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C. J. COLEMAN.

SAFETY RESERVOIR FOR EXPLOSIVE FLUIDS.

APPLICATION FILED APR. 28, 1905.

Fig. 1

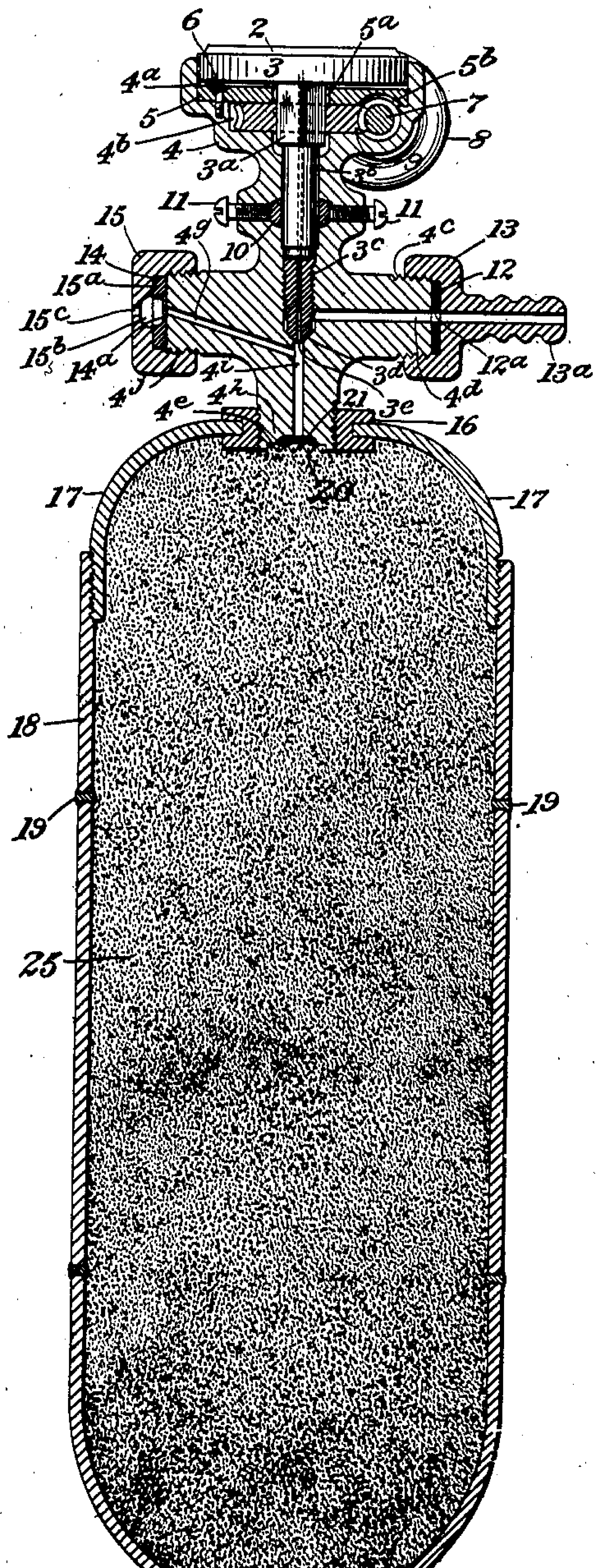
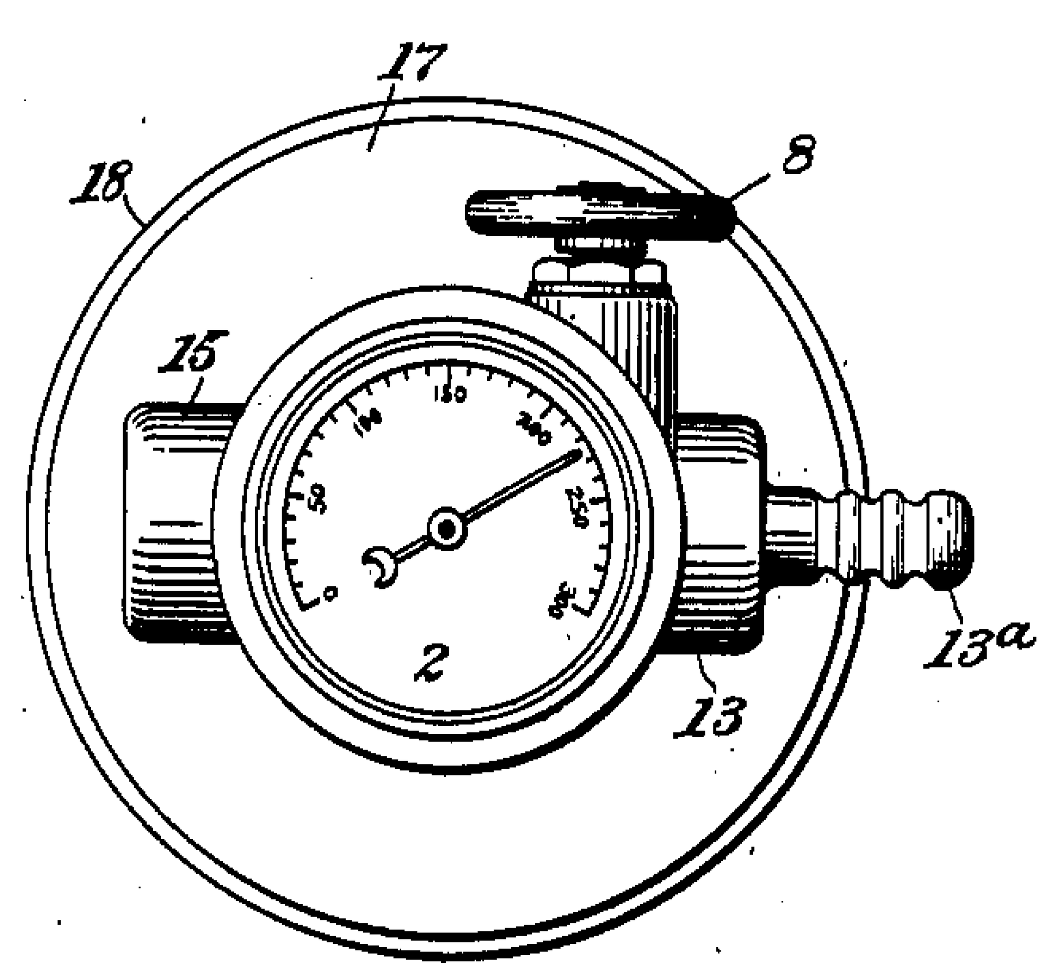


Fig. 2



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UNITED STATES PATENT OFFICE.

CLYDE J. COLEMAN, OF ROCKAWAY, NEW JERSEY, ASSIGNOR TO CONRAD HUBERT, OF NEW YORK, N. Y.

SAFETY-RESERVOIR FOR EXPLOSIVE FLUIDS.

No. 822,826. Specification of Letters Patent. Patented June 5, 1906.

Application filed April 28, 1905. Serial No. 257,853.

To all whom it may concern:

Be it known that I, CLYDE J. COLEMAN, a citizen of the United States, residing at Rockaway, in the county of Morris and State of New Jersey, have invented certain new and useful Improvements in Safety-Reservoirs for Explosive Fluids, of which the following is a specification, reference being had therein to the accompanying drawing, forming a part thereof.

My invention relates to a safe source of explosive fluid; and it consists in means for safely storing an explosive fluid, such as a gas, which is explosive by detonation, inflammation, or other causes. My invention relates more particularly, however, to a safe source of that gas known as "acetylene," which has many highly useful applications limited only by its critical liability to violent explosion either by detonation or inflammation.

It is well known that acetylene and other gases can be stored in a liquefied state in strong reservoirs and with great compactness—that it to say, in a very large quantity per unit of reservoir-space—but in the case of acetylene this practice is prohibitively hazardous, since the liquid acetylene is nearly as explosive as nitroglycerin by detonation or impact, and, further, is violently explosive by inflammation. It is also well known that acetylene can be dissolved in a liquid solvent, such as acetone, and may thus be stored in solution and with safety up to a certain quantitative limit of acetylene per unit of acetone; but when this safe limit is exceeded the solution becomes violently explosive, the solvent itself being decomposed by the explosion of the dissolved acetylene, so as to add to the explosion and its disruptive effects, and thus the acetone itself becomes a source of danger rather than of safety. As the dissolved gas is drawn off from its solvent small portions of the solvent are entrained in the gas and constitute an undesirable impurity, besides interfering with the operation of controlling-valves and other regulating devices often forming part of the apparatus in which the gas is utilized. After the liquid solvent has been charged with gas in solution the volume or quantity of the liquid solution is much greater than the initial volume or quantity of the liquid solvent, and in order to allow for this dilatation such initial volume of the liquid solvent must be considerably less than the total containing volume of the reservoir which holds it. Thus is introduced within the reservoir a very considerable free space wherein highly-explosive free gas accumulates at all times when the reservoir is not charged to its maximum capacity.

It is one object of my invention to entirely overcome the foregoing serious dangers and disadvantages entailed by the means heretofore provided for the storage of explosive fluids, such as acetylene.

It is an object of my invention to safely conserve explosive fluids, particularly acetylene, in large quantities per unit of reservoir-space approaching near to the quantities which can be conserved in free liquid form and far exceeding the quantities which can be safely conserved per unit of reservoir-space when the gas is held free or held in solution in a liquid solvent.

To the foregoing ends my invention consists in apparatus for the application of an important discovery which I have made. I have discovered that a highly-explosive fluid, such as acetylene gas, can be absorbed and concentrated in an interstitial, porous, or cellular mass of solid material, and that the explosive fluid can be safely conserved in non-explosive condition when thus absorbed and concentrated, providing the interstitial pores, cells, or spaces formed by the interstitial structure of the mass and adapted to receive the explosive fluid or element are not greater than a certain critical magnitude which is the limit of immunity to explosion. The actual substance of material *per se* of the interstitial mass of solid material may inherently exert a concentrative influence over the explosive fluid, and I have discovered that interstitial masses of certain kinds of carbon will thus safely conserve extraordinary quantities of acetylene gas, and at present I prefer to employ carbonized cocoanut-shell—that is to say, charcoal formed from the shell of the cocoanut.

In that form of my invention which at present appears to be its best embodiment the interstitial, cellular, or porous structure of the mass of solid material exerting concentrative influence upon the explosive fluid is attained partly by the coörganization of a large number of minute particles of such solid material in a closely-associated or forcibly-impacted mass forming many minute interstitial pores, cells, or spaces between the closely-associated individual particles. By this means alone a porous, interstitial, or cellular structure of the mass is attained, and when the charcoal of the cocoanut-shell is employed as material each separate particle contains minute cells, pores, or interstices of its own, thus adding to the total porosity or interstitial space of the mass as a whole. The native structure of the cocoanut-shell is minutely cellular or porous, and I believe it is due largely to this inherent characteristic that the charcoal of the cocoanut-shell has given the best results which I have so far attained by my invention.

The interstitial mass of solid material—for example, the mass of fine particles of cocoanut charcoal—exerting concentrative influence on the fluid, is preferably introduced into the interior of a strong fluid-tight reservoir, and preferably occupies all of the interior reservoir-space in order to prevent the existence of any free space greater than the interstitial magnitudes in which free explosive fluid would accumulate unprotected by the preventive influence of the interstitial mass.

When the explosive fluid—for instance, acetylene gas—is introduced into the reservoir thus filled with an interstitial mass of solid material having concentrative influence on the explosive fluid, the reservoir will receive at a given fluid-pressure a greater amount of gas than if the tank were occupied by gas alone without the interstitial mass of solid material which exerts a concentrative influence on the gas. This phenomenon is the most marked at low pressures. For instance, at atmospheric pressure the reservoir will hold about fifteen times its total containing capacity for free gas in the absence of the solid concentrative material. Of course the gas enters freely into the interstitial pores, cells, or spaces of the mass; but this free access of gas to the interstices cannot account for the extraordinary total content of gas within the reservoir exceeding its capacity for free gas alone, and such remarkable total content can only be explained by the theory that the explosive fluid or gas is highly concentrated by influence of some inherent attribute of the solid material of the interstitial mass. For instance, as a likely hypothesis, the substance or material of the interstitial mass possesses some kind of absorptive affinity for the explosive fluid or gas, which causes such fluid to be actually taken up in large concentrated quantities into the solid walls of the minute interstices of the mass, being thus literally incorporated into the material *per se*, either in fluid form or, still more likely, as a new solid component of the solid material after the manner of the occlusion of gases by metals, or, as another hypothesis, the molecular attraction or adhesive influence of the solid material upon the explosive fluid causes the fluid to accumulate upon the surfaces of the interstitial walls in a thin concentrated film of far greater density than is attainable merely by the fluid-pressure at which the gas is introduced into the reservoir. The higher the charging pressure which is employed the greater will be the quantity of explosive fluid taken into the reservoir, and, as a converse of the statement already set forth in this paragraph, it may be noted that with a given total content of explosive fluid in the reservoir the pressure thereof will be very much lower than if the fluid-concentrating interstitial mass were absent.

At ordinary temperatures the reservoir may be safely charged with two hundred or more volumes of acetylene—that is to say, two hundred or more times the actual quantity or weight of acetylene which the reservoir would contain at the same temperature and at atmospheric pressure and in the absence of the protective fluid-concentrative interstitial mass of solid material—this safe reservoir capacity being about one hundred times the maximum safe capacity of a reservoir of the same size employed to conserve free acetylene gas in a compressed state and about one and one-half to two times the maximum safe capacity of such a reservoir employed to hold the acetylene in solution in acetone, and such safe capacity of the reservoir embodying my present invention is about fifty percentage of the total amount of acetylene which could be held, although with great hazard, in liquid form in a tank of the same cubic capacity not containing the protective interstitial mass of my invention. After my reservoir has been thus charged it may be handled, hammered, and thrown about with absolute immunity from explosion by detonation, mechanical shock, impact, molecular vibration, or any similar cause and is equally free from liability to explosion by inflammation or high temperature at any local point in the reservoir. Indeed, I have demonstrated that even if a local explosion should be in any way produced in the free gas occupying the small free space of a charging and discharging duct leading to the reservoir such explosion would be confined to such local free space, and its heat and detonative force, shock, or impact would be absorbed or cushioned or otherwise prevented from propagating a general explosion by those portions of the interstitial mass of solid material immediately exposed to the free space, the explosion being not transmitted throughout the reservoir generally and the rise in pressure due to such local explosion not being sufficient to rupture the reservoir.

In order to attain in the highest possible degree the non-transmission of heat from a local point throughout the interstitial mass generally, the mass should be a poor conductor or transmitting medium for heat.

By an exhaustive series of tests I have learned that the immunity from explosion accomplished by my invention can only be attained by limitation of the interstitial spaces, cells, and pores to magnitudes below the explosive limit, and my tests have established the fact that the explosive limit of interstitial magnitudes decreases as the total reservoir content of explosive fluid increases, so that a reservoir designed for a maximum safe capacity of two hundred volumes must have smaller interstices than a reservoir designed to safely conserve a maximum content of one hundred and fifty volumes. My tests have shown that when a maximum of eighteen to two hundred volumes is to be stored and when charcoal of the cocoanut-shell is employed the interstitial spaces may be brought well below the explosive limit and well within the limit of safety if the charcoal is ground so finely that it will pass through a screen of sixty or seventy mesh and if such ground charcoal is closely and forcibly compressed or impacted within the reservoir. My tests have also shown that with the same grade of charcoal and forcibly-effected firm impactment of the particles a mesh of ninety or one hundred will bring the interstitial magnitudes well within the safe limit for storage of about two hundred to two hundred and twenty-five volumes as a maximum reservoir content. Such limitation to non-explosive magnitudes of the interstitial spaces of the mass of solid material contained in the reservoir of my invention is a most vital structural feature and necessity. I have found that the mere presence of an interstitial mass of solid material is of no avail whatever to prevent explosions unless the magnitudes of its interstitial spaces are thus regulated and determined—that is to say, unless the interstitial spaces are limited to non-explosive magnitudes. When the interstitial spaces are greater than the critical limit of safety with a given reservoir content the acetylene contained in the reservoir is violently explosive either by detonative shock or by inflaming temperatures.

A forcible impactment of the particles of the interstitial mass is not only of great importance as a means of reducing the magnitudes of the fluid-containing interstitial spaces, but is also of great importance to maintain the close association of particles with sufficient rigidity to effectually resist any dissociative force or shock which might at some local point tend to separate the particles and which might be propagated from an explosion at such local point so as to make the explosion general.

Conclusions as to the philosophy of my invention are of necessity largely empirical; but it may be stated as a likely theory that the non-explosive condition of the interstitial mass of solid material which holds the explosive fluid is attained by making each interstitial space so minute that its cubical or fluid-containing magnitude is in such a small ratio to the superficial area of its interstitial walls that the amounts of heat and detonative shock liberated and developed by explosion of the fluid in a single interstice are negligible quantities which are effectually absorbed, retarded, arrested, or cushioned without transmission to the adjoining interstices in a measure sufficient to explode the fluid contained by them. This theory is nicely compatible with the experimental finding that the limit of safe interstitial magnitudes decreases as the total reservoir content of explosive fluid increases, since according to this theory the increase of total fluid content above the safe limit with given interstitial magnitudes would incur liability to explosion merely by increasing the fluid contents and the individual explosive powers of the interstices beyond the shock and heat absorbing or arresting capability of their interstitial walls, and this increase of explosive powers of the individual interstices relative to arrestive powers of their walls could be compensated simply by decreasing the ratios of the interstitial fluid-containing volumes to their interstitial wall-surfaces, such ratios being, generally speaking, proportionate to the linear dimensions of the interstices. Upon the foregoing theory the non-explosive magnitude of an interstice might be defined as any magnitude affording a ratio of superficial wall area to cubic volume sufficiently great to effectually retard, arrest, or absorb the heat or detonation resulting from explosion of the fluid contained in the interstice. When the interstitial mass is made up of minute separate particles, other things being equal, this heat and detonation arrestive or heat and detonation absorptive ratio of superficial area to cubic volume of the interstice will vary inversely as the mesh or the linear dimensions of the separate particles of solid material, or will vary inversely as the linear dimensions or diameters of the interstices themselves, since the superficial areas of the interstices and the cubic volumes thereof vary, respectively, as the squares and the cubes of their linear dimensions. Of course it is only the maximum interstices which must be limited to non-explosive magnitudes, there being no objection, but, on the contrary, considerable advantage, as indicated hereinbefore, in having many very minute pores, cells, or interstices in the body or structure of each separate granule or particle of solid material, such pores, cells, or interstices in the granules themselves being generally much smaller than the interstitial spaces intervening between adjacent granules or particles.

As my reservoir is charged with explosive fluid the fluid-pressure therein increases until the maximum safe capacity of the reservoir is reached. The reservoir may then be sealed by a suitable valve or cock and the explosive fluid may be conserved therein for an indefinite period. When it is desired to use the explosive fluid, the valve is opened and the reservoir gives off the explosive fluid until the fluid-pressure in the reservoir is reduced to any desired value—for instance, atmospheric pressure—and during such reduction of fluid-pressure the reservoir gives back all the explosive fluid which it originally received at pressures above such terminal pressure of discharge—for instance, atmospheric pressure.

Although my reservoir when not charged beyond its safe capacity cannot be exploded by detonation or by local inflammation, such as has been described in the foregoing, it could be exploded in the absence of preventive means which I have provided and will shortly describe if the reservoir were subjected to an external temperature greatly in excess of the normal temperature. For instance, if the reservoir should be exposed to the intense heat of conflagration in a burning building the entire reservoir and its entire internal mass of interstitial solid material and explosive fluid would be subjected to a great rise in temperature, with the result of a great concurrent rise in fluid-pressure and a probable explosion of the reservoir. This contingency is avoided by the provision of a safety fluid-pressure relief-vent adapted to yield to fluid-pressure in the reservoir exceeding a predetermined value, and even with failure of the means above noted the contingency of excessive external temperatures is further anticipated by one or more fusible plugs or fillings inserted in escape holes or vents in the reservoir proper and preferably distributed over its surface, such plugs normally sealing such escape holes or vents, but fusing by the excessive temperatures so as to open the vents and relieve the internal fluid-pressure. However, even in the absence of both of the foregoing preventive measures the danger of explosion by external heat in a contingency such as noted is greatly reduced by my provision of the interstitial mass of solid material adapted by its inherent nature to retard the transmission of heat throughout the mass generally. In case of external high temperature this property of the interior interstitial mass would cause a rise of temperature to be limited for some time to the outer portions of the mass and the heat would be transmitted very slowly from the surface of the reservoir throughout its entire interior. When the fusible plugs, which have already been mentioned, are employed, this temporary confinement of the heat to the outer portions of the reservoir gives ample time for fusing of the plugs before the entire interior of the tank can become heated to a dangerous extent.

Notwithstanding the absolute safety of my reservoir when charged within its maximum safe capacity, it would be violently explosive, even at ordinary temperatures, if charged with acetylene far beyond its safe conserving capacity, and I have therefore provided automatic means for preventing such a dangerous surcharge. If my reservoir should be charged with acetylene far beyond its safe capacity, the interstitial spaces of the internal mass of solid material would accumulate acetylene in quantities having heat-producing detonative and disruptive power far in excess of the arrestive influence of the interstitial walls, and the entire reservoir would then be violently explosive either by impact, detonation, inflammation, or similar causes. In that embodiment of my invention which I have illustrated in the accompanying drawings the prevention of reservoir overcharge is accomplished by the same pressure-operated relief-vent which operates to relieve the internal fluid-pressure when the same is raised by excessive general heating from an external source of heat. This relief-vent is adjusted to open and relieve the internal fluid-pressure of the reservoir when the same rises either because of excessive internal heating or because of an overcharge during the introduction of acetylene into the reservoir.

In addition to the objects already indicated it is an object of my invention to provide compact and convenient valve mechanism for controlling communication with the reservoir in charging and discharging the same, and, still further, it is an object of my invention to provide a simple and compact fluid-pressure gage or pressure-indicating means to indicate the internal fluid-pressure of the reservoir.

I will now describe that particular embodiment of my invention which is illustrated in the accompanying drawings and thereafter I will point out my invention in claims.

In the accompanying drawings, Figure 1 is a vertical middle sectional elevation of safe explosive-fluid-conserving means embodying my invention and including the safety devices, valve mechanism, and pressure-gage already mentioned. Fig. 2 is a plan view of the apparatus shown in Fig. 1.

In the accompanying drawings, 18 is the main body of the reservoir proper, which in the particular instance illustrated is a cylindro-spherical sheet-metal tank of the seamless construction with cylindrical main portion and hemispherical bottom. The tank is filled with a mass 25 of finely-ground or granulated charcoal of cocoanut-shell, which may be forcefully tamped in place and subsequently further compressed by means of the cup-shaped screw-head 17, which screws into the open end of the main body 18 of the reservoir. The main body 18 of the reservoir is perforated at various points, and these perforations are sealed with fusible plugs 19, adapted to melt and give free vent to fluid within the reservoir when the reservoir is exposed to excessive external temperatures.

The reservoir-head 17 is provided with a central spud or connection-ring 16, swaged into a central aperture in the reservoir-head and internally threaded to receive the threaded nipple 4^h of a four-armed or four-way casting, which carries the pressure-operated safety-vent, the controlling-valve, the pressure-gage, and the nipple for connection to a charging source or a consuming apparatus.

The end of the nipple 4^h is provided with a circular recess 4^e and with a smaller counterrecess of spherical form containing cotton 21, held in place by a small circular screen 20, inserted in the circular recess 4^e and held in place also by upward pressure of the carbon granules upon which the screen lies. The screen and cotton serve to arrest minute carbon particles which might otherwwise be withdrawn, together with the explosive fluid when the tank is discharged.

A central duct 4^i leads through the connecting-nipple 4^h from its spherical cotton-containing recess upward to a conical valve-seat formed about in the center of the four-way casting and coöperating with a conical valve 3^d, formed on the lower end of a hollow valve-stem 3^b, projecting downward through a central or axial vertical bore passing through the upper arm or extension of the casting. A portion 3^c of the valve-stem 3^b is threaded in this vertical bore, so that the valve 3^d may be closed or opened by rotatively turning the valve-stem on its axis. The valve-stem contains a small axial duct 3^e, leading from the lower end of the valve-stem, where the duct always has free communication with the interior of the reservoir upward to the upper end of the hollow valve-stem 3^b and to a pressure-gage 3, fixedly mounted upon such upper end of the valve-stem and provided with a suitable glass cover or crystal 2, through which the index-hand and dial of the gage may be seen.

The pressure-gage 3 is inclosed in an annular chamber 4^a, formed upon the upper end of the upright extension of the four-way casting. A circular plate 5 is secured in the bottom of the chamber 4^a by means of flush-screws 6, and between the bottom of the pressure-gage and the top of the plate 5 sufficient clearance is allowed to permit sufficient movement of the valve-stem 3^b to close the valve 3^d. The valve-stem, which is cylindrical throughout the greater part of its length, is provided with a squared portion 3^a, extending from the pressure-gage 3 downward through an aperture 5^a in the circular plate 5 and thence through a square hole in a worm-wheel 9, contained within a circular subchamber or recess 4^b, formed in the upright arm of the casting just below the plate 5. The worm-wheel rests upon the bottom of the recess 4^b and is retained in place by the circular plate 5. A worm 7 passes tangentially through the worm-wheel chamber 4^b and meshes with the worm-wheel 9 and is provided with an operating hand-wheel 8. The circular plate 5 has a recess 5^b, providing clearance for the worm 7. Rotation of the worm 7 imparts rotation to the worm-wheel 9 and the worm-wheel in turn rotatively impels the squared portion 3^a of the valve-stem 3^b, which is free to slide longitudinally through the worm-wheel. Thus the valve-stem 3^b is operated and the valve 3^d opened or closed. A soft-metal packing 10 surrounds the cylindrical portion of the valve-stem 3^b at a point about midway between the worm-wheel 9 and the threaded portion of the valve-stem. The soft packing is held in an annular recess in the upright arm of the casting and is forced into uniform engagement with the valve-stem by means of set-screws 11, inserted radially through the casting at equiangular intervals and abutting against the soft metal.

The pressure-relief duct 4^g communicates with the upper end of the vertical duct 4^i at a point just below the controlling-valve 3^d, and thence the pressure-relief duct 4^g leads through the horizontal arm or nipple 4^j of the four-way casting and opens at the center of the extreme end of such nipple. This opening of the pressure-relief duct at the end of the nipple 4^j is normally sealed by a circular gasket or washer 14, having a thin central membrane or diaphragm 14^a, which covers the opening of the relief-duct and which yields to excessive fluid-pressure in the reservoir, whether the same is developed by overcharging or by excessive internal temperature due to accidental occurrence of great heat in the environment of the reservoir. The safety-gasket 14 is clamped firmly against the end of the nipple 4^j by a screw-cap 15, which screws over the end of the nipple and is provided with a recess 15^a, which receives the safety-gasket. A spherical subrecess 15^b provides room for the displaced ragged projections of the ruptured membrane, so that the same may not clog the central discharge-vent 15^c, leading from such spherical subrecess to the outer air.

A horizontal service-duct 4^d leads axially through the service-nipple 4^c from a point immediately above the controlling-valve 3^d to the end of the nipple. The detachable hose-nipple 13^a is formed integrally with a connecting-cap 13, which screws over the end of the service-nipple 4^c and is sealed thereto by means of a sealing washer or gasket 12, inserted in the recess of the connecting-cap 13 and clamped between such cap and the service-nipple and provided with a central perforation 12^a in register with the service-duct 4^d and with the duct passing through the hose-nipple.

It will be apparent that certain features of my invention, such as the controlling-valve and the combination of pressure-gage therewith, are not limited to adaptation in reservoirs for explosive fluids, but may be employed advantageously in pressure-fluid reservoirs generally.

It will of course be apparent that my invention may be embodied in diverse forms and arrangements of its essential elements and in various modifications of the construction which I have particularly shown and described, all such embodiments coming, however, fully within the scope and vital principles of my invention.

When it is remembered that the violent explosiveness of acetylene has heretofore prohibited its use in many utilitarian fields wherein it would be most efficiently and economically available in the absence of the explosive hazard, the great commercial value of my invention will be appreciated.

What I claim, and desire to secure by Letters Patent, is—

1. Means for safely storing explosive fluids comprising, in combination, a reservoir, and a mass of solid material inclosed in the reservoir and forming fluid-containing interstitial spaces of non-explosive magnitudes and also having inherent absorptive influence on the explosive fluid.

2. Means for safely storing explosive gases comprising, in combination, a reservoir and a dry mass of solid material possessing concentrative influence on the explosive gas, and such mass being of interstitial structure and forming gas-containing interstices of non-explosive magnitudes.

3. In a safe source of detonating-gas, the combination of a reservoir, an interstitial mass of solid material inclosed in the reservoir and having concentrative influence over the detonating-gas and also forming gas-containing interstitial spaces of non-detonating magnitude, and a gas explosive by detonation and concentrated by influence of the solid interstitial walls of the interstitial mass and also contained in the non-detonating interstitial spaces thereof.

4. In a safe source of explosive acetylene, the combination of a storage-reservoir proper, a solid material inclosed within the reservoir proper and forming minute fluid-containing interstices of non-explosive magnitude and also adapted to concentrate the explosive acetylene by inherent concentrative influence, and a charge of explosive acetylene contained in non-explosive quantities in the fluid-containing interstices and also concentrated by inherent concentrative influence of the solid material.

5. A non-explodable conserver for explosive fluid comprising, in combination, a fluid-reservoir proper and, contained therein, a mass of minutely-disintegrated solid material forcibly compacted to maintain its interstitial spaces at non-explosive magnitudes.

6. Conserving means for explosive fluids comprising, in combination, a fluid-reservoir proper and, contained therein, a mass of forcibly-compacted minute porous particles of solid-fluid-concentrative material adapted to receive the explosive fluid and to condense the same by inherent concentrative influence and also forming interstitial spaces of non-explosive magnitude adapted to receive and retain the explosive fluid between adjacent particles.

7. Means for the safe storage of explosive fluid comprising, in combination, a fluid-reservoir proper and a mass of minute particles of solid - fluid - concentrative material contained within the reservoir and forcibly compressed together to maintain their fluid-containing interstitial spaces at non-explosive magnitudes.

8. Means for storing fluids under pressure comprising, in combination, a fluid-tank, a fluid-conduit leading into the tank, a valve in control of the fluid-conduit and provided with a valve-stem, a pressure-gage mounted on the valve-stem, and a fluid-duct communicating with the fluid-conduit on the reservoir side of the valve and leading through the valve-stem to the pressure-gage.

9. Means for storing fluid under pressure comprising, in combination, a fluid-reservoir, a fluid-conduit communicating therewith, a controlling-valve in control of the conduit and provided with a threaded valve-stem, a worm-wheel through which the valve-stem passes in angularly-fixed but longitudinally-slidable relation, a worm meshing with the worm-wheel, and means for turning the worm.

10. Means for storing fluid under pressure comprising, in combination, a fluid-reservoir, a fluid-conduit communicating therewith, a controlling-valve in control of the conduit and provided with a threaded valve-stem, a worm-wheel through which the valve-stem passes in angularly-fixed but longitudinally-slidable relation, a worm meshing with the worm-wheel, means for turning the worm, a pressure-gage mounted on the valve-stem, and a fluid-duct leading from the pressure-gage through the valve-stem to a point of communication with the fluid-conduit.

11. Safe means for conserving explosive acetylene comprising, in combination, a reservoir proper and, contained therein, a number of minute particles of charcoal of cocoanut-shell forcibly impacted to maintain their

interstitial spaces at non-explosive magnitudes.

12. A source of explosive acetylene comprising, in combination, an acetylene-reservoir and a number of minute particles of charcoal of cocoanut-shell completely filling the reservoir and forcibly impacted to maintain their interstitial spaces at non-explosive magnitudes, and a quantity of explosive acetylene contained in the interstitial spaces and also concentrated by inherent concentrative influence of the cocoanut charcoal.

13. A safe conserver for explosive fluids comprising, in combination, a reservoir proper provided with a safety-vent, a fusible sealing material normally sealing the vent, and an interstitial mass of relatively non-heat-conductive solid material contained within the reservoir and adapted to confine externally-applied heat to the surface of the reservoir until the fusible sealing material is fused.

In testimony whereof I have affixed my signature in presence of two witnesses.

CLYDE J. COLEMAN.

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