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W. F. MOORE

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FLOW DIVIDER

Filed March 18, 1932

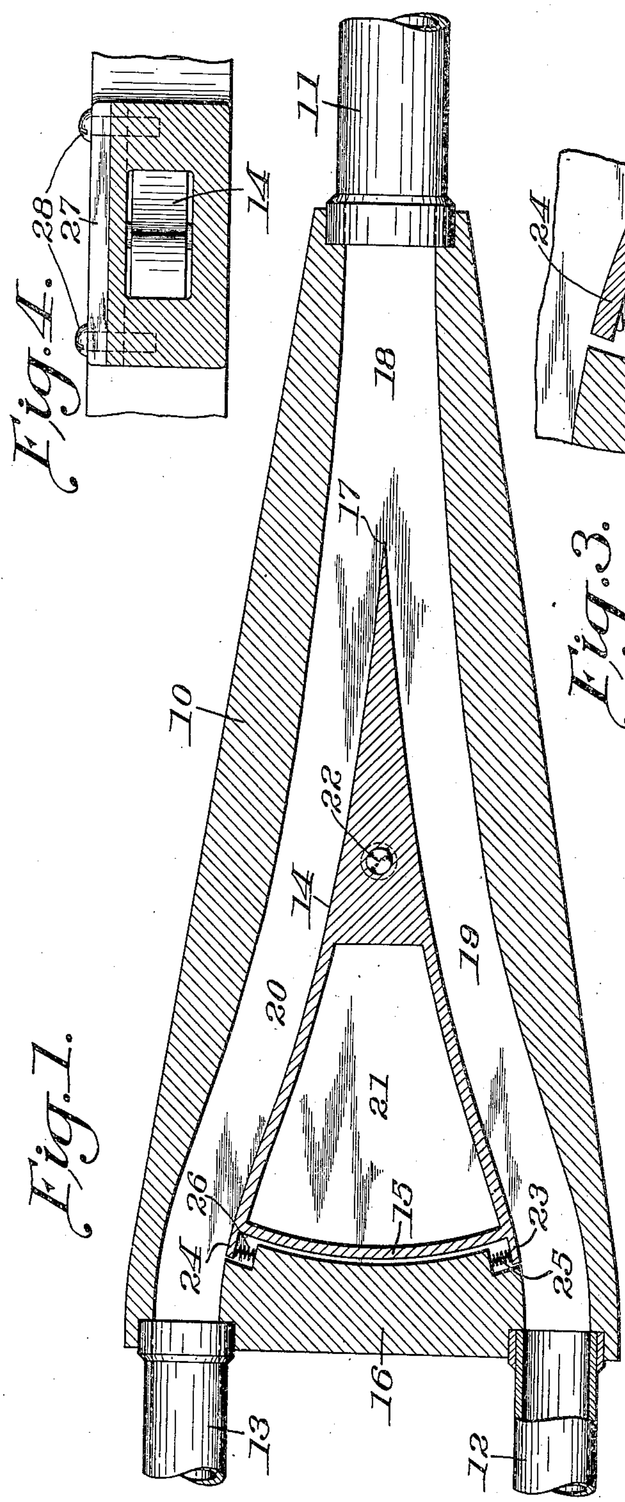

Fig. 1. Fig. 4.

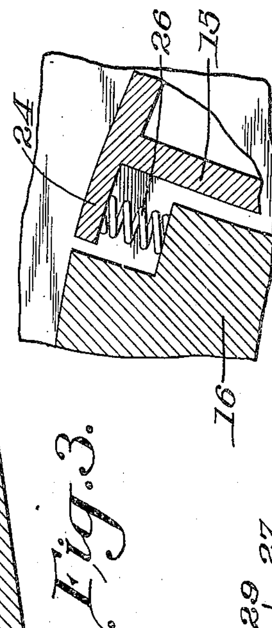

Fig. 3.

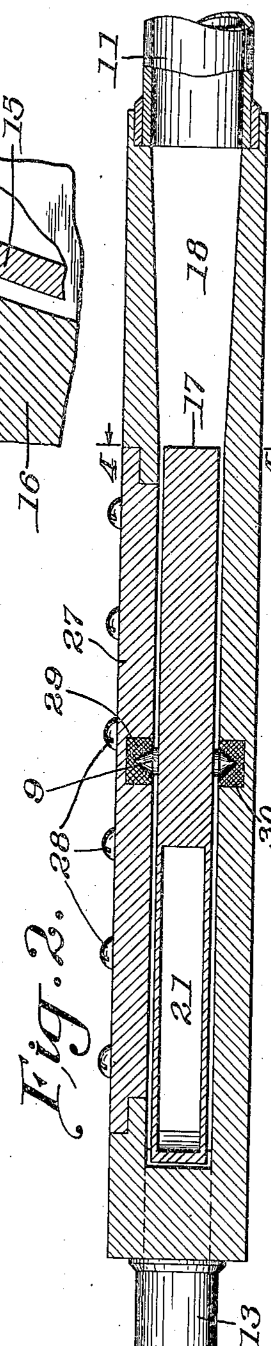

Fig. 2.

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UNITED STATES PATENT OFFICE

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FLOW DIVIDER

Application filed March 18, 1932. Serial No. 599,648.

This invention relates to a device for dividing a flowing stream of fluid and more particularly to a mechanism which is adapted to divide a stream of fluid into two streams of equal volume and to maintain the volume of these streams constant.

In the case of those fittings and arrangements which have been used up to the present time for attempting to divide a stream into two streams of equal volume and which usually comprise a Y pipe fitting and valves for regulating the volumes of the streams, great difficulty has been experienced in attaining the desired result. Slight differences in the characteristics of the internal structures of the Y fitting and the valves always result in wide variations of the volumes of the two resultant streams. By means of my invention, I am enabled to accurately divide a given stream of fluid into two streams of equal volume and to maintain these volumes constant at all times without recourse to the use of any valves or similar control fittings.

In accordance with my invention, I interpose in the stream of fluid a casing within which is pivoted a wedge-shaped vane which is limited in the extent of its rotation and is adapted to divide the fluid into two equal streams. For a better understanding of my invention, reference may be had to the following description and accompanying drawing which illustrate a preferred embodiment of the invention in which

Fig. 1 is a horizontal sectional view;

Fig. 2 is a vertical sectional view;

Fig. 3 is an enlarged fragmentary view of a spring and stop assembly used for limiting the movement of the movable member of the mechanism; and

Fig. 4 is a vertical section on the line 4—4 of Fig. 2.

In the drawing the numeral 10 designates a casing substantially triangular-shaped in cross section and having a fluid conductor 11 entering it at the apex which is the inlet end of the structure. Two conductors 12 and 13 enter the casing at the opposite base vertices, these conductors serving as outlets for the fluid entering at 11.

A wedge-shaped, vane-like member 14 is supported on a pivot 9 within the casing 10 in such a manner that its center line normally coincides with the center line of the casing. The base 15 of the vane-like member is adjacent to the base 16 of the triangular-shaped casing, while the leading edge 17 points directly toward the apex of the casing. As a result of this allocation of the members, the fluid passages in the casing conform substantially to a Y shape, the leg 18 of which coincides with the inlet portion of the casing while the arms 19 and 20 constitute the diverging fluid passages leading to the outlet conductors.

The after portion 21 of the vane-like member is symmetrically hollow so that the center of mass 22 of the structure is on the center line and, in the forward portion of the vane. As a direct result of this, the density of the head or leading portion is considerably greater than the density of the after, or tail portion. The base of the vane is curved and conforms to the arc of a circle having a radius equal to the distance between the center of mass or pivotal point and either of the vertices of the base angles of the vane. The surface of the casing against which the vane abuts is likewise curved and acts as a bearing surface.

The side walls of the vane are extended beyond the curved base of the vane-like member resulting in projections 23 and 24. The base of the casing is recessed to receive these projections and to allow a limited rotation of the pivoted member. Resilient means, 25 and 26, cooperate with projections 24 and 25 to normally maintain the vane in a central position with the leading edge positioned on the center line of the casing structure.

The diverging passages are designed to have a diameter such that the cross section of each shall be one-half of the cross section of the inlet conductor.

The casing 10 of the flow divider is fitted with a cover plate 27 suitably machined to allow of a fluid-tight closure. Screw or stud bolts 28 are provided to maintain this plate in close contact with the casing. Both the cover plate and the bottom plate of the casing are provided with recessed bearings 29 and 30 to cooperate with the pivot 9 of the vane-like member and are so designed as to allow free rotation of this member. Since the pivot 9 coincides with the center of mass 22, the vane member will normally be balanced and will swing freely except as limited by the projections 23 and 24 and the resilient means 25 and 26.

The operation of the flow divider is most easily understood by a consideration of its action under conditions of both straight line flow and turbulent flow. Considering a fluid entering the mechanism through the conductor 11 travelling with a velocity less than its critical velocity, the cross section of such a fluid contains no points having velocities higher or lower than the average velocity. The vane, being positioned in its normally central position, divides the oncoming fluid into two equal streams which follow the channels 19 and 20. The kinetic energies of each of the divided streams are equal and the clockwise moment acting on one side of the after portion of the vane equals the counter-clockwise moment acting on the other side of the after portion of the vane. Therefore, there cannot be a resultant torque and the vane remains in its normally central position.

If there is a condition of turbulent flow in the incoming fluid, the cross section of the fluid contains eddy currents or localized streams having velocities higher or lower than the average velocity. Considering the vane positioned in a normally central position, the kinetic energies of the divided streams are unequal. The moments acting on each side of the after portion of the vane are unequal and there is a resultant torque causing rotation of the vane. Referring to Fig. 1, it will be seen that if the vane is caused to swing out of its normally central position in a clockwise direction, the channel 19 is constricted by the knife edge 17, and a larger volume of fluid passes through channel 20. As a result, the velocity of the fluid adjacent to the after portion of the vane on the 20 side is increased which then produces a counter-clockwise moment greater than that tending to cause clockwise rotation, and the vane returns to its normally central position.

In order to limit the extent of rotation of the vane, the projections 23 and 24 have been provided. Cooperating with these projections are resilient means 25 and 26, for decreasing the sensitivity of the mechanism and for damping or preventing the rapid vibrations or flutterings of the vane that might be caused by slight eddy currents normally present in any flowing body of fluid.

The fluid divider, as described, may be efficiently applied in all cases where it is desirable to divide a flowing body of fluid into two streams of equal volumes. For example, it may be applied to container filling mechanisms, to the charging of oil to duplicate cracking units with one charge pump, to the supplying of liquid or gaseous fuel to duplicate burners, and the like. By changing the materials used in constructing the mechanism, it may be adapted for the handling of all types of fluids, both gaseous and liquid. It is apparent that several flow dividers similar to the one I have described may be used in series. For example, by connecting the respective inlet conductors of two flow dividers to the fluid eductors 12 and 13 of the flow divider shown in Fig. 1, it is possible to divide a stream of fluid into four equal streams.

Obviously many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. A device for dividing a stream of fluid into two equal streams comprising a casing interposed in the stream of fluid, a wedge-shaped vane pivoted centrally in the casing, limited in the extent of its rotation and adapted to divide equally the flow of fluid through the casing.

2. A device for dividing a stream of fluid into two equal streams comprising a casing interposed in the stream of fluid, a wedge-shaped vane pivoted centrally in the casing and adapted to equally divide the flow of fluid through the casing and resilient means cooperating with the vane and adapted to limit the extent of its rotation and to return the same to its normal position.

3. A device for dividing a stream of fluid into two equal streams comprising a casing provided with a fluid inlet and a plurality of fluid outlets, a wedge-shaped vane centrally pivoted in the casing and adapted to equally divide the flow of fluid through the casing, stops and resilient means cooperating with the vane and adapted to coact with it and to limit the extent of its rotation.

4. A device for dividing the flow of a fluid into two equal streams which comprises a casing triangular shaped in cross section having a fluid conductor entering it at its

apex and two fluid eductors parallel to the fluid conductor leaving the casing at opposite ends of its base, a wedge-shaped vane pivoted within the casing, and centrally positioned therein so that the fluid passages formed thereby conform substantially to a Y shape, and projections and resilient means operatively attached to the vane to limit the extent of its rotation.

In witness whereof, I have hereunto set my hand this 7th day of March, 1932.

WILLIAM F. MOORE.