A. R. DODGE.

NOZZLE PLUG.

APPLICATION FILED NOV. 17, 1913.

1,119,581. Patented Dec. 1, 1914.

Fig. 1.

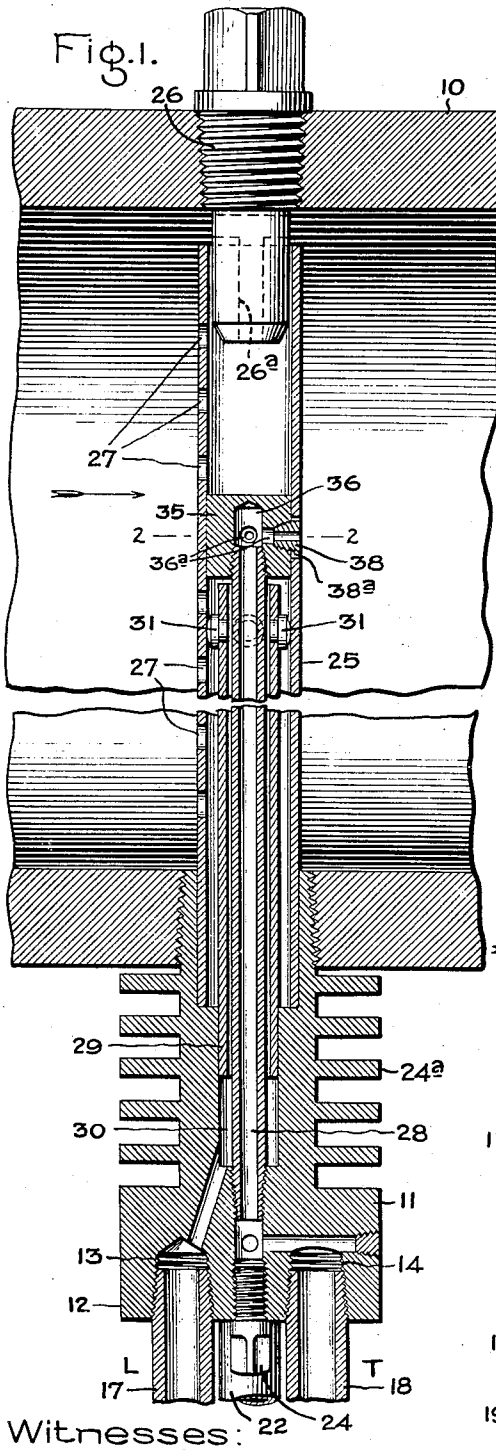


Fig. 2.

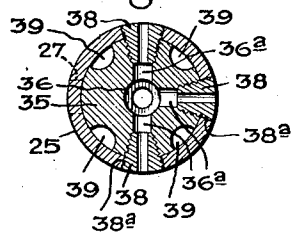


Fig. 3.

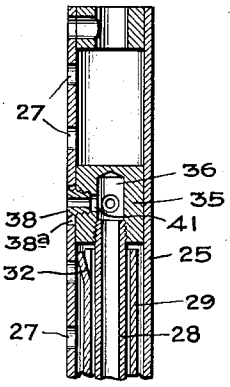


Fig. 5.

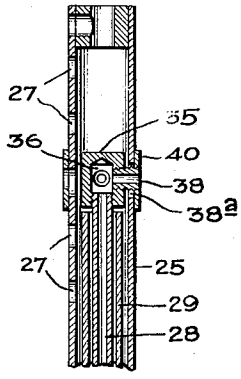


Fig. 4.

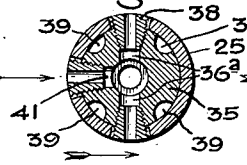


Fig. 6.

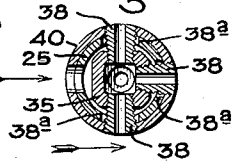
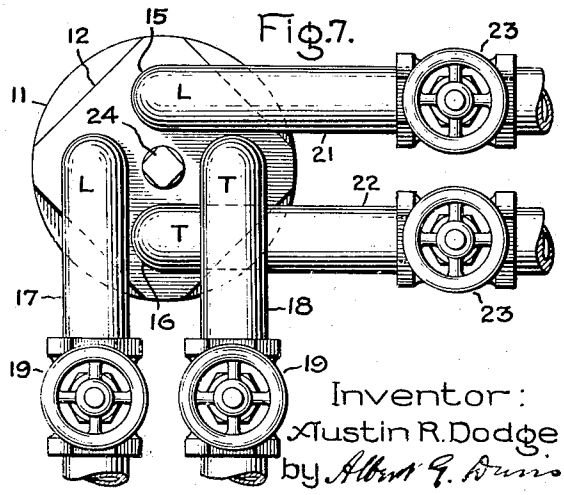


Fig. 7.



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UNITED STATES PATENT OFFICE.

AUSTIN R. DODGE, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

NOZZLE-PLUG.

1,119,581. Specification of Letters Patent. Patented Dec. 1, 1914.

Application filed November 17, 1913. Serial No. 801,360.

To all whom it may concern:

Be it known that I, AUSTIN R. DODGE, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Nozzle-Plugs, of which the following is a specification.

The present invention relates to what are commonly known as nozzle plugs and which operate on the principle of a Pitot tube to establish a pressure difference in some device, such as a mercury containing manometer, and has for its object to improve their construction, particular reference being made to the means for compensating for expansions and contractions due to temperature changes, to supporting the plugs at their inside ends, to limiting the pressure difference created thereby for fluids flowing at high velocity, and to means for freeing the plug of dirt and other foreign matter.

In the accompanying drawing, which is illustrative of my invention, Figure 1 is a longitudinal section of a plug showing the parts arranged to slide on each other to compensate for temperature changes; Fig. 2 is a cross-section taken on line 2—2 of Fig. 1; Fig. 3 is a partial axial section of a high velocity plug; Fig. 4 is a cross-section of the same; Fig. 5 is an axial section of a modified form of sliding connection between the inner and outer parts; Fig. 6 is a cross-section of the same; and Fig. 7 is a detail view showing means for blowing foreign matter out of the plug.

10 indicates the main through which the fluid to be metered flows. It may be liquid, air, steam, or other vapors.

11 indicates the base of the nozzle plug which is screwed into a tapped hole in the main. It is provided with a squared head 12 to receive a wrench. In the head are four screw-threaded ports or openings of which 13 and 14 are arranged in one pair and 15 and 16 in another. The openings 13 and 15 are connected by passages to the orifices in the nozzle plug which face the moving column of liquid and are commonly referred to as the leading or high pressure openings. The openings 14 and 16 are connected to the rear and side orifices of the nozzle plug and the moving column of liquid in passing the plug tends to create a suction effect therein. These are commonly referred to as the low pressure or trailing openings. The plug can be adapted for service in a main where the flow is from right to left, or left to right, or up or down. Further, the pipes 17 and 18 connecting the plug with the manometer should be in the same horizontal plane to insure equal water columns above the mercury. To provide for this and to insure the orifices in the plug facing in the proper direction, the additional set of openings 15 and 16 is provided. As shown, the meter, manometer, or other device, is connected to the plug by the pipes 17 and 18, each containing a shut-off valve 19. If the direction of the fluid was downward, as in a vertical pipe, the manometer would be connected by the pipes 21 and 22, each having a shut-off valve 23.

Formerly it was the practice to plug up the holes or ports not in use, but I have discovered that they can be utilized in cleaning the nozzle plug of foreign matter. Assuming that the manometer or other device is connected to pipes 17 and 18, the pipes 21 and 22 are screwed into the openings 15 and 16 and the valves 23 closed. Under these conditions the meter will work in the ordinary manner. Assuming now that it is desired to clean the plug, instead of shutting down the system and taking the plug out of the main I first shut the valves 19 to prevent the mercury in the manometer from being driven out and then open the valves 23 and permit fluid to be discharged into the atmosphere through the plug under the full pressure of the main. This will carry out any foreign particles which may be lodged in the various passages in the plug, after which the valves can be closed and the normal operation of the meter will be resumed. As an additional cleansing means the screw plug 24 is provided and located in line with the tubular member 28 in the center of the plug. By removing the screw plug access may be had to the interior of said member.

The base 11 of the nozzle plug is purposely made quite large and is provided with radiating fins 24^a to facilitate the condensation of vapor in the passages in the plug. They will be unnecessary where air or water is being metered, but since it is preferable to use a standard construction as far as possible for all purposes they may be retained. The base is counter-bored to receive the orifice tube 25, which extends

perpendicular to the direction of flow of the fluid. In order to obtain the best effects it should extend substantially across the main so that the average velocity of the fluid stream, instead of that at any given point, will be utilized. Where the mains are small in diameter it is entirely satisfactory to support the tube from the base only, but where the main is large, as is the case for water, these tubes may be 4 to 5 ft. long or even longer, and it becomes necessary to support them at their inner ends. This is accomplished by drilling and tapping the main 10 in line with the plug and inserting therein a screw-threaded supporting piece 26 that makes a reasonably good fit with the bore of the orifice tube. The arrangement between the support 26 and the tube 25 should be such that the tube is free to expand and contract with temperature changes without restraint from the part 26. When used with steam the support 26 has suitable drainage openings 26^a, shown in dotted lines.

The tube 25 is provided with a plurality of orifices 27 which face the moving column of fluid. These are distributed substantially over the entire length of the tube and in the same plane so that the average impact of the fluid will be obtained as distinguished from the impact at one point only. Screw-threaded to the base and located inside of the orifice tube is a tubular member 28 of rather small diameter. This is in turn surrounded by a sleeve 29 and between the sleeve and tube is a small annular space through which the pressure, due to the impact orifices 27, is conducted to the chamber 30, the latter communicating with the leading pipe 17 connected to the manometer. In order to preserve the proper relation between the outer end of the sleeve 29 and the tube 25, spacing devices are provided. In Fig. 1 they are shown in the form of pins 31 carried by the sleeve and having rounded heads in engagement with the orifice tube. Generally three or four of these pins may be provided. An alternative arrangement of the spacing device is shown in Fig. 3 wherein the upper end of the sleeve 29 is split at a suitable number of places, say three for example, and the little tongues 32 thus formed are bent outward into engagement with the inner wall of the orifice tube.

Referring now to the low pressure or trailing side of the device, the tubular member 28 is screw-threaded into the base and at its upper end is provided with a head or block 35 which contains a chamber 36 and one or more small passages 36^a communicating with trailing orifices in the tube 25. The head or block may be secured to the member in any suitable manner, as, for example, by screw threads. From practical experience I have found that nozzle plugs of this character sometimes break in the region of the block when subjected to steam. This is occasioned by the admission of relatively cold water to the inner member 28 from the pipe 17 and its usual connected reservoir. The entrance of water to said member has the effect of chilling it and thus causing it to contract. On the other hand, the orifice tube is still subjected to heated vapor and retains its elongated form. If the block 35 is directly fastened to the orifice tube something will have to give if the difference in expansion of the parts is great. It will either strip the threads off of the member 28 or break the pins or other connection between the block and the tube. I have discovered that this objectionable feature can be avoided in a very simple manner and at the same time the proper pressure conditions between the leading and trailing sides preserved. The sliding block is drilled with as many holes as it is desired to have trailing openings through the orifice tube. Into each of these holes is screwed a hollow pin 38. As shown in the figures, three hollow pins are shown, the opening in each pin communicating with a passage 36^a in the block. Instead of making the holes in the orifice tube for the pins of the same diameter I make them larger and in the form of slots 38^a so that the block and orifice tube can move with respect to each other without shearing off the pins. The block should be long enough, measuring in an axial direction, to cover the slots and prevent the impact pressure from by-passing into the trailing, low pressure or suction orifices, thereby decreasing the pressure difference, it being remembered that the pressure within the tube 25 is greater than in the chamber 36 in the block 35. It is, however, necessary to permit fluid under pressure to pass through the tube from the top to the bottom of the block and to this end the block is provided with a number of grooves 39 forming passages which permit free communication between the chambers above and below it.

Instead of screwing the pins 38 into the head or block and slotting the orifice tube, the arrangement shown in Figs. 5 and 6 can be employed. In these figures the block or head 35 is no longer centered and guided by the inner wall of the orifice tube as it is smaller in diameter than its bore. I obtain the same effect, however, as in the construction shown in Fig. 1 by mounting on the outside of the orifice tube a ring 40, said ring being connected with the block by hollow pins 38 that extend through the slots 38^a in the tube 25. As the tubular member 28 expands and contracts, the block 35 will move up and down within the tube 25 without disturbing it, and since the slots 38^a

are covered by the ring leakage from one set of orifices to the other will be avoided.

For a majority of the cases, the construction heretofore illustrated will be entirely satisfactory, but there are conditions where the velocity of the fluid in the pipe is very high and a nozzle plug of the type described will give too great a pressure difference for the manometer; that is to say, the pressure difference will be so great that it will either force mercury out of the manometer, or move it to a region outside of the normal. To provide for a condition of this kind, instead of having two side openings and one rearwardly opening passage 36ª as in Fig. 2, the parts are so arranged that there are one forwardly opening passage 41 and two side opening passages 38 as before. The effect of the passage 41 facing the moving column of fluid is to somewhat increase the pressure of the fluid from the side opening passages 36ª, the pressure actually entering the tubular member 29 being a resultant of the pressures in the three passages. The net effect of this is to decrease the pressure difference in the pipes 17 and 18 leading to the manometer. For example, for a given flow, with the passages in pins 38 arranged as in Fig. 2, the mercury deflection in the manometer may amount to 1½". Under the same condition, if the arrangement shown in Fig. 4 is employed, the mercury deflection will only be about 1".

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In a nozzle plug, the combination of a base containing passages and adapted to be attached to a fluid carrying main, an orifice tube supported thereby and communicating with one of said passages, a tubular member also carried by the base and located inside of the tube and communicating with another of said passages and a block carried by the member that is movable independently of the tube, said block having one or more orifices registering with those in the tube.

2. In a nozzle plug, the combination of a base containing passages and adapted to be attached to a fluid carrying main, an orifice tube supported thereby and communicating with one of said passages, a tubular member also carried by the base and located inside of the tube and communicating with another of said passages, and a block carried by the member that is movable independently of the tube, said block having one or more orifices registering with those in the tube, and means for shielding the orifices in the block from the admission of fluid from the inside of the orifice tube.

3. In a nozzle plug, the combination of a base containing passages and adapted to be attached to a fluid carrying main, an orifice tube supported thereby and communicating with one of said passages, a tubular member also carried by the base and located inside of the tube and communicating with another of said passages, a block carried by the tubular member and containing a passage in communication with that in said member, and means that are mounted on one of the parts and convey fluid under pressure from the outside of the orifice tube to said member, said means also serving to prevent the block from turning within the orifice tube.

4. In a nozzle plug, the combination of a base containing passages and adapted to be attached to a fluid carrying main, an orifice tube supported thereby and communicating with one of said passages, a tubular member also carried by the base and located inside of the tube and communicating with another of said passages, a sleeve that surrounds said member and is separated from it and the orifice tube by annular spaces, means for centering the sleeve within the said tube, and a block carried by the member which communicates with the region outside of the tube, said space and tubular member communicating with the passages in the base.

5. In a nozzle plug, the combination of a base containing passages and adapted to be attached to a fluid carrying main, an orifice tube supported thereby and communicating with one of said passages, a tubular member also carried by the base and located inside of the tube and communicating with another of said passages, a block mounted on the member and in sliding engagement with a wall of the orifice tube, and hollow pins that convey fluid from a region around the tube to the block and also slide in the orifice tube.

6. In combination, a main, a nozzle plug screw-threaded into the main and extending across it, said plug creating a pressure difference that varies with changes in the rate of flow of fluid in the main, and a device screw-threaded into the main on the side opposite the base which is in telescopic relation with and holds one end of the tube against deflection.

7. In combination, a nozzle plug comprising a base having passages and adapted to be secured to a fluid carrying main, an orifice tube mounted on the base and extending across the main, a device carried by the side of the main opposite the base for holding one end of the tube against deflection,

and a tubular member located within the orifice tube and separated therefrom by a space, said member communicating with one of the passages in the base and also with the region outside of the tube, and said space communicating with another of said passages.

8. In a nozzle plug for high velocities, the combination of a base, an orifice tube carried thereby, the orifices in said tube being adapted to face the moving column of fluid, a means carried by the base and containing orifices subjected to the suction effects of the column of fluid, and a passage that faces the moving column of fluid and acts to partially neutralize the pressure difference due to the action of the orifice tube and means.

9. In a nozzle plug for high velocities, the combination of a base, an orifice tube carried thereby, the orifices in the tube being adapted to face the moving column of fluid, a tube carried by the base, a block carried thereby and containing passages subjected to the suction effect of the moving column of fluid, and a passage that is subjected to the impact of the fluid and is connected to the first named passages to partially neutralize the suction effects of the column of fluid.

10. In a nozzle plug for high velocities, the combination of a base, a tube mounted thereon having orifices which are adapted to face the moving column of fluid, a tubular member also carried by the base and located inside the tube, a block mounted on the outer end of the member and containing a chamber, hollow pins mounted in the block and conveying fluid pressure to the chamber, one of said pins being subjected to the impact of the moving column of fluid and the remainder to the suction effect thereof.

11. In a nozzle plug, the combination of a base, an orifice tube carried thereby which is provided with slots, a hollow member secured to the base and located inside the tube, a block mounted on the member and in sliding contact with the tube, there being passages through the block to equalize the fluid pressures on opposite sides thereof, and screw-threaded hollow pins mounted in the block and movable in said slots.

12. In combination, a main, a nozzle plug comprising a base mounted on the main and containing passages arranged in pairs, means carried by the base for creating a pressure difference responsive to changes in the rate of flow of fluid through the main and communicating with said passages, pipes connected to one pair of passages for conveying fluid pressure to the point of utilization, and valved pipes connected to the other pair of passages through which fluid can be discharged from the main to clean said means of foreign matter.

In witness whereof, I have hereunto set my hand this 15th day of November, 1913.

AUSTIN R. DODGE.

Witnesses:
BENJAMIN B. HULL,
MARGARET E. WOOLEY.