April 28, 1970 J. A. KIRK ET AL 3,508,567

GAS PROPORTIONER

Filed April 6, 1966

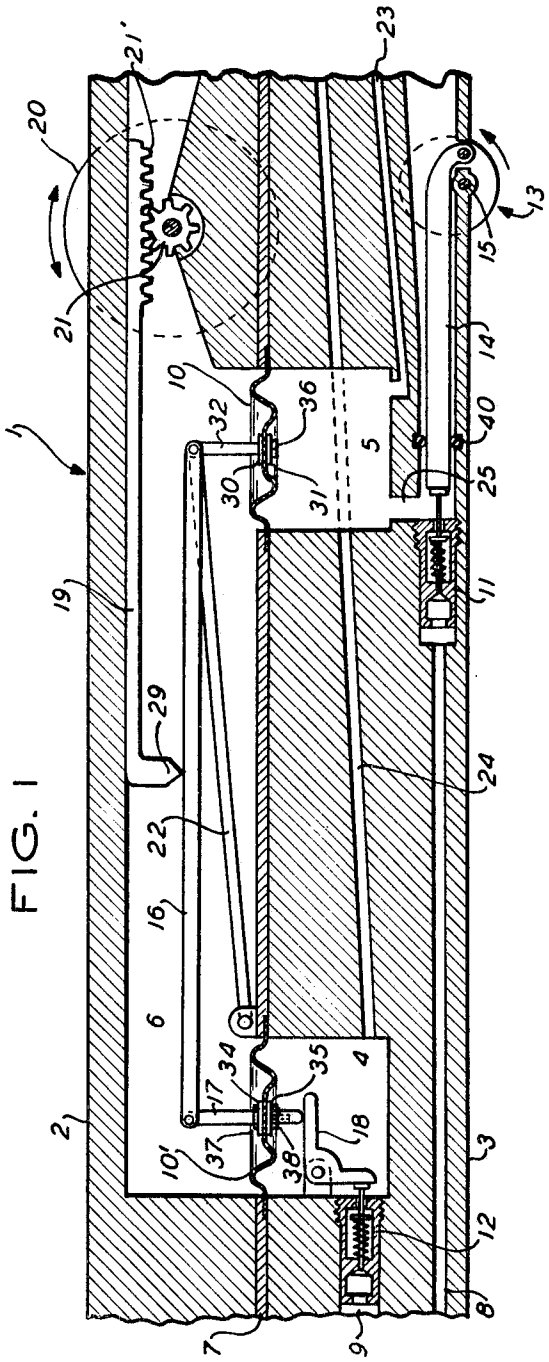


FIG. 1

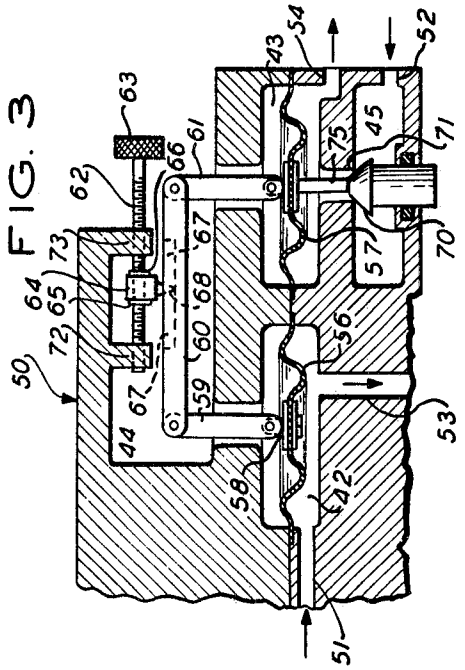


FIG. 3

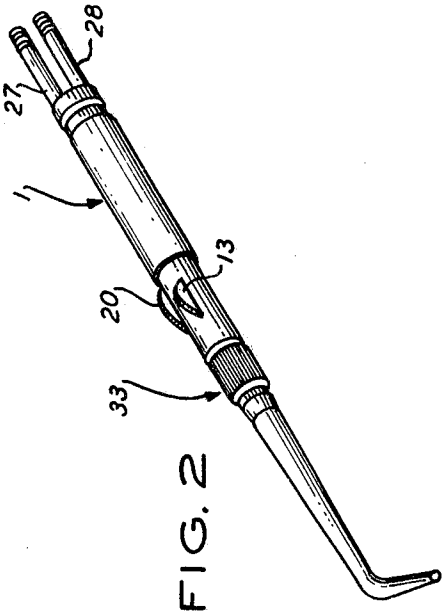


FIG. 2

INVENTOR
JERRY P. HELCK
JAMES A. KIRK
BY
Frances B. Hayes
ATTORNEY

United States Patent Office 3,508,567
Patented Apr. 28, 1970

3,508,567

GAS PROPORTIONER

James A. Kirk, Troy, N.Y., and Jerry P. Helck, Summit, N.J., assignors to Air Reduction Company, Incorporated, New York, N.Y., a corporation of New York

Filed Apr. 6, 1966, Ser. No. 540,739
Int. Cl. B23k 5/00; G05d 11/02
U.S. Cl. 137—98 2 Claims

This invention relates to a gas proportioning device in which the delivery pressure of a controlled gas is determined by the delivery pressure of a controlling gas. More specifically, this invention relates to mechanisms for determining the ratio of said pressures and for varying the flow rate.

An object of the instant invention is to fabricate a gas proportioner with a minimum of complicated or expensive parts. A further object is to greatly simplify the required structural apparatus needed for automatic gas proportioning so that the proportioner can be included in a hand held device, such as a hand torch. A hand torch including the instant gas proportioner will be generally of conventional size and shape.

Another object of this invention is to provide a first control means for initiating the flow of both gases in proper proportion, and to provide a second control means for adjusting the proportion of the mixture. Another object of the invention is to locate both said control means in close proximity to one another on a hand held device.

Another object of the invention is to provide a gas proportioning apparatus for automatically maintaining the desired proportions even though the flow rate increases or decreases.

Other objects, features and advantages will appear from the following more detailed description of illustrative embodiments of the invention, which will now be given in conjunction with the accompanying drawings, in which:

FIG. 1 is a sectional view taken through a portion of the body of a torch handle;

FIG. 2 shows a conventional torch with the dual controls located adjacent to one another; and

FIG. 3 shows a sectional view taken through another form of the gas proportioner.

In FIG. 1 a body portion **1** of a torch is show. The body portion is generally cylindrical in form and is fabricated of a pair of aluminum castings **2**, **3**. The lowermost casting **3** shown in FIG. 1 is formed with two cylindrical openings or chambers **4**, **5**. The uppermost casting **2** is formed with a longitudinal opening **6**. An intermediate plate **7** is located between the castings, the function of which will be hereinafter described. The casting **3** includes openings **8**, **9** which are connected to fuel gas (for example acetylene) and combustion supporting gas (for example oxygen) sources respectively.

FIG. 2 illustrates the conventional connections (**27**, **28**) for hoses leading from the acetylene and oxygen supplies. The openings **8**, **9** are connected directly by means of internal passages to the connections **27**, **28** without the necessity of providing the conventional throttling valves in each connection. Valves **11**, **12** are located in the openings **8**, **9**. Tire valve cores are illustrated in FIG. 1. The valve **11** is opened by means of a connecting rod **14** longitudinally movable in opening **8**. The opening **8** is somewhat enlarged in order to allow the rod **14** a degree of rocking movement. The rod is positioned by means of a rotary cam member or roller **13** which rotates about a pin **15** mounted in the casting **3**. Any suitable means may be used to hold the roller **13** in an adjusted position. For example, a friction washer with an annular spring may be placed on the pin **15** between the roller **13** and the casting **3** to hold the roller in adjusted position. The rod **14** abuts the valve stem of valve **11** and opens the valve when the rod **14** is moved to the left as shown in FIG. 1. This is done by rotating the cam **13** in the direction of the arrow shown in FIG. 1.

The cam **13** and associated connecting rod which may be described as a first control means, controls the opening and closing of valve **11** and thus throttles the flow of acetylene into the opening **5**. Acetylene flow around the rod **14** is prevented by any suitable sealing means **40**. Positioned in the openings **4**, **5** are diaphragms **10**, **10'** which may be made of fabric reinforced rubber. The diaphragms act as motors and may be described as such. The circumferential edges of the diaphragms are pressed down against the casting **3** by means of the intermediate plate **7** thus forming a gas tight seal. The diaphragm **10** includes a pair of washers **30**, **31**, a metal stem **32** and nut **36**. Similarly, diaphragm **10'** includes a pair of washers **34**, **35** and a stem **17** which extends through the diaphragm. A pair of nuts **37**, **38**, one on either side of the diaphragm locks the stem to the diaphragm. The two diaphragms are interconected by means of a rocking lever **16** which is pivotally connected to each of the stems **17**, **32** and which rocks about fulcrum **29**. The fulcrum **29** is a projection on a longitudinally movable rod **19** which has a rack **21'** at its other end. The rack cooperates with pinion **21** which rotates with a pin mounted in the casing **2**. The pinion is rotated by roller **20** and may be locked in any given position by suitable friction means, etc. The stem **17** engages one arm of the bellcrank **18** which is pivotally mounted on casing **3**. The other arm of the bellcrank engages the valve stem of valve **12**. Thus, reciprocal movement of the stem **17** opens and closes the valve **12** and thus throttles the flow of oxygen into chamber **4**. The conduits **23** and **24** extend forwardly in the torch body to the conventional mixing chamber **33** (FIG. 2). The link **22**, pivotally connecting the plate **7** and the lever **16** prevents significant horizontal movement of said lever.

The operation of the gas proportioning mechanism will now be described. The operator rotates the cam member **13** with his thumb to allow acetylene into the chamber **5**. The pressure in chamber **5** builds up and forces diaphragm **10** upwardly. The rocking lever **16** rocks about fulcrum **29** and forces the stem **17** downwardly thus rotating beltcrank **18** in a clockwise direction. Valve **12** is accordingly opened and pressure builds up in chamber **4**. The pressure build-up continues until a state of equilibrium is reached. The desired pressure ratio in the two chambers **4**, **5**, at equilibrium, is determined by the position of fulcrum **29** which can be adjusted by roller member **20**. Thus, the roller member **20** controls the percentage of the two gases in the resultant mixture. The rotary cam member **13** on the other hand controls the total flow rate of the mixture by determining the delivery pressure of the acetylene which in turn regulates the delivery pressure of the oxygen by means of the diaphragms and interconnected linkage.

The embodiment shown in FIG. 2 illustrates that the rollers **13** and **20** may be located closely adjacent to one another. They are shown separated in FIG. 1 for purposes of simplifying the illustration of the inventive concept. It being understood that to locate the rollers adjacent to one another it is merely necessary to rearrange the conduits and openings shown in FIG. 1.

The embodiment shown in FIG. 3, operates in much the same manner as the device shown in FIG. 1. Motors **56** and **57** are located in chambers **42** and **43**, respectively, which are situated in a suitable housing **50**. The motors are structurally interconnected by linkage means in order to transmit movement therebetween. Motor **56** has an upstanding member **58** rigidly fixed thereto. A link **59** is pivotally fixed to the upper end of said member and to

one end of lever **60**. The other end of said lever is pivotally connected to a link **61**, the lower end of which is pivotally connected to the second motor **57**. At some intermediate point along its length, the lever **60** abuts a fulcrum **68**. The fulcrum is fixed to the lower side of collar **64** and extends into a slot **67** in lever **60**. The collar is freely rotatably supported on a screw like member **62**. Washers **65** and **66** prevent the collar from moving axially relative to the screw. The screw member **62** is threaded into a bifurcated extension **72**, **73** of the housing **50**. Rotation of knob **63** moves the screw, associated collar **64**, and fulcrum **68** relative to the lever **60**.

The controlling fluid supply in this embodiment enters through conduit **51** and forces motor **56** upwardly. This motion causes lever **60** to rock in a clockwise manner about pivot **68** forcing motor **57** downwardly. Fixed to the bottom of motor **57** is a depending valve stem **75** of a valve **70**. This valve cooperates with valve seat **71** and throttles the flow of fluid from a lower opening **45** into the second chamber **43**. As the valve **70** is lowered more fluid is allowed to pass into chamber **43**. Conduits **53** and **54** are connected to chambers **42** and **43**, respectively, and serve to direct the proportioned fluid to its destination. Suitably designed restrictive orifices are usually placed in the delivery conduits **53**, **54**. Restrictive orifices are also located in the delivery conduits in the embodiment shown in FIG. 1.

The operation of the fluid proportioning mechanism illustrated in FIG. 3 may be described as follows: Fluid flow is initiated in conduit **51** by any known means, such as a valve, etc. This valve may be adjustable to vary the inlet pressure. Pressure builds up in chamber **42** and forces the motor **56** upward. Lever **60** is thereby rocked in a clockwise direction opening valve **70** and allowing fluid from chamber **45** to enter chamber **43**. Pressure builds up in chambers **42** and **43** until a state of equilibrium is reached. The location of the fulcrum **68** determines the pressure ratio in the said chambers. This ratio may be adjusted by rotating knob **63**. Thus the operation of this device is quite similar to that shown in FIG. 1.

The embodiment shown in FIG. 3 may also be incorporated into a hand held device, such as a torch. A cam actuated valve similar to that shown in FIG. 1 can be utilized to control the input pressure in conduit **51** and said cam may be structurally located adjacent to knob **63** in the manner shown in FIG. 2.

In the embodiments of the invention which are pictorially illustrated, atmospheric pressure on one side of the motor opposes the pressure of the gas to be proportioned which acts on the other side of the motor. For example in FIG. 1 the pressure in chamber **4** is opposed by the atmospheric pressure in chamber **6**. It is also within the concepts of this invention to provide a reference pressure, other than atmospheric, to oppose the movement of the motors. For example, chamber **6** in FIG. 1 could be sealed off and a suitable reference pressure created therein by means of a conduit leading from a reference pressure source which could be the mixing tank or chamber or any other suitable source.

While in the preferred embodiment illustrated, the fuel gas is used as the control gas, it is clearly within the inventive concept to use either gas as a control medium. Furthermore, the apparatus described may be used to proportion other fluids than those mentioned above.

The advantages resulting from inclunding the proportioning apparatus in a hand held device are apparent. The operator may quickly adjust the flow rate and/or the percentage of the two gases in the mixture by the mere movement of a thumb or finger. The apparatus is of course not limited to a use in hand held devices, such as torches. For example, the apparatus may be utilized in mixing shielding gases in arc welding equipment. It may be used to proportion lifesaving and supporting gases in operating rooms, underwater breathing apparatus, emergency mobile equipment, and in space vehicles. The apparatus may be used by the chemical industry in introducing reactants into chemical processes. In short, the inventive concepts involved may be applied wherever gas or low viscosity liquid mixing and/or proportioning is desired.

While an illustrative form of apparatus and methods in accordance with the invention have been described and shown herein, it will be understood that numerous changes may be made without departing from the general principles and scope of the invention.

We claim:

1. A hand torch comprising an elongated body portion, combustion supporting gas inlet means in said body portion and fuel gas inlet means in said body portion in the rear end thereof, a first and second gas chamber in said body portion, valve means controlling flow from said inlet means to said gas chambers, motor means comprising a flexible diaphragm in each of said chambers, an elongated rocking lever pivotally connected to each of said diaphragms, fulcrum means for said rocking lever, means for adjusting the position of the fulcrum means of the rocking lever, said adjusting means having at least a portion thereof projecting through said body portion and adapted to be contacted with the thumb, means interconnecting one of said diaphragms with said valve means for controlling flow into one of said chambers, actuating means for controlling the position of said valve means for controlling flow into the other of said chambers, said actuating means having at least a portion thereof projecting through said elongated body and adapted to be contacted with the thumb, said last mentioned portion being in close proximity to said aforementioned portion of said adjusting means so that initiation of flow and control of mixture may be effected by only slight movement of the thumb and conduit means connecting said gas chambers to outlet means in the forward end of the body portion.

2. A gas proportioning apparatus comprising, an elongated housing means adapted to be hand held, a plurality of gas chambers in said housing means with each of said chambers having a valve operated inlet means, motor means comprising a flexible diaphragm located in each of said chambers, one side of each diaphragm normally communicating with the atmosphere and the other side of each diaphragm communicating with its gas chamber, linkage means interconnecting said flexible diaphragms so that movement of one of said flexible diaphragms results in a movement of another of said flexible diaphragms, means for controlling the flow of a first gas into a gas chamber, means interconnecting the flexible diaphragm of said another of said gas chambers with its individual valve operated inlet means, the pressure of said first gas against its associated flexible diaphragm causing said linkage means to shift said another flexible diaphragm and thus actuate its respective valve operated inlet means, said linkage means comprising rocking lever means pivotally connected between and to said flexible diaphragms and means for adjusting the linkage means so that the amplitude of transmitted movement between the flexible diaphragms may be varied.

References Cited

UNITED STATES PATENTS

1,619,948	3/1927	Mangiameli.	
1,280,420	10/1918	Dibble	48—184
616,243	12/1898	Mayer	137—98
2,992,559	7/1961	Martz	137—86

FOREIGN PATENTS

262,368	1/1929	Italy.

WILLIAM F. O'DEA, Primary Examiner

H. M. COHN, Assistant Examiner

U.S. Cl. X.R.

251—234; 239—412, 416.2; 431—90