Dec. 7, 1954 M. E. HOOD 2,696,217

PROPORTIONED GAS MIXTURE AND DISPENSING BEER THEREWITH

Filed May 4, 1951 2 Sheets-Sheet 1

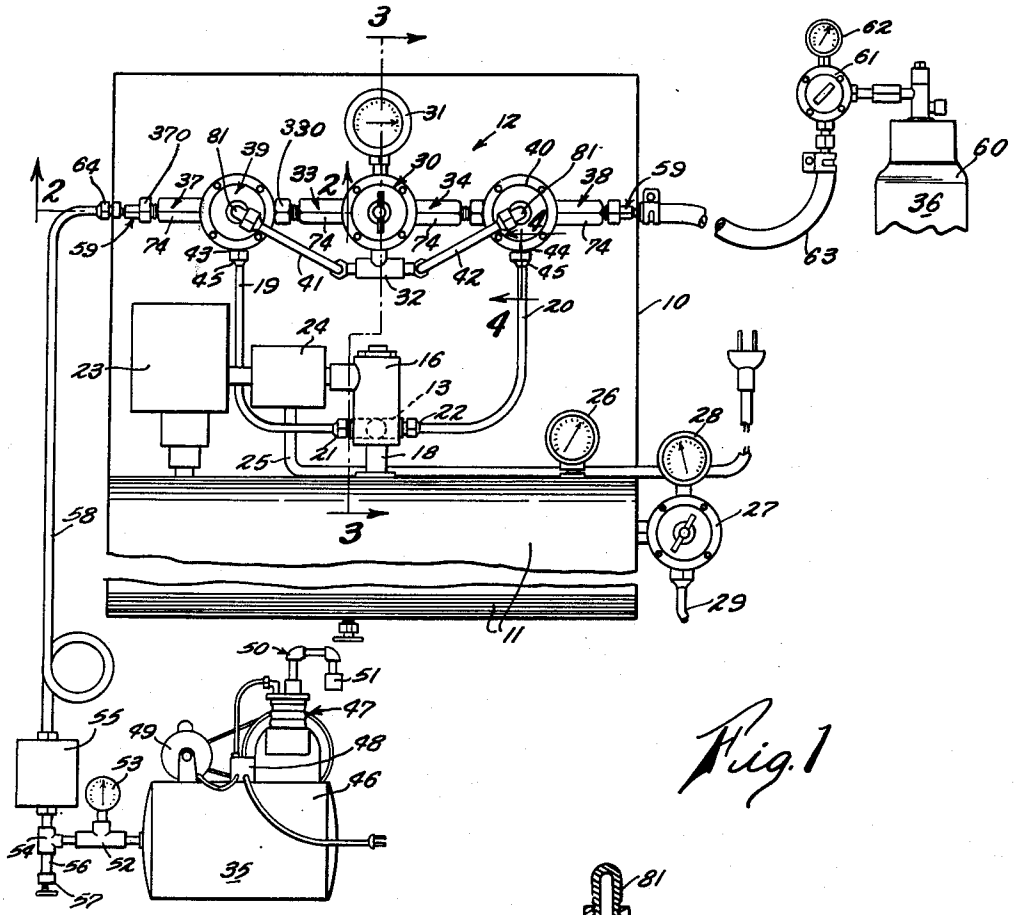


Fig. 1

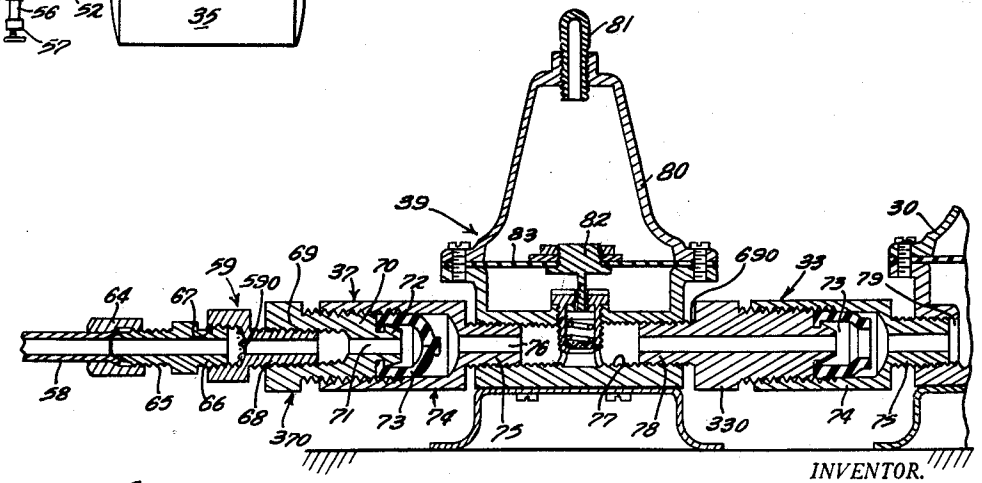


Fig. 2

INVENTOR.

BY Myron E. Hood

Murray, Sashkoff & Murray

ATT'YS

Dec. 7, 1954 M. E. HOOD 2,696,217

PROPORTIONED GAS MIXTURE AND DISPENSING BEER THEREWITH

Filed May 4, 1951 2 Sheets-Sheet 2

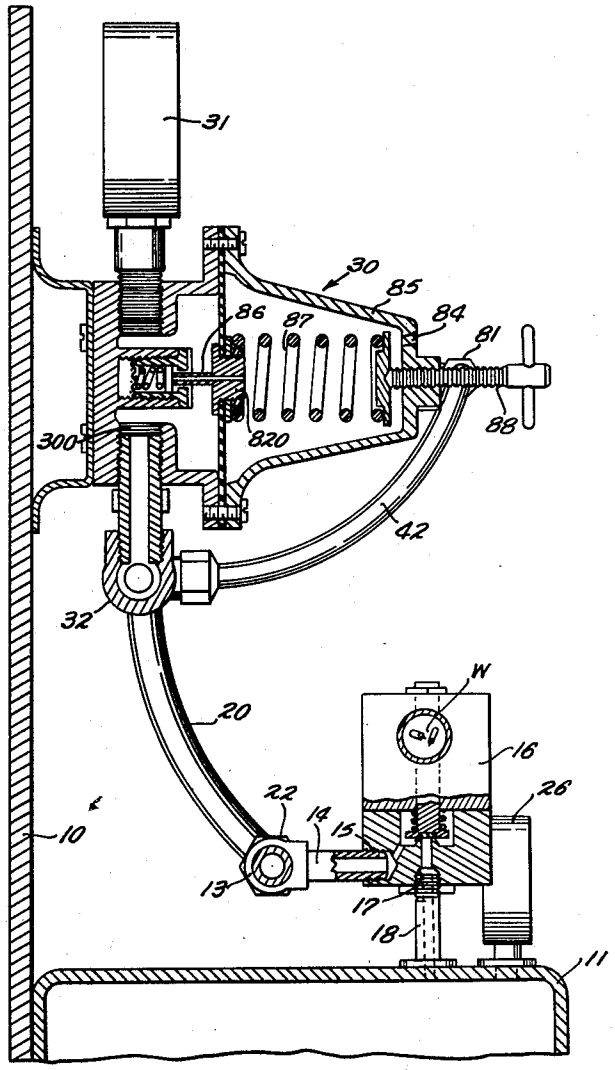


Fig. 3

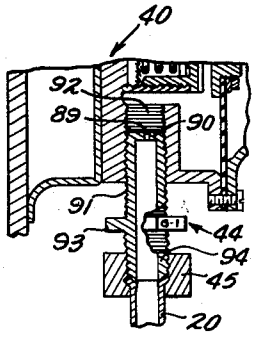


Fig. 4

INVENTOR.
Myron E. Hood

BY

Murray, Sackhoff & Murray
ATT'YS

United States Patent Office

2,696,217

Patented Dec. 7, 1954

2,696,217

PROPORTIONED GAS MIXTURE AND DISPENSING BEER THEREWITH

Myron E. Hood, Cincinnati, Ohio, assignor of sixteen per cent to Joseph M. Federika, Norwood, and eight per cent to Rose B. Guck, two per cent to Esther L. Sims, two per cent to Fred J. Kathman, Jr., one per cent to Daniel Delany, one per cent to Elmer G. Fromme, one per cent to J. Arthur Meinberg, one per cent to Ray Bigner, one per cent to Carl Lemperle, Jr., one per cent to J. W. Mathews, and one per cent to Charles C. Brown, all of Cincinnati, Ohio

Application May 4, 1951, Serial No. 224,611

12 Claims. (Cl. 137—12.5)

This invention relates to precision proportioning of gases in gas mixtures and has for an object the provision of apparatus of compact and relatively inexpensive construction of general utility for this purpose.

Another object of the invention is to provide apparatus of this kind which is adapted to automatically and continuously provide a predetermined known and accurately proportioned mixture of selected gases so long as the supplies of the components are maintained above a predetermined minimum pressure.

Another object of the invention is to provide an apparatus that is ideally adapted to precision proportioning of known gases by the introduction of fixed paired orifice elements in easily interchanged and identified pairs which are selected according to the desired mixture.

A further object of the invention is to provide an improved method and means for handling draught beer in the tavern which affords a consistently uniform satisfaction to the patron and a consistently higher money return, per barrel of beer dispensed, for the tavern keeper.

It is also an object of the invention to provide a means of this kind for the stated purpose wherein a minimum of time and attention are required of the tavern keeper after said means has been installed to suit prevailing conditions in the establishment.

A still further object of the invention is to provide apparatus of the class described that permits the use of any suitable air compressor previously installed in the tavern but which apparatus is not dependent for its accuracy upon the maintenance of a specific capacity in the air compressor, and which apparatus will also permit the uninterrupted dispensing of beer in the event of the failure of either the compressor or the gas supply.

These and other important objects are attained by the means and method described herein and exemplified in the accompanying drawings, in which:

Fig. 1 is a front elevational view showing an embodiment of the apparatus of the invention operatively connected with pressure sources of gases to be proportioned, parts being broken away.

Fig. 2 is a cross sectional view taken on line 2—2 of Fig. 1 showing the connections and control for one of the gases.

Fig. 3 is a cross sectional view taken on line 3—3 of Fig. 1.

Fig. 4 is a cross sectional view taken on line 4—4 of Fig. 1 showing one of the paired fixed orifice elements and the parts operatively connected thereto.

Heretofore proposed means for proportioning gases have been of relatively costly construction or they have left much to be desired from the standpoint of accuracy in practical use.

In the devices of the present invention it has been found highly practical and very economical to provide a device comprised of inexpensive regulators modified and arranged in a novel cooperative relationship with each other and adapted to utilize selected sets of paired fixed orifice elements in a manner such that given gases are reliably mixed in precise proportions as an automatic function of the apparatus so long as the supplies of the component gases are made available above a selected minimum pressure.

By the means of the invention it is practical and highly profitable to practice the herein described novel method of draft beer dispensing and control by incorporating the apparatus of the invention in any approved draft beer dispensing system. Hence it is a further object of the invention to provide at very reasonable cost an apparatus that is easily incorporated in an existing system and then quickly and permanently arranged to meet the particular conditions encountered in said system as installed and operating in the particular location. The method and apparatus is completely advantageous to the manufacturer and installer and to the user as well, since it can be quickly installed after a careful survey of the particular conditions of the system as operating in the tavern at hand without necessity for tests or adjustment services thereafter, and since the tavern keeper is required only to see to it that the pressure supplies of the components of his dispensing pressure medium are maintained.

As illustrated in the acompanying drawings the apparatus of the invention is arranged for wall mounting on a panel **10**, at the lower end of which is secured a reservoir **11** for a supply of accurately proportioned gas mixture of several gases of known densities. On the panel **10**, above said reservoir, is a suitably mounted precision proportioning apparatus indicated generally by reference numeral **12**. The apparatus **12** is adapted to deliver the several independent gases in proportioned amounts into the opposite ends of a T or mixing chamber **13** which has its center branch **14** connected to the inlet port **15** of a normally closed solenoid valve **16**. A bottom outlet port **17** of said valve receives an upright pipe **18** that projects upwardly out of the top of the reservoir and serves as an inlet for the tank and as a mounting standard for valve **16**.

Uniform tubes **19** and **20** are connected preferably by half-union and flare nut connections **21** and **22** on the opposite ends of T **13** for leading the individually proportioned gases from the apparatus **12**.

A pressure controller **23** of known design is supported on and in pressure communication with reservoir **11** and may be set in known fashion to energize the solenoid valve **16** for opening the latter when the pressure of the gas mixture in reservoir **11** drops to a predetermined minimum of say 40 lbs. per sq. inch, and to deenergize valve **16** for closing it when the pressure in said reservoir reaches a predetermined maximum, of say 45 lbs. per sq. inch. An electrical connector box **24** is supported at its opposite ends by connecting said ends to the casings of valve **16** and controller **23** respectively. An electric supply cord **25** is arranged at one end to be plugged into a suitable electrical outlet (not shown) while the other end of cord **25** enters box **24** from the rear and is connected therein in known manner with the control circuit wires, such as W, for the solenoid valve **16** and the controller **23**.

The pressure of the mixed gases in reservoir **11** is indicated by a pressure gauge **26** supported thereon and in pressure communication therewith and is used to verify the pressure limit settings of controller **23**.

A manually set adjustable gas pressure regulator **27** controls the delivery pressure of the gas mixture from the reservoir **11** and is provided with a pressure gauge **28** which indicates the adjusted output pressure from said reservoir to a gas delivery tube **29** which leads to a utilizing device (not shown) that may require the proportioned gas mixture at a selected pressure of say 38 lbs. per sq. inch for its operation.

I prefer in order to facilitate initial adjustments that the regulator **27** shall be of known type which will automatically vent and quickly relieve any excess pressure in a line such as **29** that is connected with the output side of the regulator and thus obviate having the gauge **28** register an accumulated pressure instead of its adjusted delivery pressure in the event the regulator is adjusted backward to a lower delivery pressure. If desired an ordinary pressure regulator and a pressure relief cock in the system may be substituted for the preferred form of regulator **27**.

In the apparatus **12** at the top of the panel **10** is a centrally located manually adjustable master gas pres-

sure regulator 30, of the same preferred type as the regulator 27, and the gauge 31 on the regulator serves at all times to indicate the outlet pressure as adjusted by the said regulator. Into the regulated pressure outlet 300 of the master regulator 30 is connected the center branch of a pipe T 32. The master regulator 30 has two opposed inlet ports and a pair of like check valves 33 and 34 are connected with said ports for admitting a non-return flow of two independent gases which are mixed in undetermined proportions in said regulator and pass through the regulator into T 32 as a fluid pressure medium at the pressure for which the master regulator 30 has been manually adjusted and which desired pressure is indicated on gauge 31.

In the embodiment shown (Fig. 1) the independent gases to be proportioned are air and carbon dioxide and the supplies thereof are provided by a motor driven air compressor and tank unit 35 such as is commonly used in taverns, and a commercially available tank of liquid CO_2 36. These independent gases are directed at suitable pressures from their sources 35 and 36 through check valves 37 and 38 into fluid pressure adjustable gas pressure regulators 39 and 40 respectively, the latter being of like construction. Regulators 39 and 40 are herein variously referred to as pressure adjustable, or pressure adjusted gas pressure regulators to distinguish this special type of regulator from the commonly known manually adjustable gas pressure regulators. As a matter of economy these regulators may be a simply and easily modified form of an inexpensive commercially available gas pressure regulator with the bonnet adapted to have a tube such as 41 and 42 connected thereto instead of the well known pressure spring and adjusting screw such, for example, as used in the master regulator 30. The tubes 41 and 42 serve to connect the opposite ends of T 32 with the pressure tight interiors of the bonnets of regulators 39 and 40 respectively so that both of said regulators will be always simultaneously adjusted to identical pressures as established by the setting of master regulator 30. In this way I have eliminated all possibility of error in securing absolutely equal adjusted pressure output of independent gases through regulators 39 and 40 and no gauges nor pressure springs of possible inequality of response are involved.

The regulators 39 and 40 each have an unregulated bypass port from which the pressures of the independent gases are directed through check valves 33 and 34 respectively into the opposed intake ports of the master regulator 30.

The independent gas sources 35 and 36 are arranged close to panel 10 and are subjected to the same atmospheric temperature conditions and the gases, as supplied therefrom to the opposite sides of proportioning apparatus 12 may be safely assumed to be at equal or substantially equal temperatures. These independent gases at assumed equal temperature are directed at equal pressures to the outlet ports of the respective regulators 39 and 40 from whence they are to be directed through tubes 19 and 20 into a common mixing chamber or T 13 which is connected to the normally closed solenoid valve 16. Therefore any pressure drop is uniform for each of the independent gases when they are allowed to flow through mixing chamber 13 and valve 16 into reservoir 11. Moreover the densities of the independent selected gases to be mixed are known or can be determined.

In order to enable a precise calculation of the action of the gases according to accepted equations relating to the gas laws, I arrange, by means of paired fixed orifice elements 43 and 44, to cause the gases to effuse therethrough from the regulators 39 and 40 into tubes 19 and 20 at a rate that is slow enough to avoid appreciable cooling of the gases.

The sets of fixed paired orifice elements 43 and 44 form an important feature in the combination hereinbefore described. They are superficially identical and can be interchangeably introduced into the apparatus by screwing one end of each into the respective outlets of regulators 39 and 40 while the remaining ends are connected with tubes 19 and 20 by means such as flare nuts 45. The individual element of each pair, such as 43 and 44, has a precision drilled orifice of selected size that is related to the orifice in the companion element in said pair, according to calculations under the gas laws so that volumes of gases of known densities passing therethrough during the identical time period will be in known proportions to each other and hence the mixture of the gases will be of precise and known proportions. As an example if the orifices in elements 43 and 44 are of equal area and CO_2, with a density of 0.0019768 and air, with a density of 0.0012928 are effused through them in the apparatus under the conditions of assumed equal temperatures (and without cooling) and subject to equal pressures before said orifices and flow into a common mixing tank it will be found by mathematical calculation that the amount of CO_2 delivered into the mixture will be 44.712% of the total mixture and the air delivered into the mixture will be 55.288% of the same total mixture during any given period of time. By computations the specific and unequal orifice areas for various other sets of fixed paired orifice elements may be determined for yielding other wanted percentage proportioned mixtures of the same gases by the apparatus.

The calculations as required for two specific gases may prove ponderous and ill suited to use by field installers of the devices particularly where the several factors in the particular use may differ appreciably from each other in some cases, and only slightly in other cases. In order to expedite the process of selection of the proper set of fixed paired orifice elements to the existing conditions at hand it is preferred that all of the calculations for covering the complete range of probable requirements of percentage proportioned mixtures of specific pairs of known gases may be carefully made and examined and then grouped where negligible differences are permissible and thus provide a basis for producing a corresponding reduced number of different sets of fixed paired orifice elements. The results may be charted under simplified identification numbers for both elements in a given set as a field working chart or table. The elements themselves may be properly drilled with standard and special drills as required and both elements of the set clearly identified by the number indicated in the chart or table, and the individual elements of the set are further identified as to the gas to be effused therethrough to expedite correct installation in the apparatus.

In this process of simplification for field use it is frequently found that tooling costs may be reduced by careful attention to the grouping of permissible orifice sizes to enable the employment of standard drill sizes to the greatest extent. This is made possible by the fact that the effectiveness of the apparatus is dependent on the proportionate relation of the orifice sizes in a given pair of elements rather than on a specifically designated size of orifice area in each of them.

The detailed construction of the parts may be varied, within reasonable limits, from those illustrated but it has been found practical in adapting the proportioning apparatus of the invention to the improved method of dispensing draught beer, to utilize as the air pressure source the existing air compressor assembly in the tavern in which the improved method is to be practiced. Such an air pressure source usually comprises an air pressure tank 46 with a motor driven compressor 47 mounted thereon and an electrical control 48 responsive to the pressure in the tank 46 for starting the motor 49 when the tank pressure reaches a predetermined minimum of say 55 lbs. per sq. inch and for deenergizing the motor when the compressor has built up the tank pressure to a selected maximum of say 75 lbs. per sq. inch. The motor 49 thus operates at relatively infrequent intervals. The air intake pipe 50 may be extended as desired in order to secure the purest and cleanest air available in the environs of the tavern and the end of said pipe is desirably downturned and provided with a dust strainer 51 to preclude the entry of dust particles and to avoid the intake of moisture to the best advantage. The air tank 46 preferably has a pipe T 52 connected to its outlet port and a pressure gauge 53 is connected to the upturned center branch of said T for indicating the actual pressure in said tank. Another pipe T 54 has its center branch connected with one end of T 52. An air filter 55 of the activated carbon type, connected at its lower end with the upturned end of the T 54, serves to filter, deodorize and largely purify air from tank 46, and a moisture trap 56 is connected with the downturned leg of T 54 and is equipped with a suitable drain cock 57.

An air supply line 58 leads from the air filter to the

check valve 37 and has a suitably mounted strainer 59 therein (see Fig. 2).

The CO_2 supply 36 includes the usual steel tank 60 containing liquid carbon dioxide which supplies the CO_2 gas to a conventional pressure reducing valve 61 of the adjustable type and provided with a pressure indicating gauge 62 for the gas delivered at say 65 lbs. per sq. inch through suitable means such as a flexible hose 63 to the check valve 38 through another strainer (not shown) similar to strainer 59 (Fig. 2) in the air line.

Reference is now made to Fig. 2 for detailed consideration of one of the two substantially similar arrangements of parts that are connected with opposed intake ports of the master regulator 30 to the respective gas supply lines with gas-tight connections. As illustrated the air supply line 58 with flared end has a flare nut 64 thereon for connection with one end of a half union member 65—66 supported in the strainer member 59. Member 65—66 has a male SAE threaded and seated end 65 which receives the flared end of line 58 and the flare nut 64. Strainer member 59 contains a wire cloth element 590, and has a female pipe threaded end 67, that receives the pipe threaded end 66 of the half union member, and a male pipe threaded end 68. A check valve assembly 37 comprises an end 370 with a female threaded inlet 69 which has the pipe threaded end 68 of part 59 secured therein. An externally standard ⅜" pipe threaded body 70 on part 370 has a reduced bore 71 of 3/16" diameter, approximately the diameter of the passage for air through the reduced bores of half union 65—66 and strainer member 59 and said bore 71 extends through the reduced end 72 which is annularly undercut on the external periphery for receiving a well known type of Thomas vent 73. The end part 370 with the Thomas vent 73 mounted thereon is screwed into the hollow ⅜" standard pipe threaded interior of an exteriorly polygonal retainer sleeve 74, which has a pipe threaded male projection 75 that is screwed into the inlet port of regulator 39 and has a passage 76 of the same reduced diameter as bore 71 in end 370. It will be noted after the rubber Thomas vent 73 has been expanded and seated over the part 72 of end 370, the said member 73 will contract at its base to allow the assembled parts to enter snugly into the retainer sleeve 74 as end 370 is screwed tightly therein. The Thomas vent is thus circumferentially restrained against expansion under sudden pressure surges and hence cannot under any circumstances be displaced as otherwise often happens with this desirable elastic element.

Into the by-pass outlet port 77 of regulator 39 is screwed a check valve assembly 33 comprising an end 330 which is a modified form of end 370 and has a projecting male pipe threaded inlet part 78 instead of female threaded inlet part 69 and said end 330 cooperates in the manner just described with another of the retainer sleeves 74 which has the male extension 75 thereof threaded directly into one of the opposed intake ports 79 of the master regulator 30. The Thomas vent in check valve 33 is shown in a different radially adjusted position from the corresponding element in check valve 37 in the interest of disclosure only.

The simple conversion of the fluid pressure adjustable gas pressure regulators 39 and 40 from commonly available manually adjustable regulators will be readily understood from an inspection of Fig. 2 wherein the bonnet 80 of the regulator is shown to have the usual pressure adjusting spring and the externally operable adjusting screw removed and a pipe elbow 81 (or any other fitting) screwed into the bore that normally takes the adjusting screw. It will thus be appreciated that the pressure regulating valve element 82 is responsive to the pressure introduced into the bonnet and acting on diaphragm 83 which carries said valve element 82. The bonnet 80 is imperforate and gastight.

It is to be noted that the master regulator 30 is of known commercially available type and has a vent hole 84 in the bonnet 85 thereof and a bleeder bore 86 through the center of its valve element 820. This regulator employs a pressure spring 87 and an adjusting screw 88 similar to those used in this and other types of manually adjustable gas pressure regulators.

In Fig. 4 there is shown partly in cross section, one of the members 44 of the pair or set of paired fixed orifice elements 43—44. These are of special design and all elements for all sets are cheaply produced in quantity save for the drilling of the selected precision orifice 89 which is formed, according to specification, in the originally closed thin end wall 90 of the male pipe threaded end 91 that is screwed into the adjusted pressure outlet port 92 of the pressure adjustable gas pressure regulator 40. The element 44 has an intermediate hexagonal shoulder 93 and its opposite end 94 is formed to provide a thread and a male flare seat in known fashion to cooperate with the pipe 20 and flare nut 45.

The fixed orifice in each element, such as 43 or 44, is drilled to provide an orifice area which, during operation of the apparatus, will effuse a desired proportional volume of a gas of known density into mixture with another gas of known density that effuses through the fixed orifice area of a companion element during an identical time interval in which said companion orifice area will deliver its own desired proportional volume of said other gas. The orifice areas in any given pair of elements are of selected size-relation and the dimensions may be increased or decreased, so long as the size-relationship is maintained, without changing the proportions of the gases in the mixture. The dimensions are selected as small as feasible for the required rate of supply of the mixture. The employment of a reservoir such as 11 is imperative because it provides a means for supplying a required minimum pressure drop beyond the paired fixed orifices to assure accurate results.

The aforementioned size-relationships of the orifices of different pairs of elements may include equal orifice areas in several actual dimensions for a selected percentage of proportioned mixture of stated gases to be delivered in mixture at selected minimum rates. The size-relationships may include unequal orifice areas of varying size-relationships to provide various known mixtures in which the percentage proportions of the gases are varied as required. When a different pair of gases is to be mixed by the apparatus the selection of paired orifices will be made after computations are made on the basis of the known densities and the proportional volumes required for each gas in the desired mixture.

From the foregoing it will be understood that any two gases of known densities (which do not act chemically on each other) may be mixed in known percentage proportions, using a unit of apparatus as described and one properly selected pair of fixed orifice elements. Before a detailed review of the operation of the unit, it may be pointed out that percentage proportioned mixtures of more than two gases may be effected by employing additional units of the invention. To mix three gases, two of the gases may be proportionally mixed in one unit of the apparatus and the resultant mixture (at suitable pressure) may be entered at one side of a second unit while the third gas will be entered at the remaining side of said second unit. When four known gases are to be proportionally mixed, two of said gases may be mixed in suitable proportions by means of one unit of the apparatus, while the remaining two of said gases are mixed in a second unit. Then the mixtures from both units are proportionally mixed by means of a third unit. As an alternative mode of mixing four gases, two of said gases may be mixed in a first unit, then the product mixture of said first unit may be mixed with a third gas by means of a second unit and finally the mixture from the second unit may be mixed with a fourth gas by using a third unit of the apparatus. In every instance the unit referred to will have its own complete arrangement of elements including its own reservoir for accumulating the gas mixture and delivering it at regulated pressure.

The operation of the apparatus, after selecting the two gases to be mixed in stated proportions and inserting the properly chosen pair of fixed orifice elements, is as follows. Assuming the gases are air and CO_2, and the delivery pressure of a selected mixture thereof through the pipe 29 is required to be maintained at a constant 38 lbs. per sq. inch, gauge pressure reading, the apparatus and gas supplies would be set as follows. The pressure controller 23 would be adjusted to open valve 16 when gauge 26 indicates a pressure of 40 lbs. per sq. inch, and to close valve 16 when said gauge 26 indicates a pressure of 45 lbs. per sq. inch in the reservoir 11. The master regulator would be set to register 50 lbs. per sq. inch. The air supply unit 35 would be adjusted so that the control 48 will start the

motor 49 when the pressure in tank 46 drops to 55 lbs. and will stop the motor at an arbitrarily selected pressure of 75 lbs. per sq. inch according to the reading on gauge 53. The regulator 61 for the CO_2 cylinder 60 would be set to equal a mean between the high and low pressures of the air supply which in this example would be 65 lbs. per sq. inch gauge reading on gauge 62. The air and gas supplies 35 and 36 are located in the same room and close to the apparatus so that both of the gases assume room temperature and assumed equal temperature. Tests made in summer and winter with an intake 51 located in the outside atmosphere have shown no appreciable change in results and this is apparently due to the fact that in passing through the compressor and into mixture with air in tank 46 at room temperature and then through the line 58, the air as well as the CO_2 supply, entering check valves 37 and 38 respectively, are close enough to equal temperatures for practical purposes.

When the connections have been made and the regulated supplies of the gases adjusted the pressure air through line 58 and check valve 37 will be delivered into the fluid pressure adjustable regulator 39 at a pressure between 55 and 75 lbs. per sq. inch, and will also be by-passed at the same pressure through regulator 39 and check valve 33 and delivered into one side of the master regulator 30. The CO_2 is delivered at an adjusted pressure of 65 lbs. per sq. inch by regulator 61 as indicated on gauge 62 and passes through check valve 38 into fluid pressure adjusted regulator 40, and is also by-passed therefrom and through check valve 34 into the opposite side of master regulator 30 in which the two gases, viz air and CO_2 mix in some undetermined proportions to provide a regulatable pressure fluid medium at the higher of the pressures as delivered by the independent supply sources 35 and 36 and received in said master regulator 30. The check valves 33 and 34 preclude return flow so that the individual gases are not mixed due to unequal pressures of their respective supplies. Assuming the reservoir 11 to have atmospheric pressure therein when the device is installed, the gauge 26 will indicate zero gauge pressure and pressure controller 23 when properly energized will hold solenoid valve 16 open. Since there is no pressure flow from reservoir 11 to line 29 and the latter is presumed to be initially vented to atmosphere the gauge 28 will also indicate zero. Gauge 53 will indicate the accumulated pressure in air tank 46.

The master regulator 30 is now adjusted until the gauge 31 indicates 50 lbs. per sq. inch (gauge reading) which is less than the lower of the two gas supplies and thereupon the undetermined mixture of the gases flows as a fluid pressure adjusting medium at a pressure of 50 lbs. per sq. inch into T 32 and from opposite ends of the latter, through the tubes 41 and 42 into the bonnets of the gas pressure regulators 39 and 40 where this pressure acts on the diaphragms such as 83 (Fig. 2) so that both of said regulators are uniformly and simultaneously adjusted according to the adjusted pressure setting of the master regulator 30.

The individual gases, viz air and CO_2 will then be delivered at equal pressure of 50 lbs. per sq. inch to the top or orifice ends of the fixed paired orifice elements 43 and 44 respectively and will effuse through the selected orifices into the equal tubes 19 and 20 respectively and from thence into opposite ends of mixing T of chamber 13. The mixture according to the percentage proportioning operation of the apparatus now flows through tube 14 into the inlet 15 of the now open solenoid valve 16 and through it into reservoir 11. This flow of accurately proportioned gas mixture continues until the accumulated pressure thereof in reservoir 11 reaches 45 lbs. per sq. inch gauge reading on indicator 26 at which time the controller 23 will deenergize the solenoid valve and allow it to close automatically, if said controller 23 has been properly adjusted. When valve 16 is closed the regulated pressure of 50 lbs. for the air may pass from regulator 39 through the orifice element 43, tube 19, T 13, tube 20 and up to regulator 40. Under the same condition the CO_2 may similarly reach but will not pass the regulator 39. Since the gases in the tubes 19 and 20 have been proportioned the diffusion of the gases even after a long period of time will in nowise affect the proportions of the mixture when it is later charged into the reservoir.

It is to be noted however that if one of the independent gas pressure sources fails or falls below the adjusted pressure of the master regulator 30 while the other gas supply is continued at above the said adjusted pressure, then the latter gas alone may be supplied by its regulator 39 or 40 and the reservoir 11 may ultimately deliver the single gas to pipe 29 at the adjusted pressure of regulator 27. Such an emergency allows a selected pressure to be continued without the benefit of a specific selected proportional mixture of gases until the deficiency or difficulty with a gas supply is remedied and is particularly valuable as a stand-by adjusted pressure source for the draught beer dispensing method of my invention hereinafter described.

Method of dispensing draught beer

The beer dispensing method of the present invention presupposes proper refrigeration temperatures for beer stored in cooperage and serves to maintain draught beer in said cooperage after the cooperage is tapped, in the original fine condition which it had when sealed in the cooperage at the brewery so that each glass of beer drawn therefrom is perfect from the standpoint of taste and appearance regardless of how long the said cooperage remains on tap before it is completely emptied. In maintaining the beer in its original condition until the tapped cooperage is finally emptied by the method of the invention, the gas proportioning apparatus as described hereinbefore is preferably used although other means for accurately proportioning gases may be used if the high cost of other precision apparatus is ignored.

In carrying out the method of the invention, the combination of the individual factors of precooler temperatures, and temperatures which the beer may acquire in the beer lines and proper dispensing pressure must be taken into consideration and from them an accurate determination must be made of the requirements for retaining, in solution in the beer, the original amount of CO_2 that was introduced into the beer at the brewery to provide the desired characteristics in the beer.

These original characteristics may be lost in many ways after the cooperage is tapped at the tavern although they are retained in the sealed cooperage if handled in approved manner. Since the aforesaid characteristics of the dispensing equipment may vary in different taverns, the initial preparation for the practice of the improved method of this invention should be carefully carried out and thereafter uniformly maintained.

The invention consists essentially in matching the internal pressure from the original average volume of CO_2 in solution in the beer with a like pressure of CO_2 gas on top of the beer in the tapped cooperage under the particular temperature conditions prevailing in the precooler in the tavern at hand and supplementing the pressure of the CO_2 gas with air pressure sufficient to provide a proper dispensing pressure for the particular installation. These factors are resolved into a predetermined mixture of CO_2 and air applied to the top of the beer in the cooperage at a determined dispensing pressure from the time the cooperage is tapped until it is completely emptied. The per cent of CO_2 required in the pressure dispensing medium depends on storage temperature and dispensing pressure of the beer being dispensed.

Under these conditions it has been found that beer dispensed by the glass will always be uniformly fine as judged by taste and appearance and a barrel or other cooperage unit will yield a greater number of glasses of beer when dispensed according to the improved method in a given tavern than a similar barrel could yield in the same tavern before adopting the method although the same dispensing equipment (excluding the accurate gas proportioning apparatus) was used. The result can be accounted for in a comparative cash return average per barrel before and after the practice of the invention.

It is to be understood that it has been heretofore proposed to mix CO_2 and air in some generalized attempt at securing a general proportion for universal use as a pressure dispensing medium for draught beer, and also that air pressure alone or CO_2 gas pressure alone have been used to dispense beer. In nearly all such practices there has been resultant deterioration from the original fine quality of the beer, either in the cooperage or in the beer lines or in both, due to the fact that the original CO_2 content of the beer was not maintained constant throughout the entire dispensing system during the entire period of dispensing each cooperage unit from the time

of tapping until emptied. Thus it has followed that beer has long been dispensed with inferior, or depreciated quality and with accompanying tapping losses due to wild beer, flat beer, and/or discarded tail end beer. These evils have been generally accepted by the tavern keeper as unavoidable, and often without his realization of their existence.

In preparation for adopting the improved method of dispensing draught beer to a given dispensing apparatus in a given tavern, a survey is made of the conditions prevailing there. First, the average precooler temperature for storage of beer in cooperage is determined, then after determining the highest temperature in the beer lines or faucets and the total vertical lift for the beer as measured from the bottom of the cooperage to the highest point in said lines or faucets, a correct minimum dispensing pressure is calculated and adopted. This correct minimum dispensing pressure is the sum of two calculated pressure factors. The first factor is the pressure required for the total vertical lift of the beer in the system at hand. The second factor is the calculated pressure required to retain the CO_2 content in the beer in the warmest point in the lines against separation from the beer at that point. As a matter of good practice the high temperature point in the lines or faucets should not exceed 60° F. and if it does the condition should be corrected. If the existing dispensing pressure is less than the calculated correct minimum dispensing pressure, then corrections must be made to permit the use of a higher dispensing pressure.

Where an excessively high dispensing pressure is found in use in a given installation where the method is to be adapted it is usually found that faulty installation has made it necessary to adopt said excessively high dispensing pressure to cover up the fault, and a generally inexpensive correction of the fault will permit a lower and safer dispensing pressure to be used. Exceedingly high dispensing pressures should be avoided because they are unnecessary; dangerous to the person who taps the cooperage; too hard on equipment, such as beer lines, flares, connections, taps, faucets and wood cooperage; and they make it unnecessarily difficult to hold pressure completely in cooperage without loss at base of tap, at the bung, or through wood cooperage itself.

What is claimed is:

1. Apparatus for percentage proportioning of gases in a mixture comprising a pair of pressure adjusted gas pressure regulators, a manually adjusted gas pressure regulator connected for delivering the adjusted output pressure therefrom equally to said pair of regulators for adjusting the latter, check valves leading into the respective regulators of said pair of regulators, other check valves providing by-pass connections respectively from said pressure adjusted regulators into said manually adjusted regulator, a pair of fixed orifice elements removably mounted one in the outlet port of each of said pressure adjusted regulators, a T member having a center outlet port, a valve connected to said port, a pair of uniform tubes extending from opposed ends of said T, and means on the free ends of said tubes removably connecting said ends severally to the respective orifice elements.

2. In a gas proportioning apparatus the combination of a pair of pressure adjustable gas pressure regulators each having an adjusting pressure inlet port, a pressure gas inlet port, a pressure gas by-pass port, and a regulated pressure outlet port, a selected pair of fixed orifice elements having size-related orifice areas, said elements removably and replaceably connected one in the regulated pressure outlet port of each of said regulators, a pair of uniform tubes each adapted at one end for removable connection with one of the said elements, a T having the remaining ends of said tubes connected at opposite ends thereof, a valve controlling discharge from the T midway its ends, a pair of check valves connected one into the pressure gas inlet port of each of said regulators, a manually adjusted gas pressure regulator having a pair of opposed pressure inlet ports, a pair of check valves connecting the pressure gas by-pass ports of the pair of regulators with the opposed pressure inlet ports of the manually adjusted regulator, a uniformly branched connection between the output port of the last mentioned regulator and the adjusting pressure inlet ports of said pair of regulators, and means for connecting the first pair of check valves severally with independent sources of gases of known densities at assumed equal temperature, said selected pair of orifice elements having the orifice areas of computed sizes according to the known densities of the gases and wanted proportions of each in a mixture.

3. Gas proportioning apparatus comprising a pair of fluid pressure adjustable gas pressure regulators, independent sources of gases of known densities at assumed equal temperatures connected independently for delivering non-return supplies of the respective gases one to each of said regulators at pressures above a selected common minimum, manually adjustable means for delivering fluid pressure simultaneously and equally to both of said regulators, a selected pair of fixed orifice members removably connected one in the outlet port of each regulator whereby the several gases are supplied to the orifice members at equal pressures and equal temperatures, a T constituting a mixing chamber having an outlet intermediate its ends, a valve on said T controlling said outlet, a pair of uniform tubes connected one to each of the opposed ends of the T, means on the remaining ends of said tubes for connecting the tubes individually with the several orifice elements, and a pressure gauge on said manually adjustable means for indicating the delivery fluid pressure thereof.

4. Gas proportioning apparatus comprising two fluid pressure adjustable gas pressure regulators, two independent sources of gases of known densities at assumed equal temperatures connected severally to the respective regulators, a manually adjustable gas pressure regulator, means providing non-return by-pass connection of each of said two regulators with said manual regulator, a pressure gauge indicating the regulated output pressure of said manually adjusted regulator, a uniform branched connection directing the output pressure of the last named regulator as a pressure fluid to the two first mentioned regulators for equal adjustment thereof, selected paired fixed orifice elements removably mounted one in the output orifice of each of said first mentioned two regulators, a pair of uniform tubes removably connected one to each of said orifice elements, a T comprising a mixing chamber having remaining ends of said tubes connected respectively with the opposite ends of said chamber and having an outlet midway the ends of said chamber, a reservoir connected with said outlet, a valve controlling communication of said chamber outlet with said reservoir, a pressure controller for the valve and actuated in known manner for closing and opening the valve according to selected high and low pressure limits in said reservoir.

5. In a gas proportioning apparatus the combination of a pair of fluid pressure adjustable gas pressure regulators, separate sources of gases of known densities at assumed equal temperatures and above a common minimum pressure, means connecting the several sources for non-return flow, one to each of said regulators, manually adjusted means including a pressure gauge for delivering a fluid at adjusted pressure simultaneously to both of said regulators for adjusting them, a selected pair of fixed orifice elements removably connected one in the pressure output port of each of said regulators for receiving the several gases respectively at equal temperatures and equal pressures, a T having an outlet intermediate its ends, a valve controlling said outlet, removable connecting means for connecting said orifice elements respectively with opposed ends of said T whereby said gases are permitted to effuse through the orifice elements with an equal drop in pressure and to enter said T, the valve being adapted for opening and closing for providing equal intervals for effusion of the respective gases through the several orifice elements, the areas of the respective orifices in said elements being size-related one to the other on the basis of the individual densities of the respective gases and the effusion thereof through the specific orifice areas under equal conditions of temperature, time and pressure differential before and after said orifices.

6. In a percentage proportioning gas mixing apparatus the combination with a selected pair of independent sources of gases of known densities and assumed equal temperatures, of a pair of pressure regulators each connected for receiving a non-return flow of one of the gases, means, for simultaneously and equally adjusting both of said regulators, paired fixed orifice elements removably mounted one in each of said regulators, a T comprising a mixing chamber with a valve con-

trolled center outlet and means for effecting removable connection between the several orifice elements and the opposite ends of said T, the opening and closing of said outlet by the valve defining a common flow interval for both gases at equal temperatures, equal pressures and equal pressure drops through the several orifice elements, the areas of the respective orifices being of computed size-related areas determined on the basis of the known density of each gas and the required proportion thereof in a mixture of said gases and the stated equal conditions for both gases.

7. The draught beer dispensing method which includes the step of employing, as an unchanging dispensing pressure medium constantly acting on top of beer of known CO_2 content in tapped cooperage in a given installation of an approved beer dispensing system, an individually suited pressure of an individually suited mixture of CO_2 and air, wherein the pressure is calculated to preclude separation of original CO_2 from the beer in the warmest part of the beer lines of said system and deliver beer in a true liquid condition from the open beer faucets of the system at proper flow rate, and wherein the percentage proportion of CO_2 in said dispensing medium provides a pressure of CO_2 which matches the calculated internal pressure of the known volume of CO_2 in solution in the beer when the tapped beer in cooperage in the system is at the average temperature of beer storage in said given system.

8. The method of dispensing draught beer from tapped cooperage in a given installation of a draught beer dispensing system which comprises predetermining a correct minimum dispensing pressure for said system to deliver beer in a true liquid state at suitable speed from the tapped cooperage in said system through the open beer faucets thereof, determining the internal pressure in the beer exerted by the known amount of CO_2 in said beer when it is at the average storage temperature of tapped cooperage in said system and then constantly supplying to the top of said tapped beer in cooperage in said system, at not less than said predetermined pressure, a predetermined percentage proportioned mixture of air and CO_2 gas in which the CO_2 gas per se exerts a pressure matching the said determined internal pressure in the beer in the tapped cooperage in said given system.

9. The draught beer dispensing method which includes the step of employing in a selected installation of a draught beer dispensing system, at a determined correct minimum dispensing pressure for said system, a dispensing pressure medium of air and CO_2 gas of calculated proportional volumes in a mixture thereof, in which mixture the pressure of the CO_2 will match the internal pressure exerted in the beer, at the prevailing average storage temperature of tapped cooperage in said system, by a known original amount of CO_2 in the beer on tap in cooperage in said system.

10. The method of dispensing draught beer into the glass in prime condition from tapped cooperage in a given installation of a draught beer dispensing system during an indeterminate time interval required to empty the cooperage unit, which comprises determining a correct minimum dispensing pressure for the system to lift beer from the tapped cooperage to the open faucets of the system at a satisfactory dispensing flow rate and to prevent separation of CO_2 from the beer in the warmest part of the beer lines and faucets of said system, then determining a pressure of CO_2 gas required to act on the surface of beer of known CO_2 content in tapped cooperage in the system for matching the internal pressure due to the said known CO_2 content of said beer when the latter is at the average storage temperature for tapped beer in cooperage in said system, and finally applying continuously, at not less than the determined correct dispensing pressure, a selected percentage proportioned mixture of CO_2 and air on top of the tapped beer, said selected mixture containing a percentage volume of CO_2 to equal and match the said known internal pressure of CO_2 and a percentage volume of air to supply the difference in pressure between that of the CO_2 in the mixture and the determined correct dispensing pressure.

11. The draught beer dispensing method which comprises the step of originally determining, for a given installation of a draught beer dispensing system, a correct minimum dispensing pressure on the basis of the temperature of the warmest point in the beer lines and faucets in said system and the required vertical lift of beer from tapped cooperage in the system through said beer lines and faucets, then determining a correct actual dispensing pressure for said system exceeding the said minimum pressure sufficiently to assure adequate rate of beer flow simultaneously through all faucets in said system, originally determining the internal pressure in beer, at the average storage temperature of beer in tapped cooperage, due to known content of CO_2 in the beer and thereafter constantly supplying to the top of beer in tapped cooperage, at the said correct actual dispensing pressure, a selected correct dispensing medium consisting of a percentage volume of CO_2 to provide proper CO_2 pressure to match the aforementioned determined internal pressure in the beer and a percentage volume of air to supply the difference in pressure between the said CO_2 pressure and the said correct actual dispensing pressure.

12. The method which comprises originally determining for a given installation of a draught beer dispensing system, a correct actual dispensing pressure for said system, originally determining the average storage temperature of beer in tapped cooperage in said system, then predetermining a percentage volume of CO_2 in mixture with air, wherein the CO_2 alone will exert a pressure matching the internal pressure of beer containing a known amount of CO_2, when the beer is at said average storage temperature, and thenceforth constantly supplying the mixture so determined at the determined correct actual dispensing pressure as a beer dispensing pressure medium in said system.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,818,895	Klotz	Aug. 11, 1931
2,168,059	Buttner	Aug. 1, 1939
2,320,969	Kromer et al.	June 1, 1943
2,569,378	Hood	Sept. 25, 1951
2,580,516	Chapplow	Jan. 1, 1952

FOREIGN PATENTS

Number	Country	Date
9,436	Great Britain	May 13, 1895