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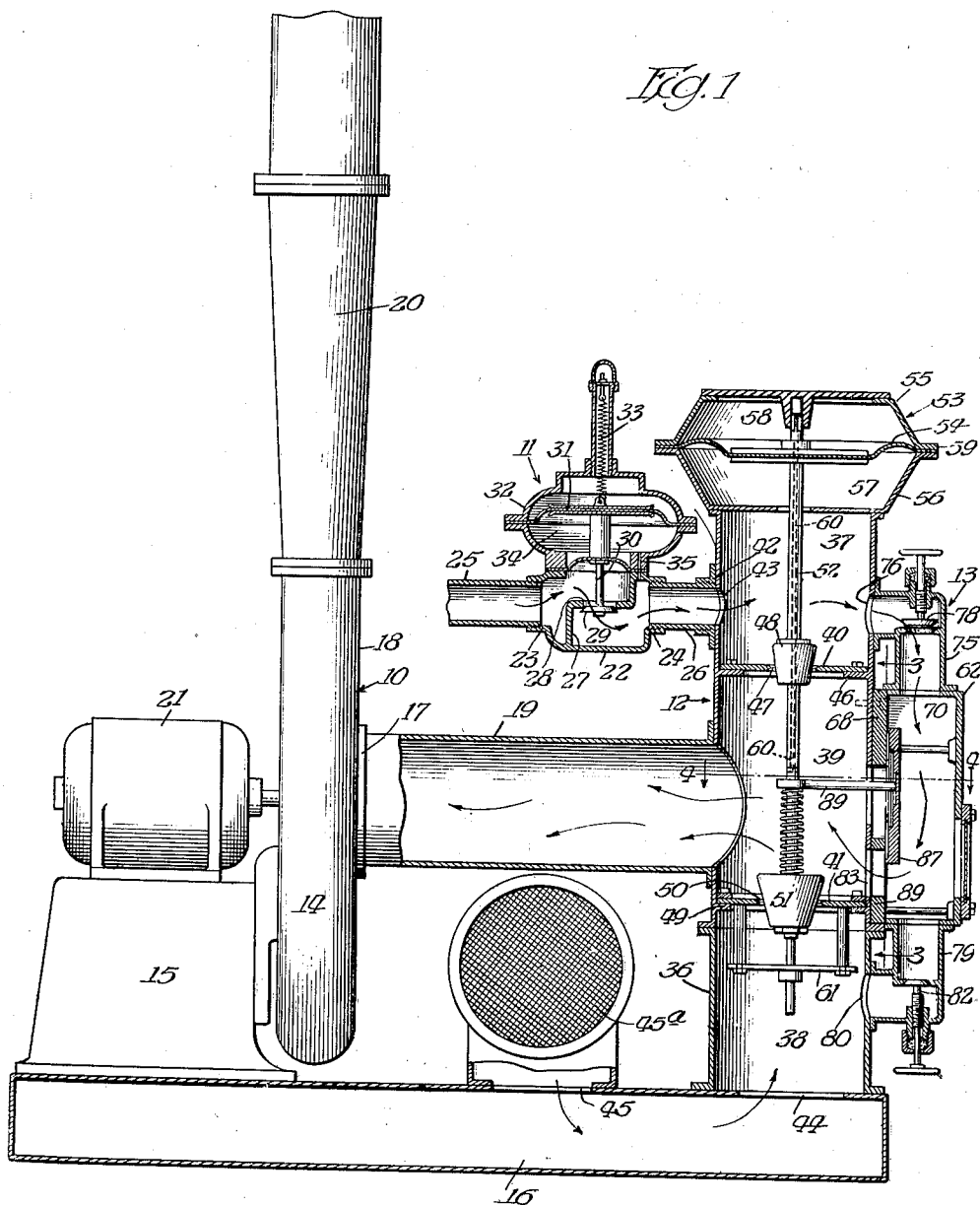
G. W. McKEE

2,244,111

GAS MIXING APPARATUS

Filed April 22, 1939

3 Sheets-Sheet 1



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June 3, 1941.

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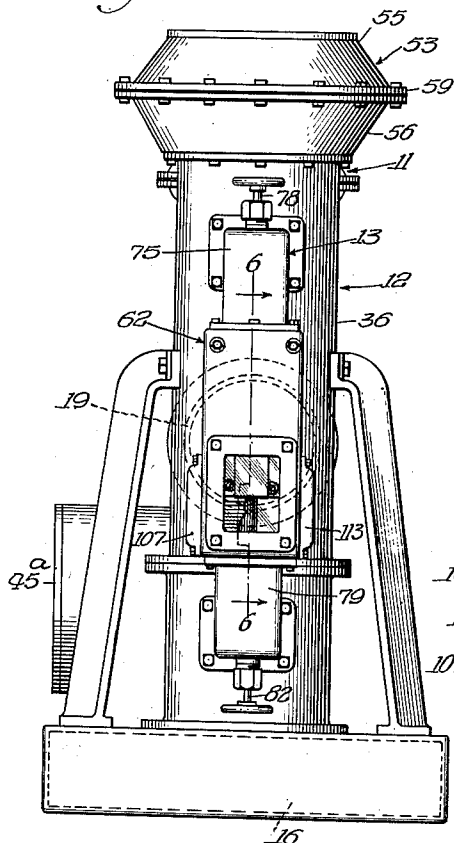
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Fig. 2



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Fig. 5

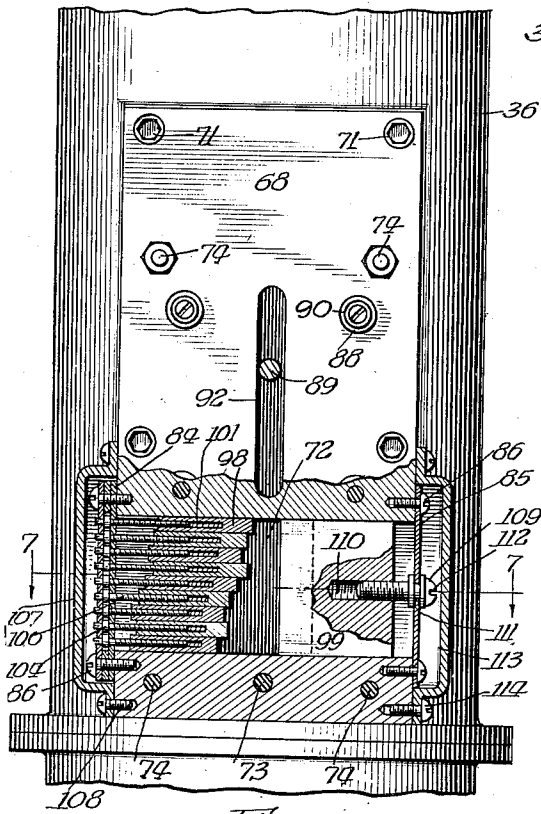


Fig. 6

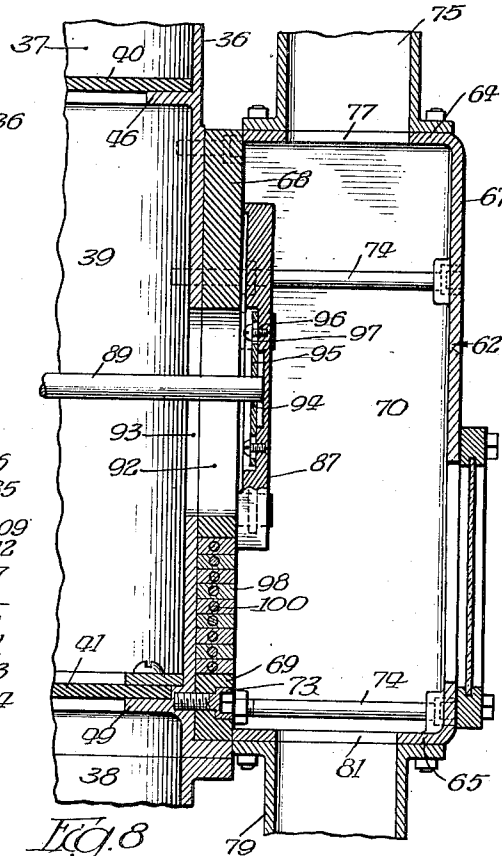


Fig. 7

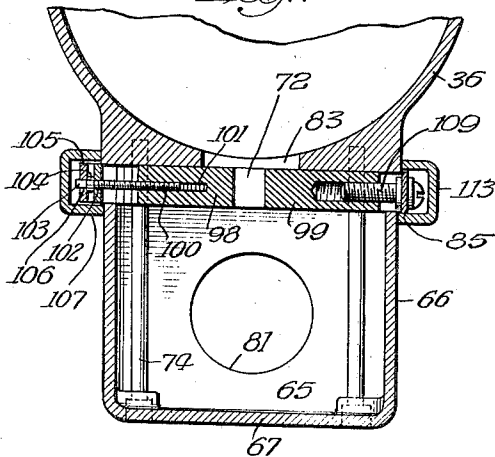


Fig. 8

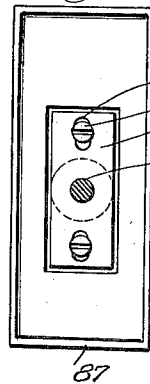
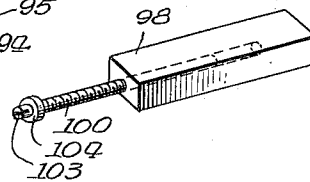


Fig. 9



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UNITED STATES PATENT OFFICE

2,244,111

GAS MIXING APPARATUS

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Application April 22, 1939, Serial No. 269,387

12 Claims. (Cl. 48-184)

In general the present invention relates to apparatus for mixing different kinds or species of gases and supplying the mixture under pressure to its point of use. More particularly the invention relates to that type of apparatus which is designed primarily to mix a gas of high calorific value such, for example, as butane or propane with air in order to dilute the same for combustion purposes, and as the main or essential parts thereof comprises (1) a motor driven compressor having the outlet or pressure side thereof connected to the point or device to be supplied with the mixture of gas and air; (2) a zero governor having the inlet side thereof connected to receive gas under a comparatively low pressure from a source of supply; and (3) a mixing device having an elongated mixing chamber therein with a circular, plate formed, air inlet orifice at one end thereof communicating with the atmosphere around the apparatus, a coaxial, circular, plate formed, gas inlet orifice at the other end of the chamber communicating with the outlet side of the zero governor and a side outlet leading to and in communication with the suction side of the compressor, and also having a pair of proportioning cone valves for controlling the inflow of gas and air into the mixing chamber, and means for conjointly opening and closing the valves in response to variations in the compressor produced suction in the mixing chamber.

An apparatus of this type because of the use of proportioning cone valves in the mixing device operates efficiently and effectively so to control the mixture that the ratio of gas and air is substantially constant or uniform throughout the range of capacity of the apparatus. It is, however, objectionable or defective from a practical standpoint for the reason that if there is a change in the calorific value of the gas and it is hence necessary or essential to change or vary the ratio of the gas and air an adjustment can be made or effected only by removing the orifice forming plates and the proportioning cone valves and substituting plates with different sized orifices and valves of different size or shape. Because such adjustment necessitates stopping the compressor and requires much time and the services of a skilled mechanic or workman an apparatus of the type under consideration has met with success only where there is no periodic variation or fluctuation in the calorific value of the gas.

One object of the invention is to provide a gas and air mixing apparatus of the type and character under consideration which has greater capabilities of use and is more practical than pre-

viously designed apparatus of the same general character by reason of the fact that it embodies as a part thereof simple means whereby additional gas or air to compensate for any change in the calorific value of the gas may be introduced into the mixing chamber while the compressor is in operation and without the necessity of dismantling the mixing device and changing or substituting the orifice plates and the proportioning cone valves.

Another object of the invention is to provide a gas and air mixing apparatus of the last mentioned character in which the compensating means comprises an elongated chamber with a valve controlled conduit at one end thereof for the introduction of air under atmospheric pressure, a valve controlled conduit at its other end for the introduction of gas under zero or atmospheric pressure from the outlet side of the zero governor, and an elongated longitudinally extending side opening leading to the gas and air mixing chamber of the mixing device, and in addition comprises a plate valve which is slidably mounted with respect to, and serves to control the flow of gas or air for compensating purposes through, the side opening and is connected to the actuating or control means for the proportioning cone valves of the mixing device in such manner that it opens and closes conjointly with the cone valves.

Another object of the invention is to provide a mixing apparatus of the last mentioned type and character in which the compensating means includes at one side of the plate valve controlled side opening leading to the mixing chamber of the mixing device, a series or stack of longitudinally and individually adjustable plates whereby the opening may be changed or adjusted as far as shape is concerned in order that during progressive opening of the plate valve its exposed portion is of the proper size to admit into the mixing chamber the right or proper amount of gas or air to maintain uniformity of the gas and air ratio of the mixture.

A further object of the invention is to provide a mixing apparatus of the type and character under consideration in which the compensating means includes at the other side of the plate valve controlled side opening a laterally adjustable plate whereby the effective area of the opening may be increased or decreased at will in order to increase or decrease the amount of air or gas introduced into the mixing chamber for compensating purposes.

A still further object of the invention is to pro-

vide a gas and air mixing apparatus which is generally of new and improved construction, efficiently and effectively fulfills its intended purpose, and is an improvement upon that which is shown in, and forms the subject matter of United States Letters Patent No. 2,063,453, granted to me December 8, 1936.

Other objects of the invention and the various advantages and characteristics of the present mixing apparatus will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawings which accompany and form a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Figure 1 is a vertical section of a gas and air mixing apparatus embodying the invention;

Figure 2 is a front view of the apparatus;

Figure 3 is an enlarged section taken on the line 3—3 of Figure 1 and illustrating in detail the design and arrangement of the series or stack of longitudinally and individually adjustable plates for changing the shape of the opening leading to the mixing chamber of the mixing device and also illustrating the design and construction of the laterally adjustable plate for increasing or decreasing the effective area of such opening;

Figure 4 is an enlarged transverse section taken on the line 4—4 of Figure 1 and disclosing the manner in which the plate valve of the compensating means is connected to the actuating means for the proportioning cone valves so that it opens and closes conjointly with such valves;

Figure 5 is a section illustrating the construction and design of the adjusting means for the plates at the sides of the side opening leading to the mixing chamber of the mixing device;

Figure 6 is an enlarged vertical section on the line 6—6 of Figure 2;

Figure 7 is a horizontal section on the line 7—7 of Figure 5;

Figure 8 is a view of the inner side face of the plate valve of the compensating means; and

Figure 9 is a perspective of one of the plates for changing or adjusting the shape of the side opening leading to the mixing chamber of the mixing device.

The apparatus which is shown in the drawings constitutes the preferred embodiment of the invention. It is adapted to mix a combustible gas of high calorific value such, for example, as butane or propane with air for diluting purposes and to supply the mixture under pressure to a furnace or other point of use or consumption and as its main parts comprises a compressor 10, a zero governor 11, a gas and air mixing device 12, and a compensating unit 13 for varying or adjusting the ratio of the gas and air of the mixture.

The compressor 10 is adapted, as hereinafter described, to draw gas and air under atmospheric pressure into the mixing device 12 and to discharge the mixture under pressure. It is positioned in close proximity to the mixing device and comprises a casing 14, and a rotor (not shown) in the casing. The casing is carried by a bracket 15 on a hollow base 16 and embodies a side inlet 17 and a peripheral outlet 18. The inlet 17 faces the mixing device 12 and is connected to the latter by a horizontally extending pipe 19. The outlet 18 of the compressor casing

is connected by a pipe 20 to the point of gas consumption. The compressor is driven by an electric motor 21 on the bracket 15. The armature shaft of the motor extends horizontally, as shown in Figure 1, and is connected to the rotor. During operation of the motor, the compressor is driven and operates to draw gas and air into the mixing device 12 for mixing purposes and to supply the mixture under pressure to the point of use or consumption via the pipe 20. The suction which is created in the pipe 19 during drive or operation of the compressor is proportional to the demand at the outlet 18 of the compressor. When the requirement for the mixture of gas and air increases the suction in the pipe 19 increases correspondingly, and when the demand or requirement for the mixture decreases the suction in the pipe 19 decreases.

The zero governor 11 is of standard or conventional design and serves to supply the gas under atmospheric pressure to the mixing device 12. It is positioned above the horizontally extending pipe 19 and embodies a cast metal casing 22. The latter embodies a horizontally extending gas inlet 23 at one end thereof and a horizontally extending gas outlet 24 at its other end. The inlet is horizontally aligned with the outlet and is connected by way of a pipe 25 to receive gas under comparatively small pressure from a reservoir or other source of supply. The outlet 24 extends between and is connected by a horizontally extending pipe 26 to the mixing device 12. The interior of the casing 22 is divided by means of a cross-wall 27. The latter embodies a circular aperture 28 whereby the gas is permitted to flow from the inlet 23 to the outlet 24. The flow of gas through the aperture is controlled by a vertically movable valve 29. The latter is located in the outlet side of the casing and is provided with a vertically extending stem 30. This stem projects upwardly through the aperture 28 and is connected to a horizontally extending flexible diaphragm 31 in a two-piece housing 32 above the casing 22. The diaphragm operates in response to fluctuation thereof to shift the valve to and from the aperture in order to regulate or control the flow of gas through the casing 22. It is clamped at the margin thereof between the housing sections and is supported by means of a vertically extending spring 33. The housing 32 defines a chamber 34 under the diaphragm and this chamber communicates with the outlet 24 of the casing of the governor by way of a duct 35. When suction is created in the chamber 34 the diaphragm 31 moves downwards and opens the valve 29. When the suction in the chamber 34 decreases or diminishes the diaphragm is moved upwards by the action of the spring 33 and operates to close the valve. The diaphragm and spring so control the valve that the valve regulates the gas passing into the outlet so that it is under zero or atmospheric pressure at all times. The upper piece of the housing is suitably vented to atmosphere by a hole (not shown).

The mixing device 12 operates in response to the suction created by the compressor 10 and comprises an elongated vertically extending casing 36. The latter rests on the hollow base 16 and has a gas chamber 37, an air chamber 38, and a mixing chamber 39. The gas chamber is located in the upper end of the casing 36 and the air chamber 38 is located in the lower end of the casing. The mixing chamber 39 is disposed between the gas and air chambers and is separated

from the latter by means of a pair of circular plates 40 and 41. The gas chamber 37 receives gas under zero or atmospheric pressure from the zero governor by way of the pipe 26. The latter, as shown in Figure 1, is connected to an internally threaded ring 42 on the upper end of the casing 36 and communicates with the chamber 37 by way of a hole 43 in the casing. The air chamber 38 communicates with and is adapted to receive air from the interior of the hollow base by way of a hole 44. The latter is formed in the top wall of the base and is located under the lower end of the casing 36. The base is connected to the atmosphere surrounding the apparatus by way of a hole 45. An air cleaner 45^a overlies the hole 44 and serves to filter any air passing into the base. When suction is created within the chambers 37 and 38 gas under zero or atmospheric pressure is drawn into the chamber 37 from the governor 11 and air under atmospheric pressure is drawn into the air chamber 38. The inlet end of the pipe 19 is connected to the central portion of the casing 36 and communicates with the mixing chamber 39 by way of a hole in the casing. The plate 40 separates the gas chamber 37 from the mixing chamber 39 and rests on an inwardly extending annular flange 46. It is bolted or otherwise removably secured to the flange and has a centrally disposed circular orifice 47. The latter is controlled by means of a valve 48 and permits gas to flow from the gas chamber 37 into the mixing chamber 39 when the valve is open. The plate 41 is disposed beneath the plate 40 and serves to separate the air chamber 38 from the mixing chamber 39. It is supported or removably connected to an inwardly extending annular flange 49 and has in the central portion thereof a circular orifice 50. This orifice is vertically aligned or centered with the orifice 47 and the plate 40 and is controlled by a valve 51. When the latter is in its open position air under atmospheric pressure is permitted to flow from the chamber 38 into the mixing chamber 39. The valves 48 and 51 are in the form of inverted cones and are of the proportioning variety in that they are the same in height from vertex to point of orifice contact. By reason of the fact that the valves are of the proportioning cone variety or type the proportion of gas and air mixed together in the mixing chamber is constant throughout the entire capacity range of the apparatus. If, for example, the orifice in the plate 41 has a net area five times that of the orifice in the plate 40, then the ratio of air to gas will be approximately five to one and this ratio will remain constant regardless of whether the apparatus is operating at low or high capacity. The valves 48 and 51 are mounted on a vertically movable shaft 52. The upper end of this shaft extends through the gas chamber 37 and into a two-piece cast metal housing 53 on the upper end of the casing 36. The housing 53 surrounds and supports a flexible diaphragm 54 and consists of a top section 55 and a bottom section 56. The bottom section is secured to and forms a closure for the upper end of the gas chamber 37 and forms a compartment 57 under the diaphragm 54. The top section 55 of the housing 53 forms an air-tight compartment 58 over the diaphragm and has an outwardly extending annular side flange 59 which is bolted or otherwise secured to an adjoining outwardly extending side flange on the bottom section 56. The margin of the diaphragm is clamped between the two

flanges, as shown in Figure 1. The upper end of the shaft 52 extends through and is connected to the central portion of the diaphragm and has a longitudinally extending duct 60. This duct establishes communication between the mixing chamber 39 and the air-tight compartment 58 above the diaphragm with the result that any suction which is created within the mixing chamber as a result of operation of the compressor 10 is transmitted to the compartment 58. When suction is created in the compartment 58, the diaphragm 54 moves upwardly and operates to open the proportioning cone valves 48 and 51. When the suction increases the diaphragm moves upwardly to a greater extent and effects a greater opening of the cone valves with the result that more gas and air flow into the chamber 39. When the suction in the compartment 58 decreases due to a decrease or falling off in the demand for the mixture of gas and air at the outlet of the compressor the diaphragm moves downwardly by gravity and operates to close either partially or fully the cone valves. The lower end of the shaft 52 projects into the air chamber 38 and the lower end of the casing 36 and is slidably mounted in a guide bracket 61.

The compensating unit 13 is associated with the mixing device 12 and constitutes simple and novel means whereby additional gas or air may be introduced into the mixing chamber 39 to compensate for any change in the calorific value of the gas. It is located at one side of the casing of the mixing device and comprises an elongated housing 62. The latter extends vertically, as shown in Figure 1, and comprises a top wall 64, a bottom wall 65, a pair of side walls 66, a front wall 67, and a pair of plates 68 and 69. The top, bottom, side and front walls are formed integrally with one another and define an elongated chamber 70. The plate 68 fits against and is removably secured by bolts 71 to the casing 36 and seals or closes the upper rear portion of the chamber 70. The plate 69 is disposed beneath the plate 68 and is separated from the latter by way of a rectangular space 72. It is removably secured by bolts 73 to the casing 36 and serves to seal or close the lower rear portion of the chamber 70. Bolts 74 extend through the front wall 67 and into the plates 68 and 69 and serve releasably to hold in place the top, bottom, side and front walls of the housing 62. The upper end of the chamber 70 in the housing is connected by a conduit 75 to receive gas from the gas chamber 37 in the casing 36. This conduit leads from a hole 76 in the upper end of the casing 36 to a hole 77 in the top wall 64 of the housing 62 and has a valve 78 whereby the flow of gas therethrough from the gas chamber 37 to the chamber 70 may be cut off. The lower end of the chamber 70 is connected by a conduit 79 to receive air under atmospheric pressure from the air chamber 38 in the lower end of the casing 36. The conduit 79, as shown in Figure 1, leads from a hole 80 in the lower end of the casing 36 to a hole 81 in the bottom wall 65 of the housing 62 and has a valve 82 whereby the flow of air through it from the air chamber 38 to the chamber 70 may be cut off. The chamber 70 communicates with the mixing chamber 39 by way of the space 72 between the plates 68 and 69 and a vertically elongated side opening 83 in the central portion of the casing 36 of the mixing device. When it is desired to introduce into the mixture of gas and air an additional amount of air for diluting purposes, the valve 83 is opened and the valve

78 is closed. In the event that it is desired to make the mixture of gas and air more rich as a result of a lessening of the calorific value of the gas, the valve 78 is opened and the valve 83 in the conduit 79 is closed. The ends of the space 72 are closed or sealed by way of a pair of vertically extending strips 84 and 85. These strips are secured in place by means of screws 86 and are equal in width to the thickness of the plates 68 and 69. Flow of air or gas from the chamber through the side opening 83 into the mixing chamber 39 is controlled or regulated by means of a vertically elongated plate valve 87. This valve is disposed in the chamber 70 and fits against the plate 68. It is guided for vertical sliding movement by a plurality of rollers 88 and is connected by a horizontally extending rod 89 to the shaft 52 so that it moves conjointly with the proportioning cone valves of the mixing device 12. The rollers 88 are rotatably mounted on spindles 90 and have ribs 91 which fit within vertically extending grooves in the side faces of the plate valve. The spindles 90, as shown in Figures 3 and 5, extend into and are carried by the plate 68. The rod 89 extends through aligned vertically extending slots 92 and 93 in the plate 68 and the central portion of the casing 36 and is connected at one end thereof to the shaft 52, in such manner that it is free to rotate longitudinally but cannot move vertically with respect to said shaft. The other end of the rod fits within a hole 94 in a plate type bracket 95 on the inner face of the plate valve 87. The lower end of the plate valve projects beneath the plate 68 and is adapted when the valve is raised in connection with opening of the proportioning cone valves to uncover progressively the side opening 83. It is further adapted upon lowering of the valve in connection with closing of the proportioning cone valves to cover or close the side opening. When the side opening is closed no air or gas can flow from the chamber 70 into the chamber 36. When the plate valve is shifted upwardly into its open position air or gas is permitted to flow into the chamber 36 via the side opening 83. By reason of the fact that the plate valve is connected for conjoint movement with the proportioning cone valves the amount of flow of gas or air into the chamber 36 is properly regulated. The bracket 95 is secured to the plate valve by way of a pair of screws 96. These screws extend through vertically extending slots 97 in the ends of the bracket and fit within internally threaded sockets in the valve 87. The slots 97 permit the plate valve 87 to be adjusted vertically with respect to the bracket 94 and the rod 89. By shifting or adjusting the plate valve with respect to the bracket, the valve may be positioned with respect to the rod 89 that its lower end is aligned with the bottom of the side opening 83 when the proportioning cone valves are in their fully closed position.

In addition to the housing 62 and the plate valve 87 the compensating unit comprises a stack or series of plates 98 and a plate 99. The plates 98 constitute means for changing or varying the shape of the side opening 83 and the plate 99 constitutes means for increasing or decreasing the size of such opening. The plates 98 are positioned at one side of the side opening 83 and fit within the space 72 between the plates 68 and 69. They are horizontally slidable, one relatively to the other and extend from the bottom of the side opening to the top. For adjustment purposes the plates 98 are provided with screws 100. The inner ends of these screws fit within internally

threaded sockets 101 in the outer ends of the plates 98, as shown in Figure 5. The outer ends of the screws extend through holes 102 in the strips 84 and have kerfs 103 so that the screws may be turned by way of a screw driver in connection with adjustment of the plates 98. In order to prevent axial displacement of the screws enlarged heads 104 are formed on the outer ends of the screws. These heads fit between the strip 84 and a strip 105. The last mentioned strip is positioned outwardly of the strip 84, as shown in Figure 5, and has holes 106 for the kerf equipped outer ends of the screws. By turning the screws in one direction or the other the plates 98 may be shifted inwards or outwards. By adjusting the plates 98 the shape of the side opening 83 may be fixed or changed so that the exposed portion of the opening is of the proper size to admit into the mixing chamber the right or proper amount of gas and air to maintain uniformity of the gas and air ratio of the mixture in the chamber 39. For a set of cone valves of predetermined size or shape the side opening must have a certain shape if during progressive opening of the plate valve it is desired to introduce into the mixing chamber 39 the proper amount of gas or air, whereas for a different set or pair of proportioning cone valves the side opening 83 must have a different shape. The plates 98 are preferably adjusted for side opening shaping purposes either at the factory or at the time the apparatus is installed and are not further adjusted unless the proportioning cone valves in the casing 36 are replaced with other valves of different size or shape. When the plates 98 are properly set or adjusted the side opening 83 will have such a shape that as it is uncovered during opening of the plate valve the proper amount of gas or air is introduced into the mixing chamber to maintain uniformity of the gas and air ratio of the mixture. The outer ends of the adjusting screws 100 are covered by means of a cap 107. This cap, as shown in Figures 3 and 5, fits against the plates 68 and 69 and is removably secured in place by means of screws 108. When it is desired to adjust the plates 98, it is only necessary to remove the screws 108 and then move the cap out of its operative position. The plate 99 is located at the other side of the side opening 83 and is disposed in the space 72. It fits slidably between the plates 68 and 69 and is provided with a horizontal screw 109 for adjusting or sliding it laterally. The inner end of the screw fits within an internally threaded socket 110 in the outer portion of the plate 99 and the outer end of the screw extends through a hole 111 in the strip 85 and embodies a kerf 112 for a screw driver or other turning tool. A pair of opposed enlargement formed shoulders on the outer end of the screw serves to hold the screw against axial movement. When the screw 108 is turned in one direction the plate 99 is slid inwards and hence decreases the size of the side opening leading to the mixing chamber 39. When the screw is reversely rotated the plate 99 is shifted outwards and thus increases the size of the side opening. A cap 113 serves to protect or cover the outer end of the adjusting screw 109 and this cap is removably secured in place by means of screws 114. By adjusting the plate 99 the amount of gas or air introduced into the gas and air mixture in the mixing chamber 39 for compensating purposes may be increased or decreased.

The operation of the apparatus is as follows: When the compressor 10 is driven by the electric

motor 21 suction is created in the mixing chamber 39 in the casing 36 of the mixing device 12. This suction, as previously pointed out, is transmitted to the compartment 58 over the diaphragm 54 and causes the diaphragm to move upwardly. In response to upward movement of the diaphragm the cone valves 48 and 51 move upwards and permit gas and air to be drawn into the mixing chamber 31. After being mixed together the gas and air flow through the pipe 19 into the casing of the compressor and are then forced under pressure through the pipe 20 to the point of consumption. In the event that the demand at the pressure side of the compressor decreases the suction created in the mixing chamber 39 and the compartment 58 decreases with the result that the diaphragm 54 moves downwards and causes closing of the proportioning cone valves 48 and 51. If it is necessary to introduce an additional amount of air into the mixing chamber 39 to compensate for an increase in the calorific value of the gas the valve 82 in the conduit 79 is opened and the compensating unit 12 is thus brought into play. When the valve 82 is in its open position and the proportioning cone valves 48 and 51 are unseated, the plate valve 87 is also unseated or moved upwards and permits air to flow from the chamber 70 into the chamber 39. By adjusting the plate 99 the amount of air introduced into the mixing chamber 39 via the side opening 83 may be increased or decreased. In the event that for compensating purposes it is necessary to introduce gas into the mixing chamber 39 from the chamber 70 the valve 82 is closed and the valve 78 is opened. When the valve 78 is in its open position and the proportioning cone valves 48 and 51 are moved upwards into their open position the plate valve 87 moves upwards conjointly with the valves and permits gas to flow through the side opening 83 into the mixing chamber 39.

The herein described apparatus is an extremely practical one in that the compensating unit makes it possible to change the ratio of gas and air without the necessity of dismantling the mixing device 12 and changing the orifice plates and proportioning cone valves.

Whereas the apparatus has been described as being primarily adapted for use in diluting gas of high calorific values with air, it is to be understood that it may be put to other uses.

It is also to be understood that the invention is not to be restricted to the details set forth since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. In a gas mixing and supplying apparatus of the character described, the combination of a compressor; a mixing device comprising a casing with a mixing chamber therein, a pair of inlet orifices for the chamber and a chamber outlet in communication with the suction side of the compressor, a pair of proportioning cone valves fitting in and serving to control the orifices respectively, and means actuated by the compressor created suction for progressively and conjointly opening the valves as the suction increases and closing the valves as the suction decreases; means for supplying two different kinds of gases under atmospheric pressure to the inlet orifices for passage into the mixing chamber for mixing purposes upon opening of

the valves; and means for adding to the mixture an additional quantity of either one or the other kind of gas under atmospheric pressure for compensating purposes, including a separate valve positively connected to open and close conjointly with the cone valves.

2. In a gas mixing and supplying apparatus of the character described, the combination of a compressor; a mixing device comprising a casing having formed therein a mixing chamber and a gas chamber and embodying means forming an inlet orifice from the gas chamber to the mixing chamber, a second inlet orifice leading to the mixing chamber, and a mixing chamber outlet in communication with the suction side of the chamber, a pair of proportioning cone valves fitting in and serving to control the orifices respectively, and means actuated by the compressor created suction for progressively and conjointly opening the valves as the suction increases and closing the valves as the suction decreases; means for supplying gas under atmospheric pressure to the gas chamber for passage into the mixing chamber via the first mentioned inlet orifice upon opening of the valve for such orifice; means for supplying a different gas under atmospheric pressure to the other inlet orifice for passage into the mixing chamber for mixing purposes upon opening of the valve for the last mentioned orifice; and means for introducing into the mixing chamber independently of said first mentioned orifice an additional quantity of gas under atmospheric pressure from the gas chamber for compensating purposes, including a separate valve positively connected to open and close conjointly with the cone valves.

3. In a gas mixing and supplying apparatus of the character described, the combination of a compressor; a mixing device comprising a casing having formed therein a mixing chamber and a pair of gas chambers at opposite ends of the mixing chamber and provided with means forming inlet orifices leading from the gas chambers to the mixing chamber and a mixing chamber outlet in communication with the suction side of the compressor, a pair of proportioning cone valves fitting in and serving to control the orifices respectively, and means actuated by the compressor created suction for progressively and conjointly opening the valves as the suction increases and closing the valves as the suction decreases; means for supplying two different kinds of gases under atmospheric pressure to the gas chambers for passage via the inlet orifices into the mixing chamber for mixing purposes upon opening of the valves; and means for supplying an additional quantity of gas under atmospheric pressure from either gas chamber into the mixing chamber independently of the inlet orifices for compensating purposes, including a separate valve connected to open and close conjointly with said proportioning cone valves.

4. In a gas mixing and supplying apparatus of the character described, the combination of a compressor; a mixing device comprising a casing with a mixing chamber therein, a pair of inlet orifices for the chamber and a chamber outlet in communication with the suction side of the compressor, a pair of proportioning cone valves fitting in and serving to control the orifices respectively, and means actuated by the compressor created suction for progressively and conjointly opening the valves as the suction increases and closing the valves as the suction decreases; means

for supplying two different kinds of gases under atmospheric pressure to the inlet orifices for passage into the mixing chamber for mixing purposes upon opening of the valves; and a compensating unit comprising a housing having a chamber therein with a side opening leading from it to the mixing chamber, means for delivering gas under atmospheric pressure into the chamber in the housing for passage to the mixing chamber via said side opening, and a valve adapted to control the quantity of gas passing into the mixing chamber via said side opening and connected to open and close conjointly with the cone valves.

5. In a gas mixing and supplying apparatus of the character described, the combination of a compressor; a mixing device comprising a casing with a mixing chamber therein, a pair of inlet orifices for the chamber and a chamber outlet in communication with the suction side of the compressor, a pair of proportioning cone valves fitting in and serving to control the orifices respectively, and means actuated by the compressor created suction for progressively and conjointly opening the valves as the suction increases and closing the valves as the suction decreases; means for supplying two different kinds of gases under atmospheric pressure to the inlet orifices for passage into the mixing chamber for mixing purposes upon opening of the valves; and a compensating unit comprising a housing having a chamber therein with a side opening leading from it to the mixing chamber, means for delivering gas into the chamber in the housing for passage to the mixing chamber via said side opening, a plate valve adapted to control the quantity of gas passing into the mixing chamber through said side opening and connected to open and close conjointly with the cone valves, and means for changing or adjusting the shape of said side opening.

6. In a gas mixing and supplying apparatus of the character described, the combination of a compressor; a mixing device comprising a casing with a mixing chamber therein, a pair of inlet orifices for the chamber and a chamber outlet in communication with the suction side of the compressor, a pair of proportioning cone valves fitting in and serving to control the orifices respectively, and means actuated by the compressor created suction for progressively and conjointly opening the valves as the suction increases and closing the valves as the suction decreases; means for supplying two different kinds of gases under atmospheric pressure to the inlet orifices for passage into the mixing chamber for mixing purposes upon opening of the valves; and a compensating unit comprising a housing having a chamber therein with a side opening leading from it to the mixing chamber, means for delivering gas into the chamber in the housing for passage to the mixing chamber via said side opening, a plate valve adapted to control the quantity of gas passing into the mixing chamber through said side opening and connected to open and close conjointly with the cone valves, and a series of individually adjustable plates located at one side of said side opening and adapted upon adjustment thereof to change the shape of said opening.

7. In a gas mixing and supplying apparatus of the character described, the combination of a compressor; a mixing device comprising a casing with a mixing chamber therein, a pair of inlet orifices for the chamber and a chamber outlet in communication with the suction side of the compressor, a pair of proportioning cone valves fitting in and serving to control the orifices re-

spectively, and means actuated by the compressor created suction for progressively and conjointly opening the valves as the suction increases and closing the valves as the suction decreases; means for supplying two different kinds of gases under atmospheric pressure to the inlet orifices for passage into the mixing chamber for mixing purposes upon opening of the valves; and a compensating unit comprising a housing having a chamber therein with a side opening leading from it to the mixing chamber, means for delivering gas into the chamber in the housing for passage to the mixing chamber via said side opening, a plate valve adjacent to the side opening adapted to control the flow of gas passing into said mixing chamber via said side opening and connected to open and close conjointly with the cone valves, and means for decreasing the effective size of said side opening.

8. In a gas mixing and supplying apparatus of the character described, the combination of a compressor; a mixing device comprising a casing with a mixing chamber therein, a pair of inlet orifices for the chamber and a chamber outlet in communication with the suction side of the compressor, a pair of proportioning cone valves fitting in and serving to control the orifices respectively, and means actuated by the compressor created suction for progressively and conjointly opening the valves as the suction increases and closing the valves as the suction decreases; means for supplying two different kinds of gases under atmospheric pressure to the inlet orifices for passage into the mixing chamber for mixing purposes upon opening of the valves; and a compensating unit comprising a housing having a chamber therein with a side opening leading from it to the mixing chamber, means for delivering gas into the chamber in the housing for passage to the mixing chamber via said side opening, a plate valve adjacent to the side opening adapted to control the flow of gas passing into said mixture chamber via said side opening and connected to open and close conjointly with the cone valves, and means including a laterally adjustable plate at one side of said side opening for increasing or decreasing the effective size of said opening.

9. In a gas mixing and supplying apparatus of the character described, the combination of a compressor; a mixing device comprising a casing with a mixing chamber therein, a pair of inlet orifices for the chamber and a chamber outlet in communication with the suction side of the compressor, a pair of proportioning cone valves fitting in and serving to control the orifices respectively, and means actuated by the compressor created suction for progressively and conjointly opening the valves as the suction increases and closing the valves as the suction decreases; means for supplying two different kinds of gases under atmospheric pressure to the inlet orifices for passage into the mixing chamber for mixing purposes upon opening of the valves; and a compensating unit comprising a housing having a chamber therein with a side opening leading from it to the mixing chamber, means for delivering gas into the chamber in the housing for passage to the mixing chamber via said side opening, a plate valve in the housing and adjacent said side opening adapted to control the flow of gas into the mixing chamber via said side opening and connected to open and close conjointly with the cone valves, means between the plate valve and the side opening and at one side of said opening, for adjusting the shape of the open-

ing and means opposite said last mentioned means and at the other side of said side opening for increasing or decreasing the size of said opening.

10. In a gas mixing and supplying apparatus of the character described, the combination of a compressor; a mixing device comprising a casing with a mixing chamber therein, a pair of inlet orifices for the chamber and a chamber outlet in communication with the suction side of the compressor, a pair of proportioning cone valves fitting in and serving to control the orifices respectively, and means actuated by the compressor created suction for progressively and conjointly opening the valves as the suction increases and closing the valves as the suction decreases; means for supplying two different kinds of gases under atmospheric pressure to the inlet orifices for passage into the mixing chamber for mixing purposes upon opening of the valves; and a compensating unit comprising a housing having a chamber therein with a side opening leading from it to the mixing chamber, means for delivering gas into the chamber in the housing for passage to the mixing chamber via said side opening, a plate valve adapted to control the flow of gas into the mixing chamber through said side opening and connected to open and close conjointly with the cone valves, a series of individually movable or adjustable plates at one side of the side opening for changing the shape of the latter and a laterally adjustable plate at the other side of said side opening for increasing or decreasing the size of said opening.

11. In a gas mixing and supplying apparatus of the character described, the combination of a compressor; a mixing device comprising a casing having formed therein a mixing chamber and a pair of gas chambers at the ends of the mixing chamber and provided with means for a pair of inlet orifices between the gas chambers and the mixing chamber, and a mixing chamber outlet in communication with the suction side of the compressor, a pair of proportioning cone valves fitting in and serving to control the orifices respectively, and means actuated by the compressor created suction for progressively and conjointly opening the valves as the suction increases and

closing the valves as the suction decreases; means for supplying two different kinds of gases under atmospheric pressure to the gas chambers for passage via the inlet orifices into the mixing chamber for mixing purposes upon opening of the valves; and a compensating unit comprising a housing having a chamber therein with a side opening leading from it to the mixing chamber and a pair of valve controlled conduits leading to it from the two gas chambers, and a valve associated with and adapted to control the side opening and connected to open and close conjointly with the cone valves.

12. In a gas mixing and supplying apparatus of the character described, the combination of a compressor; a mixing device comprising a casing having formed therein a mixing chamber and a pair of gas chambers at the ends of the mixing chamber and provided with means for a pair of inlet orifices between the gas chambers and the mixing chamber, and a mixing chamber outlet in communication with the suction side of the compressor, a pair of proportioning cone valves fitting in and serving to control the orifices respectively, and means actuated by the compressor created suction for progressively and conjointly opening the valves as the suction increases and closing the valves as the suction decreases; means for supplying two different kinds of gases under atmospheric pressure to the gas chambers for passage via the inlet orifices into the mixing chamber for mixing purposes upon opening of the valves; and a compensating unit comprising a housing having a chamber therein with a side opening leading from it to the mixing chamber and a pair of valve controlled conduits leading to it from the two gas chambers, a plate valve positioned opposite to and adapted to control said side opening and connected to open and close conjointly with the cone valves, a series of individually adjustable plates at one side of said side opening for changing or adjusting the size of said opening, and a laterally adjustable plate in the other side of the side opening for closing or decreasing the effective area of said opening.

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