

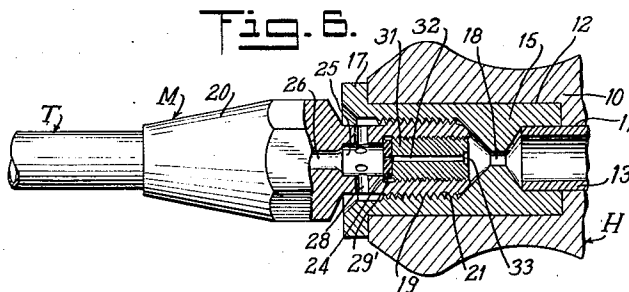
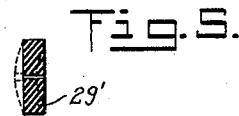
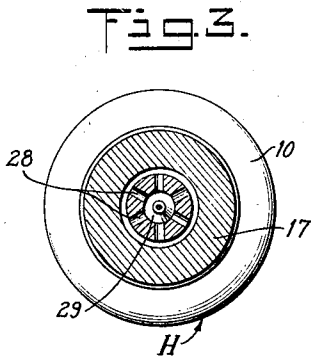
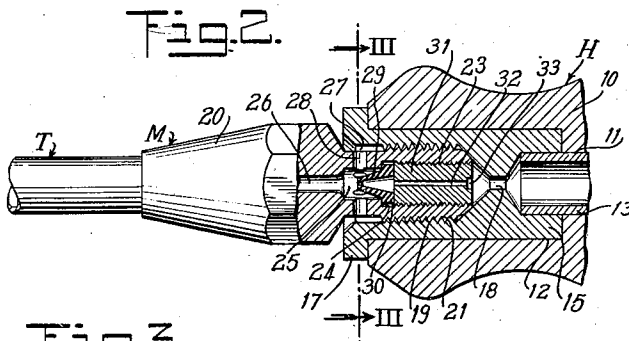
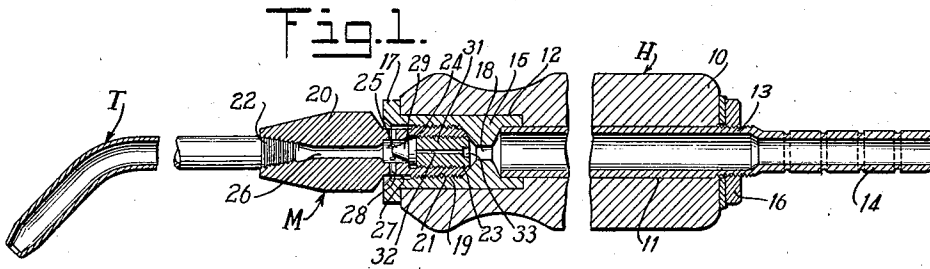
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GAS MIXER

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GAS MIXER

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This invention relates to a gas mixer, and more particularly to a gas mixer including an injector which may be used for mixing two gases by injecting one gas, under pressure, into the other. The invention is especially useful in its application to a gas-air torch, to which use, however, it is not limited.

In the art of applying heat by means of a heating instrumentality such as a blowpipe or a torch, a single blowpipe or torch is ordinarily used with a selected stem, tip, or the like, of a capacity appropriate to the work to be done. A mixing injector of metal is commonly employed to provide the gas mixture which is used by the blowpipe or torch. Upon undertaking a different kind of work with such apparatus, it is usually necessary to change the gas pressure, as by a needle valve, and to employ a stem, tip, or the like, of different capacity, which generally requires, also, the use of a mixer of different capacity. Furthermore, the difficulty of drilling and centering the small orifices which are required in the smaller sizes of mixing injectors when made of metal, and the difficulty of the alternative process of swedging the injector over a wire in order to produce the necessary small orifice, makes such metal injectors expensive. Still further, when the pressure of the gas passing through the mixing injector is reduced, the flame no longer remains neutral. Finally, because of the very small orifices which are employed in the smaller mixing injectors, it is necessary to screen the gas coming to these injectors to prevent stoppage of the orifices by impurities in the gas.

One object of the invention, therefore, is to provide a gas mixer whereby one gas may be aspirated by another to form a gas mixture of substantially constant proportions over a wide range of pressure of the aspirating gas. Another object is to provide a heating instrumentality including a gas mixer having a mixing injector which can be used with different gas pressures and with a plurality of tips of different capacities, to the end that each change of gas pressure and of tip will not also require a change of mixing injector. Another object is the provision of a mixing injector in inexpensive form. A further object is the provision of a mixing injector which will tend to produce a neutral flame regardless of the gas pressure. Still a further object is the provision of such an injector in a form which will not require screening of gas coming to it in order to prevent stoppage of its orifice.

The above and other objects and novel features of the invention will be apparent from the follow-

ing description taken with the accompanying drawing, in which:

Fig. 1 is a broken longitudinal mid-section through a gas-air torch to which the invention is applied;

Fig. 2 is a fragmental elevation of the torch illustrated in Fig. 1, partly in longitudinal mid-section, shown on an enlarged scale;

Fig. 3 is a cross section of the torch taken on the line III—III of Fig. 2;

Fig. 4 is an enlarged longitudinal mid-section through the mixing injector illustrated in Figs. 1 and 2;

Fig. 5 is a similar enlarged mid-section through a different form of mixing injector; and

Fig. 6 is a fragmental view, similar to Fig. 2, of a torch to which the mixing injector shown in Fig. 5 is applied.

According to the present invention, an injector formed of resilient material is employed to project a gas under pressure into another gas under a lesser pressure, or to project a gas under pressure across atmospheric vents thereby aspirating air along with it, in order to mix the two gases and to propel the gas mixture away from the mixing point to a point of use. Because the mixing injector is formed of resilient deformable material, the orifice therein will expand with greater pressure of gas passing forwardly therethrough and will contract with lower pressure of such gas. The same injector may, therefore, be used with widely different gas pressure and with different stems, tips, or the like for doing different kinds of work. If a fixed diameter orifice were used, variation in acetylene pressure would cause variation of the velocity, but insufficient variation in the quantity of acetylene flowing through the orifice to give a substantially constant mixture with the variable quantity of air aspirated by the different acetylene velocity, and hence the flame characteristics would change with changing acetylene pressures. It has been found that the use of a substantially soft rubber injector, preferably of substantially conical form having an axial orifice pierced through its apex, will be self-acting and will automatically control the flow of acetylene in accordance with its pressure. The self-acting resilient orifice of the injector of this invention will set up a condition within the gas mixer such that the velocity of the acetylene passing through the injector tends to remain substantially constant irrespective of variations of acetylene pressure. Actually, this acetylene velocity varies in accordance with its pressure, and by virtue of the expansible and contractible

orifice, the volume of acetylene flowing through the orifice varies. However, the variation in velocity is only sufficient to aspirate the correct amount of air to combine with the variable quantity of acetylene flowing through the orifice to produce a mixture capable of maintaining the flame characteristics substantially constant, even until the flame is extinguished. As a result of such constant flame characteristics, there is but a slight problem of backfires such as occur in the ordinary gas-air torch having an orifice of fixed size designed for use over a certain limited range of pressures. In the ordinary torch, when an attempt is made to use at a low pressure an injector which is designed for a relatively high pressure, the acetylene enriched mixture produced at the low pressure is very susceptible to the propagation of backfires. In the device of the present invention, however, the ratio of gas to air in the combustible mixture is substantially the same at any pressure of the gas because of the variation in the injector orifice size in accordance with the pressure, and the danger of backfires is therefore negligible. Finally, should a backfire occur it will close the orifice in the injector momentarily, thereby acting to prevent passage of a burning or combustible mixture back of the injector. The injector may be constructed in different forms, two being illustrated in the drawing by way of example.

In the embodiment which is illustrated in Figs. 1 to 4, inclusive, there is shown a gas-air torch comprising a handle H, a mixing assembly M, and a stem or tip T, all operatively connected together in series.

The handle H comprises a hand-gripping element 10, which may be formed of wood, having an axial passage 11 extending therethrough, terminating in an enlarged cavity 12 at the forward end of the hand-gripping element. A gas conduit 13 having its rear end formed as a hose-engaging nipple 14 extends through the axial passage 11 in the hand-gripping element H, and is connected at its forward end, as by silver soldering, to a socket member 15 which fits snugly into the cavity 12 at the forward end of the hand-gripping element. A locking nut 16 is threaded on the gas conduit 13 and bears against the rear end of the hand-gripping element 10 to hold the gas conduit 13 and the socket member 15 in place. The socket member 15 is formed with an annular flange 17 on its forward end which contacts the forward end of the hand-gripping element 10 when the socket member is in place. The socket member has an axial passage 18 therein which extends forwardly from its connection with the gas conduit 13 to an internally threaded socket 19 coaxial with the passage 18. Thus, the handle H has an axial gas passage therethrough comprising the passage through the gas conduit 13, the passage 18 through the socket member 15, and the internally threaded socket 19 at the forward end of the socket member 15.

The mixing assembly M comprises a body 20, having its rear end externally threaded, as at 21, for connection with the internal threads in the socket 19. The forward end of the body 20 is internally threaded, as at 22, for engagement with the stem or tip T. Part of the periphery of the body 20 is formed as a hexagonal nut in order that a wrench may grip the body in making these connections.

An internally threaded axial cavity 23 is formed in the rear end of the body 20, and ex-

tends forwardly to an inwardly projecting annular shoulder 24 at the rear end of a chamber 25 formed in the body coaxially with the cavity 23. An axial passage 26 extends forwardly from the chamber 25 to the internally threaded forward end of the body 20 in which the rear end of the stem or tip T is connected. The rear end of stem T constitutes a throat member in the forward end of passage 26 between the mixer M and the main passage of stem T. An axial passage of varying diameter thus extends completely through the body 20 from the handle to the stem or tip.

The body 20 of the mixing assembly M is slightly reduced in section immediately ahead of the external thread thereon and behind the hexagonal nut section, so that, when the mixing assembly is screwed into the socket member 15, an annular space 27 is provided between the body 20 and the socket member 15 ahead of the connecting threads. Furthermore, the body and the socket member are so shaped that this space is open to atmosphere. Radial air holes 28 are formed in the reduced section of the body 20 and extend from the atmosphere into the chamber 25. It is here noted that the outer ends of these radial air passages lie in the annular space 27 and are thereby protected from stoppage.

An injector or injector nozzle 29 is disposed in the chamber 25 in a position to project gas coming to the mixing assembly from the handle across the chamber and into the axial passage 26. The injector 29 will thus produce a sub-atmospheric pressure in the chamber 25, and will aspirate air from the chamber 25 into the passage 26. There the gas which is discharged by the injector will mix with the air, in a well-known manner.

The injector 29 is made of elastic resilient material, as soft rubber, and in the embodiment which is illustrated in Figs. 1, 2, and 4, the injector is of hollow conical shape and has an outwardly projecting flange 30 at its rear end. The injector is inserted into the mixing body 20 through the cavity 23 and is held in place by means of a screw plug 31, the forward end of which bears upon the rear end of the injector 29 and compresses its annular flange 30 between the forward end of the screw plug and the annular shoulder 24 at the forward end of the cavity 23. The screw plug 31 has an axial passage, as a metering orifice 32, extending therethrough, and also has a kerf 33 in its rear end by means of which a screw driver or like instrument may be employed to screw the plug into the cavity 23 at the rear of the mixing body 20.

Since the injector 29 is made of resilient material, as soft rubber, it is inexpensive to manufacture. The orifice therein may be pierced by a needle after the injector nozzle blank is in place in the mixing assembly. The metering orifice in the screw plug 31 serves conveniently as a guide for the piercing needle. After piercing, the resiliency of the material of which the injector is formed closes the orifice therein. Gas under pressure coming to the injector, however, expands the latter and opens the orifice at a predetermined pressure (see dotted lines, Fig. 4). Accordingly, the greater the pressure of the gas coming to the injector the larger will be the cross-sectional area of the orifice. Conversely, the lower the pressure of the gas coming to the injector the smaller will be the cross-sectional area of the orifice. Thus, the volume of

gas passing through the injector varies with the pressure of the gas coming to the torch, but the velocity of the gas passing through the mixer tends to remain constant so that air will be aspirated in an amount directly proportional to the volume of gas passing therethrough. As the pressure of the gas is reduced, the orifice diameter will likewise be reduced, which will cause the flame to remain in a neutral condition until the self-closing orifice returns to normally-closed position and the flame is extinguished. Obviously, the sizes of the openings of the radial passages 28 into the chamber 25 are substantially independent of the deformation of the aspirator injector nozzle 29 so that an adequate supply of gas through the passages 28 may be maintained at all pressures of the gas discharge from the nozzle 29. It will also be apparent that if impurities clog the orifice, the pressure behind the impurities will build up and the orifice will expand until the impurities pass therethrough.

The stem or tip T which is illustrated in Fig. 1 is a gooseneck stem and tip combined, being externally threaded at its rear end for attachment to the threads 22 at the forward end of the mixing assembly M. Obviously, other types of stems or tips might be substituted for the one which is illustrated.

In the embodiment which is illustrated in Figs. 5 and 6, the injector 29' employed is not conical but is a disc of deformable resilient material which is supported adjacent to its edges, the major portion of the front face of the injector being otherwise free of support. Otherwise, the construction is precisely the same as that which has already been described. Clearly, an orifice may be pierced in the disc injector 29' exactly as in the conical injector 29. Furthermore, the resiliency of the material will tend to close the orifice in the disc injector exactly as is the case with the conical injector; and pressure behind the disc will tend to bow it forwardly and to open the orifice. The dotted line in Fig. 5 illustrates the action of pressure upon the disc form of injector.

From the foregoing, it will be apparent that the present invention provides a mixing injector which can be used with different gas pressures and with tips of different capacities. Furthermore, the material of which the injectors are made is inexpensive and the method of forming the orifices in them is easy and cheap. In addition, expansion and contraction of the orifice tends to produce a neutral flame regardless of the gas pressure, and also makes unnecessary screening of the gas, since impurities are easily forced through the expansible orifice.

The embodiments of the invention herein described and shown in the accompanying drawing are presented merely as examples of how the invention may be applied. Other forms, differing in detail but not in principle from those here disclosed, will, of course, suggest themselves to those skilled in the art.

I claim:

1. In a gas mixer including a chamber, a first gas passage, and a second gas passage opening into said chamber: an injector communicating with said first gas passage and arranged to discharge gas into said chamber, said injector comprising a nozzle having an orifice and being formed of an elastic material deformable in response to pressure exerted thereon to vary the cross-sectional area of said orifice directly in accordance with the pressure.

2. A gas mixer comprising a body having a

passage therethrough and a second passage therein joining the first passage, and an injector formed of gas-pressure responsive resilient material fixed in the first-mentioned passage and provided with a self-closing orifice disposed in a position to discharge across the junction of the first-mentioned passage with the second.

3. In a gas mixer including a chamber, a first gas passage, and a second gas passage opening into said chamber: an injector nozzle of elastic material, said nozzle having a self-closing orifice communicating with said first passage and arranged to discharge gas into said chamber, said nozzle being deformable in response to pressure exerted thereon to open said orifice in response to a predetermined pressure and thereafter to render the cross-sectional area of said orifice substantially directly proportional to the operating pressure.

4. In a gas mixer including a chamber, a first gas passage, and a second gas passage opening into said chamber: an injector communicating with said first gas passage and arranged to discharge gas into said chamber, said injector comprising a nozzle of soft rubber deformable in response to pressure exerted thereon, said nozzle being provided with an orifice adapted to open in accordance with increase of the pressure on said nozzle.

5. In a gas mixer including a chamber, a first gas passage, and a second gas passage opening into said chamber: an injector nozzle communicating with said first passage and arranged to discharge gas into said chamber, said nozzle having a normally-closed orifice and being formed of a material resiliently deformable in response to gas pressure exerted thereon to open said orifice an amount in accordance with the pressure.

6. In a gas mixer including a chamber, a first gas passage, and a second gas passage opening into said chamber: an injector communicating with said first passage and arranged to discharge gas into said chamber, said injector comprising a rubber member having a normally-closed orifice, said member being deformable in response to pressure exerted thereon to open and close said orifice in accordance with the pressure of the gas passing therethrough.

7. In a gas mixer including a chamber, a first gas passage, and a second gas passage opening into said chamber: a hollow conical aspirator injector nozzle communicating with said first passage and arranged to discharge gas into said chamber, said nozzle being perforated at its apex to provide an orifice, said nozzle being formed of resilient material deformable in response to pressure exerted thereon to render the cross-sectional area of said orifice substantially proportional to the pressure, said orifice being normally closed by the natural resiliency of said material.

8. In a gas mixer including a chamber, a first gas passage, and a second gas passage opening into said chamber: a substantially disc-shaped injector communicating with said first passage and arranged to discharge gas into said chamber, said injector being formed of resilient deformable material and having an orifice therein, said injector being deformable in response to gas pressure exerted thereon to open said orifice an amount directly in accordance with the pressure.

9. In a gas mixer including a chamber, a first gas passage, and a second gas passage opening into said chamber: a substantially disc-shaped injector communicating with said first passage and having an orifice arranged to discharge gas

into said chamber, said injector being supported adjacent to its edges, the major portion of the front face of said injector being free of support, and said injector being formed of resilient deformable material whereby pressure applied behind said injector will bow said injector forwardly, thereby opening said orifice an amount directly in accordance with the pressure.

10. In a heating instrumentality, a gas mixer comprising a body having a first passage therethrough including a chamber, and a second passage opening into the chamber and adapted to communicate with a supply of gas to be aspirated; and an injector nozzle secured in said first passage, said nozzle having an orifice for discharging aspirating gas into said chamber, said nozzle being formed of a material resiliently deformable in response to pressure changes to vary the cross-sectional area of said orifice directly in accordance with such pressure changes.

11. In a heating instrumentality, a gas mixer comprising a body having a first passage therethrough including a chamber, and a second passage opening into the chamber and adapted to communicate with a supply of gas to be aspirated; and an injector nozzle secured in said first passage, said nozzle having an orifice for discharging aspirating gas into said chamber, said nozzle being formed of a material resiliently deformable in response to pressure changes to vary the cross-sectional area of said orifice directly in accordance with such pressure changes; the size of the opening of said second passage into said chamber being substantially independent of the deformation of said nozzle.

12. In a heating instrumentality, a gas mixer comprising a body having therein a chamber, a first gas supply passage and a second gas supply passage terminating in the chamber, and a gas discharge passage leading from the chamber; and an injector nozzle secured in said first passage for discharge into the chamber toward the discharge passage, said nozzle having an orifice for discharging aspirating gas into said chamber, and said nozzle being formed of a material resiliently deformable in response to pressure changes to vary the cross-sectional area of said orifice directly in accordance with such pressure changes; the size of the opening of said second passage into said chamber being substantially independent of the deformation of said nozzle.

13. In a heating instrumentality, a gas mixer comprising a body having a first passage therethrough including a chamber, and a second passage therein joining the first passage in the chamber and adapted to communicate with a supply of gas to be aspirated; and an injector nozzle secured in said first passage for discharge

into said chamber, said nozzle being formed of a resiliently deformable material and having an orifice normally closed by the natural resiliency of said material, said nozzle being deformable to open said orifice in response to a predetermined gas pressure exerted therein and to vary the cross-sectional area of said orifice in accordance with variations of the pressure exerted therein; the size of the opening of said second passage into said chamber being substantially independent of the deformation of said nozzle.

14. In a gas-air torch, a mixer body having a longitudinal passage therethrough and substantially radial air ports communicating with the longitudinal passage, and an injector formed of resilient material having a self-acting gas-pressure responsive orifice fixed in the longitudinal passage through said mixer body in a position to discharge across the openings of the air ports, said injector being deformable in response to pressure variations in said orifice to vary the cross-sectional area thereof in accordance with the pressure to maintain a substantially constant velocity of gas discharge therefrom.

15. In a gas-air torch, a mixer body having an internally threaded longitudinal cavity formed in its rear end extending forwardly to an inwardly projecting shoulder at the rear end of a chamber formed in the mixer body coaxially with the cavity, an injector formed of resilient material having a gas discharge orifice the effective opening of which is responsive to the gas pressure acting thereon, and a plug having a longitudinal passage therethrough threaded in the cavity in said mixer body and holding said injector between its forward end and the inwardly projecting shoulder in said body, said mixer body having a longitudinal passage extending forwardly from the chamber therein and a passage extending therethrough from atmosphere to the chamber.

16. In a gas-air torch, a mixer body having an internally threaded axial cavity formed in its rear end extending forwardly to an inwardly projecting shoulder at the rear end of a chamber formed in the mixer body coaxially with the cavity, an injector formed of resilient material having a gas-pressure responsive gas orifice, and a screw plug having an axial passage therethrough threaded in the cavity in said mixer body and holding said injector between its forward end and the inwardly projecting shoulder in said body, said mixer body having an axial passage extending forwardly from the chamber therein coaxially with the axial passage through said screw plug and a plurality of radial passages extending therethrough from atmosphere to the chamber.

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