

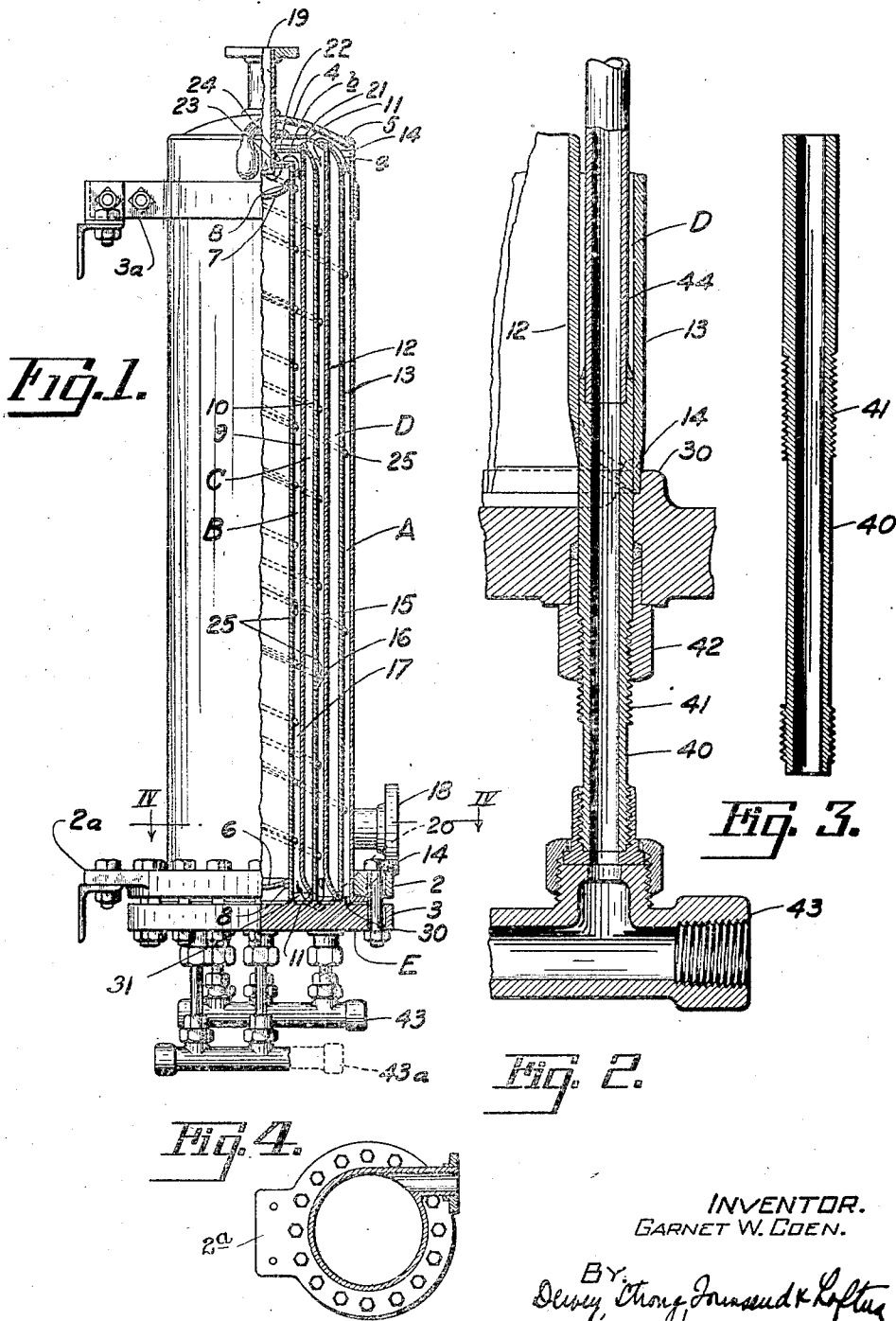
Feb. 16, 1926.

1,573,223

G. W. COEN

LIQUID HEATER

Filed Feb. 9, 1924



INVENTOR.
GARNET W. COEN.

BY
Dewey, Strong, Innes & Loftis
ATTORNEYS.

UNITED STATES PATENT OFFICE.

GARNET W. COEN, OF PASADENA, CALIFORNIA.

LIQUID HEATER.

Application filed February 9, 1924. Serial No. 691,676.

To all whom it may concern:

Be it known that I, GARNET W. COEN, a citizen of the United States, residing at Pasadena, county of Los Angeles, and State of California, have invented new and useful Improvements in Liquid Heaters, of which the following is a specification.

This invention relates to liquid heaters, and especially to oil heaters such as are employed in conjunction with oil burners and the like.

One of the objects of the present invention is to generally improve and simplify the construction of oil heaters, and especially to provide a structure which will permit a maximum heat transfer to be obtained between the heating medium and the oil or liquid to be heated; high efficiency being obtained in this instance, first, by maintaining the oil in ribbon or film-like conditions during its passage through the heater, second, by maintaining the oil in a state of agitation by forcing it through the heater under high velocity, and third, by providing a series of large heating surfaces which the steam or other heating medium employed can efficiently act upon.

Another object of the invention is to construct a heater which may be readily taken apart for inspection, repairs, etc., but particularly for the purpose of cleaning the same, and which when taken apart will present a series of exposed surfaces readily accessible for cleaning by scraping, brushing, or otherwise.

Another object of the invention is to provide a heater which is simple, compact, substantial in construction, and cheap to manufacture, and in which all parts are free to expand without danger of imposing strains on the assembled or connected parts; to provide a series of nested heating compartments alternately presenting oil flow passages and steam heating compartments, and which are so assembled that they are not liable to stick by the formation of carbon or other deposits; and further to provide a structure which will prevent leakage of steam into the oil flow compartments and vice versa.

One form which my invention may assume is exemplified in the following description and illustrated in the accompanying drawings, in which—

Fig. 1 is a side elevation of the heater partially in section.

Fig. 2 is an enlarged detail view showing

the hollow studs whereby the nested units are secured to the bottom head.

Fig. 3 is a detail view of one of the securing studs.

Fig. 4 is a cross section of the exterior shell taken on line 4—4 of Fig. 1.

Crude oils such as employed today for fuel purposes under boilers and the like, and particularly crude oils derived from an asphalt base, are becoming thicker and more viscous as time passes due to the greater extraction of gasoline, kerosene, and other by-products. Crude oils of this character when obtained from the refiners are often so thick and heavy that the oil must be heated to a temperature of from 200 to 300 degrees Fahrenheit before the oil is rendered sufficiently liquid to be readily handled and efficiently atomized by the burners. The heating of fuel oil of this character is therefore not only a necessity, due to the reasons specified, but it also presents a difficult problem in actual practice as the heaters rapidly lose their efficiency due to the formation of deposits of carbon, asphalt, sand, etc., on the surfaces through which the heat transfer takes place. Such deposits are, practically speaking, non-conductors of heat and they form a coating which bakes and hardens on the heat transferring surfaces and furthermore gradually clogs the passages through which the oil is forced. Therefore, unless such accumulations or deposits are removed from time to time, the heater will become so inefficient as to be practically useless.

Having these problems and conditions to encounter, a heater has been developed which is particularly adapted to handle crude oils such as referred to, and which will efficiently heat a given volume of oil if cleaned from time to time. The main feature of the present invention is therefore the provision of a heater which permits a maximum heat transfer at all times, and which permits quick and ready disassembly for cleaning whenever necessary.

I have accordingly constructed a heater consisting of an exterior cylinder or shell A, an inner cylinder B, and a pair of intermediate shells C and D. The several shells are supported by a bottom head E; the exterior shell A being secured thereto by a clamping ring 2 and bolts 3, while the inner and intermediate shells are secured thereto as will hereinafter be described.

The exterior shell is provided with an upper head 4, welded or otherwise secured thereto as indicated at 5. The inner shell or cylinder B is provided with upper and lower heads as indicated at 6 and 7 which are both welded thereto as shown at 8.

The intermediate shell C consists of two annular wall sections 9 and 10 which are flanged together at their upper and lower ends as indicated at 11 and welded. The intermediate shell D similarly consists of two annular wall sections 12 and 13 flanged at their upper and lower ends as indicated at 14 and also welded.

The intermediate shells C and D therefore form annular compartments closed and welded at their upper and lower ends, respectively, and no leakage from these compartments can take place as they are provided with separate inlet and discharge pipes connected therewith as will hereinafter be described. Steam is introduced into these compartments and as they are separated with relation to each other, and also with relation to the exterior shell A and the inner cylinder B, three oil flow passages are formed as indicated at 15, 16 and 17.

Oil is admitted to the outer passage 15 by means of a tangentially disposed inlet pipe 18 which is connected with an oil pump or other suitable source of supply. The oil passes upwardly through the annular passage 15 and then enters the second annular passage 16, through the upper end, in the direction of arrow *a*. The oil then flows downwardly through this annular passage and it is then transferred to the innermost passage 17 where it again flows upwardly, being finally permitted to discharge in the direction of arrow *b* through a discharge pipe 19 secured and welded in the upper head member 4.

A series of cored passages 20 in the lower head member E form communication between the lower ends of the oil flow passages 16 and 17, and to prevent the oil discharging from the upper end of the oil flow passage 15 from entering the discharge pipe 19, a combined deflecting and guiding plate 21 is employed. This plate is welded to the upper end of the heating unit C and snugly fits the pipe 19. It thus serves as a guide and centering member for the heating unit or intermediate shell C, and it also prevents the oil discharging from the upper end of the passage 15 from entering the oil flow passage 17 and the discharge pipe 19. In other words, the oil is forced to flow downwardly through the passage 16 and as this communicates with the passage 17 through the cored ports 20, an upward flow will take place therethrough and the oil will finally enter the lower end and discharge through the pipe 19.

The intermediate shell or heating unit

D is also provided with a guiding and centering plate such as shown at 22. This also snugly fits the lower end of the pipe 19, but its outer edge is provided with a series of perforations which permit the oil to enter the upper end of the passage 16. The inner cylinder B is similarly provided with a guiding and centering head as shown at 23, but the outer portion thereof is perforated as at 24 to permit the oil to escape from the upper end of the passage 17 and enter the pipe 19. It will be noted that no rigid connection is formed between the several units and the pipe 19, and that these units will therefore be free to expand in a vertical direction without imposing any stress or load on the adjacent unit.

By referring to Fig. 1 it will be noted that a wire 25 is spirally wound around the exterior of the intermediate heating section D, and similarly that a wire is spirally wound exterior of the intermediate heating section C and also exterior of the inner heating section or drum B. These wires may be flat or round and in actual practice are welded to the surfaces about which they are wound. These wires are disposed in the oil flow passages and as the passages are fairly restricted in area, it will be noted that the oil is maintained in a film-like condition, and further that it flows in a helical path when flowing through the several passages. This is important as it maintains the oil in a condition of high velocity and insures agitation thereof so that all parts of the oil film will be equally heated. The pressure exerted by the oil feed pump of course maintains the velocity, but this velocity would rapidly drop in the oil flow passages unless the helical passages formed by the wires 25 were not provided.

The diameter of the wires is slightly less than the greatest dimension of the passages in which they are mounted. A certain amount of oil is therefore permitted to by-pass from one helix to another, but this is not detrimental as the greater volume of oil will be maintained in its helical path. The clearance formed between the wires and the adjacent units is important as the small amount of oil by-passing at all times prevents accumulation of carbon or asphalt on the adjacent surfaces, and thereby prevents sticking of one unit with relation to the other when disassembling the same.

The units when assembled are secured with relation to each other and the lower head E in the following manner:

The exterior shell A is supported by the lower clamping ring 2, a bracket 2^a, and an upper clamping bracket 3^a. The intermediate section D is then inserted, the upper end when inserted being guided by the lower end of pipe 19 and the proper spacing between the intermediate section and the ex-

terior shell being maintained by the wire 25. The second intermediate section C is then inserted, the upper end being centered and guided by the pipe 19, the proper spacing with relation to the section D being approximately maintained by the exterior wire 25. The inner cylinder or section B is then inserted and its upper end is centered by the pipe 19, it being otherwise held in substantial proper position by the exterior wire 25. The lower head E is then applied, the intermediate section A being centered with relation thereto by an annular guide flange 30, the intermediate section C by the exterior surface of guide lugs 31, and the inner section or cylinder B by the interior surface of said guide lugs. A gasket is also inserted between the lower flange of the exterior shell A and the bolts 3 are then applied and drawn up tight. Means are also employed for the purpose of drawing the sections B, C and D down into tight engagement with the head E and this is accomplished as follows:

Each section is provided with two hollow studs, one of which is shown in Figs. 2 and 3. Two studs are welded into the bottom section 6 of the inner cylinder B, and similarly two studs to each of the intermediate sections C and D. These studs are indicated at 40, the manner of welding the same to the lower head 6 and the bottom portion of the intermediate sections C and D being shown in Fig. 2. The studs extend through openings formed in the lower head with which they register. Each stud is threaded as indicated at 41 and a stuffing gland 42 is carried by the threaded section. These glands when tightened exert a downward pull on the cylinder B and on the intermediate sections C and D and thus secure them with relation to the lower head. The packing inserted is at the same time tightened or placed under compression and leakage of oil is prevented. One hollow stud of each section is connected with a steam inlet manifold as indicated at 43^a, while the other stud of each section is connected to a condensate outlet manifold as shown at 43. The studs which form the inlet connections are provided with pipe extensions such as shown at 44 (see Fig. 2). These deliver the steam into the upper ends of the heating compartments C and D and the steam thus gradually settles, as it liberates its heat, in the form of a condensate which is drained through the other hollow studs and discharged through the condensate manifold shown at 43.

Leakage of steam from the heating sections into the oil flow passages cannot take place as the upper and lower ends of the heating sections are welded and similarly the hollow studs through which the steam is admitted and the condensate discharged.

Packing between the lower ends of the heating sections and the head E is not required as they are drawn tightly against the head E by means of the studs and the stuffing glands 42, and even though a slight leakage or transfer of oil from one passage to the other should take place, it would be of no consequence as the oil could not enter the steam heating sections and would thus only by-pass from one oil flow passage to the other, but as such leakage would be exceedingly small, it would in no way impair the function and efficiency of the heater.

From the foregoing description it will be readily understood that high efficiency, as far as heat transfer is concerned, is obtained as the oil flowing through the heater is maintained in a film-like condition and in a high state of agitation due to the velocity maintained and the helical flow, and also due to the fact that the film is heated from opposite sides, except in the first passage indicated at 15. Steam or condensate cannot escape into the oil flow passages due to the construction of the intermediate heating sections and the manner of admitting the steam and discharging the condensate; quick removal of the parts is permitted due to the manner of assembling the units; parts may be readily cleaned when disassembled as all surfaces exposed to oil are readily accessible for scraping, brushing and cleaning, and it will also be noted that sticking of one section with relation to the other is largely prevented by providing ample clearances and by permitting a slight leakage around the wires, thus preventing carbon formations or steam deposits between the wires and the adjacent units.

While certain features of the present invention are more or less specifically illustrated, I wish it understood that various changes in form and proportion may be resorted to within the scope of the appended claims. I similarly wish it understood that the materials and finish of the several parts employed may be such as the experience and judgment of the manufacturer may dictate or various uses may demand.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. A liquid heater comprising an inner shell closed at the top and bottom, an exterior shell spaced therefrom and closed at the top, a bottom head member forming a closure for the lower end of the exterior shell and also forming a support for both shells, a pair of annular shells interposed between the inner and outer shells and also supported by the bottom head member, said annular shells being closed at the top and bottom, means maintaining a predetermined annular spacing between the annular shells and the outer and inner shells respectively

to form annular passages therebetween, means for circulating a heating medium through the annular shells and the inner shell, and means for directing a flow of liquid through the annular passages formed between the several shells.

2. In a heater of the character described, the combination with a bottom head member, of a plurality of annular shells supported thereby, said shells being placed one exterior of the other and interspaced with relation to each other, a steam inlet and a condensate outlet pipe extending into each shell and welded thereto, said pipes extending through the head member and being threaded, and a nut carried by the threaded section of each pipe and engageable with the head to secure and draw the shells snugly against the opposite side of the head.

3. In a heater of the character described, the combination with a bottom head member, of a plurality of annular shells supported thereby, said shells being placed one exterior of the other and interspaced with relation to each other, a steam inlet and a condensate outlet pipe extending into each shell and welded thereto; said pipes extending through the head member and being threaded, and a combination nut and stuffing gland carried by the threaded portion of each pipe and engageable with the head to secure and draw the shells snugly against the opposite side of the head.

4. In a heater of the character described, the combination with a bottom head member, of a plurality of closed shells supported thereby, said shells being placed one exterior of the other and interspaced with relation to each other, a steam inlet and a condensate outlet pipe extending into each shell and welded thereto, said pipes extending through the head member and being threaded, a combination nut and stuffing gland carried by the threaded portion of each pipe and engageable with the head to secure and draw the shells snugly against the opposite side of the head, a steam inlet manifold connected with the inlet pipes, and a condensate outlet manifold connected with the outlet pipes.

5. A heater of the character described, comprising a head member, a cylindrical shell supported thereon and centrally disposed, said shell being provided with top and bottom heads, a pair of annular shells exterior of said shell and concentric and interspaced with relation thereto to form annular liquid flow passages, said annular shells being also supported by the head, an exterior shell enclosing the first named

shell and the annular shells, said exterior shell being secured to the head member at one end and being provided with an enclosing head member at the opposite end, an outlet pipe connected with the last named head member, said outlet pipe having an inner extension, means for centering the inner shell and the annular shells with relation to said outlet pipe, means for directing a flow of liquid through the annular spaces formed between the respective shells and for directing the oil after flowing through these passages to the outlet pipe, and means for circulating steam through the first named shell and the annular shells.

6. A heater of the character described, comprising a bottom head member, an inner shell centrally disposed thereon, said shell being closed at the top and bottom, a pair of annular shells exterior thereof and interspaced with relation to each other and the inner shell, said annular shells being closed at their top and bottom ends and being also supported by the bottom head member, an exterior shell having a top head member formed thereon enclosing all of the shells and being itself closed by the bottom head member, said exterior shell being interspaced with relation to the remaining shells, means for securing the inner shell and the annular shells to the bottom head member, means for circulating steam through the inner shell and the annular shells, and means for directing a flow of liquid through the annular spaces formed by interspacing the shells.

7. In a heater of the character described, the combination with a bottom head member, of a plurality of annular shells supported thereby, said shells being placed one exterior of the other and interspaced with relation to each other, a steam inlet and a condensate outlet pipe extending into each shell and welded thereto, said pipes extending through the head member and being threaded, a combination nut and stuffing gland carried by the threaded portion of each pipe and engageable with the head to secure and draw the shells snugly against the opposite side of the head, an exterior shell supported by the bottom head and bolted thereto, said shell being interspaced with relation to the outermost of the annular shells and being provided with a top head member so as to form a complete enclosure for all of the shells, and means for directing a flow of liquid through the annular passages formed by interspacing the shells.

GARNET W. COEN.