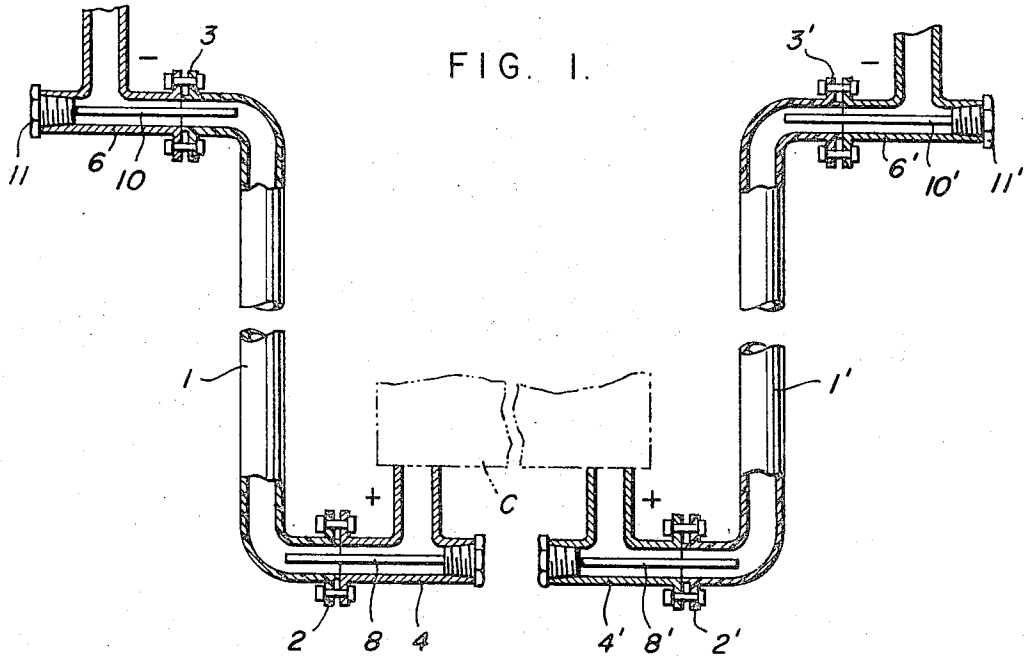
Oct. 15, 1968 H. E. TURNES ET AL 3,406,110

CATHODIC PROTECTION OF PIPING IN COOLING SYSTEMS FOR OSCILLATORS AND THE LIKE

Filed Nov. 21, 1963

FIG. 1.



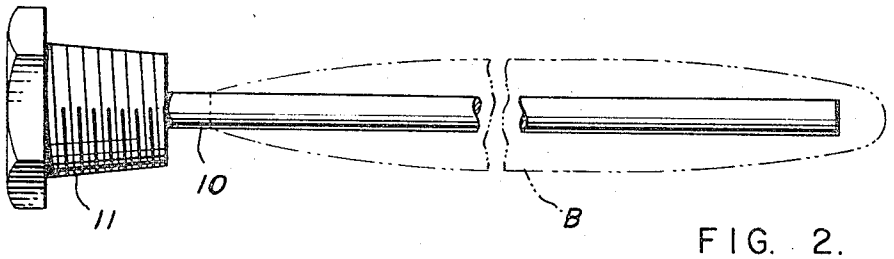


FIG. 2.

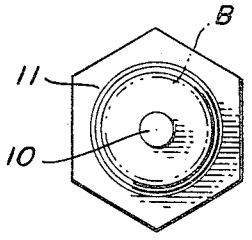


FIG. 3.

INVENTORS
HENRY E. TURNES
CHARLES HORVATH, JR.
BY George K. Stalker
ATTORNEY

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CATHODIC PROTECTION OF PIPING IN COOLING SYSTEMS FOR OSCILLATORS AND THE LIKE

Henry E. Turnes, 7041 Arkansas Ave., Hammond, Ind. 46323, and Charles Horvath, Jr., 2105 Franklin St., East Chicago, Ind. 46312

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This invention relates to cathodic protection of water piping systems to minimize corrosion due to electrolytic action and reduce deposits on the inner walls of the piping.

More particularly in cooling systems for the oscillator plates of high frequency induction heaters such as those used for continuously heating electrolytic tin plate as it emerges from the plating bath it is customary to interpose lengths of non-metallic high resistance pipe between metallic pipes respectively connected to intercommunicating units to insulate electrically, for example, the oscillator plate and its cooling jacket from the grounded piping, coolant circulating pump or other unit; as the plate is at the same potential as the positive pole of the power supply from which the plate voltage is drawn in the absence of such insulation the plate would be short circuited and lose all or a major part of its effectiveness.

However, even when distilled water is utilized as the coolant the high voltage of the positive potential in the plate, which normally is about 21 kv. or under unusual conditions may even rise to 44 kv., produces sufficient ionization to induce migration of metal from the jacket and its associated piping, or from sacrificial anodes if they are used, through the insulating pipes and ultimate deposit thereof at and adjacent the connection of the latter with grounded metal pipes, these being the nearest electrically conductive points or zones to the positively charged parts of the system, and such deposits gradually build up as high density solid annuli which ultimately attain a size to seriously obstruct the flow of coolant thereby necessitating dismantling of the pipe connections to enable removal of the deposited material, with consequent idling for a considerable period of the entire production line of which the heater is a component in addition to the actual expense involved in the dismantling, cleaning and replacement operations.

It is therefore an object of the present invention to provide conveniently removable and replaceable means for minimizing the deposition of metal on the inner surfaces of tubular conduits under conditions such that electrical potential tends to cause migration of metal in the coolant fluid and its flow-impeding accumulation in the fluid passage defined by the conduits.

Another object is to provide in a coolant circulating system containing sacrificial anodes designed to be electrochemically eroded while minimizing like erosion of a positively charged metal cooling jacket or the like and its attendant piping cooperative means of negative potential with respect to the anodes to inhibit deposition of passage-obstructing material on the interior of the piping.

A further object is the provision of means adapted for the performance of the aforesaid functions of such character that the deposit collecting element thereof may be readily and quickly removed and cleaned or replaced without breaking any joints in or otherwise disturbing the other components of the system.

Other objects, purposes and advantages of the invention will hereinafter more fully appear or will be understood from the following description of a preferred embodiment of it illustrated in the accompanying drawing in which:

FIG. 1 is a fragmentary diagrammatic representation in axial section of a portion of a coolant circulating system interconnected with a structure to be cooled by the circulation therethrough or thereabout of a liquid and including (not shown) means for maintaining the flow of the liquid in the system and a heat exchanger in which heat imparted to the liquid is dissipated, this figure showing the location, in relation to other parts of the system, of cathodic targets installed in accordance with the invention;

FIG. 2 is an enlarged side elevation of one of the targets illustrated in FIG. 1 suggesting in dotted lines the manner in which electrodeposited metal accumulates thereon, and

FIG. 3 is an end elevation on the same scale of the target viewed from the right in FIG. 2 with its burden of deposited metal again indicated in dotted lines.

More particularly there are illustrated in the drawing pipes **1**, **1'** made of insulating material such as the polytetrafluoroethylene marketed under the trademark "Teflon," having end fittings **2**, **2'**, **3**, **3'** for securing them respectively to metal conduits **4**, **4'** through which circulates coolant to or from a high voltage oscillator plate cooling jacket C and other metal pipes **6**, **6'** connected with an impeller, heat exchanger or the like (not shown).

Disposed and suitably supported in conduits **4**, **4'** are sacrificial anodes preferably comprising brass or copper rods **8**, **8'** which project axially into the adjacent ends of pipes **1**, **1'** and are designed to afford protection thereto.

In accordance with our invention we provide in conduits **6**, **6'** generally similar rods **10**, **10'** respectively fixed to threaded plugs **11**, **11'** removably seated in openings in T-fittings or generally comparable elements interposed at appropriate points in the conduits in such manner that the rods extend respectively into the other and proximate ends of pipes **1**, **1'** and bridge the joints between them and the conduits. In consequence the rods can be removed when occasion arises by simply unscrewing the plugs to which they are affixed preparatory to cleaning deposits from the rods or replacing them with new ones.

With this arrangement when the oscillator plate and hence its cooling jacket C are energized to the potential adequate, for example, to produce the high frequency voltage essential for continuous induction heating of electrolytic tin plate, their potential relatively to the ground is at least several thousand volts and while conduits **6**, **6'** may be, and normally are, at ground potential Teflon pipes **1**, **1'** and the, usually employed, distilled water coolant passing through them, both being non-conductive, prevent electrical discharge between conduits **4**, **4'** and **6**, **6'**.

There is, however, due perhaps to some electrochemical phenomenon which has not been explained, a migration of the material of which rods **8**, **8'** are made through pipes **1**, **1'**, possibly in an ionized state and in the absence of targets **10**, **10'** deposits of this material tend to accumulate proximate the first grounded metal encountered, namely, in and adjacent the ends of conduits **6**, **6'** which are respectively coupled to pipes **1**, **1'**; these deposits gradually build up in the conduits and constrict the passages they define. With targets **10**, **10'** disposed axially in the conduits in the region mentioned, however, the material deposits on the targets which are encountered before the conduits rather than on inner surfaces of the latter. Hence when a body B of the material sufficient to seriously obstruct the water flow has accumulated the plugs **11**, **11'** can be withdrawn carrying the targets with them and the deposits then readily removed from the cathodes before reinsertion in the pipes or they can be disengaged from the plugs and replaced by new uncontaminated rods before return of the plugs.

Ordinarily erosion of anodic rods **8**, **8'** occurs gradually and periodic replacements are required and our invention thus is concerned not with the intended erosion of those rods but with the disposition of the eroded material, and it will be apparent the invention provides means for re-

moving this material from the system in a simple and economical way not requiring the dismantling of any units or breaking of couplings to enable the scraping of hard and resistant passage-obstructing deposits from the interiors of the conduits.

While we have herein described one embodiment of the invention with particular reference to its use in association with a high frequency induction heater for an electrolytic tin plate production line, its employment is not to be considered as limited or confined to that environment; hence changes and modifications in the details of construction from those of the presently preferred embodiment we have herein disclosed will readily occur to those skilled in the art and may be made if desired without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described our invention, we claim and desire to protect by Letters Patent of the United States:

1. In combination with an electrically non-conductive coolant-carrying pipe, a pair of electrically conductive coolant-carrying elements connected to the ends thereof for transfer of coolant therethrough, one of said conductive elements having a positive charge in relation to the other and sacrificial anode means extending from the positively charged element into the proximate end of the pipe, a cathodic target comprising an electrically conductive rod extending axially into the other end of the pipe, and removable means carried by the other of said conductive elements for supporting said rod therefrom.

2. In combination with an electrically non-conductive coolant-carrying pipe, a pair of electrically conductive coolant-carrying elements connected to the ends thereof for transfer of coolant therethrough, one of said conductive elements having a positive charge in relation to the other, and sacrificial anode means extending from the positively charged element into the proximate end of the pipe, means defining an opening aligned with the axis of the pipe carried by the other element, removable means normally seated in and closing the opening, and an electrically conductive rod fixed to the last mentioned means extending axially into the other end of the pipe and removable through said opening with said last mentioned means.

3. A cooling system for an electrically charged element comprising a coolant-containing jacket for the element, metal conduits, one of which is in electrical communication with said element, connected with and adapted for conducting coolant to and from the jacket, electrically non-conductive pipes respectively connected at one end to one of the conduits and at the other to another metal conduit carrying a charge electrically opposite that of the element, and a metal rod supported from each of said last mentioned conduits extending therefrom into the interior of the adjacent non-conductive pipe and into the coolant carried thereby.

4. A cooling system as specified in claim 3 in which each of the rods bridges the joint between the end of the adjacent metal conduit and the end of the non-conductive pipe juxtaposed thereto.

5. A cooling system for a positively charged element of an induction heating system comprising a coolant-containing jacket for said element carrying a like charge and having metal inlet and outlet conduits extending therefrom, a pair of polytetrafluoroethylene pipes, means connecting the end of each conduit remote from the jacket with an end of one of said pipes, a pair of negatively charged metal conduits, means connecting the other end of each pipe respectively thereto, a metal rod extending from each of said negatively charged conduits across the proximate connecting means into the adjacent pipe substantially in alignment with its axis and in contact with the coolant therein, and means removably supporting the rods from the respective negatively charged conduits.

References Cited

UNITED STATES PATENTS

2,076,422	4/1937	Zimmerer et al.	204—196
2,101,029	12/1937	Koerber	204—196
2,673,940	3/1954	Slifkin	204—196
2,752,308	6/1956	Andrus	204—196
2,893,938	7/1959	Bremerman	204—196

JOHN H. MACK, *Primary Examiner.*

T. TUNG, *Assistant Examiner.*