

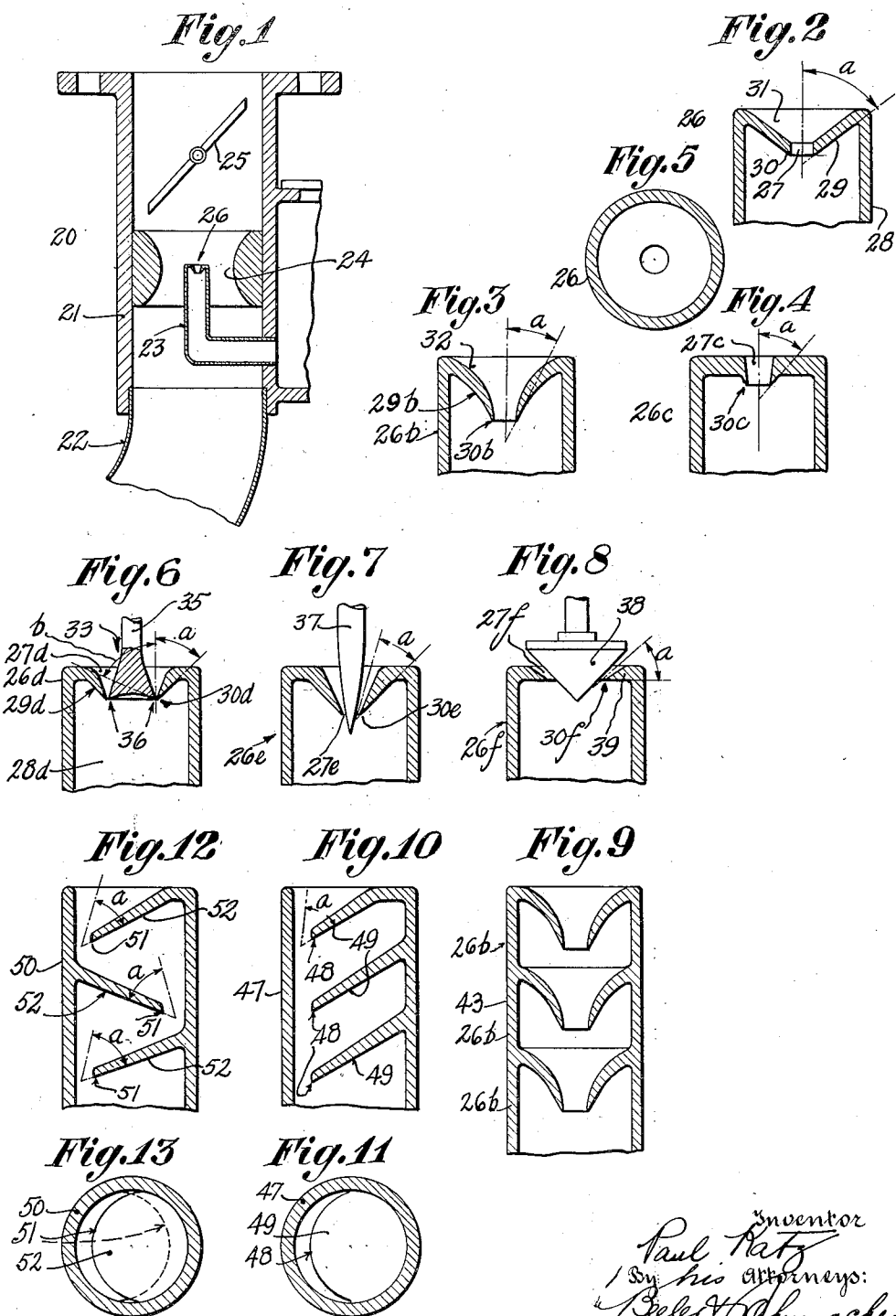
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AUTOMATIC FLOW REGULATOR

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AUTOMATIC FLOW REGULATOR

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This invention relates to flow regulators.

One object of the invention is to provide an improved device of the character described which shall regulate the flow of one fluid with respect to another.

Another object of the invention is the provision of an improved device of the nature set forth for automatically proportioning the flow of one fluid with relation to another according to certain required conditions, which obtain, for example, in the carburetor of an engine, and may be necessary for the economic and efficient operation thereof.

Another object of the invention is to furnish a very simple improved device of the type mentioned, which is free of moving parts.

More specifically, it is an object of the invention to construct a device of the class alluded to which, in its specific application to a carburetor, can maintain desired proportions between the fuel and the air, these proportions being constant both at high as well as low engine speeds, or being leaner at high than at low speeds, or having other characteristics as desired.

Briefly the invention may be defined, for purposes of specific description of certain characteristics thereof as having a comparatively sharp angle disposed substantially opposite to the direction of flow of one of the fluids at a point of high or maximum velocity of the stream to be regulated.

Other objects and advantages of the invention will become apparent as the specification proceeds.

With the aforesaid objects in view, the invention consists in the novel combinations and arrangements of parts hereinafter described in their preferred embodiments, pointed out in the subjoined claims, and illustrated on the annexed drawing, wherein like parts are designated by the same reference characters throughout the several views.

In the drawing:

Figure 1 is a fragmentary sectional view showing an embodiment of the invention and a typical application thereof.

Fig. 2 is a similar view of a modification formed of sheet metal.

Fig. 3 is a similar view of a modification showing a curved face at the angle.

Fig. 4 is a similar view of a modification showing a relatively small angle.

Fig. 5 is a cross sectional view applicable to the devices shown in Figs. 2 and 3.

Fig. 6 is a sectional view of a device with means to adjust the volume of flow.

Fig. 7 is a similar view with said means being in the form of a needle.

Fig. 8 is a similar view with said means being in the shape of a cone having a large base.

Fig. 9 is a sectional view of the device arranged to form a lean mixture at high engine speeds.

Fig. 10 is a sectional view of a modification of the invention, with a plurality of baffles forming angles.

Fig. 11 is a bottom view thereof.

Fig. 12 is a further modification of the invention with staggered angles.

Fig. 13 is a bottom view thereof.

The advantages of the invention as here outlined are best realized when all of its features and instrumentalities are combined in one and the same structure, but, useful devices may be produced embodying less than the whole.

It will be obvious to those skilled in the art to which this invention appertains, that the same may be incorporated in several different constructions. The accompanying drawing, therefore, is submitted merely as showing the preferred exemplification of the invention.

Generally described, the invention may be considered as providing a sharp angle or surface in proximity to the path of flow of a fluid, which angle may tend to cut certain portions of the stream. The operation of the device may, accordingly, be accompanied by a deflection of portions of the stream, but this will depend upon the size and disposition of the angle or other characteristics that may be involved, and in this device space is provided for such deflection. I do not know the precise action of the fluid stream, and am therefore constrained to limit myself somewhat as to the terminology employed in describing the same, but I do not intend to thereby limit the invention.

The device finds important application in proportioning the flow of one fluid with respect to another, although it may also be used with one fluid only. The fluids mentioned may be gases or liquids or any combinations thereof, and the device may be used with either. For purposes of illustration only, the device is shown applied to a carburetor of a gasoline engine. In that embodiment, the invention may be constructed in the form of a nozzle, or in the shape of a tube having baffles forming angles. Within the principle of the invention, it can also be embodied in other forms, in which the sharp angle extends with its apex against the fluid stream. In the

carburetor mentioned, the nozzle is connected to the gasoline supply and is responsive to any differential pressure as by being centrally positioned with respect to the carburetor to be influenced by the reduced pressure created by the air flow.

The nozzle in question may have one or more outlets, and adjacent thereto are one or more angles providing the sharp deflecting surfaces mentioned. In a simple form of the device, the angle forms a single conical surface around its outlet which extends inward into the nozzle. Any suitable valve may control the flow through the device, and if desired the valve may be directly associated with the nozzle and may be in the nature of a needle or a cone. The invention may also have a series of baffles formed thereon, which may be parallel or staggered and provide a plurality of angles. While the invention proportions accurately and constantly when a single angle, or the equivalent thereof, is used, it may render the mixture leaner at high rates by the use of a plurality of angles.

Referring in detail to the drawing, 20 denotes a device embodying the invention. The same is shown for purposes of illustration as being applied to a carburetor 21 having an air inlet pipe 22, a gasoline inlet 23, which extends into a throat 24. A fly valve 25 or other form of control may be used.

On the end of the tube 23 is a device or nozzle 26 that embodies the invention, and which is connected in any suitable manner to the tube 23. The said nozzle may be in axial alinement with the throat 24 and is so arranged with respect thereto as to be preferably in the region of high air velocity therein so that a reduced pressure obtains at the outlet side of the nozzle.

The nozzle 26 has an outlet port 27 that bears a predetermined relation to the diameter of the nozzle chamber 28. The latter may be of any desirable shape, though as shown herein, it is cylindrical. The outer end of the nozzle may be in shapes other than the flat form. Interiorly of the nozzle, is provided a cone 29 which is coaxial with the port 27. The apex of the cone is spaced inward in the nozzle, so that the elements thereof intersect the axis of the fluid stream at an acute angle α . Thus there results an annular sharp angle 30 which is in proximity to the path of maximum velocity of the fluid stream, the velocity being highest in the outlet 27. This angle 30 extends in a direction substantially opposite to the direction of flow of the fluid through the nozzle. Apparently, then, it cuts into a part of the stream in the chamber 29, and deflects the same laterally. This may cause eddy currents in the fluid. But precisely to what the proportioning action of the invention may be ascribed is not known. At any rate, there is ample room for the deflection to occur, since the angle 30 is spaced a sufficient distance from the side wall of the chamber 28. It is contemplated that this distance may be changed to suit different operating conditions.

In each form of the invention herein described, the angle α may approach zero as a limit. That is, a tube extending inward from the end of the nozzle.

In Fig. 3 is shown a modification of the invention in which the nozzle 26b has the cone or tube 29b forming a concave surface that terminates in the sharp angle 30b. The end of the nozzle may provide an expansion cone 32 with stream line characteristics.

In Fig. 4 is a modification of the invention 26c having a small cone 30c about the outlet 27c. The latter is arranged to increase in diameter in the direction of flow. The invention shows to what extent the deflecting surface of the cone may be reduced in area, and the device still function efficiently with the angle α . The small cone 30c may be used also with other outlets.

In Fig. 6 is shown a modification of the invention, in which a nozzle 26d has associated therewith a fluid control 33. As in the preceding forms of the invention, the nozzle has a cone 29d extending into the nozzle chamber 28d, the said cone terminating in an annular acute angle 30d which is coaxial with the outlet 27d. The latter is of somewhat larger diameter to receive a central valve of the control 33. Supporting the valve is a stem 35 whereby the valve can be adjusted by movement in an axial direction into or out of the reentrant space 27d. The inner surface of the valve may be concaved along an angle b if desired to form an additional annular angle 36 that defines the inner edge of the orifice.

In Fig. 7 is shown another modification of the invention including a flow chamber or a nozzle 26e having an outlet 27e at the entrance of which is the sharp edge or angle 30e. Extending into the outlet is a tapered needle 37 which is in alinement with the outlet and is axially movable to adjust the area of the same. Since the needle is centrally positioned the ratio of the length of the sharp edge to the area referred to is greater in this arrangement than in the modification shown in Figs. 2 to 4.

In Fig. 8 is shown another modification of the invention including a flow passage or nozzle 26f having an outlet 27f that receives a tapered valve member 38. This nozzle differs particularly from those hereinbefore described in that the angle α is formed with the end wall 39 of the nozzle. A sharp edge 30f results from the large taper of the outlet, and as above noted, the ratio of the circumference of the edge 30f to the outlet area is high, and increases as the member 38 is made larger.

The modifications of Figs. 6 to 8 may be considered as consisting of a plurality of small nozzles circularly arranged side by side to form the annular nozzles.

In Fig. 9 is shown an arrangement of the invention having a unit 43 comprising a plurality of the foregoing nozzles, as, for example, 26b shown in Fig. 3. The nozzles may be arranged in any desirable relation, and while preferably in alinement as shown, need not necessarily be so positioned. By the use of a plurality of nozzles, the ratio of fuel to air may decrease slightly at high rates, thus making for higher economy in the operation of the gasoline engine.

In Fig. 10 is shown a further modification of a device embodying the invention. This device includes a chamber 47 having a plurality of angles 48 that may be symmetrically disposed, and are formed, for example, on similar or parallel elements that may be in the nature of baffles 49. At each baffle, the edge 48 makes an angle α with the line of flow. Although the baffles are shown as having a circular contour, any other shape may be used with equal success.

In Fig. 12 is shown a still further modification of the invention comprising a passage 50 of any desired shape and having a plurality of staggered sharp edges 51 provided in any suitable manner, as, for instance, on partition or baffle walls 52. In each case the said edge and the adjoining sur-

face of which it forms a part, makes an angle α with the path of flow, which, in this case, may assume a zig-zag direction. The baffles may, in plan view, be of any shape consistent with the form of the passage or chamber in which they are mounted.

I claim:

1. A flow regulator including an inner liquid passage and an outer gas passage surrounding the same, a common chamber for receiving the gas and liquid from said passages, the inner passage having a diverging outlet nozzle for the liquid and an inward projecting portion in the nozzle extending substantially opposite to the direction of flow through the nozzle, and a conical element extending through the nozzle, said element forming a diverging passage in the outlet nozzle, said element having an edge portion opposed to the direction of flow.

2. A device of the character described, including a passage for a supporter of combustion, a fuel oil passage associated therewith so that the flow of the former influences the flow of the fuel oil, the fuel oil passage having a constricted diverging orifice, providing an unobstructed element thereat that projects at an acute angle into the liquid stream and laterally deflects a portion thereof beyond the inner end of the orifice, and a central member extending through the orifice and forming a restriction with the free edge of said element.

3. A device of the character described, including an air passage, a fuel oil passage therein, the latter having a diverging orifice, the air exerting a suction on said orifice, the orifice having a portion projecting into the fuel oil at an acute angle with the direction of flow of the fuel therethrough to cause the latter to be supplied in substantially constant proportion to the air at low as well as at high rates, and a central member extending through the orifice and forming a restriction with the inner edge of said orifice portion, said member having an edge opposed to the direction of flow.

4. A device of the character described, including an air passage, a fuel oil passage therein, the latter having an orifice, the air exerting a suction on said orifice, the orifice having a portion to cause the fuel oil to be supplied in predetermined proportions to the air at low and high rates, the said portion being in the nature of a relatively sharp thin projection forming an internal acute angle with the path of flow of the oil through the orifice and constituting said orifice a diverging orifice, and a member having an edge at the orifice entrance and opposed to the direction of flow.

5. A device of the character described, including a plurality of communicating gas and liquid conveying passages, and means at the point of communication to regulate the flow through the liquid passage with respect to the other, said means including a relatively sharp thin projection extending substantially opposite to the general direction of flow and at an acute angle thereto for laterally deflecting a portion of the liquid away from the point of communication in order to regulate the flow through one of the passages with respect to that through the other passage.

6. A flow regulator including a passage for a fluid, said passage including an outlet having a plurality of staggered projections therein constricting the passage and extending opposite to the general direction of flow of the fluid, the free ends of the projections being the innermost points on the projections as measured along the path of flow of the fluid.

7. A carburetor for gasoline engines including a flow regulator nozzle for the liquid gasoline and subject to external suction, said flow regulator nozzle being of diverging form and having an edged portion therein providing a recess lateral to the orifice and forward of the edged portion, the edge of said portion being close to the point of smallest area of the orifice and being unobstructed, so as to cause deflection of a portion of the gasoline approaching the nozzle.

8. A flow regulator including a nozzle for liquids having an annular relatively sharp thin projection therein extending substantially opposite to the direction of flow through the nozzle and having the free end thereof unobstructed, said projection being continuously annularly connected remotely from the end thereof in fluid-tight relation with a side wall of the nozzle, said projection forming with an adjacent portion of the nozzle an outwardly diverging flow passage for the nozzle terminating substantially at the point of connection with the side wall, a device for producing an air flow closely past the nozzle on the outside and in the general direction thereof for creating a suction on the nozzle, and means to produce a variable pressure condition of the medium into which the nozzle discharges.

9. A carburetor nozzle connected to a gasoline feed tube for regulating gasoline flow, said nozzle having a side wall and an annular flange extending inward of the nozzle from the side wall, said flange having its opposite faces substantially parallel to each other and a relatively sharp edge portion projecting opposite to the general direction of flow through the nozzle and at an acute angle thereto, and the flange forming a divergent outlet passage from said edge, said edge portion being so spaced from the walls of the nozzle as to be unobstructed thereby.

10. A carburetor having an inner passage solely for liquid fuel, and an outer passage surrounding the inner passage for the flow of a gaseous supporter of combustion, said passages being so arranged that the supporter of combustion is adapted to exert a suction on an end of the inner passage as a result of said flow, said inner passage having a nozzle at the end thereof subject to said suction, said nozzle having a projection extending inward at an acute angle to the axis of the nozzle so as to form an orifice for said nozzle diverging outwardly thereof, said projection being of generally annular shape and being continuously connected to a wall of the nozzle in spaced relation to the free end thereof, the free end of the projection being thin edged and remote from said wall, said nozzle having a small mean cross sectional area at the divergent orifice for rapid flow of the liquid fuel therethrough, and the cross sectional area of the nozzle at the free edge of the projection being substantially smaller than the first mentioned cross sectional area.

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