

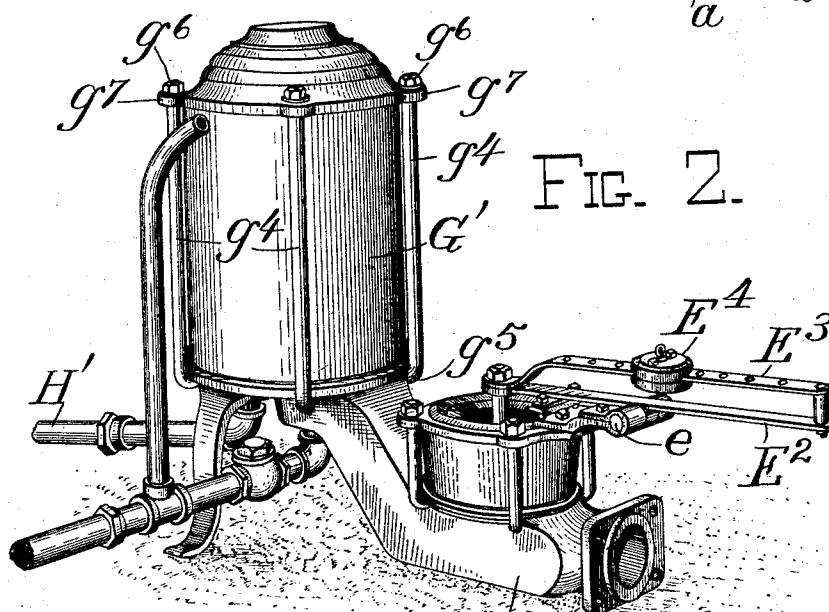
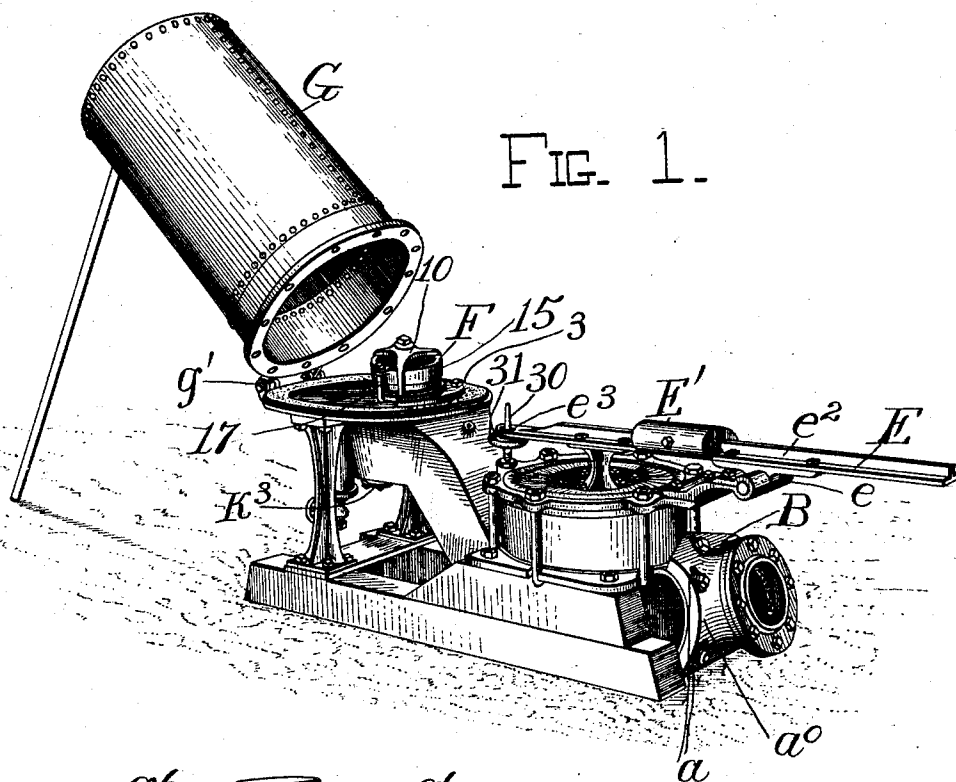
(No Model.)

5 Sheets—Sheet 1.

W. A. RIFE.
HYDRAULIC RAM OR ENGINE.

No. 519,970.

Patented May 15, 1894.



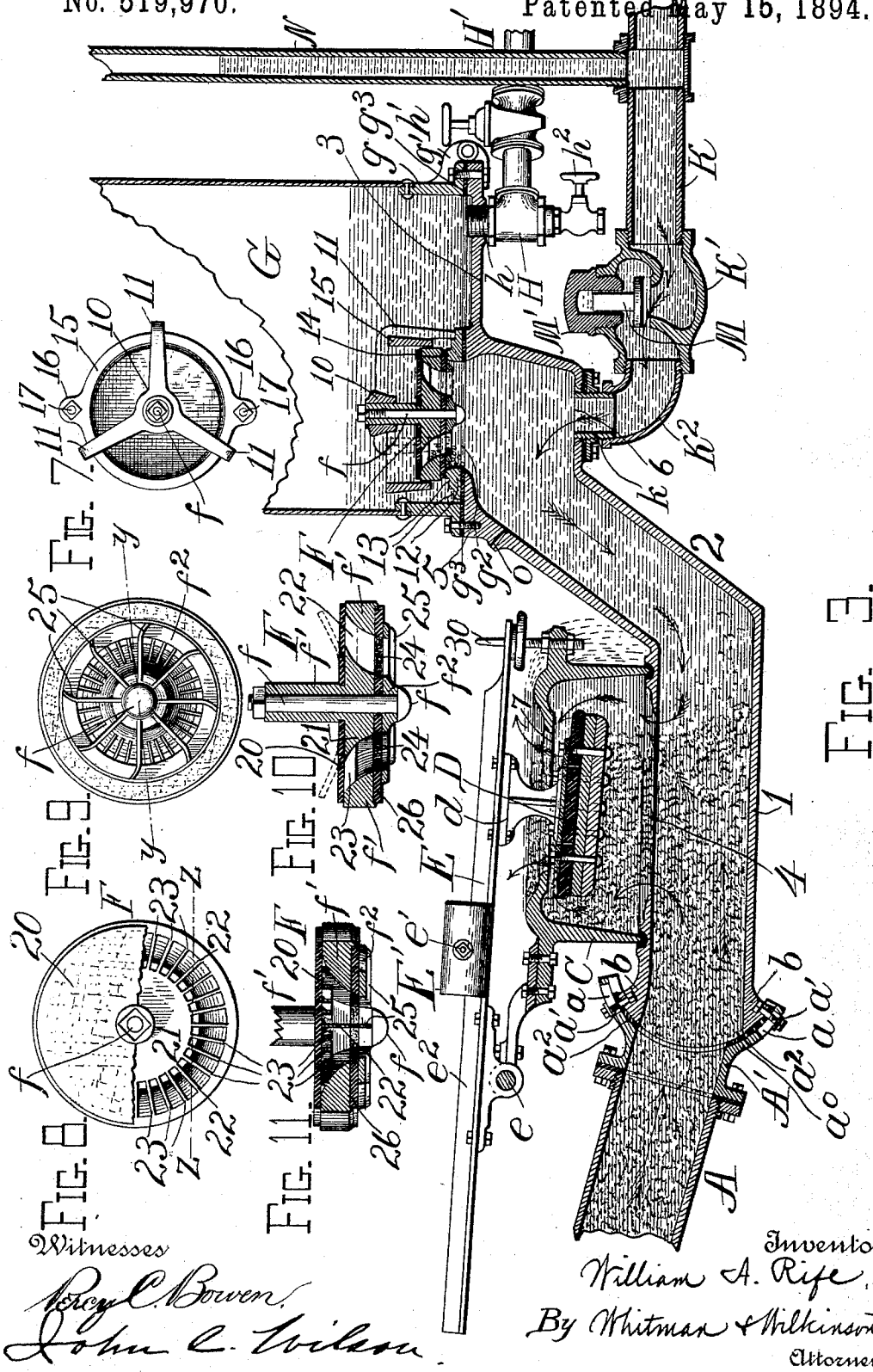
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W. A. RIFE.
HYDRAULIC RAM OR ENGINE.

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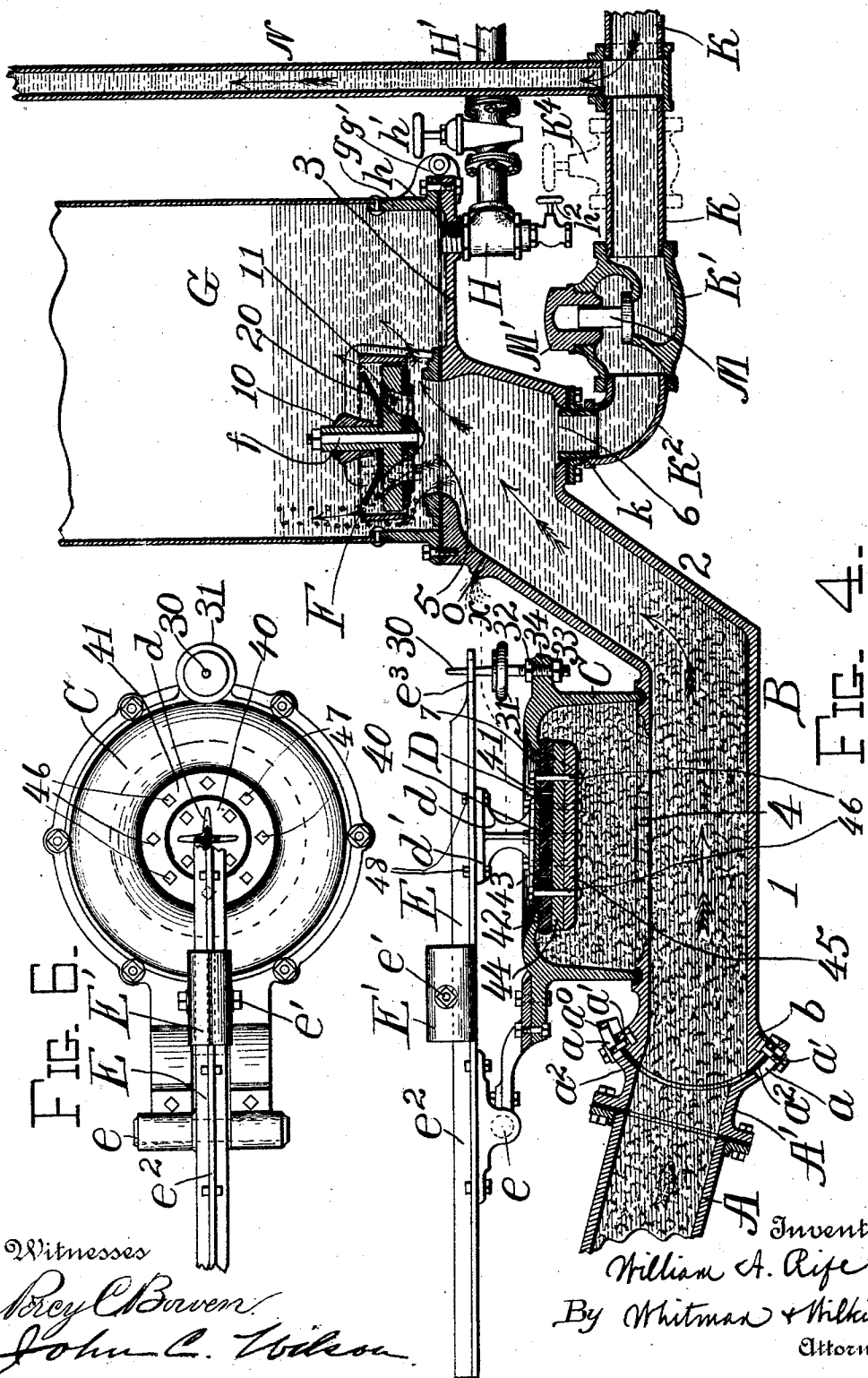
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W. A. RIFE.
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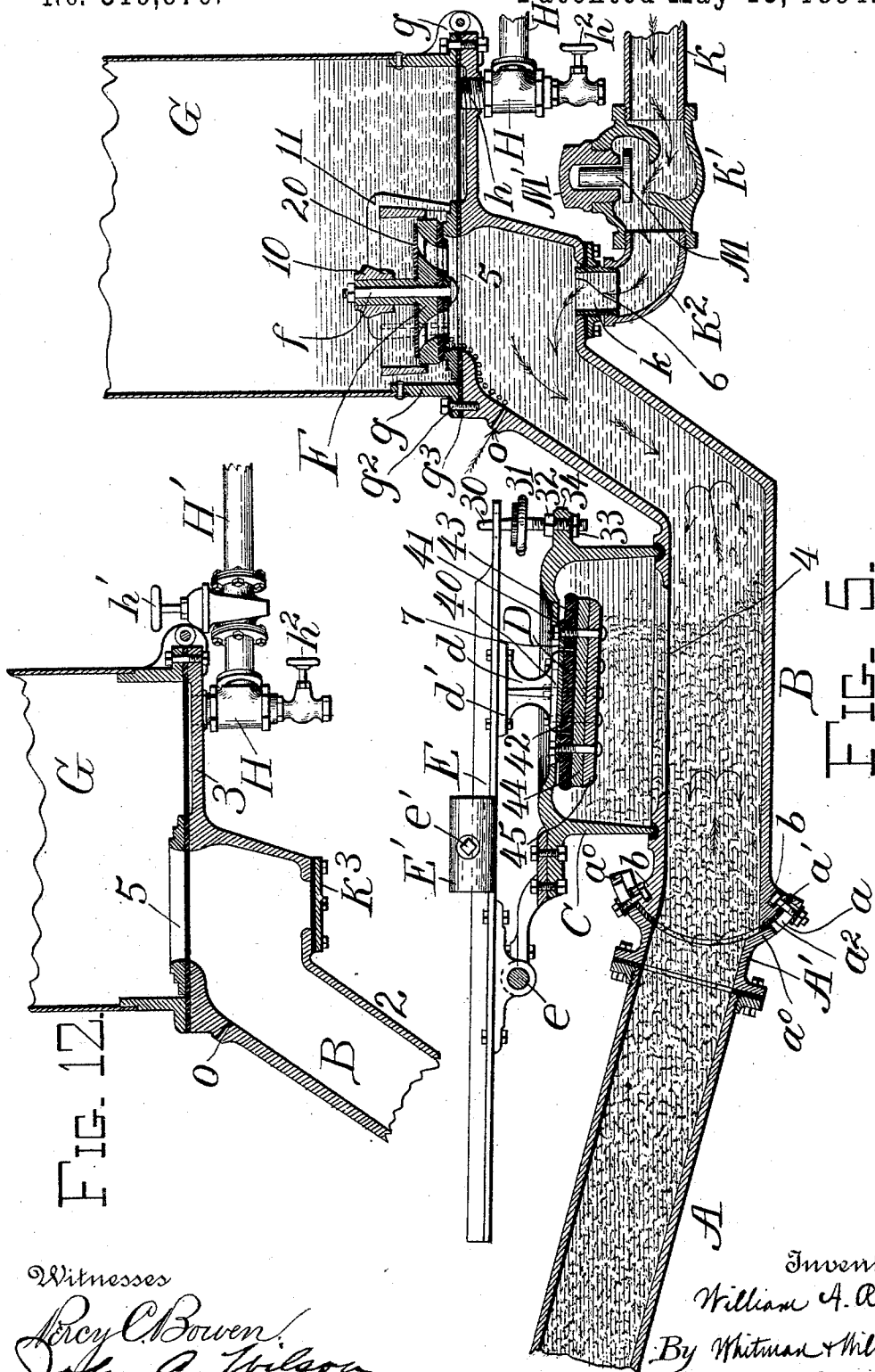
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W. A. RIFE.
HYDRAULIC RAM OR ENGINE.

No. 519,970.

Patented May 15, 1894.



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(No Model.)

5 Sheets—Sheet 5.

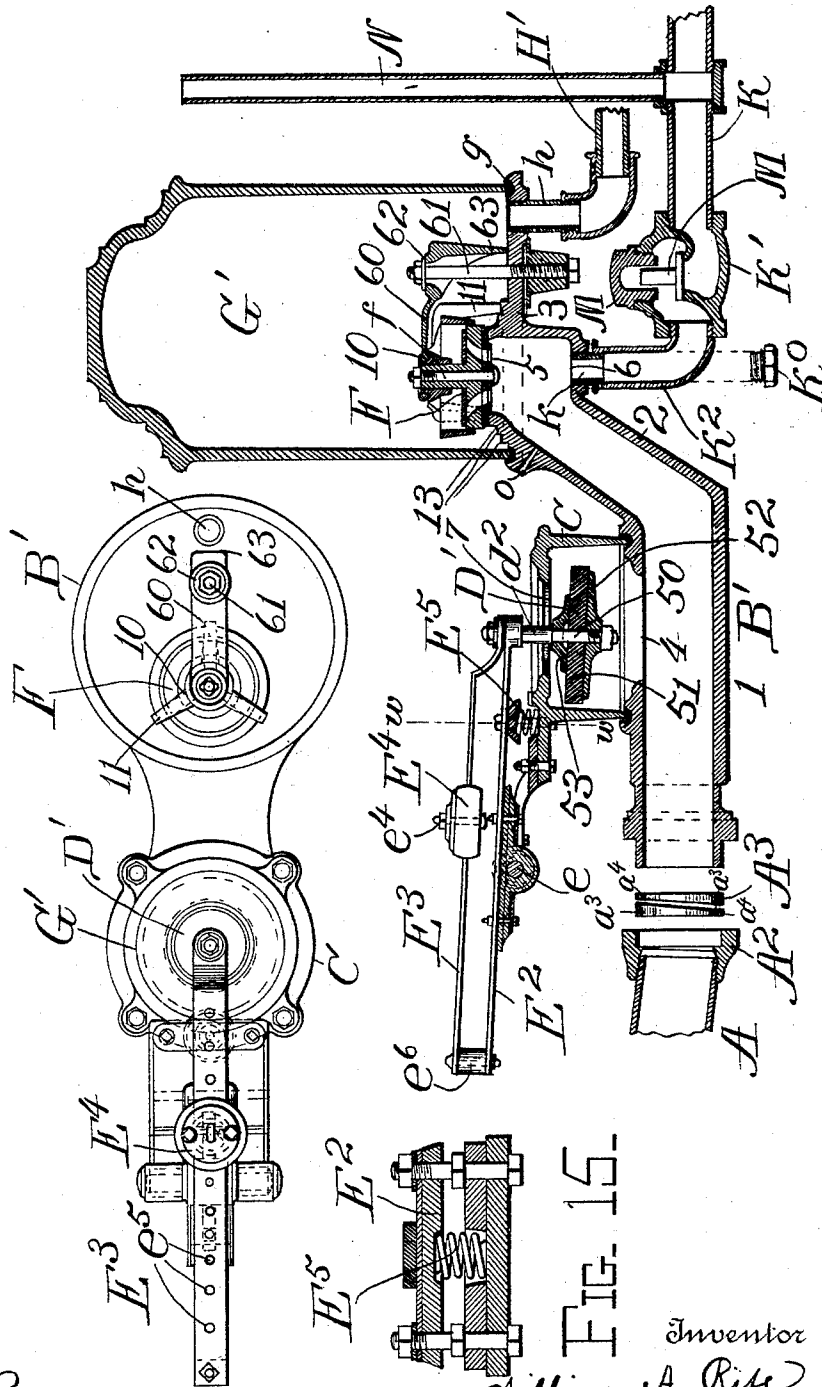
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FIG. 13.

FIG. 14.



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UNITED STATES PATENT OFFICE.

WILLIAM A. RIFE, OF WAYNESBOROUGH, VIRGINIA.

HYDRAULIC RAM OR ENGINE.

SPECIFICATION forming part of Letters Patent No. 519,970, dated May 15, 1894.

Application filed June 16, 1893. Serial No. 477,840. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. RIFE, a citizen of the United States, residing at Waynesborough, in the county of Augusta and State of Virginia, have invented certain new and useful Improvements in Hydraulic Rams or Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in hydraulic rams or engines intended for use for pumping water, and it consists especially of certain improvements upon the device described in Letters Patent No. 357,414, granted to me February 8, 1887, and of certain novel features hereinafter described and claimed.

Reference is had to the accompanying drawings, wherein the same parts are indicated by the same letters and numerals throughout the several views.

Figure 1 represents a perspective view of one form of my improved device arranged to receive water from only one source, the hinged air chamber being tilted back, and the delivery valve being exposed to view. Fig. 2 represents a modified form of the device shown in Fig. 1, arranged to receive water from two sources and with the air chamber in operative position. Fig. 3 represents a central longitudinal section through the device shown in Fig. 1, with attachments for receiving water from two sources, the water being shown as entering from two sources and escaping past the escape valve. Fig. 4 represents a similar section to that shown in Fig. 3, except that the escape valve is now closed, and water is being delivered into the air chamber. Fig. 5 represents a similar section to that shown in Figs. 3 and 4 when the escape valve begins to open again, and the delivery valve is closed. Fig. 6 represents a plan view of the escape valve and its connections, as shown in Figs. 1, 3, 4, and 5, parts being broken away, along the line z of Fig. 4. Fig. 7 represents a plan view of the delivery valve and its connections. Fig. 8 represents a plan view, enlarged, of the delivery valve, the upper flap being broken away to show the grating beneath. Fig. 9 represents an in-

verted plan view of the delivery valve. Fig. 10 represents a section of the delivery valve along the line $y y$ of Fig. 9. Fig. 11 represents a section of the delivery valve along the line $z z$ of Fig. 8. Fig. 12 represents a similar section through the base of the air chamber and water chamber, to that shown in Figs. 3 to 5, with the device for introducing water from the second source removed, as shown in Fig. 1. Fig. 13 represents a central longitudinal section of the device shown in Fig. 2, with the valve in the position corresponding to that shown in Fig. 3. Fig. 14 represents a plan view of the apparatus shown in Fig. 13, with the air chamber removed, and Fig. 15 represents a section along the line $w w$ of Fig. 13.

The apparatus is placed below the level of the source or sources of water, which is free to run down through the pipe A, or through the pipes A and K, as will be hereinafter described.

A represents the drive pipe which leads down from a source of water, not shown, for instance, a creek or river, and delivers into the water chamber B, provided with an opening 4 beneath the chamber C inclosing the escape valve D, which valve is attached to a pivoted arm E provided with a sliding weight E'.

The delivery end of the water chamber B is provided with an opening 5 beneath the delivery valve F, which is mounted on its seat in the base of the air chamber G of Fig. 1, or G' of Fig. 2. At the base of this portion of the water chamber, if the device is to be made double acting, the supply pipe K is connected as by the elbow K²; but if the device is to be single acting, the aperture in the base of the water chamber may be closed by a plate K³ bolted over the said aperture, as shown in Figs. 1 and 12; or by inserting a common plug K^o, as shown in Fig. 13.

M represents a check valve mounted on a valve seat in the pipe coupling K', and moving vertically in suitable guides M'.

N represents an overflow pipe connected to the supply pipe K by which a steady flow of water is kept through said pipe.

O represents a small air hole in the water chamber B near the upper part thereof.

H represents a T coupling by which the de-

livery pipe H' is connected vertically through the elevated portion of the water chamber B to the base of the air chamber G.

The operation of the device is as follows:—

5 If the device is to be driven by one source of water and to pump water from a purer source, the water from the creek or river or other impure source which we shall call the muddy water, flows down through the pipe A and escapes through the opening over the escape valve D, and at the same time the water from the spring or purer source, which we shall call the clear water, runs down the pipe K entering the water chamber by the opening 6 and unites with the muddy water flowing through the opening 7 in the valve chamber C. This is represented in Fig. 3. When the pressure of the escaping current of water flowing upward is sufficient to lift the valve D against its seat, the escape of the water through the valve is then stopped and the momentum of the moving mass of muddy water coming through the pipe A forces backward the clear water which has meantime filled the part 2 of the water chamber causing it to lift the valve F and to be forced into the air chamber, at the same time the backward pressure of the water forces the valve M down on its seat, and the clear water is prevented from moving backward through the opening 6 into the pipe K, all as shown in Fig. 4. The water coming down the pipe K would also be stopped like that coming down the pipe A as shown in Fig. 5, were it not for the overflow pipe N, through which the water coming down the pipe K is diverted, and thus a continuous stream down the said pipe K is maintained. When the pressure in the air chamber becomes greater than that of the water flowing down the pipe A, the valve F closes, at which time the water in the lower portion 1 of the water chamber eddies backward as shown by the arrows in Fig. 5, and the pressure upward on the valve D being temporarily relieved the weight of the valve D, and of the weighted arm E causes the valve D to open once more; and then water in the pipe A flowing down again under the influence of gravity escapes through the opening 7 over the valve D once more until the pressure upward is sufficient to lift the valve and to close it again when the before mentioned operation is repeated. When the muddy water in the part 1 of the water chamber begins to regurgitate, as shown in Fig. 5, the pressure of the clear water in the pipe K lifts the check valve M, and the water running down from the overflow pipe N, and also through the pipe K, re-establishes the flow of clear water into the upper end of the water chamber, and replaces in the water chamber the amount of clear water just driven into the air chamber. This new supply of clear water runs toward the escape valve as shown in Fig. 3, but about the time the clear water begins to escape through the valve D that valve closes and the clear water is forced back again as before. By means of

the air pressure in the air chamber, the water is forced continuously out through the pipe H' to the point of consumption. In this way the power of the creek or river water is used to force the spring water into the air chamber and the clear water alone is delivered, the muddy water discharging itself at a lower point distant from where the clear water enters the air chamber, at which points where the muddy water used as power and the clear water delivered are at all times kept separate from each other by natural law without the intervention of any diaphragms or pistons, or other complicated apparatus for keeping the two apart. The small part of the clear water that mixes with the muddy water during the backward movement of the latter escapes through the aperture 7 just before the escape valve closes.

In order to obtain the proper cushion in the air chamber a small orifice *o* for admitting air into the upper portion of the water chamber is provided. As the water in the upper portion of the chamber B regurgitates as shown in Fig. 5, upon the closing of the valve S, a partial vacuum is created underneath said valve, which is partly filled by the influx of air through the said hole *o*. As soon as the valve S is forced open again, these bubbles of air that have been caught beneath the valve rise up into the upper part of the air chamber G as shown in Fig. 4, and thus preserve the necessary air supply in the said chamber. This aperture *o* though small, is made of such size that it may supply the amount of air carried off by the water, an appreciable part of the inclosed air under pressure being absorbed by the water delivered through the pipe H'.

When it is desired to operate the device as a single acting ram, the pipe K and its attachments, such as the valve seat K', the coupling K², and the thimble *k* are detached, and a plate K³ is secured over the opening 6 in the water chamber B, as shown in Figs. 1 and 12. Or instead of detaching these various portions, a valve may be provided as at K⁴, shown in dotted lines in Fig. 4, by means of which the pipe K may be closed and thus the ingress of water from that side of the machine may be avoided. The operation of the device when single-acting is as follows:—The water flowing down the pipe A, as before, passes around and upward over the valve D and escapes through the aperture 7 in the chamber C until sufficient force is created by the escaping current to lift the valve against its own weight and that of the weighted arm E, causing it to close the said escape opening 7. The flow of the water through the opening 7 being checked, the momentum of the mass of water coming down the pipe A lifts the valve F and the water flows into the chamber G, until there is sufficient air pressure therein to counteract the pressure of the water flowing down the pipe A, when the valve F will fall upon its seat and the moving mass of water

will be stopped. As soon as the flow of water into the chamber B is stopped, there will be a reaction of the water outward toward the pipe A, and during the temporary relief of pressure the escape valve will fall and the water will soon begin to escape through the orifice 7. Since the air hole *o* and valve F are above the orifice 7 at the beginning of the escape of water, there will be a slight downward flow of the water in the part 2 of the water chamber, causing a partial vacuum beneath the valve F which will be filled by air rushing in through the hole *o* and thus the necessary fresh supply of air is automatically injected into the air chamber. By adjusting the weight on the pivoted bar so that the valve D may require greater or less lifting pressure to lift it, the length of the stroke may be varied, and hence the velocity of the water in the pipe A.

It will be obvious that when the velocity of the water in the pipe A is great, the force of the blow given when the valve D is closed will be greater than when the velocity is small, and, therefore, the greater will be the force expended in pushing up the water in the part 2 of the water chamber and hence the longer the time the valve F will remain open, and the greater the supply of water per stroke that will be delivered into the air chamber. Thus by making the strokes fewer, which is done by adjusting the weight on the pivoted bar, a greater pressure is obtained in the air chamber and consequently the water is forced to a higher position through the pipe H'. In Figs. 1, 3, 4, and 5, the lengths of the vibrations of the valve D are also adjusted by the hand-wheel 31 carried by the screw 30 which projects upward through the aperture *e*³ in the pivoted bar E, and is provided at its lower end with a screw thread which engages in the projection 34 and is held in position by nuts 32 and 33. The bar E is pivoted at *e* on an arm projecting from the chamber C and is provided with a vertical longitudinal rib *e*² on which the weight E slides, and on which it is clamped by means of the clamp screw *e*'.

In the form of device shown in Figs. 2, 13, and 14, the sliding weight E⁴ is mounted on the upper and perforated one of the pair of bars E² and E³, which bars are connected together at *e*⁶, and are pivoted at *e*, the valve stem *d*² of the valve D' being attached to the lower bar E². The weight E⁴ is secured by means of the pin *e*⁴ which passes down in one of the perforations in the said bar E³, and is thus adjusted at any desired position on the said bar.

Having thus described the general construction and operation of the single and double acting ram, I will proceed to describe in detail certain novel features by which increased efficiency or economy, or both, are obtained.

Since it is desirable in frequent instances, to mount the apparatus on rocky sites, and since the relative positions of the creek or river, and of the spring, may vary very materially, and also for other reasons, it becomes

necessary to have the various pipes leading to or from the ram so arranged that they may be pointed in different directions. For this reason, the couplings H and K² connecting the supply pipe K and the delivery pipe H' to the apparatus, are provided with screw-threaded thimbles or nipples *k* and *h* screwed into the base vertically, which allow the said couplings and pipes to be readily led out in any desired direction. The drive pipe A is similarly arranged, and connected to the water chamber B by a coupling A' provided with an arc-shaped flange *a*^o slotted as at *a*, and held to the corresponding arc-shaped flange *b* of the water chamber by the bolts *a*'. A rubber or leather gasket *a*³ is interposed between these members to make a tight joint. It will be seen that the inclination of the drive pipe A may be varied within the limits of the slot *a*, and thus it may conveniently be adapted to receive water at any incline from a higher or a lower source. Another method of varying the angle of elevation of the drive pipe, is shown to the left of Fig. 13, where two rings A³ deeper at one side *a*³ than at the opposite *a*⁴, are interposed between the coupling A² and the water chamber B'. It will be seen that if the rings be placed obversely, as shown in Fig. 13, they will be equivalent to a single ring of uniform thickness, while if one of the said rings be revolved through one hundred and eighty degrees the effect of a wedge-shaped annular gasket will be obtained, and by adjusting the rings in the intermediate positions, the elevation of the pipe A may be varied within certain predetermined limits.

It is very important that some simple manner of adjusting the elevation of the drive pipe to the various conditions of the place where the ram is to be used should be provided.

In order to facilitate the flow of water into the air chamber, to limit the necessary travel of the delivery valve as much as possible, and to prevent it from becoming choked or clogged up in any way, I preferably use the form of valve shown in detail in Figs. 3, 7, 8, 9, 10, and 11.

In all figures the delivery valve proper is marked F, the main portion consisting of a vertical hollow stem or sleeve *f*', terminating at its lower end in an annular flange, which is perforated with ports or water passages, as will be hereinafter described with other contiguous parts which are securely connected by means of the bolt *f* passing up through the center provided with a nut on top of stem or sleeve. This valve F is revolvable, and is held in a proper rotating and vertical vibrating position by means of a valve cage, which cage consists of a cylindrical shell 15, a part of which is the spider 10 having downwardly projecting legs 11, which legs rest upon one of the lower steps 13 of the valve seat 12. The cage is securely fastened to the valve seat by means of two bolts 17, the heads of which engage in slots in each side or edge of the valve seat passing

up through the lugs 16 with nuts on top of valve cage as shown in Fig. 7. The upper portion of the valve seat is a flat annular surface 14 dropping in steps as at 13, and is securely fastened down by the tap bolts through each corner into the base plate 3 as shown in Fig. 1. The valve proper consists first of the combined sleeve and ring f' already mentioned, a second solid annular portion f^2 forming the bottom of the valve, and the annular flap 20, and the perforated annular gasket 26. The annular flap 20, preferably made of leather, rests on the annular shoulder 21, of the part f' , and on the ribs 22 and 23 which form a circular gridiron-like arrangement connecting the inner and outer parts of the ring between the flap 20 and the gasket 26. The ribs 22 extend through the depth of the said ring, while the ribs 23 form a perforated platform or support to relieve the flap 20 from downward pressure from above. Ports 24 extend through the valve and the gasket 26, to the base of the flap 20, but are divided in their upper portion by the ribs 23 already referred to. The ring f^2 , which also serves as a washer, for the gasket 26, is perforated in the line of the ports already referred to, and the inner and outer parts of the ring are connected together by ribs 25, which are curved at their outer ends, as shown in Fig. 9. The function of these ribs is that as the valve is lifted, it being revolvably mounted in the spider 10, the pressure of the water passing through underneath the valve, acting on these helicoidal ribs 25, will cause the valve to revolve through a small angle at each stroke, and thus the wear on the gasket 26, and on the valve seat, will be made uniform.

By the herein described construction of valve, not only will the water flow radially from beneath the valve when it is lifted, but it will flow up through the port 24, lifting the flap 20, as shown in dotted lines in Fig. 10, and escaping through the valve itself into the air chamber. In this way the requisite travel of the valve is materially lessened, and the pounding of the valve on its seat is to a certain extent avoided.

By having the valve seat cut away as shown, and having the spider legs rest on the lower annular step of the valve seat, at some distance from the periphery of the valve proper, the flow of water from under the valve having less surface exposed to frictional contact, is also facilitated, and by placing the spider legs 11 below and at some distance from the valve, any particles of grass, weeds, sticks, &c., which might lodge against the surface of the said legs, are kept clear of the valve seat, and hence the possibility of the escape of water from the air chamber down through the valve or beneath the same is to a large degree avoided. These various features tending to insure the close contact of the valve on its seat, are of great importance, since any material leakage back through the valve largely impairs the efficiency of the device.

In order that the valve F may be accessible for examination and repair, the air chamber G is preferably hinged as at g' to the plate 3 projecting from the water chamber. The air chamber G is attached to the said plate 3 by means of bolts or tap rivets g^2 passing through the flange on the ring g . A rubber gasket g^3 is interposed between the base of the air chamber G and the said plate 3.

In the form of device shown in Figs. 2 and 13, bolts g^4 , hooked as at g^5 , and passing through lugs g^7 at the top of the air chamber, are screwed down with nuts g^6 , thus firmly holding the said air chamber in place.

In the form of device shown in Fig. 13, the escape valve D' is attached by means of the valve stem d^2 to the pivoted bars E² and E³. The lower portion of the said valve stem d^2 is turned down, or a sleeve may be put upon the upper end if desired, and then passes through the washers 52 and 53, which compress between them the rubber disk 51, which strikes against the under side of the valve seat, as the valve closes. In this form of valve, however, and in those forms most generally in use, no adequate provision is made for the unequal wear of the valve on the seat. In order to provide a means of adjusting the valve for this inequality of wear, I preferably construct the valve as shown in Figs. 3 to 6.

Referring, especially to Figs. 4 and 6, the valve D is connected by a cruciform piece d , flanged top and bottom as shown at d' and 40, to the pivoted bar E. The lower flange 40 is in the form of a circular plate provided with bolt holes through which pass the bolts 47 holding together the central rubber disk 43, and the plates 44 and 45 forming the back of the valve. Exterior to this circular plate 40, an annular disk 41 is mounted over the broader annular disk or rubber ring 42, and is held in place thereon by the bolts 46 passing entirely through the valve, and provided on their upper ends with angular nuts, 47. These nuts are ordinarily screwed down compressing the rubber ring 42 somewhat. Now, if for any cause this rubber ring wears more at one part than at another, if the nuts 47 near the worn part, are screwed down firmly, the rubber beneath them will be compressed, raising the periphery of the valve at that side, and with very little difficulty any slight wear may be thus compensated therefor. Should the wear on the greater part of the valve prove to be more than on any limited portion, then by easing up on the nuts 47 near the portion not worn, part of the rubber will tend to recede under that side of the flange 40, and thus compensation will again be had. Should it be desired to shift the valve end for end, the bolts 47 or 48 may be eased up and taken out and the valve turned around and then put back in place. By this improved construction a simple and convenient means of adjusting the valve without taking the valve apart, is obtained. These, and

other advantages of the herein described construction, would readily suggest themselves to any one skilled in the art.

5 Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States, is—

1. In an escape valve for a hydraulic ram or engine, the combination with a circular rigid support of greater diameter than the interior of the valve seat; of a ring of rubber or other yielding elastic material mounted near the periphery of said support, and adapted to engage the valve seat; a metal ring mounted over the inner portion of said rubber ring; 10 bolts and nuts for compressing said rubber ring between said metal ring and said support; a rubber disk mounted on said support within said rubber ring and concentric therewith, a flanged valve stem mounted over said 20 rubber disk, and bolts and nuts adjustably

connecting said support said rubber disk and said flange together, substantially as and for the purposes described.

2. In a hydraulic ram or engine, a circular delivery valve provided with a metallic body 25 perforated with curved grid-iron ports, a flap of leather or similar material mounted over said ports, a perforated rubber disk beneath said valve body, a perforated ring provided with curved ribs secured beneath said perforated rubber disk, and means for securing 30 the said valve body, leather flap, rubber disk, and perforated ring together, substantially as described.

In testimony whereof I affix my signature in 35 presence of two witnesses.

WILLIAM A. RIFE.

Witnesses:

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J. S. BOOZ.