

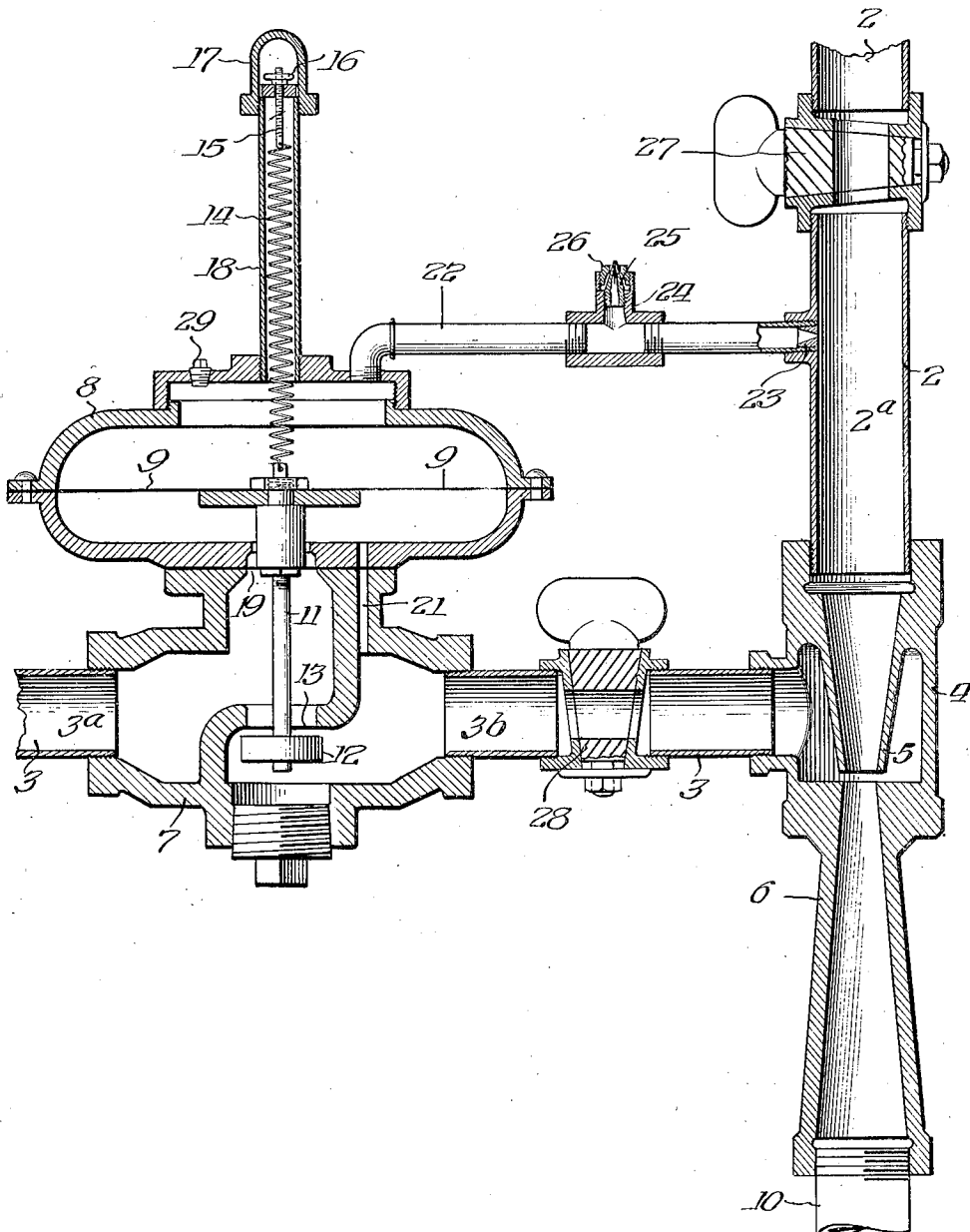
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APPARATUS FOR PROPORTIONATELY MIXING FLUIDS

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APPARATUS FOR PROPORTIONATELY MIXING FLUIDS.

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This invention pertains generally to the mixing of two fluids in predetermined proportions, and while it may be used for various purposes, the specific embodiment of the invention shown herein for illustrative purposes is designed for the mixing of air and fuel such as gas, to provide a combustible mixture of the requisite proportions adapted to be supplied to various gas burning industrial appliances.

While I am aware that apparatus have heretofore been designed with the view of furnishing a mixture of air and gas in predetermined proportions such apparatus have failed to accomplish the desired result under practical conditions because they were designed to vary the flow of gas in direct proportion to the pressure of the air delivered.

It is a well known fact that in most two pipe system gas installations in this country, where gas is used for industrial purposes, the air is supplied at from $\frac{1}{2}$ pound to 2 pounds pressure, this being a pressure that can be reached economically by the use of rotary machines of either the displacement or centrifugal type, and the gas is supplied at a pressure of a few inches of water column, usually two to five, this low pressure being deemed necessary to keep leakage on the mains and service systems at a minimum. While there has been a growing tendency to lessen the air pressure to effect a power saving, the common practice is to have the air pressure in such systems greater than the gas pressure.

Simply cross connecting with a pressure line from the air at the inlet of the injector to the top of a zero regulator on the gas, as shown in Patent No. 1,092,204, and as subsequently carried out in marketing this device, causes a proportioning effect which ceases as soon as the air pressure used equals the gas pressure at the inlet of the zero governor. Consequently, if air pressure is available in excess of the gas pressure carried in the city mains, this additional air pressure is of no use in a proportioning device of the above mentioned type.

The purpose of this invention is to make the energy in this additional air pressure in excess of the gas pressure, available to increase the pressure of the mixture of air and gas.

A further purpose of this invention is to provide a method and apparatus for producing a mixture which will be of uniform pre-

determined proportions irrespective of the fluctuations in the pressure of the constituents of which the mixture is composed and to control the volume of the mixture by the manipulation of a single valve on the line carrying one constituent.

For the purpose of facilitating an understanding of my invention I have illustrated on the accompanying drawing a preferred apparatus by which my method may be carried out, from an inspection of which when considered in connection with the following description my invention and many of its inherent advantages should be readily understood and appreciated.

The single figure of the drawing is a sectional view illustrating a preferred form of apparatus.

Referring to the drawing more in detail, reference character 2 indicates a fluid supply pipe through which the primary fluid of the resultant mixture is delivered from any suitable source under pressure and reference character 3 indicates a supply pipe for the other constituent of the mixture and which for convenience will be referred to as the secondary fluid. In the specific form of the invention illustrated the pipe 2 is an air supply pipe and pipe 3 a gas supply pipe and while they will hereafter be thus referred to, it should be understood that the invention is not restricted to the production of a mixture consisting of air and gas but that the principles thereof may be utilized in producing a mixture of any desired constituents.

The pipe 2 is connected to one end of a mixer 4 which may be of any preferred construction but is illustrated as comprising a nozzle 5 adapted to deliver into an expansion tube 6 to the other end of which a mixture delivery pipe 10 leading to a point of use is connected. The fuel supply pipe 3 is connected to the side of the mixer 4 as shown and upon delivery of air under pressure from the nozzle 5 a flow of fuel from the pipe 3 is induced which is drawn into the expansion tube 6 and thoroughly mixed with the air.

In the fuel supply pipe 3 is interposed a flow regulating device in the form of a zero governor which consists of a valve casing 7 surmounted by a diaphragm casing 8 in which is disposed a flexible diaphragm 9 connected to a valve stem 11 carrying at its lower end a valve 12 adapted to close against a seat 13 formed in the valve casing. The

weight of the valve and stem is carried by a coiled tension spring 14 suspended at its upper end from a threaded rod 15 which may be vertically adjusted by the turning of a nut 16 upon the upper end of the rod, the nut being normally covered by a removable cap 17 threaded upon the upper end of a tube 18 projecting from the top of the diaphragm casing. A sealing diaphragm 19 precludes gas pressure delivered by the pipe 3 from entering the diaphragm casing and also serves to balance the valve since the areas of the diaphragm and the valve exposed to the gas pressure are substantially equal. At the delivery side of the valve casing a duct 21 establishes communication with the diaphragm casing beneath the diaphragm.

The casing above the diaphragm communicates through a pressure conducting connection 22 with the air supply pipe 2, so that air under pressure may act upon the upper face of the diaphragm 9 to open the valve 12. If, however, this connection were a direct and unrestricted connection the pressure upon the diaphragm would be the same as the pressure in the pipe 2 at point C, and if sufficient gas pressure were available in the pipe 3 at the point 3^a the pressure in the pipe 3 at the point 3^b would also become the same as the pressure in the pipe 2 at the point 2^a. Inasmuch as the gas pressure in the pipe 3 at the point 3^a is, as previously explained, usually much less than the air pressure in the pipe 2 at the point 2^a, it will be obvious that any pressure at point 2^a caused by opening of the cock 27, in excess of the pressure in pipe 3 at point 3^a, could not cause any further increase in gas pressure at point 3^b. The proper proportions of air and gas in the resultant mixture could not therefore be maintained whenever the pressure of the air delivered to the mixer exceeded the pressure of the gas at the inlet side of the zero governor.

For the purpose therefore of producing a uniform mixture and at the same time permitting the use of air pressure in excess of the gas pressure, the connection between the pipe 2 and the diaphragm chamber is in my invention both restricted and open to the atmosphere so as to reduce the pressure conducted to the chamber above the diaphragm 9 and make the variations of pressure in the diaphragm chamber above 9 less than but proportional to the variations in the pressure in the pipe 2 at the point 2^a.

The restriction between the connection 22 and the pipe 2 may be of any preferred form but is illustrated as consisting of a plug 23 disposed in the connection and provided with a restricted orifice. A T 24 is interposed in the connection 22 and communicates with the atmosphere through a split jet or nipple 25, the orifice of which may be regulated in size by adjusting the threaded nut 26

which embraces the split portion of the jet and is threaded into the stem of the T. By adjusting this nut the escape of pressure from the connection 22 to atmosphere may be regulated to give the desired result. A regulating cock 27 is interposed in the pipe 2 and a similar regulating cock 28 is interposed in the pipe 3.

The spring 14 is made sufficiently long so that a small increase in length produces only a slight increase in tension and on assembling the apparatus the spring 14 is adjusted so that it just counterbalances the weight of the parts it supports and holds the valve 12 very lightly against the seat against the inlet pressure of the gas. A regulating device of this kind, when the chamber above the diaphragm 9 is freely open to the atmosphere, is what is commonly known as a zero governor.

In further adjusting the above device, the minimum gas pressure over a suitable period of time is determined by attaching a recording pressure gauge to the pipe 3 in front of the governor. When this minimum available gas pressure is determined, a water gauge is attached to the diaphragm casing in the opening normally closed by plug 29, the adjusting screw 26 is then so adjusted that when cock 27 is full open (with the mixer and cock 28 adjusted to give perfect combustion) the pressure shown above the diaphragm 9 is equal to the minimum gas pressure as shown by the recording gauge mentioned above. The device is then ready for service.

It will be apparent therefore that because of the reduction of the pressure transmitted from the pipe 2 to the upper face of the diaphragm 9, the gas permitted to flow past valve 12 will range between zero and maximum as the air pressure at point 2^a ranges from approximately zero to maximum. Since with my invention the maximum pressure at point 2^a may be far above the gas pressure at point 3^a, a high mixture pressure can be secured while at the same time the desired proportion of air and gas in the mixture is maintained.

The details of construction illustrated and described may obviously be varied within considerable limits without departing from the essence of the invention as defined in the following claims.

I claim:

1. In an apparatus of the character described, the combination of an air supply pipe, a fuel supply pipe, a diaphragm governor interposed in said fuel supply pipe, a connection between said governor and said air supply pipe, and means comprising the combination of a restriction and an air vent open to the atmosphere for regulating the delivery of pressure from said air supply pipe to the governor.

2. In an apparatus of the character described, the combination of a primary fluid supply pipe, a secondary fluid supply pipe, a pressure controlled flow regulating device interposed in said secondary supply pipe, and means comprising the combination of a restriction and an air vent open to the atmosphere for controlling said pressure controlled means from the pressure in the primary fluid supply pipe so that the flow of said secondary fluid varies in proportion to the variations in pressure of said primary fluid from zero to a maximum pressure in excess of the secondary fluid pressure.

3. In an apparatus of the character described, the combination of an air supply pipe, a fuel supply pipe connected therewith, a pressure controlled flow regulating valve interposed in said fuel supply pipe, a pressure conducting connection between said regulating valve and said air supply pipe, and means comprising the combination of a restriction and an air vent open to the atmosphere for reducing the pressure conducted to said regulating valve to a predetermined ratio of the pressure in said air supply pipe.

4. In an apparatus of the character described, the combination of a mixer, an air supply pipe and a fuel supply pipe connected thereto, a flow regulating valve interposed in said fuel supply pipe, pressure controlled means for actuating said valve, a pressure conducting connection between said

pressure controlled means and said air pipe, a restricted orifice through said pipe, and a restricted orifice establishing communication between the interior of said pipe and atmosphere, one of said orifices being regulatable to control the pressure in said connection.

5. In an apparatus of the character described, the combination of a mixer, an air supply pipe and a fuel supply pipe connected thereto, a flow regulating valve interposed in said fuel supply pipe, a pressure controlled means for actuating said valve, a pressure conducting connection between said pressure controlled means and said air supply pipe, and means comprising the combination of a restriction and an air vent open to the atmosphere for regulating the pressure conducted through said connection.

6. In an apparatus of the character described, the combination of a mixer, an air supply pipe and a fuel supply pipe connected thereto, a flow regulating valve interposed in said fuel supply pipe, a pressure controlled means for actuating said valve, a pressure conducting connection between said pressure controlled means and said air supply pipe, and means comprising the combination of a restriction and an air vent open to the atmosphere for causing a predetermined reduction in the pressure conducted through said connection relatively to the pressure in said air supply pipe.

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