

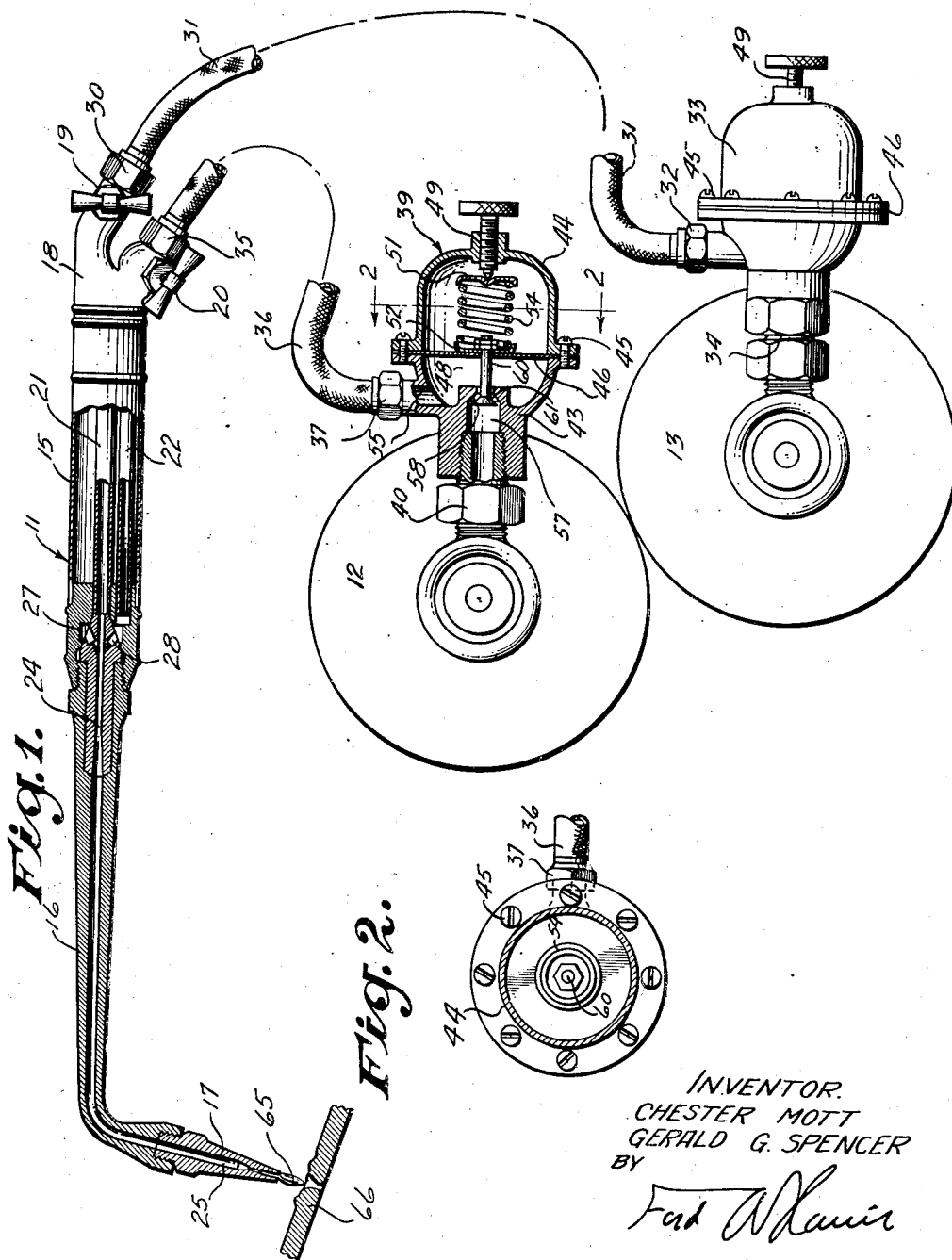
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METHOD OF PREVENTING POPPING OF TORCHES

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METHOD OF PREVENTING POPPING OF TORCHES

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Our invention is applicable to torches which use a fuel gas and combustion-supporting gas. One important use of our invention is in connection with oxyacetylene apparatus.

Various types of torches burning a gas mixture are subject to popping, and the injector type of torch is quite susceptible to popping. Popping is caused by decreasing the velocity of the mixed gas stream below the rate of flame propagation in the mixed gas. Such a condition can be obtained by bringing the torch tip too close to the molten metal or by the throwing off of an incandescent particle from the molten metal into the orifice of the tip. What occurs then is that the mixed gases burn back in the torch as their velocity is less than that of flame propagation, causing a small explosion. The explosion is usually sufficient to blow the molten metal around and to impair the welding operation. After popping, the burned gas is expelled and a fresh supply issues from the torch tip and relights from the molten metal.

Popping usually occurs when through negligence the welder allows the tip to come too close to the molten metal. In doing so two things result: first, the possibility of incandescent particles being thrown into the orifice is increased, and second: by holding the tip close to the metal, a greater resistance is offered to the gas mixture, and this resistance causes a decrease in the speed with which the mixture issues from the tip. A popping which is in reality an explosion usually results, first: because there is a condition to initiate an explosion in the tip and in the torch itself by incandescent particles, and second: because the velocity of normal flow of the gas mixture is reduced so that the gas mixture is slowed down to the extent that it is moving at a rate of speed slower than the rate of flame propagation. It will be plainly seen, therefore, that in a conventional torch it is possible to reduce, or almost entirely

prevent the torch from popping if it is held at such a distance that incandescent particles will not enter the tip, and the gas pressure at the tip will not be reduced so that the flow of gas would be slower than the rate of flame propagation. It is impossible for the ordinary welder to hold the torch at a proper distance because he becomes tired, his attention is distracted, or his hose may be jerked by an outside force, with the result that the tip of the torch is moved closer to the metal than it should be, and with the result that popping of the torch occurs.

It is one of the objects of our invention to provide a method whereby the popping of the torch is eliminated, even though the welder does not maintain the tip of the torch at the desired distance from the work.

It is a fact that the rate of flame propagation may be varied by changing the richness of the gas mixture. The richer the mixture in fuel gas (acetylene) the slower the speed of flame propagation.

It is an object of our invention to provide a method of preventing popping of torches by decreasing the rate of flame propagation by enriching the mixture when the tendency to pop occurs.

A further object of our invention is to provide a method of preventing popping by increasing the pressure of fuel gas in a manner to enrich the combustible mixture.

A still further object of our invention is to provide a method in which the combustible mixture is enriched when the normal flow thereof is decreased.

Another object of our invention is to provide a method of automatically delivering extra fuel gas to the torch whenever there is a tendency to pop.

It is another object of the invention to provide a method in which the fuel gas pressure at the torch builds up faster than the combustion-supporting gas pressure, when the normal flow of the mixture is decreased.

Other objects of our invention will be emphasized in the following description.

Referring to the drawing in which an apparatus is illustrated, this apparatus being of a preferred form to carry out the method of our invention,

Fig. 1 is a diagrammatic view illustrating the apparatus partly in section.

Fig. 2 is a section taken on the line 2—2 of Fig. 1.

In the drawing, 11 is a torch, 12 is a fuel-gas supply tank, and 13 is a combustion-supporting gas supply tank.

The torch 11 has a handle 15 from which a tube 16 is extended. Secured to the outer end of the tube 16 is a tip 17. The handle 15 includes a fixture 18 including a valve 19 and a valve 20 which are adapted to close passages connecting separately to a tube 21 and to a tube 22. The tube 21 is connected to a passage 24 which extends through the tube 16, the passage 24 being connected to a passage 25 of the tip 17. The tube 22 connects to an annular chamber 27, the annular chamber 27 being connected by ducts 28 to the passage 24. The torch 11 which we have just described may be of any conventional type of torch, and the details of construction thereof do not constitute a part of this invention. This torch is only one of many types of torches which may be used in the combination.

Connected to the valve 19 by a coupling 30 is a flexible hose 31 which is joined by a coupling 32 to a regulating valve 33, this regulating valve 33 being attached by a fixture 34 to the tank 13. Connected to the valve 20 by a coupling 35 is a flexible hose 36 which is also connected by a coupling 37 to a regulating valve 39, the regulating valve 39 being attached by a fixture 40 to the tank 12.

In the form of the apparatus illustrated, the regulating valves 33 and 39 are of substantially the same construction and are constructed as follows: Each valve has a body 43 to which a bonnet 44 is secured by screws 45. The screws 45 also serve to clamp the diaphragm 46 to the body 43 in order to provide a pressure chamber 48. Carried by the bonnet 44 is an adjustment screw 49 which retains a cup 51. Secured to the diaphragm 46 is a cup 52, and compressed between the cups 51 and 52 is a coil spring 54.

The body 43 has a gas outlet 55. In the regulator valve 39 the gas outlet communicates with the flexible hose 36, and in the valve 33 a similar outlet communicates with the flexible hose 31. The body also provides a passage 57 which connects with passages formed in either the fixture 40 or the fixture 34. Formed in the passage 57 is a seat 58. Extending from the diaphragm 46 into the passage 57 is a valve stem 60 carrying a head 61 adapted for engagement with the seat 58. It will be noted that the valve

which consists of the stem 60 and the head 61, closes with the direction of the flow of gas into the chamber 48.

The function of the regulating valves 33 and 39 is to reduce the gas pressures so that the gases will be under suitable pressure to be handled by the torch 11. In other words, the function of these regulating valves is to change the pressure of the gas from tank pressure to torch pressure. The tank pressure of the fuel gas, which is ordinarily acetylene, has a maximum of about 300 pounds per square inch, and a combustion supporting gas which is usually oxygen has a maximum of about 2000 pounds per square inch. The pressure of the gas in the chamber 48 forces the diaphragm 46 in a direction which tends to seat the head 61 against the seat 58.

By operating the adjustment screw 49, the pressure in the chamber 48 is opposed to an extent to hold the valve in such a position that this pressure in the pressure chamber 48 is maintained at a torch pressure.

In operating the torch, the valves 19 and 20 are opened to an amount at which the gases are proportioned so that a proper combustible mixture will pass through the passages 24 and 25 and issue from the tip 17. The combustible mixture is then ignited to form a flame 65 which is used for welding two pieces of metal 66 together.

Before explaining the process of the invention we will point out certain inherent characteristics of the regulating valves 33 and 39. When the valves 19 and 20 are opened and gas is flowing through them, the gas pressure at the torch is a certain amount. For example we may assume that the gas pressure of the acetylene at the torch is ten pounds. Now if the valve 20 is closed so that no flow can occur through the regulator 39, the pressure on the torch side of the regulator 39 will rise to a point where pressure in the chamber 48 is sufficient to close the valve of the regulator 39. This rise in pressure on the torch side of the regulator valve 39 is commonly termed "climbing." In other words climbing is an increase in pressure which takes place when the flow of gas through the torch 11 is decreased. When the valve 20 is closed, the pressure on the torch side of the regulator valve 39 may climb five pounds so that instead of the pressure being ten pounds, it will be fifteen pounds. Although we have explained the climb in pressure with respect to the acetylene side of the apparatus, a climb in pressure also occurs when the valve 19 is closed, or when the flow of oxygen through the torch is decreased.

The regulating valves 33 and 39 are made so that the regulator 39 for the acetylene will climb more rapidly than the regulator 33 for the oxygen. The result is that the torch pressure for the acetylene will build up faster than will the oxygen pressure on the torch

side. Since the acetylene pressure builds up faster than the oxygen pressure, a greater proportion of acetylene will pass through the torch and the result will be that the combustible mixture is enriched in acetylene.

Designing the regulators 33 and 39 so that the acetylene regulator will climb faster than the oxygen regulator may be accomplished in various ways. For example, if the same weight of bonnet spring were used in both oxygen and acetylene regulators, there would be a difference in the climb due to the difference in cylinder pressure. Acetylene is compressed to a maximum pressure of 300 pounds while oxygen is compressed to a maximum pressure of 2000 pounds. Now it is clear that the coil spring pressure must balance the tank pressure. If the coil springs 54 in both oxygen and acetylene regulators are equal, then it is clear that it will take a further compression on the acetylene bonnet spring to provide a certain valve opening. This being the case, the climb in pressure to effect shutting off the valve will be greater in the case of the acetylene than the oxygen, for the bonnet spring can be considered in greater initial tension and therefore any movement tending further to compress it will represent a greater increment in the acetylene regulator.

Let us consider two bonnet springs, each two inches long when not compressed. Now compress one one-half inch. Let this represent the oxygen, but compress the other one inch. Let it represent the acetylene. This is illustrative of the condition then prevailing in the two regulators. Now let it be assumed that each spring must be still further compressed one-eighth of an inch to effect a closure. It is evident that the force required to move the acetylene spring that one-eighth inch is greater than the force required to move the oxygen spring that same one-eighth inch.

We will now explain the operation of the apparatus for accomplishing the results of the invention.

During the operation of the apparatus it is possible for the operator to move the tip 17 too close to the work 66 with the result that the flow of mixture through the passage 25 is resisted. This has the same effect as restricting the valves 19 and 20. When the flow of gas through the passage 25 is restricted there is immediately a climbing of the regulators 33 and 39. As previously pointed out, the acetylene regulator 39 will climb faster than the oxygen regulator 33, and the result is that the combustible mixture will be enriched in fuel. When the flow of gas through the passage 25 is restricted, there is a strong possibility that the gas issuing from the passage 25 will be flowing at a rate of speed slower than the rate of flame propagation of the combustible mixture. This would create a possibility of

popping and of the combustible mixture burning back into the torch 11.

In the method of this invention we prevent such a possibility by immediately and automatically enriching the combustible mixture so that the rate of flame propagation is decreased. In other words, when the flow of a combustible mixture is decreased, the rate of flame propagation is also decreased sufficiently so that the flame will not burn back into the torch, and will not pop.

In using the torch there is a possibility of the torch tip being brought too close to the metal or incandescent particles of metal being thrown upward into the lower end of the passage 25 of the tip 17. Either would cause a reduction in the rate of flow of the combustible mixture through the passage 25, and a tendency for ignition to follow backward in the passage 25. However, at this time the regulators 33 and 39 will climb, the valve 39 climbing faster, with the result that the mixture is enriched. This will decrease the rate of flame propagation sufficiently to prevent the combustible mixture from burning back into the torch 11. The flame will immediately cease to burn in the end of the passage 25 in view of the fact that the rate of flow of flame propagation is decreased below the rate of flow of the gas so that the flame is immediately forced from the passage 25 and caused to burn at the outside of the tip 17.

From the foregoing description it will be seen that in our invention the torch is prevented from popping by reducing the rate of flame propagation. This reduction in rate of flame propagation is accomplished by enriching the combustible mixture in fuel. Various means may be employed for enriching the mixture. In the present form of the invention the mixture is enriched by increasing the amount of fuel-gas supplied to the torch. We do not wish to be limited to this particular embodiment of the invention in view of the fact that substantially the same results might be accomplished by decreasing the amount of oxygen or combustion-supporting gas, rather than by increasing the amount of fuel-gas or acetylene.

The process of our invention, as will be obvious from the fact that the results of the invention might be accomplished by slightly different steps, is not limited to the particular apparatus shown in the invention. In this application we disclose the process and one form of apparatus by which the process may be carried out. We desire to have protection on the process, regardless of the apparatus used for carrying it out, and in addition to this we desire protection on the form of apparatus which we illustrate in this application for accomplishing the process.

We claim as our invention:

1. A method of preventing popping in a torch which burns a combustible mixture sup-

- plied thereto from separate fuel gas and combustion-supporting gas sources, said method comprising: delivering fuel gas and combustion-supporting gas at substantially equal pressures to said torch, and enriching said combustible mixture when a tendency occurs for said torch to pop.
2. A method of preventing popping in a torch which burns a combustible mixture supplied thereto from separate fuel gas and combustion-supporting gas sources, said method comprising: delivering fuel gas and combustion-supporting gas at substantially equal pressures to said torch, and enriching said combustible mixture when the normal flow of said combustible mixture is decreased.
3. A method of preventing popping in a torch which burns a combustible mixture supplied thereto from separate fuel gas and combustion-supporting gas sources, said method comprising: increasing the torch pressure of said fuel gas faster than the torch pressure of the combustion-supporting gas is increased when a tendency occurs for said torch to pop.
4. A method of preventing popping in a torch which burns a combustible mixture supplied thereto from separate fuel gas and combustion-supporting gas sources, said method comprising: increasing the torch pressure of said fuel gas faster than the torch pressure of the combustion-supporting gas is increased when the normal flow of said combustible mixture is decreased.
5. A method of preventing popping in a torch which burns a combustible mixture supplied thereto from separate fuel gas and combustion-supporting gas sources, said method comprising: delivering fuel gas and combustion-supporting gas at substantially equal pressures to said torch, and decreasing the rate of flame propagation of said combustible mixture when a tendency occurs for said torch to pop.
6. A method of preventing popping in a torch which burns a combustible mixture supplied thereto from separate fuel gas and combustion-supporting gas sources, said method comprising: delivering fuel gas and combustion-supporting gas at substantially equal pressures to said torch, and decreasing the rate of flame propagation of said combustible mixture when the normal flow of said combustion mixture is decreased.
7. A method of preventing popping in a torch which burns a combustible mixture supplied thereto from separate fuel gas and combustion-supporting gas sources, said method comprising: delivering extra fuel gas to the torch whenever there is a tendency to pop.
8. A method of preventing popping in a torch which burns a combustible mixture supplied thereto from separate fuel gas and combustion-supporting gas sources, said method comprising: automatically delivering extra fuel gas to the torch whenever there is a tendency to pop.
9. A method of preventing popping in a torch which burns a combustible mixture supplied thereto from separate fuel gas and combustion-supporting gas sources, said method comprising: building up the fuel gas pressure at the torch faster than the combustion-supporting gas pressure when the normal flow of the mixture is decreased.
- In testimony whereof, we have hereunto set our hands at Denver, Colorado, this 14th day of December, 1928.
- CHESTER MOTT.
GERALD G. SPENCER.

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