

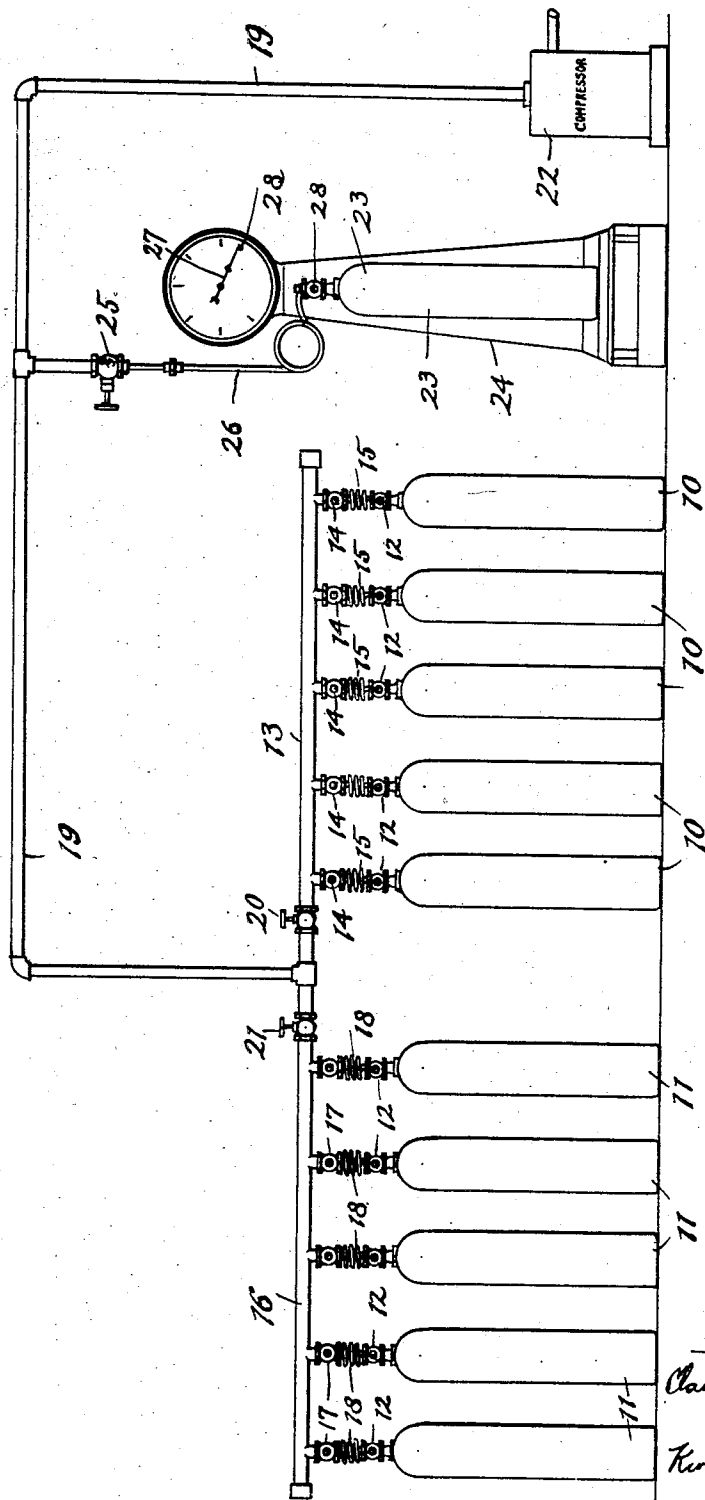
Feb. 14, 1928.

C. R. THOMAS

1,659,384

METHOD AND APPARATUS FOR FILLING GAS TANKS

Filed Jan. 29, 1927



Inventor
Claude R. Thomas
by
Kerr Hudson & Kent
Attys.

UNITED STATES PATENT OFFICE.

CLAUDE R. THOMAS, OF YOUNGSTOWN, OHIO, ASSIGNOR TO THE OHIO OXYGEN COMPANY, OF NILES, OHIO, A CORPORATION OF OHIO.

METHOD AND APPARATUS FOR FILLING GAS TANKS.

Application filed January 29, 1927. Serial No. 164,629.

This invention relates to an improved method and apparatus for charging gas tanks of the type in which gas is stored for the purpose of being transported to the point of use. It is customary to charge such tanks or "bottles," as they are sometimes called, under high pressure so that a relatively large volume of gas may be stored in a small space.

In charging systems which are now in general use, it is customary to determine the amount of gas in the tanks or bottles by means of the pressure and temperature. These tanks or bottles are ordinarily of substantially uniform capacity, that is, the space for the gas in the different tanks is uniform within commercial manufacturing limits, and it is customary to supply each tank with an amount of gas which, at normal temperature of, say 68° F., and atmospheric pressure, would have a prescribed volume, as, for example, in the case of a particular size of tank in common use, 220 cubic feet, which may be called the nominal capacity of the tank. Experience in the operation of gas manufacturing and charging plants has demonstrated that it is difficult to accurately charge the tanks or bottles with a prescribed quantity of gas, or to their nominal capacity, by the methods of measurement ordinarily used because the charging pressure necessary to supply such prescribed quantity of gas to the tank or to charge the tank with its nominal capacity will vary with the temperature of the gas.

The usual means for determining the temperature and the corresponding pressure are by means of a thermometer and the usual type of pressure gauge. In the course of the charging process the pressure is read and the corresponding temperature is also observed and a calculation is necessary to determine the pressure necessary within the container under the temperature then existing in order that the container may be filled up to its nominal capacity. The gauges available for these measurements are inaccurate and vary in the degree of accuracy from time to time, requiring almost constant calibration. In commercial plants the work of charging the tanks must be left to comparatively unskilled labor to whom the necessary temperature-pressure calculation is difficult, and as a result the

present method of charging cylinders with compressed gases is difficult, complicated, and inaccurate and causes endless annoyance in the charging plants and in the hands of customers due to the uncertainty as to the exact quantity of gas contained in such tanks.

It is the object of the present invention to overcome the difficulties that have been experienced with the methods of charging now in use by providing a method and apparatus for charging the tanks that will be accurate and will largely eliminate the matter of making allowances for variations in the temperature of the gas and permit the tanks or bottles to be charged with the prescribed volume of gas within allowable limits of variation and without requiring any particular skill on the part of the operator.

My invention will be described with reference to the apparatus illustrated in the accompanying drawing which diagrammatically shows one form of apparatus embodying my invention.

Referring to the drawing, two groups of tanks or bottles to be charged with gas are shown, one group being indicated by the numeral 10, and the other group by the numeral 11. While each of these groups are shown as consisting of five tanks or bottles, the number may be more or less, as desired. Each tank has the usual closing valve 12 thereon which is permanently attached to the tank. The tanks 10 are connected with a supply header 13 by means of branches containing shut-off valves 14 and flexible connections 15. In a similar manner, the tanks 11 are connected with a supply header 16 through branches containing shut-off valves 17 and flexible connections 18. A supply line 19 is connected to the headers 13 and 16 through the shut-off valves 20 and 21 respectively. The supply line 19 is connected with a suitable source of supply, such as the compressor 22, and there is a master tank 23, similar to tanks 10 and 11 and of the same capacity as the latter, which is mounted on the platform of a scale 24 and connected with the supply line 19 by a branch containing the shut-off valve 25 and a flexible coil 26. The coil 26 should have sufficient flexibility so as not to affect the operation of the scale 24. The scale 24 is preferably of the type having a hand 27 for

indicating the weight of the tank and its contents. The tank 23 is equipped with a shut-off valve 28 similar to the valve 12.

A given volume of any gas at atmospheric pressure and normal temperature, such as 70° F., has a definite weight which varies with different gases. My improved method and apparatus for charging the tanks utilizes this fact, and, in the charging operation, each tank is supplied with a given weight of gas regardless of its temperature or pressure.

In practicing my invention, by means of the particular apparatus illustrated in the drawing, the two groups of tanks 10 and 11 are connected with the respective headers, and, in order to operate the system continuously, I prefer to charge one group of tanks at a time. Assuming that it is desired to charge the tanks 10, the valve 21 is closed and the valve 20 is opened. The valves 12 of the tanks 10 would also be opened, the same being true of the valves 25 and 28 which control the master tank 23. The compressor 22 then pumps the gas through the supply line 19 into the tanks 10 and 23, and, on account of all of these tanks having a common supply line, the pressure and temperature in the tanks will be substantially equalized at all times. Since the weight of the master tank, when empty, can be easily ascertained from the scale 24, and since the prescribed volume that is to be charged into the tanks has a definite and known weight, I continue the charging operation until the indicator 27 shows that the desired weight of gas has been charged into the tank 23.

The pressure and temperature of the gas in the tanks 10 and 23 being equalized during the charging operation, when a given weight of gas has been supplied to the tank 23 practically the same amount of gas, by weight, has been supplied to each of the tanks 10. When the indicator 27 registers the prescribed weight on the scale 24, the valve 20 is closed and the valve 21 is opened. This allows the high pressure gas in the tank 23 to flow into the tanks 11 until the pressure is equalized in all of these tanks, after which the compressor 22 continues to pump gas into the tanks 11 and 23 until the indicator 27 shows that the desired weight of gas has been again pumped into the tank 23.

While the tanks 11 are being charged, the valves 12 on the tanks 10 are closed and the valves 14 are closed. The tanks 10 are then disconnected and replaced by empty tanks which may be charged after the charging of the tanks 11 has been completed. Upon the completion of the charging of the tanks 11, the valve 21 is closed and the valve 20 is opened, and the operation is repeated.

The master tank 23 remains connected to the system at all times and, for convenience, one or more marks 28 may be placed on the dial of the scale 24 to show the position of the indicator 27 corresponding to the desired weight of the gas that is to be charged, this weight, as above stated, varying with different gases.

My improved method and apparatus, as will be understood from the foregoing, insure that each of the tanks will be charged with substantially the same weight of gas regardless of the temperature or pressure, and the operator of the system is therefore not required to observe the pressure and temperature as in charging systems heretofore used and to vary the pressure to which the tanks are charged in accordance with variations in temperature. The operator has only to watch the indicator 27, and when this indicator reaches the desired mark 28, it is known that the proper amount of gas has been charged into the tanks. The matter of watching the indicator 27 does not require special skill on the part of the operator and the operations will be reliable because of the elimination of calculations by the operator and the inaccuracies of pressure gauges.

While I prefer to use the master tank, on the scale 24, which is of the same capacity as the tanks to be charged, it is not necessary for the master tank to be of the same capacity as the others. It may be of either greater or less capacity and the weight of gas may be measured in accordance with the ratio of the master tank to the tanks which are being charged.

Having thus described my invention, I claim:

1. The herein described method of providing a plurality of gas containers with a predetermined amount of gas which consists in simultaneously charging said containers from a supply line that is common to all and whereby the pressure in all of the containers is equalized, weighing one of the gas-receiving containers to determine the amount of gas that is supplied thereto and then stopping the charging operation when the weight of the gas in the last mentioned container reaches a predetermined amount.

2. The herein described method of providing each of a plurality of containers with a quantity of gas having a prescribed volume under prescribed conditions of pressure and temperature which consists in simultaneously charging all of said containers from a common source of supply, weighing one of the containers as it is being charged, and then stopping the charging of all of said containers when a predetermined weight of gas has been supplied to the container that is weighed.

3. The herein described method of provid-

ing each of a plurality of containers with a quantity of gas having a prescribed volume under prescribed conditions of pressure and temperature which consists in simultaneously charging some of said containers from a common source of supply, then stopping the charging of all but one of the latter containers when a predetermined weight of gas has been supplied to said one container, then allowing gas from said one container to flow into the uncharged containers to equalize the pressures, and then charging the latter containers and the one specifically referred to until the weight of gas in the latter reaches a predetermined amount.

4. In apparatus of the class described, the combination of a gas supply line, means for detachably connecting a tank, to be charged, to said line, a weighing scale, a master tank on said scale and connected to said line by means permitting said master tank and its contents to be accurately weighed, and a valve in said line for interrupting the flow of gas from said line to the tank to be charged.

5. In apparatus of the class described, the

combination of a gas supply line, a plurality of headers connected to said line, and each of which is provided with means for detachably connecting a plurality of tanks, to be charged, thereto, a weighing scale, a master tank on said scale and connected to said line by flexible means so that said master tank and its contents may be accurately weighed, and valves for interrupting the flow of gas from said line to either of said headers.

6. In apparatus of the class described, the combination of a gas supply line, a plurality of headers connected to said line, and each of which is provided with means for detachably connecting a plurality of tanks, to be charged, thereto, a weighing scale, a master tank on said scale and connected to said line by flexible means so that said master tank and its contents may be accurately weighed, and valves for interrupting the flow of gas from said line to tanks connected to either of said headers.

In testimony whereof, I hereunto affix my signature.

CLAUDE R. THOMAS.