

Jan. 7, 1941.

F. NEUKIRCH

2,228,015

LIQUID CATCHER FOR JET-PIPE RELAYS

Filed Nov. 28, 1939

2 Sheets-Sheet 1

Fig. 1

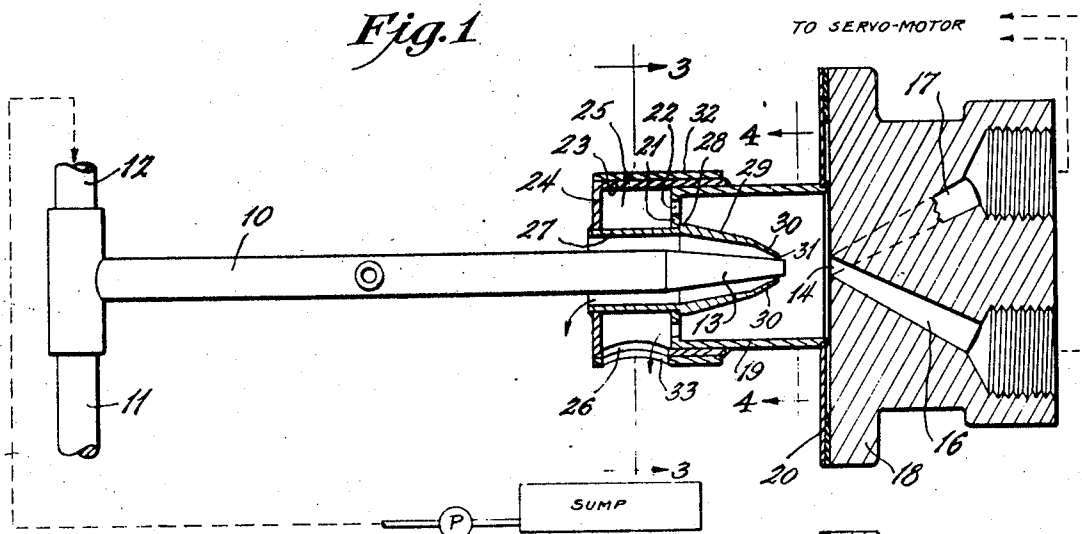


Fig. 2

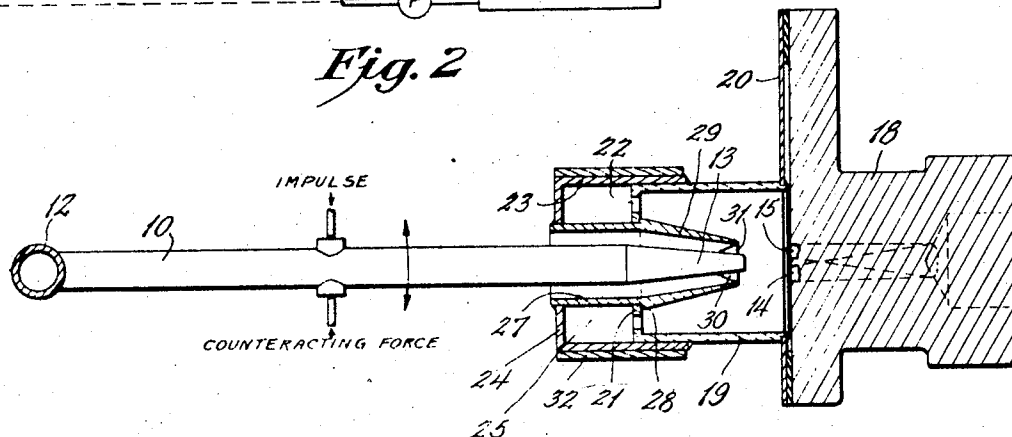


Fig. 3

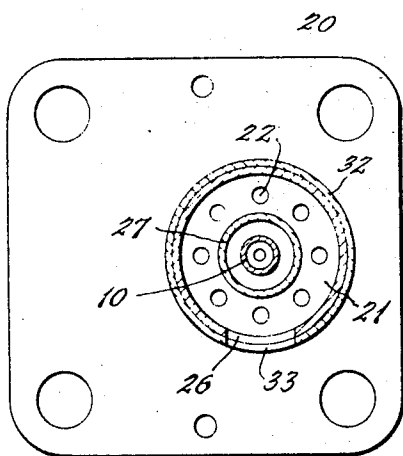
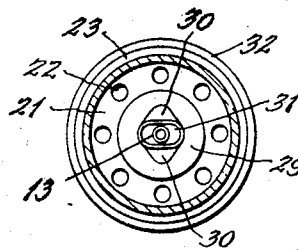


Fig. 4



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2 Sheets-Sheet 2

Fig. 5

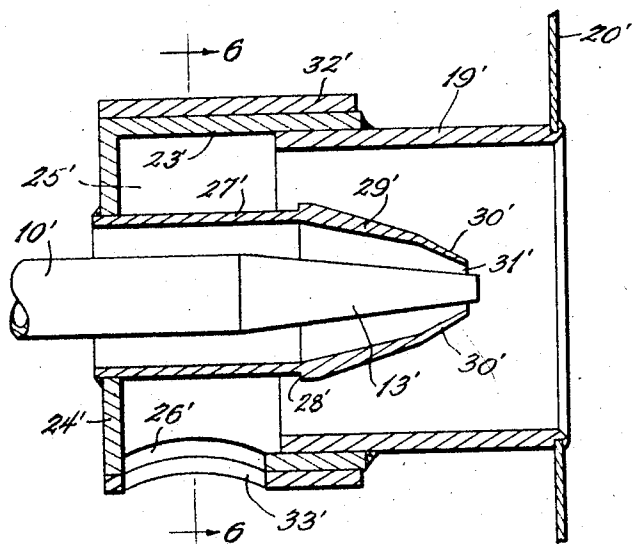


Fig. 6

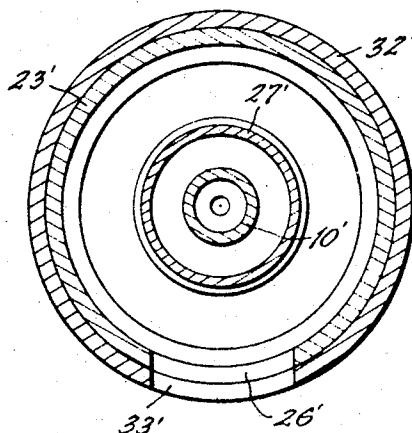


Fig. 7

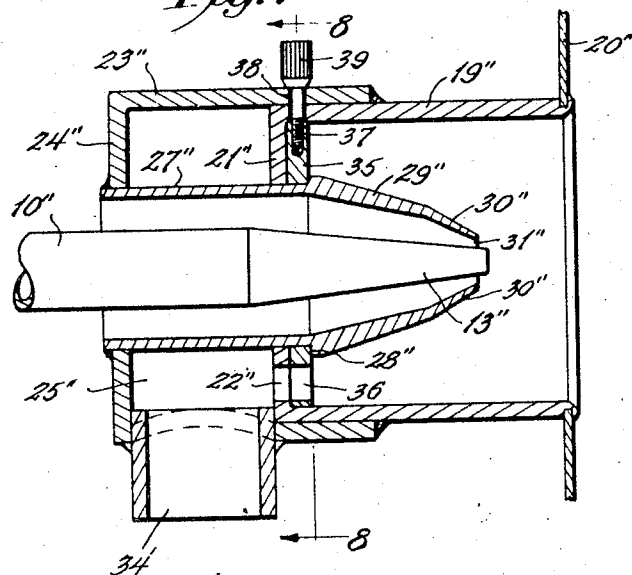
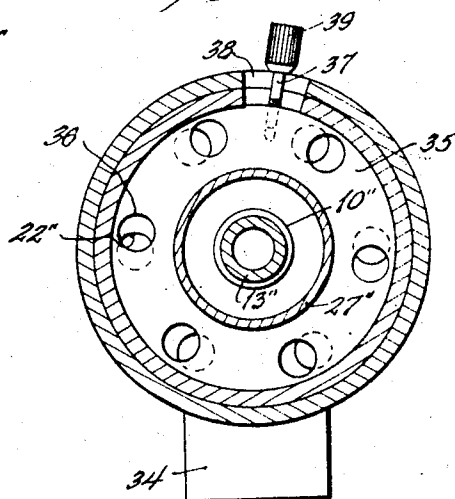


Fig. 8



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2,228,015

LIQUID CATCHER FOR JET-PIPE RELAYS

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corporation of Illinois

Application November 28, 1939, Serial No. 306,549

10 Claims. (Cl. 137-111)

This invention relates to catchers for jet-pipe relays of the well known "Askania" type in which a liquid, usually oil under pressure, is delivered by an impulse controlled movable jet pipe through either of a pair of receiving orifices to a servo-motor which acts to control a condition. The main idea is to provide an improved oil catcher having means to deflect returning oil and prevent it from acting directly on the nozzle of the jet-pipe, thereby disturbing or obstructing its movement. Another object is to provide in an oil catcher of this type improved means to prevent turbulence of the returning oil in the catcher and to insure that the catcher will remain full of oil at all times, thereby eliminating the possibility of air being sucked into the catcher and entering the orifices. Still another aim is to prevent the returning oil from entering the jet pipe control mechanism and affecting its operation.

Other aims and advantages of the invention will appear in the specification, when considered in connection with the accompanying drawings, wherein:

Fig. 1 is a vertical sectional view showing one embodiment of the improved catcher applied to a jet-pipe relay;

Fig. 2 is a horizontal sectional view of the catcher and jet pipe shown in Fig. 1;

Fig. 3 is a sectional view taken on the line 3-3 of Fig. 1;

Fig. 4 is a sectional view taken on the line 4-4 of Fig. 1;

Fig. 5 is an enlarged vertical sectional view of a slightly modified form of catcher;

Fig. 6 is a sectional view taken on the line 6-6 of Fig. 5;

Fig. 7 is an enlarged vertical sectional view of another slightly modified form of catcher; and

Fig. 8 is a sectional view taken on the line 8-8 of Fig. 7.

Referring particularly to the drawings, the improvements are applied to a jet-pipe relay assembly of the well known "Askania" type, an illustrative example of which is disclosed in the patent to Wunsch 2,074,882. Such relays are employed for transmitting an impulse from any suitable outside source or derived from changes in a condition to be controlled, to a servo-motor by means of a stream of oil or other liquid under constant pressure. The jet pipe is controlled by the impulses and directs a stream of oil into either of a pair of orifices to the servo-motor and the oil is returned through the other orifice. In the practical operation of such relays it is of great importance that the returning liquid or oil stream

shall be so guided or directed as to prevent undue interference with the movement of the jet pipe. Also, it is important that the central portion of the jet pipe to which the impulse controlling means is usually connected shall be entirely free of oil to permit necessary adjustments and inspection, as well as to prevent oil from entering the control mechanism, such as an ordinary diaphragm casing.

Heretofore, the jet pipes of such assemblies have either been fully or partially submerged in the oil or liquid. An example of a partially submerged jet pipe having an oil catcher is shown in the patent to Wunsch No. 2,111,466. This invention relates to a horizontally movable jet pipe having an improved type of oil catcher and protecting tube for the nozzle end of the jet pipe to avoid any submergence of the jet pipe in the returned oil, thereby preventing friction, turbulence and other influences from affecting the impulse controlled movement of the jet pipe and preventing air from being sucked into and mixing with the oil in the catcher.

Referring more particularly to the jet-pipe relay disclosed in Figs. 1 to 4, there is shown a horizontal jet pipe 10 mounted on a vertical pivoted shaft 11 and an oil supply pipe 12 constitutes a part of the pivoted shaft. The movement of the jet pipe is adapted to be controlled by an impulse usually acting against a counter-acting force and its inner end is provided with a tapered nozzle or tip 13 which discharges into either of a pair of orifices 14 and 15 into and through conduits 16 and 17 extending at an angle to each other in a distributor block 18. The distributor block is usually connected by pipes indicated by dotted lines, to a servo-motor which, in turn, is arranged to control or regulate a condition. When the jet pipe directs the oil into one of the orifices, oil is returned from the servo-motor through the other orifice. The angular arrangement of the distributor conduits is such as to direct the stream of returning oil to one side of the jet pipe nozzle. The returned oil passes into a sump which is usually provided in a housing which encloses the entire regulator and a constant delivery pump is connected to the sump of the housing to recirculate the oil through the jet pipe. A diagrammatic lay-out of the connections is shown for illustrative purposes in Fig. 1.

In the form illustrated in Figs. 1 to 4, there is shown a cylindrical cup 19 carried by a bolting flange 20 adapted to be secured to the face of the distributor block. The outer end of this cup is shown as having an inwardly extending annular

flange or partition 21 provided with perforations 22. A cap member 23, also in the form of a cup is shown as being telescoped over and secured to the cup 19 and has an end wall formed by an inwardly extending flange 24 presenting an opening to receive the end portion of the jet pipe. This cap member also provides an outlet chamber 25 separated from the catcher chamber by the perforated flange or partition 21 and has an outlet opening 26 at the bottom to permit oil to flow into the sump. Within the aligned openings in the partition 21 and flange 24 there is secured a combination protecting and deflector tube 27 within which the jet pipe is adapted to oscillate. This tube is shown as being substantially cylindrical between the partition 21 and the flange 24 and within the chamber 25. It has a shoulder 28 which contacts the inside face of the partition 21 and is suitably secured by welding or the like to the end wall 24 at its outer open end. The inner end 29 of the tube is shown as being generally funnel-shaped or conical and the extreme tip portion is flattened at the top and bottom as indicated at 30 in Figs. 1 and 4, thereby providing a horizontal elongated or slot-like opening 31 permitting ample movement of the jet-pipe in a horizontal plane. Incidentally, the flattened upper and lower walls 30 of the tip are angular and are substantially parallel with the axis of the respective conduits 16 and 17 in the distributor block and they are so arranged that a stream of returned oil from one or the other of the conduits passes or is directed above or below the slotted opening instead of into the funnel end of the tube.

It is desirable to keep the catcher compartment full of oil to prevent air from being sucked in through the tube 27 around the outside of the jet pipe nozzle which would create a negative pressure in the catcher chamber. To this end, the outlet opening 26 is adjustable to maintain a positive pressure in both the catcher chamber and the outlet chamber 25. Any suitable type of valve may be employed for this purpose. In this example, a rotatable sleeve 32 having an opening 33 registering with the outlet opening 26 is frictionally mounted on the cylindrical cup section 23. By rotating the sleeve, the size of the outlet opening may be varied. The adjustment is properly made when sufficient oil is returned through the tube 27 to indicate that the catcher is completely filled with oil. When the catcher is full, the perforated partition helps to prevent eddies and undue foaming of the liquid.

In the modified form of catcher shown in Fig. 5, the catcher cylinder or cup section 19' has no perforated partition. In this example, the outlet chamber shown in Figs. 1 and 2 forms a part of the catcher chamber. By properly adjusting the outlet opening, the entire chamber is kept full of oil. It has been found that in some installations, the slight turbulence produced in the catcher around the funnel-shaped end of the deflector tube does not unduly disturb or affect the controlled movements of the jet pipe. This is especially true in cases where impulses of a relatively large magnitude act on the jet pipe.

In Fig. 7 the adjustable outlet opening is omitted and the adjustment is made by varying the openings in the perforated partition 21'. In this instance, a short piece of pipe 34 is shown as being connected to the opening. To adjust the size of the perforations of the partition 21' there is shown an annular perforated plate 35 having openings 36 adapted to register with the openings

22' in the partition. It is confined to be oscillated between the partition and the shoulder 28' on the tube 27'. In this instance, it has a screw-threaded stem 37 projecting through registering slots 38 in the cup sections 19'. The stem has a knurled knob 39 on its outer end adapted to be grasped by the fingers to turn the perforated adjusting plate 35 to the desired position. When it is so adjusted, the stem may be tightened so that the inner end of the knob engages the top wall of the cup section 23' on opposite sides of the slot 38 and holds the plate in that position.

It is contemplated that in some instances, the adjustable feature may be omitted, especially in installations employing oil at high pressure and in which the controlling impulses are of relatively great magnitude. However, in all cases, the size of the outlet opening or of the perforations in the partition, when a perforated partition is employed, should be empirically determined to insure that the oil catcher is maintained full of oil.

It will be understood that the term "oil" used in this specification is to be construed as synonymous with any liquid adapted for use in operating jet pipe regulators of the general type shown.

From the foregoing description, it will be seen that the improved oil catcher greatly increases the efficiency and dependability of jet pipe regulators. It is simple in its design and easy to install. The deflector around the jet pipe nozzle prevents the returning oil stream and any eddies in the catcher chamber from disturbing the movements of the jet pipe.

Obviously, the present invention is not restricted to the particular embodiments thereof herein shown and described herein. Moreover, it is not essential that all the features of the invention be used conjointly, since they may be employed advantageously in various combinations and sub-combinations.

What is claimed is:

1. In a liquid operated jet-pipe relay having a jet pipe and a distributor member presenting a pair of orifices adapted to receive and return liquid delivered through said jet pipe, a cup-shaped catcher for the returning liquid on the distributor around the nozzle end of the jet pipe having an outlet opening; and a liquid deflector having a funnel-shaped end projecting into the cup from its outer end and surrounding the jet pipe nozzle.
2. In a liquid operated jet-pipe relay having a jet pipe and a distributor member presenting a pair of orifices adapted to receive and return liquid delivered through said jet pipe, a cup-shaped catcher for the returning liquid on the distributor around the nozzle end of the jet pipe having an outlet opening; and a tube projecting into the catcher from its outer end around the jet pipe and having a funnel-shaped inner end flattened at the tip surrounding the jet pipe nozzle.
3. In a liquid operated jet-pipe relay having a jet pipe and a distributor member presenting a pair of orifices adapted to receive and return liquid delivered through said jet pipe, a cup-shaped catcher for the returning liquid on the distributor around the nozzle end of the jet pipe having an outlet opening; a protecting tube secured in the outer wall of the catcher and surrounding the jet pipe; and a liquid deflector on the inner end of said tube around the tip portion of the jet pipe presenting a narrow elongated opening to permit movement of the jet pipe and

deflect a returning liquid stream from either orifice into the catcher.

4. In a liquid operated jet-pipe relay having a jet pipe and a distributor member presenting a pair of orifices adapted to receive and return liquid delivered through said jet pipe, a cup-shaped catcher for the returning liquid on the distributor around the nozzle end of the jet pipe having an outlet opening; and a funnel-shaped liquid deflector projecting into the catcher from its outer end around the end portion of the jet pipe having opposite flattened walls to present an elongated slotted opening in which the jet pipe is adapted to move said walls preventing a returning oil stream from either orifice from entering the said opening.

5. In a liquid operated jet-pipe relay having a jet pipe and a distributor member presenting a pair of orifices adapted to receive and return liquid delivered through said jet pipe, a cup-shaped catcher for the returning liquid on the distributor around the nozzle end of the jet pipe having an outlet opening; a perforated transverse partition in the catcher having a central opening; a tube projecting inwardly through the outer end of the catcher and through said partition; and a funnel-shaped end on said tube about the tip portion, the jet pipe presenting an elongated opening extending in the direction of movement of the jet pipe.

6. In a liquid operated jet-pipe relay having a jet pipe and a distributor member presenting a pair of orifices adapted to receive and return liquid delivered through said jet pipe, a cup-shaped catcher for the returning liquid on the distributor around the nozzle end of the jet pipe having an outlet opening; a perforated transverse partition in the catcher having a central opening and dividing said catcher into two chambers, the outlet opening being provided in the outer chamber; a tube projecting inwardly through the outer end of the catcher and through the central opening in said perforated partition; a funnel-shaped deflector on said tube about the tip portion of the jet pipe presenting an elongated opening extending in the direction of movement of the jet pipe; and means to vary the size of the outlet opening to maintain the catcher full of liquid.

7. In a liquid operated jet-pipe relay having a jet pipe and a distributor member presenting a pair of orifices adapted to receive and return liquid delivered through said jet pipe, a cup-shaped catcher for the returning liquid on the distributor around the nozzle end of the jet pipe having an outlet opening; an annular perforated

transverse partition in the catcher dividing the catcher into two chambers with the outlet opening in the outer chamber; a tube secured in the outer end of the catcher and projecting therein through said perforated partition; a funnel-shaped end on said tube about the tip portion of the jet pipe presenting an elongated opening extending in the direction of movement of the jet pipe; and an adjustable perforated annular plate cooperating with the perforations in said partition to adjust the size of said perforations and maintain the inner chamber of the catcher full of liquid.

8. In a liquid operated jet-pipe relay of the class described, a jet pipe pivoted about a vertical axis and a distributor block having a pair of angularly arranged conduits into either of which liquid from the nozzle of the jet pipe may be adapted to discharge and be returned through the other; a cup-shaped catcher secured to the distributor block into which the jet pipe projects; a funnel-shaped deflector member in the catcher chamber surrounding the jet pipe nozzle; and adjustable outlet means permitting returned liquid to flow out of the catcher chamber.

9. In a liquid operated jet-pipe relay of the class described, a jet pipe pivoted about a vertical axis and a distributor block having a pair of angularly arranged conduits into either of which liquid from the nozzle of the jet pipe may be adapted to discharge and be returned through the other; a cup-shaped catcher secured to the distributor block into which the jet pipe projects; a tube projecting into the catcher around the jet pipe and having a funnel-shaped inner end surrounding the jet pipe nozzle, the upper and lower sides of the funnel-shaped end being flattened to present an elongated slot-like opening for the nozzle and the flattened walls being substantially parallel with the axes of said conduits; and an adjustable outlet to permit the returned liquid to flow out of the catcher chamber and to maintain a positive pressure therein.

10. In a liquid operated jet-pipe relay having a jet-pipe and a distributor member presenting a pair of orifices adapted to receive and return liquid delivered through said jet-pipe, a catcher for the returning liquid on the distributor around the nozzle end of the jet-pipe having an outlet opening; a liquid deflector having a portion projecting into the catcher from its outer end and surrounding the jet-pipe nozzle; and a perforated partition in the casing around the deflector intermediate its ends providing a discharge chamber for the liquid.

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