HEATING PIPE FIXTURE

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This invention relates to an induction process or pipe line having fixtures therein. More particularly it relates to a pipe line construction having fixtures located therein which may be maintained at the same elevated temperatures as the pipe line.

This invention has for an object the provision of a pipe line construction which allows a fixture to be readily accessible and removable and at the same time maintainable at the same uniform elevated temperature as the line. A further object is to provide a pipe line for conveying substances of high melting point with heated fixtures which may be maintained at the same temperature as the line. Other objects include the heating of process pipe lines and fixtures in the lines such as check valves, strainers and closure valves and plug cocks to a desired temperature. Other objects will appear hereinafter.

Heretofore, the customary means of heating pipe lines for the transfer of high-melting point materials has involved expensive jacketing of the lines and valves; and, for temperature ranges in the neighborhood of 250° C. and above, direct-fire or electrical resistance heater elements have been employed. Such means have distinct disadvantages, however. For instance, direct-fire heating is inefficient, due to heat losses from radiation and convection, and in addition entails a constant fire hazard. Electrical resistor heaters, on the other hand, localize the application of their heat, and thus cause over-heating of the material in contact with the heater. Furthermore, their life at elevated temperatures is very limited.

Induction-heating coils have also been used to heat pipe lines, but in high temperature practice fixtures such as flanges and valves have fallen substantially below the temperature of the main line, because of the increased heat dissipation from their surfaces and the decreased rate of heat generation per unit of their volume. Consequently, it frequently has been impossible to pass high freezing-temperature liquids through such systems.

It is true that the above-stated fixtures can be heated to requisite temperatures by applying additional turns of the induction-heating coil around them, but low efficiency results, over heating of the adjacent piping occurs, and such windings are bulky. Moreover, they are productive of costly delays in plant operations, in connection with the making of valve repairs or replacements, and are otherwise generally unsatisfactory.

These and other disadvantages are obliterated, and the above-mentioned objects accomplished by this invention, in which the induction-heating coils are omitted from the said fixtures but their ampere turns in proximity thereto are increased. Specific characteristics of magnetic flux are thereby utilized. These may be shown by the following illustrations. If a magnetic member is encircled by one or more turns of current carrying wire, a magnetic flux is set up such that continuous flux lines pass through the magnetic member, reverse their direction in smooth curves at the ends of the member, and join on the opposite side of the current carrying wire. If the current in the wire is alternating, the reversals in direction of the current and consequently the flux will induce voltage and a current in the magnetic member. The current will be dissipated in the form of heat, which may be detected by a temperature rise of the magnetic member. If two such members be brought sufficiently close together in such a manner that the two groups of wire turns have a common axis, some of the continuous flux lines will be common to both magnetic members. Heat will be generated in both members in this case, as previously described for the single member. Also, if two such magnetic members, encircled by current-carrying wire, be separated by a third magnetic member which is not encircled by current-carrying wire, some of the lines of flux will be common to all three members, and heat will be generated in all three members.

The nature of this invention will be more fully understood by the devices described below and illustrated in the accompanying drawing wherein similar reference numerals refer to similar parts throughout the several views.

Fig. 1 is a side elevation of a pipe line having a plug cock therein, certain parts being shown in section.

Fig. 2 is a transverse section taken along the line 2—2 of Fig. 1.

Fig. 3 is an end elevation of the heating cylinder.

In the drawing the plug cock 1 has attached to each flange a heating cylinder or magnetic sheath pipe sections 2 which has thick walls and contains a fluid passage 3 which is of the same internal diameter as the standard type of pipe 4 composed of iron or other magnetic material which is connected to the heating cylinder by means of pipe flange 5 and bolts 6 and nuts 7. The bolt heads fit into recesses 8 in the heating cylinder, the shanks of the bolts fitting in the U-shaped slots 9.
Heat insulating material 10 surrounds the pipe 4 and heating cylinder 5. Insulating material 11 of the same type surrounds the plug cock 1 and is preferably separate from material 10 so that the plug cock may be readily removed for repairs or replacement. Wire coils 12 surround the heating cylinder and carry an electrical current. Similarly, electrical current carrying wire coils 12 surround the insulated pipe line 4. The coils 12 and 12' are generally in the same circuit being connected to an alternating current supply of normal commercial frequency.

The cylinders which are in close proximity to the fixture have an increased number of turns as shown, and enable the fixture to be maintained at the same temperature as the line without any wire coils around the fixture itself. Thus, liquids which solidify at high temperatures may be passed through the line free from any deposition or precipitation in the fixture.

The electrical alternating current in the wire coils sets up lines of flux in the magnetic members 1, 2, 4, 5, 6, and 7 including in them alternating voltage and current, which causes heating of these members. The amount of heating may be controlled by the density of the wire coils, and by regulating the voltage and current in the wire coils, thus adjusting the number of ampere turns. For example, to maintain operating temperatures in the range of 350° and 450° C. in 2 in. pipe and fixtures, it has been found that with the wire turn density of coils 12 and 12' in the relation of approximately 4 to 1, with the latter having a coil density of 10 turns per foot of length pipe, and by impressing on these coils a voltage such that they carry a current of approximately 70 amperes, satisfactory uniform heating is obtained within all the heating members. Higher and lower temperature ranges than that given may easily be obtained, and other sizes of pipes and fixtures may be readily heated by varying the ampere turns, etc.

In place of the plug cock, other fixtures such as a check valve, strainer, or other fixture may be substituted and may similarly be removed, repaired and replaced, cleaned or adjusted, without altering the heating means. The installation is simple and inexpensive to construct, and since the heating and heated elements have definite lives they normally require no maintenance repairs. An installation may be made fire-proof, and, due to its flexibility, may be designed for continuous or automatically controlled heating.

While the form of embodiment of my invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims, which follow.

1. A pipe line construction comprising a removable pipe fixture, a magnetic pipe section having thick walls attached to said fixture, a pipe section of normal wall thickness attached to the first mentioned section, an induction heating coil disposed about each of said pipe sections, said coil having an increased number of turns about the thick wall section whereby the fixture may be maintained at the same temperature as the pipe line.

2. A pipe line construction comprising a removable pipe fixture, a magnetic pipe section having thick walls attached to each side of said fixture, pipe sections of normal wall thickness attached to the first mentioned sections, insulation disposed about the fixture and each of said pipe sections, an induction heating coil disposed about each of said pipe sections, said coils having an increased number of turns about the thick walls, whereby they and said fixture will be maintained at the same temperature as the line.

3. A pipe line construction comprising a removable pipe fixture, short magnetic pipe sections having thick walls attached to each side of said fixture, magnetic pipe sections of normal wall thickness attached to the first mentioned sections, insulation disposed about the fixture and each of said pipe sections, an induction heating coil disposed about each of said pipe sections, said coils having an increased number of turns about the thick walls, whereby they and said fixture will be maintained at the same temperature as the line.

4. A pipe line construction comprising a removable pipe valve, short magnetic pipe sections having thick walls attached to each side of said valve, magnetic pipe sections of normal wall thickness attached to the first mentioned sections, insulation disposed about the valve and each of said pipe sections, an induction heating coil disposed about each of said pipe sections, said coils having an increased number of turns about the thick walls, no coils being placed around said valve, whereby they and said valve will be maintained at the same temperature as the line.

5. In a pipe line having a removable fixture, an induction-heating fixture disposed about the line, said coils having increased ampere turns in close proximity to said fixture, whereby said fixture can be maintained at approximately the same temperature as the line.

6. In a pipe line having a removable fixture, an induction-heating fixture disposed about the line, said coil having increased ampere turns in close proximity to opposite sides of said fixture, whereby said fixture can be maintained at approximately the same temperature as the line.

7. An induction-heating coil disposed about a pipe line, a removable fixture in said pipe line, and increased ampere turns in portions of said coil adjacent to said fixture.

8. An induction-heating coil disposed about a pipe line, a removable fixture in said pipe line, and increased ampere turns in portions of said coil adjacent to opposite sides of said fixture.

9. In an induction-heated insulated pipe line of magnetic material, an insulated removable magnetic fixture, the walls of said line having appreciably increased bulk in portions in close proximity to said fixture, and an induction-heating coil disposed about the insulation and line, said coils having an increased number of turns about said portions, whereby said fixture can be heated to approximately the same temperature as the line.

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