is best seen in Figure 2, but is joined to the next adjacent turn in the same section by an inclined tubular length, indicated at 10 and 20. It is now possible, by offsetting the complemental tubes only within the region which would otherwise be occupied by these inclined lengths 10 and 20, to avoid interference, and yet to permit the two coils to come into substantial axial coincidence. Such offsets are indicated at 11 and 21, respectively.

While the relative movement of the two sections may be accomplished in any convenient manner, it is preferably accomplished by making the coil 2 swingable about an axis S which is outside the axes of either heater coil. To this end, and to the end of properly supporting each coil and of supplying water thereto or receiving water therefrom, it is convenient to provide two fittings 3 each having a branch 31 for connection to the terminus 13 of the fixed coil, and a branch 32 having means for connecting to and supporting the terminus 23 of the swingable coil. The third branch 30 of the fitting connects fixedly to the normal hot and cold water pipes that lead into the furnace, shown at P.

The connection of the terminus 23 to the fitting 3 is by a swivel fitting of suitable form, and that illustrated in section in Figure 2 has been found eminently suitable for such a purpose. Interiorly the branch 32 is provided with a shoulder 34. Externally it is threaded to receive a sleeve or cap 35. The end of the terminus 23 is belled or flared, as indicated at 24, and is received between the end of the branch 32 and the sloping end wall of the cap or collar 35. Packing means 25 may be employed to hold the joint tight at this point, and the joint is also made tight, yet the terminus 23 is permitted to swivel, by screwing home the sleeve 35 upon the branch 32. The sleeve may be screwed home until its end contacts the external shoulder 36, or packing means may be employed at this point. The parts are so proportioned that at this time the belled end 24 merely contacts, but is not clamped against the end of the branch 32 by the sleeve 35. The packing ring 25 is compressed to maintain a tight joint, and parts are held in water-tight position by a spring 4 interposed between the shoulder 34 and the interior of the belled end 24, which spring is compressed somewhat by threading home the sleeve 35. The fitting is connected to a supply of water under pressure, and the water pressure, acting upon the flared end 24 of the tube, is the principal agent which presses the flared end 24 tightly against the packing ring 25, and thus the water pressure primarily retains the joint tight. Swiveling is permitted about the swivel axis S.

It will be noted that the swivel axis S coincides in both the upper and lower fittings 3, one of which connects to the hot water and the other to the cold water. It is of course immaterial whether two separate fittings be employed, or whether the two fittings be combined physically into one piece, except as the choice may be dictated by convenience of connection to the pipes P within the furnace, and to the termini of the coils.

Thus assembled it is obvious that the coil 2 may be swung about the swivel axis S from the position shown in full lines in Figure 1, wherein the coils 1 and 2 have their axes coincident, into a spaced-apart position, as indicated in the dash lines in Figure 1, wherein their axes are non-coincident. The coil 2 swings substantially in the manner indicated by the arrows A in Figure 1, and the arrangement of the portions 20 and 11, 21 and 10 of the respective coils is such as will permit this swinging movement.

As is self-evident from Figure 2, when the coils have their axes coincident, hot gases which tend to sweep over or through the heater meet a substantially unbroken continuous peripheral wall, and can only sweep generally over the exterior or perhaps also over the interior of such wall, but cannot sweep through interstices between the individual coils that make up the wall to any appreciable degree. As a result the heating is a minimum when parts are in this position. When the parts are swung laterally apart, into such a position as is indicated in dash lines, the hot gases can now pass through the spaced adjacent turns of each given coil, and thereby the heating effect is greatly increased, each with lower fire or less frequent firing.

If desired, access of the hot gas to the intra-coil space, at the interior of the heater, may be obstructed more or less by restricting the diameter of the terminal turns of the coils, especially at the lower end of the heater, as is indicated at 12 and at 22. This restriction of these lowermost turns tends to restrict the lower aperture admitting to the intra-coil space, and also tends to deflect the hot gases which enter this space, and to hold them away from the interior walls thereof. This effect may be continued further, if desired, to reduce the effective opening, when parts are in the full line position of Figure 1, to a very small opening.

The number of turns in each coil of the heater may be varied as may be required by each individual installation. Several turns in each coil are preferred, but the particular number employed is largely a matter of choice. Similarly the size of the tubes that form the coils, their

diameter as coiled, and the spacing apart of the turns is likewise a matter of choice and convenience, in accordance with the demands of any particular installation.

What I claim as my invention is:

1. A water heater for exposure to a flow of hot gas comprising water supply and delivery connections, two coils of similar shape and of substantially equal extent communicating with such connections, and means supporting said coils for relative movement between a disposition wherein the coil axes coincide and the coils are substantially in registry and thus mutually shielded from the hot gas, and a disposition wherein the axes of the coils are generally parallel but in spaced relationship, to spread the coils for increased exposure to the hot gas.

2. A water heater for exposure to a flow of hot gas, comprising a plurality of relatively movable coils, means to supply water to and to receive water from the coils, the coils being relatively so formed that in one relative position they are mutually shielded from exposure to the hot gas, by a turn of one coil being substantially in registry with a turn of another coil, and when relatively shifted from such position their turns are severally exposed more greatly to the hot gas.

3. A water heater for exposure to a flow of hot gas, comprising water supply and discharge connections, two coils communicating with said connections and disposed with their axes substantially parallel, the major portion of each coil turn defining a plane substantially perpendicular to its respective coil axis, and the turns of the two coils being relatively staggered, and means supporting said coils for relative lateral movement, to dispose a turn of one coil in substantially parallel, overlapping relationship with a turn of the other coil.

4. A water heater for exposure to a flow of hot gas, comprising water supply and discharge connections, two coils each having a plurality of turns and communicating with said connections, and means supporting said coils for relative movement between positions wherein a plurality of turns of each coil are interleaved in alignment mutually shielded from the hot gas, and a position wherein such coil turns are spread out of such alignment for increased exposure to the hot gas.

5. A water heater for disposition within the combustion chamber of a furnace, to be swept by the hot gas in such combustion chamber, and in communication with means to supply water to and to receive water from said heater, said heater comprising two independently coiled and relatively movable coils, the turns of each individual coil being spaced apart, and the turns of the coils being relatively staggered, for relative movement of the coils between an interleaved position with the turns of the respective coils substantially in alignment, to mutually shield one another from the heat, and a spread-apart position wherein both sections are exposed more fully to the heat.

6. A water heater for exposure to a flow of hot gas, comprising two generally helical tubular coils supported for relative movement, means to supply water to and to receive water from each coil, for circulation therethrough independently of the other coil, the several turns of each individual coil being spaced apart, along their respective axes, slightly in excess of the diameter of the tube constituting the other coil, and the turns of the two being relatively staggered, for relative movement of the coils from an interleaved position of greatest peripheral coincidence, wherein they mutually shield one another from the hot gas, to a spread-apart position wherein both coils are exposed more fully to the hot gas.

7. A water heater comprising a cold water and a hot water terminal fitting, each including a swivel joint and disposed with their swivel axes coincident, a first generally helical coil and a second generally helical coil supported from and having their termini in communication with said fittings, the second coil being supported by said swivel joints for swinging movement about the swivel axis relative to the first coil, the turns of each of the two coils being spaced apart, and the turns of the two coils being in staggered relationship, whereby the coils may be swung relatively from an interleaved, generally coaxial position to a position wherein they are non-coaxial.

8. A water heater comprising two generally helical tubular coils disposed with their axes parallel, connected for circulation of water through each coil independently of the other coil, turns of the two coils being of like peripheral extent and shape, and the turns of each coil being spaced apart by a distance slightly in excess of the tubular diameter of the turns of the other coil, and means supporting said coils for relative movement perpendicular to their axes to dispose the turns of one coil in positions interleaved with those of the other coil, in such manner that they define jointly a substantially unbroken periphery, the several turns of each individual coil, which are spaced from adjoining turns of the same coil, lying each principally in a single plane, and being connected to such adjoining turns by an inclined tubular length, the several individual turns being offset, each in its own plane, to accommodate the inclined length which joins the contiguous turns of the other coil, relative lateral movement of the coils in the reverse direction being effective to destroy the unbroken periphery of the heater as a whole.

9. A water heater as in claim 8, including means fixedly supporting one of the coils, and swivel means, the axis whereof is outside the coils, supporting the other of the coils for swinging movement relative to the fixedly supported coil.

10. A water heater as in claim 8, the terminal turns at one end of a heater coil being of lesser peripheral extent than the majority of the turns of such heater coil, to restrict the entrance to the intra-coil space at this end.

11. A water heater as in claim 8, the terminal turns at one end of the coil assembly being of lesser peripheral extent than the majority of the turns of the heater as a whole, and the extent of such end turns of both coils, considered jointly, being progressively less toward such coil assembly end, to restrict the entrance at this end to the intra-coil space.

12. A water heater for disposition within the combustion chamber of a furnace, to be swept inside and out by the hot gas in such combustion chamber, and in communication with means to supply water to and to receive water from said heater, said heater comprising two independent and relatively movable coils disposed with their axes upright, the several turns of each individual coil being spaced apart, and of generally helical form and principally like diameter, but the lowermost turns of each coil being of lesser diameter than upper turns of the respective coils, and

adjacent lower turns of the two coils being of respectively different diameter; the turns of one coil being at levels intermediate the levels of the turns of the other coil, the turns of the two coils when generally coaxial and mutually interleaved shielding one another from the heat, and the lower turns of smaller diameter cooperating to obstruct entrance of hot gas within the coils, in position of minimum heating, and when disposed with their axes non-coincident being more greatly exposed to the heat.

13. A water heater for exposure to a flow of hot gas, comprising water supply and delivery connections, a plurality of generally cylindrical coils of substantially the same diameter communicating with said connections, the turns at corresponding ends of both coils being of progressively smaller diameter toward such ends, and means supporting said coils for relative movement between a coaxial position of the coils with such end turns alternately and closely interengaged, to define a substantially imperforate frusto-conical structure obstructing access of the hot gas to the interior of the cylindrical portions of the coils, and a spread position in which the coils are exposed more fully to the hot gas.

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