(Model.) 2 Sheets—Sheet 1.

A. H. AIKMAN & G. K. OSBORN.

Hydraulic Relay.

No. 242,806. **Patented June 14, 1881.**

Fig. 1.

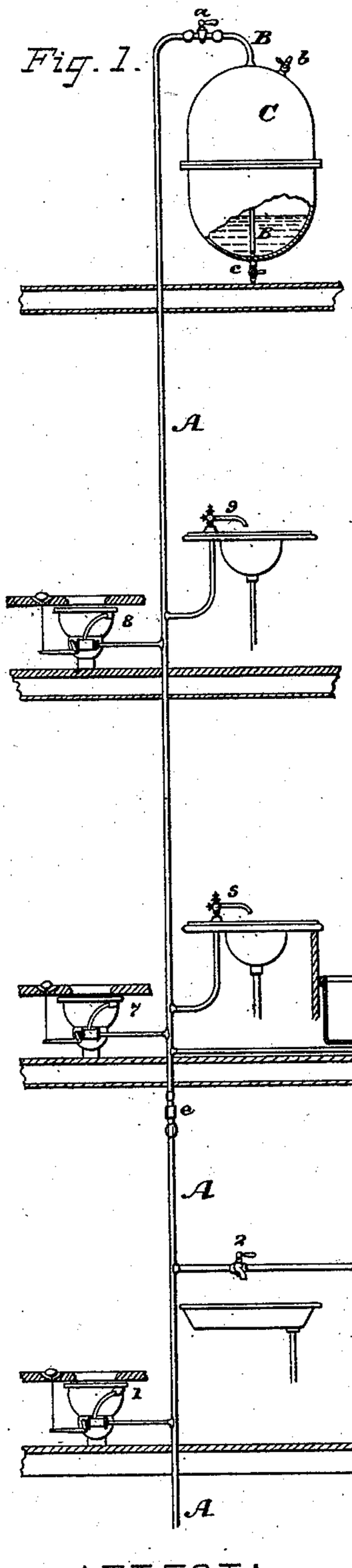


Fig. 2.

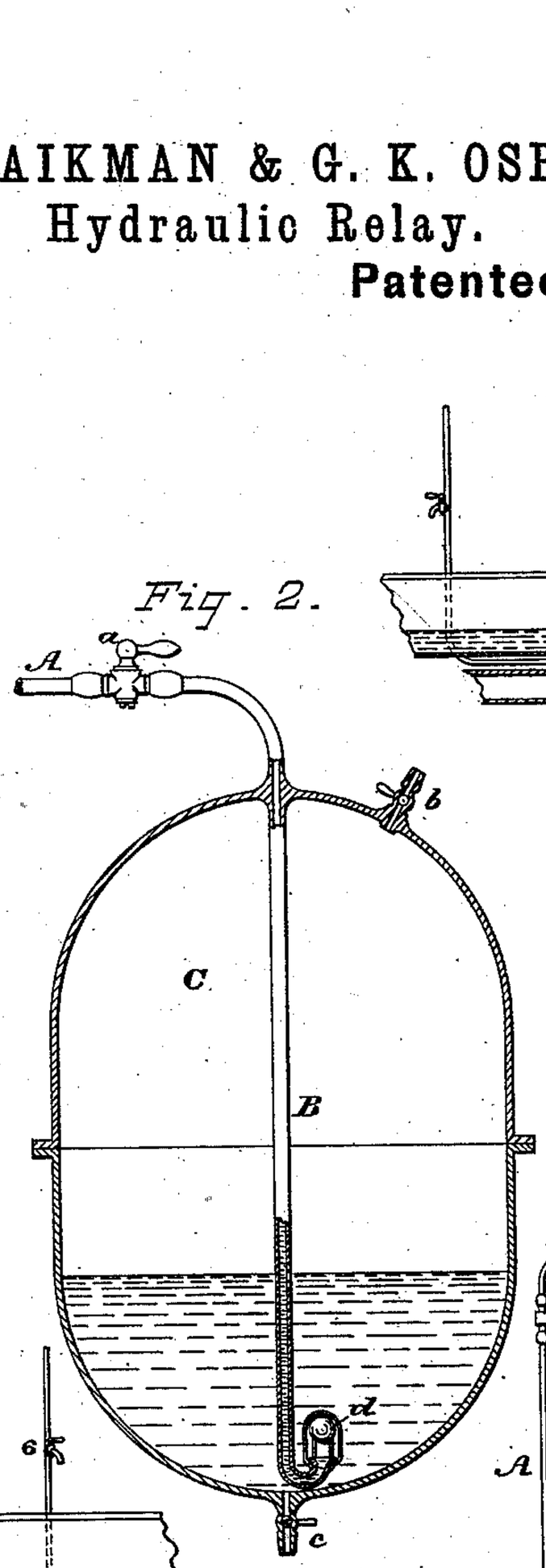
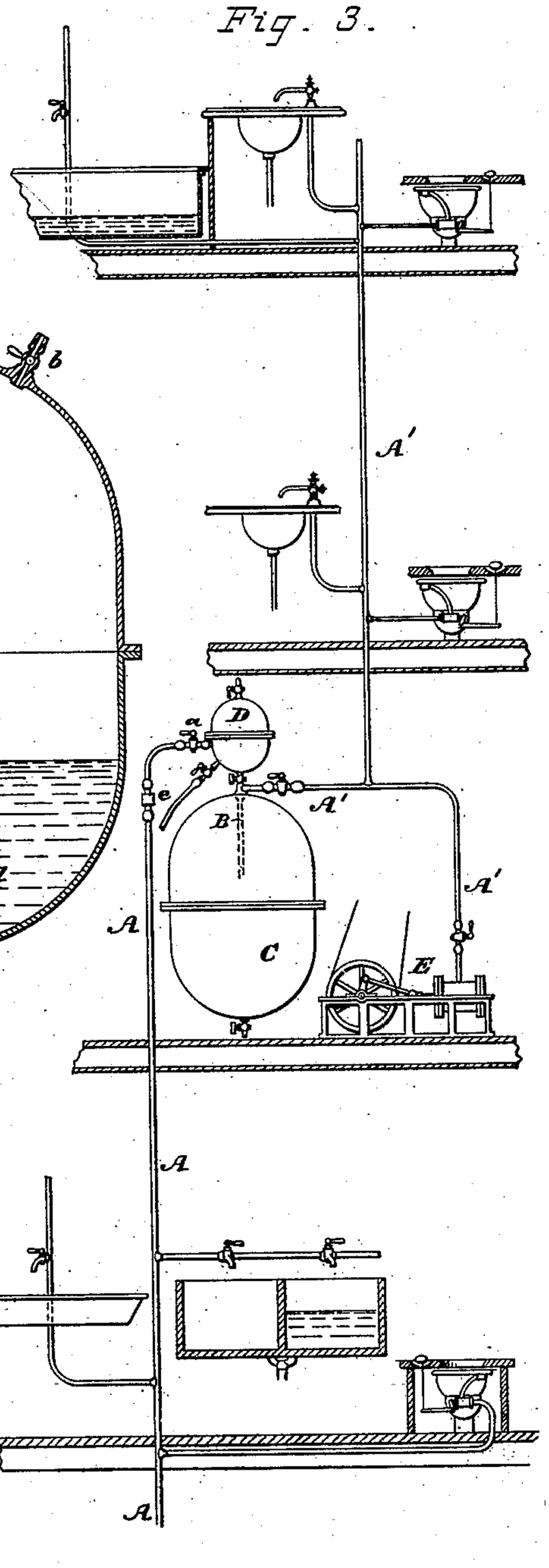


Fig. 3.



ATTEST;

Walter W. & Co. A.

George H. Fraser.

INVENTORS;

Augustus H. Aikman.

George K. Osborn

by their Attorneys

Burke, Fraser & Bennett

(Model.) 2 Sheets—Sheet 2.

A. H. AIKMAN & G. K. OSBORN.

Hydraulic Relay.

No. 242,806. **Patented June 14, 1881.**

Fig. 4.

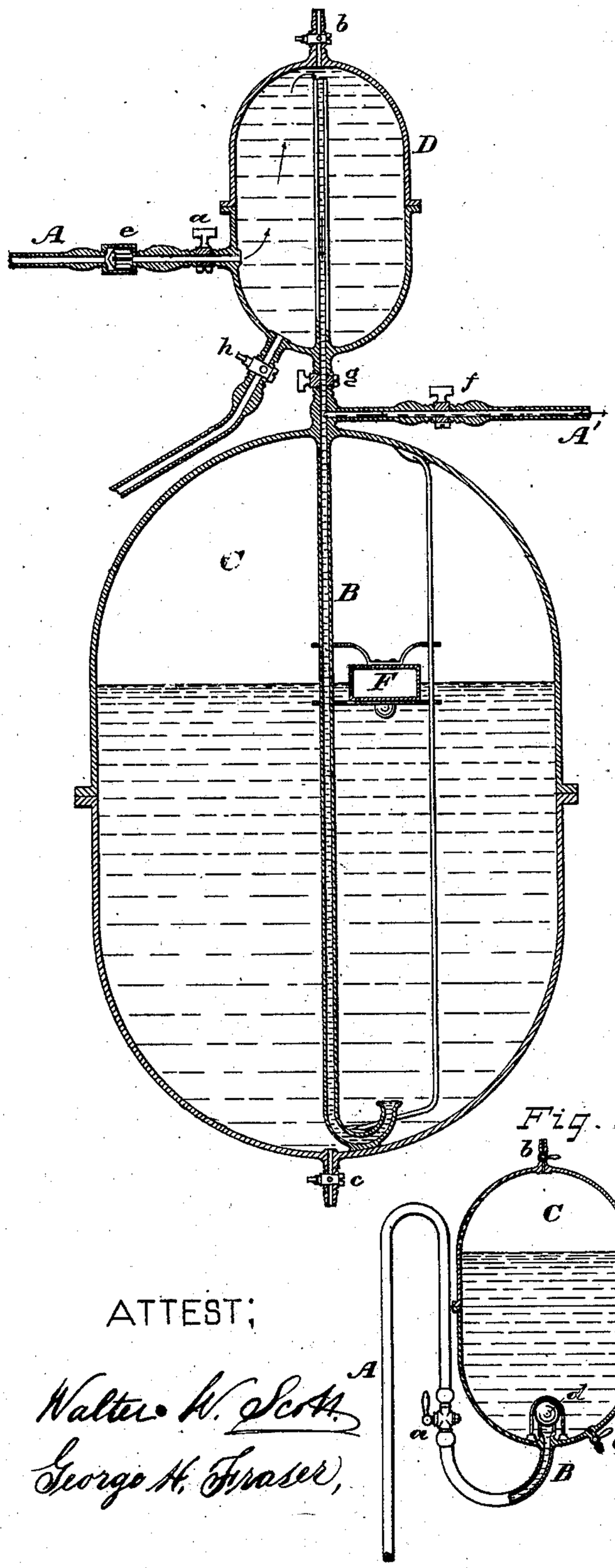


Fig. 5.

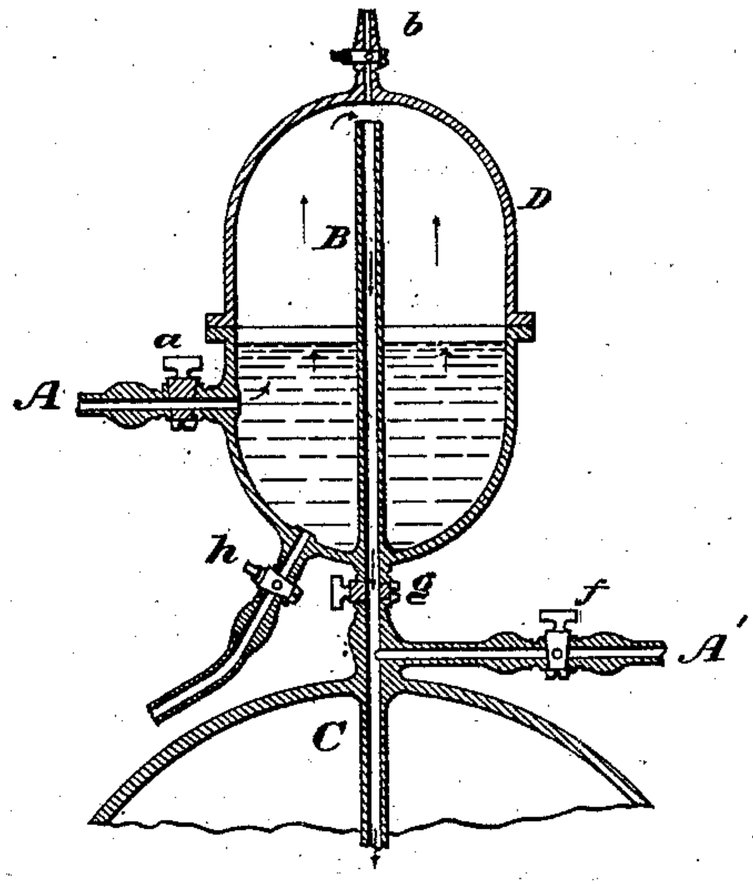


Fig. 6.

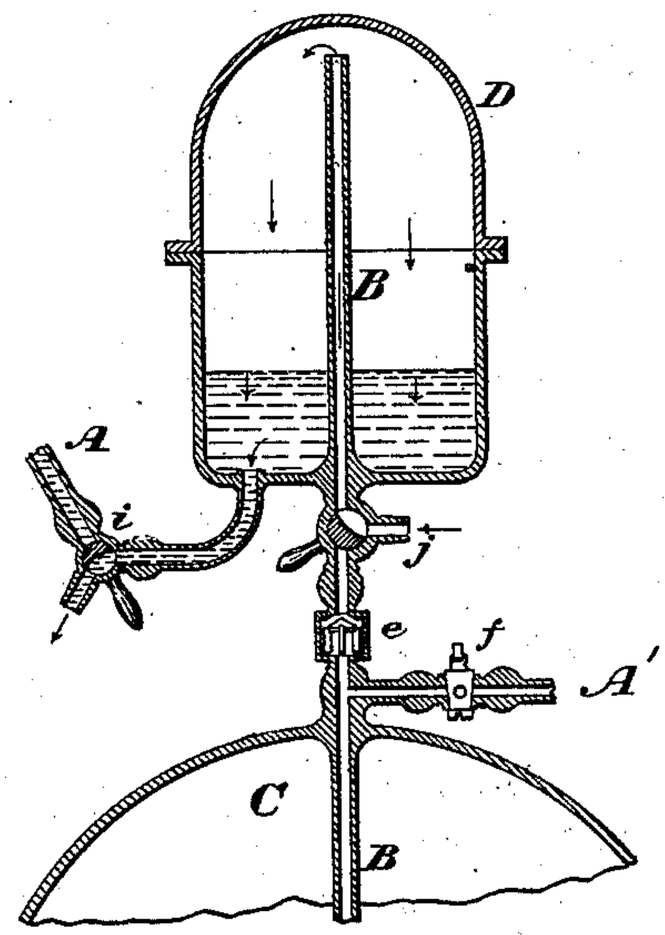


Fig. 7.

ATTEST;

Walter W. Scott
George H. Fraser,

INVENTORS;

Augustus H. Aikman
George K. Osborn
by their Attorneys,

Burke, Fraser & Bennett.

UNITED STATES PATENT OFFICE.

AUGUSTUS H. AIKMAN, OF BROOKLYN, AND GEORGE K. OSBORN, OF BAY RIDGE, ASSIGNORS TO UNITED STATES KEROSENE GASLIGHT COMPANY, OF NEW YORK, N. Y.

HYDRAULIC RELAY.

SPECIFICATION forming part of Letters Patent No. 242,806, dated June 14, 1881.

Application filed July 12, 1880. (Model.)

To all whom it may concern:

Be it known that we, AUGUSTUS H. AIKMAN and GEORGE K. OSBORN, citizens of the United States, residing, respectively, in Brooklyn and Bay Ridge, in the county of Kings and State of New York, (formerly of Brooklyn, New York,) have jointly invented certain Improvements in Hydraulic Relays or Automatic Reservoirs for Storage of Water to Supply Temporarily-Increased Consumption, of which the following is a description.

In buildings supplied with water from city water-works, and especially in dwellings, it frequently occurs that when water is being drawn from one or more faucets in the lower part of the building the supply is cut off from the upper floors. In dwelling-houses where (as is usually the case) the size of the supply-pipe is insufficient, this difficulty is invariably encountered, proving a great annoyance to their inmates.

Our invention has for its object to provide a means whereby this difficulty may be in a great part overcome; and it consists in the arrangement of an air-tight vessel in such operative connection with the service pipe or pipes that the water entering through said pipe or pipes compresses the volume of air contained in the vessel until it exerts a reactionary pressure equal to that in the pipe, which pressure will act to expel the water from the vessel when the pressure in the said pipe decreases; also, in certain details of construction and arrangement, all of which will be more fully hereinafter set forth.

In the drawings, Figure 1 is an elevation illustrating the relay and its necessary connections when arranged upon the upper floor of a building. Fig. 2 is an enlarged view of the relay in vertical mid-section. Fig. 3 is an elevation illustrating the relay and its connections when arranged upon an intermediate floor, an air-injecting device being shown in connection with the relay. Fig. 4 is an enlarged vertical mid-section of the relay, showing its connections in detail, when arranged as in Fig. 3. Figs. 5 and 6 are views of the air-injector, the latter showing a modified arrangement of the cocks and check-valves; and Fig. 7 illustrates a modification of the relay.

Referring to Figs. 1 and 2, let A represent the water-service pipe of a building, having the usual connections for supplying sinks, baths, wash-bowls, closets &c.; and B, the extremity of this pipe, or a branch pipe from it, connecting with a strong air-tight vessel, C. The pipe B enters the vessel C at the top and passes down through the same to or near its bottom, where it is provided with a suitable opening for the passage of the water. The vessel C and pipe B together form the relay, which, as shown in these figures, we have arranged at the top of the building or at the extremity of the supply-pipe A. The inlet-pipe is provided with a cut-off cock, *a*, and the vessel C with an air-cock, *b*, at the top, and a water-cock, *c*, at the bottom.

The operation of the relay thus arranged is as follows: The vessel C being full of air and the cocks *b* and *c* closed, the cock *a* is opened and water admitted to the vessel through the pipe B. As the water rises in the vessel it covers and submerges the open end of the pipe B, sealing the same and preventing the escape of air, and as it further rises it compresses the confined air contained in the vessel until the tension of the air equals the pressure of the water, when the entrance of the latter ceases automatically. As long as the pressure of the water in the pipe B remains uniform the water will remain in the vessel C; but when its pressure is reduced by drawing from the pipe A at any of the faucets 1 2 3, &c., a portion of the water in C will be forced out by the expansion of the compressed air above it, and will flow through the pipe B into the pipe A, where it will, if needed, supply or partially supply the running faucets. Thus the pipe A and all its branches will be kept constantly filled until all the water has been forced out of the relay, when a partial vacuum will be formed in the latter and the outward flow will cease, as it began, automatically. Thus when some faucet on a lower floor is opened, as at 1, and the pressure in the pipes above or beyond that point is reduced, a small quantity of water will flow out of the relay into the pipes and out at the faucet until the pressure in the pipe A above 1 and in the pipe B equals the ten-

sion of the air in C, when, an equilibrium being established, the flow will cease; but if, while faucet 1 is running, another faucet, as at 5, be opened, the pressure in the pipes A and B will be still further reduced, and an increased flow of water from the relay will be effected. If the lower faucet, 1, requires for the time all the water that the pipe A can supply, then the faucet 5 will be supplied entirely from the relay until all the water in the latter is exhausted. When the faucets 1 and 5 are closed the relay will be again automatically charged with a supply of water, as at first.

If the relay is intended to furnish water to the faucets on the upper floors only, a check-valve, *e*, may be arranged in the pipe A at some point below the lowest faucet that is and above the highest that is not to be supplied by the relay. When thus arranged none of the contents of the relay will be discharged when drawing only from the faucets below the check-valve. In case there should be an excess of air in the relay, which would act to prevent the admission of water up to its full discharging capacity, the cock *b* may be opened until the water entering through the pipe B has risen to the desired height in the vessel and the necessary volume of air been forced out. Should sediment collect in the bottom of the vessel C it may be removed by opening the cock *c*, when it will be discharged with the outflowing water. By closing cock *a* and opening cocks *b* and *c* the fluid contents of the relay may be discharged for cleaning or repairs.

It is desirable that the level of the water in the vessel C may never fall below the mouth of the pipe B, so as to unseal the same and permit of the passage of air through it. Under some circumstances or in case the air becomes sufficiently rarefied to cease forcing the water out before its level descends to that point, this desideratum will be accomplished with the construction thus far described; but when such is not the case or when otherwise desirable, we provide a valve which seats itself when the water-level reaches a point slightly above the mouth of the pipe B and prevents the further discharge of water. The preferred construction of this valve is shown in Fig. 2, the lower portion of the pipe B being curved upward and flared slightly to form a suitable seat for the ball *d*, which is made of some impervious and slightly-yielding material, to adapt it to its seat, and is somewhat lighter than water, to enable it to float. It may consist of a hollow rubber ball filled with air, and be confined and guided by being inclosed within a light frame or cage attached to the mouth of the pipe B; or, in lieu of this, a guided float bearing a valve or some equivalent float-valve, as shown at F in Fig. 4, may be employed, the only requisite being that the valve shall be closed automatically by the falling of the water to some predetermined level.

When the relay is situated at the top of the building and is connected to the extremity of the supply-pipe A its form and connections are of the simplest kind, and its strength need not be so great as when placed at a lower level, where the water-pressure is greater. In many cases, however, it may be preferable to place the relay at some intermediate point between the upper and lower discharge-faucets and arrange it to supply either the entire system of pipes throughout the house or only those above or beyond itself. The latter arrangement is shown in Fig. 3, in which A represents the supply-pipe which conducts water to the relay; B, the vertical pipe in the latter, and A′ the supply-pipe leading from the relay to the faucets beyond. The pipe A is provided with a check-valve, *e*, interposed at some point between the relay and the branch or faucet, tapping the pipe A nearest the relay. The effect of this arrangement is, that the check-valve permits the water to pass through the pipe A to the relay, but prevents its flowing back again into the pipe, so that the faucets which tap the pipe A are unaffected by the relay, which supplies only the faucets beyond itself or those from the pipe A′. This construction has the advantage that no decrease of pressure in the pipe A can rob the relay of any portion of its water, which is all retained to supply the faucets beyond.

In some connections, such as that just described, the pressure necessary to lift the water to the upper floor is so great that when the relay is started with air at the normal pressure of the atmosphere, as first described, the air will not expand with sufficient force to expel the whole volume of water contained in the relay and raise it to the height required. To meet this difficulty, we pump or force into the relay enough air to raise its tension sufficiently to approximate the pressure of a column of water of the height to be lifted. This may be done by means of an air-pump or bellows; but we prefer to use for this purpose some hydraulic air-injector which can be permanently attached to the relay, so as to be always ready for use. A convenient form of such a device we have shown in elevation in Fig. 3, and on a larger scale in section in Figs. 4 and 5. Referring to the latter figures, D is an air-tight vessel situated, for convenience, directly over the relay and receiving the end of the supply-pipe A. The vertical pipe B from the relay passes up through the vessel D, and opens inside the latter, near its top. The delivery-pipe A′ taps the pipe B between the two vessels, and is provided with a cut-off cock, *f*. A similar cut-off cock, *g*, is placed in the pipe B, between the pipe A′ and the vessel D, and the latter is provided with a water-cock, *h*, to drain off its contents, and with an air-cock, *b*, to admit air. This latter cock may be in place of the one in the relay, as before described, or in addition to it. During the ordinary operation of the relay the cocks are turned as shown in Fig. 4, permitting the water entering the pipe A to flow up through vessel D into and down pipe B, and out at pipe A′, or down pipe B into the relay, or

from the relay up pipe B and out pipe A′, as the case may be; but when it is desired to force air into the relay the operation is as follows: The cocks *a*, *g*, and *f* are closed and *b* and *h* opened, which permits all the water contained in D to escape through the latter cock, and causes the vessel to fill with air which enters through cock *b*. Cocks *b* and *h* are then closed and cocks *a* and *g* opened, thus admitting a stream of water into the vessel D. As the water rises it forces the confined air to the top of the vessel and down the pipe B into the relay, as shown in Fig. 5. When the vessel D is nearly full the cocks *g* and *a* are closed and *b* and *h* opened, to drain off this water and fill the vessel with air, when the previous operation is repeated, and both are continued until the desired quantity of air is accumulated in the relay. Should any of the air in the vessel C leak out or be absorbed and carried away by the water it may be restored by the operation of the injector, as just described.

In Fig. 6 is shown a modified arrangement of cocks for the air-injector, a three-way cock, *i*, being substituted for the cocks *a* and *h*, and another, *j*, for the cocks *b* and *g*, the operation being substantially the same. In this view, also, we have shown the check-valve *e* in a different place, though its effect is not altered.

We consider it preferable that the pipe B should enter the vessel C at the top, though this is not material to its operation, as it might enter at the side of the vessel, or even at its bottom, as illustrated in Fig. 7, in which latter cases we consider it preferable to arch the pipe A to a height equal to or above the highest level of the water in the relay. This construction serves as a seal and insures the retention of the water in the relay when it is thrown open to the air, as it may be during repairs to the service-pipes. It also opposes the weight of a column of water in the pipe to the pressure in the relay, and thus reduces the tendency to leak through the valve *d*; or, in case no valve is used, it tends to prevent the too great escape of water, whereby the end of the pipe B might be left unsealed.

Besides its usefulness in supplying the basins and faucets in dwellings, our invention is especially applicable to hydraulic engines or air-pumps operated from service-pipes used for other purposes. These, to be effective—as in supplying lamps with air—must run steadily and constantly, which they would not be able to do without a relay, where they are likely to be robbed of their water by opening faucets. Such an air-pump or hydraulic engine is shown at E in Fig. 3.

We claim as our invention.

1. As a relay for the service-pipe of a building or other construction where a water-supply is used, the combination of an air-tight vessel, C, the service-pipe A, arranged to admit water into the lower part of said vessel C, and provided with the ordinary faucets, and an automatic check-valve, *e*, arranged in said service-pipe, whereby the water is permitted to pass freely to the vessel C, but prevented from flowing back beyond the point where the said valve is located, substantially as set forth.

2. As a hydraulic relay for supplying those faucets or outlets from the service-pipe of a building that are farthest from the main, and to prevent their being robbed by the faucets nearest the main, an air-tight vessel, C, connected with the main service-pipe at a point beyond the farthest faucet or outlet from the main, substantially as shown.

3. The combination of the supply-pipe A, relay B C, faucets or other outlets 1 2 3, &c., arranged in tiers on the different floors, and an automatic check-valve, *e*, arranged in the pipe B, whereby those faucets between said valve and the water-main are cut off from the operation of the relay, substantially as set forth.

4. As a hydraulic relay adapted to be filled with air compressed beyond the tension of the atmosphere before it is connected with the water-service pipe, the combination of the air-tight vessel C, the water-service pipe opening into the same at or near its bottom, and the cut-off cock *a*, arranged in the inlet-pipe, substantially as shown, whereby the escape of air from the vessel C prior to its attachment to the service-pipe may be prevented.

5. In a hydraulic relay consisting of an air-tight vessel, C, and connecting-pipe B, and arranged to expel its contained water by the elastic pressure of its contained air, the combination, with said vessel and pipe, of a valve arranged to prevent the further discharge of water when the level of the latter descends to a predetermined point, substantially as set forth.

6. In a hydraulic relay which expels its water by the force of compressed air contained within it, the elastic ball *d*, arranged to seat itself upon the mouth of the inlet-pipe when the level of the water in the vessel C falls to a predetermined point, substantially as shown and described.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

AUGUSTUS H. AIKMAN.
GEORGE K. OSBORN.

Witnesses:
HENRY CONNETT,
WALTER W. SCOTT.