No. 606,715. Patented July 5, 1898.

G. H. HARRIS.

HYDRAULIC RAM.

(Application filed Dec. 28, 1897.)

(No Model.) 4 Sheets—Sheet 1.

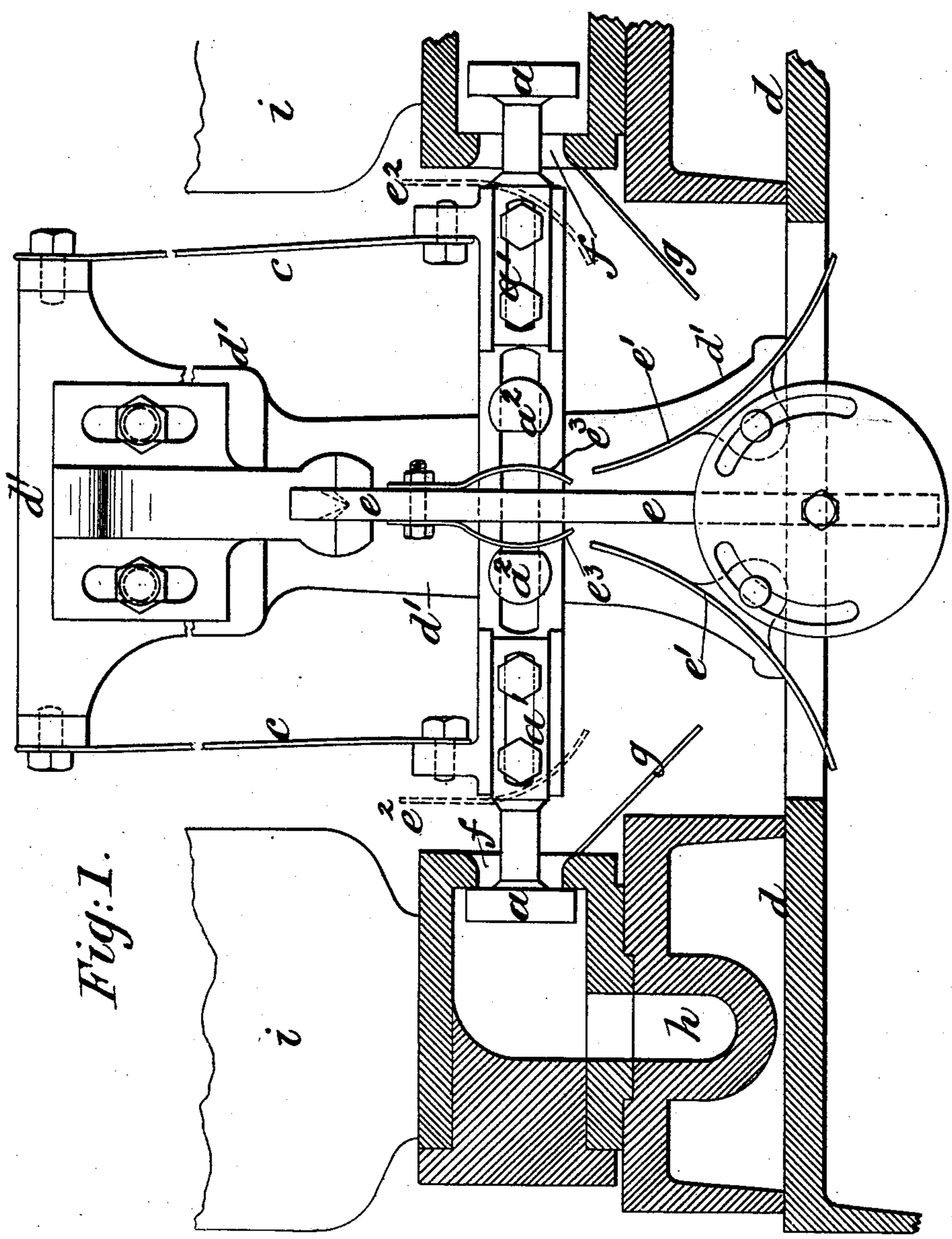

Fig. 1.

Witnesses.
E. A. Finckel.
Nellie Callahan.

Inventor.
George Hicks Harris.
by Wm. V. Finckel.
his Attty.

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(No Model.) 4 Sheets—Sheet 2.

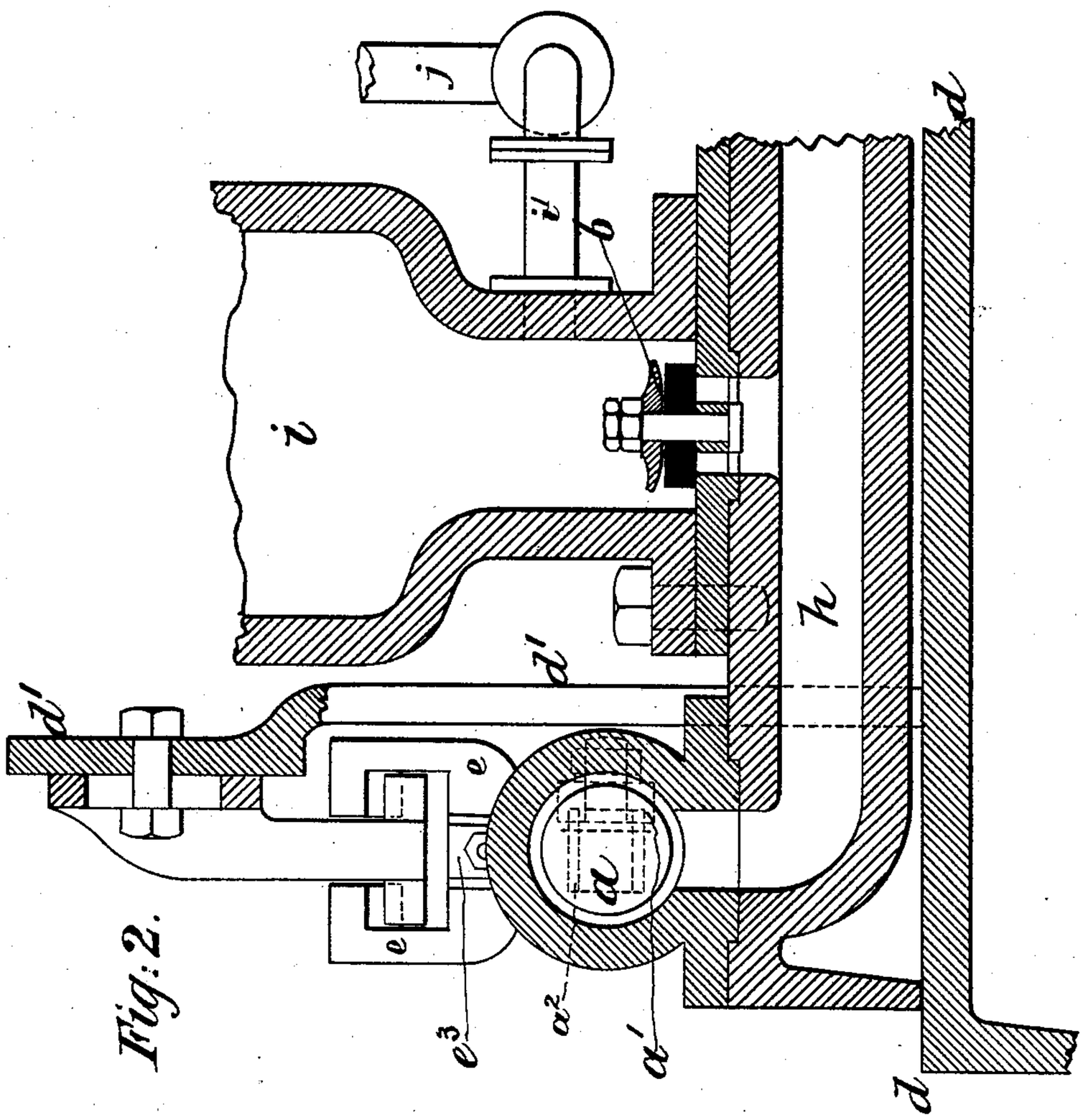

Fig. 2.

Witnesses:
E. A. Finnell.
Nellie Callahan

Inventor:
George Hicks Harris.
by Wm. N. Finnell
his Atty.

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(No Model.) 4 Sheets—Sheet 3.

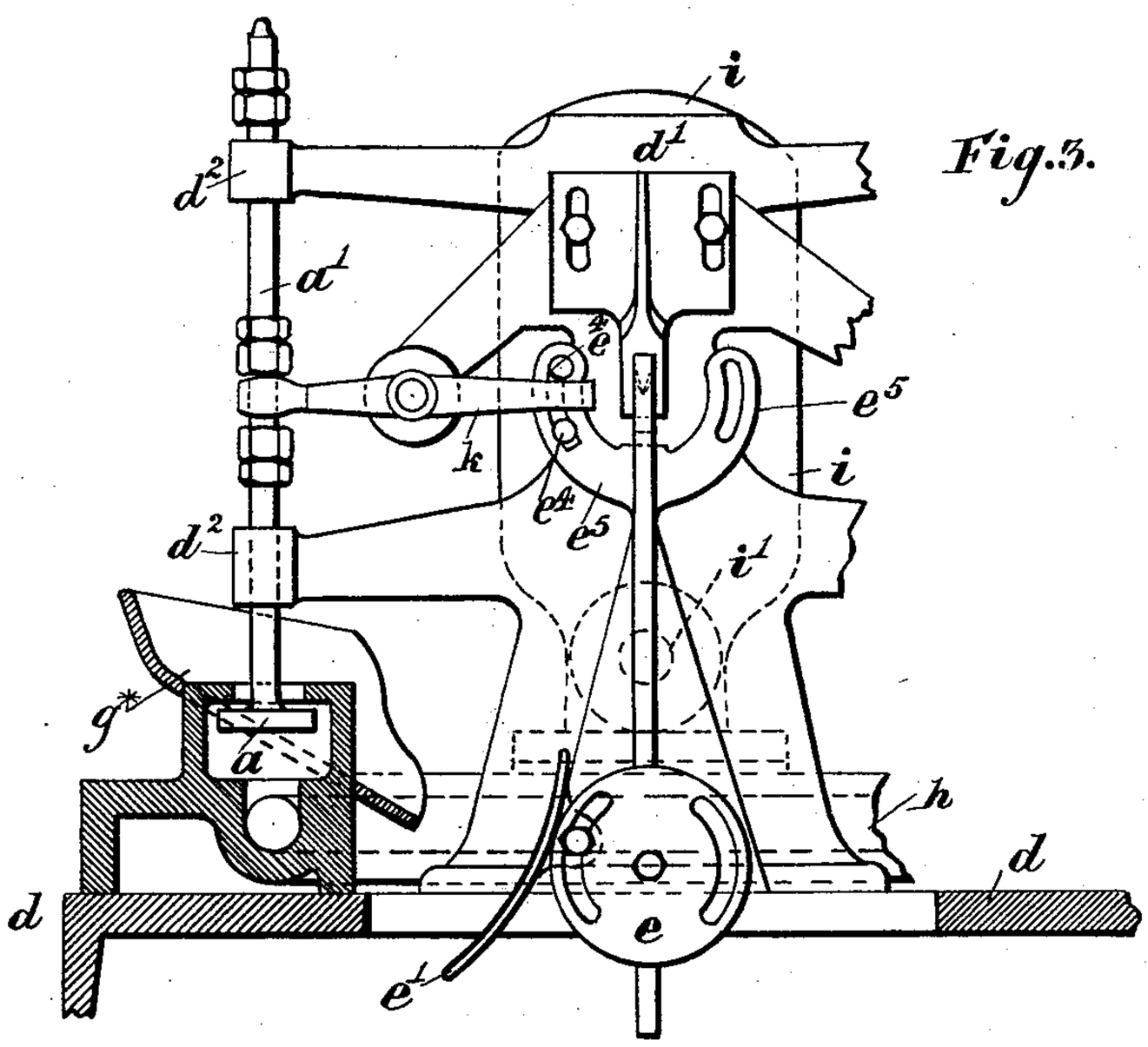

Fig. 3.

Witnesses.
E. A. Finney,
Nellie Callahan.

Inventor.
George Hicks Harris.
by Wm. H. Finney
his Atty.

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G. H. HARRIS.

HYDRAULIC RAM.

(Application filed Dec. 28, 1897.)

(No Model.) 4 Sheets—Sheet 4.

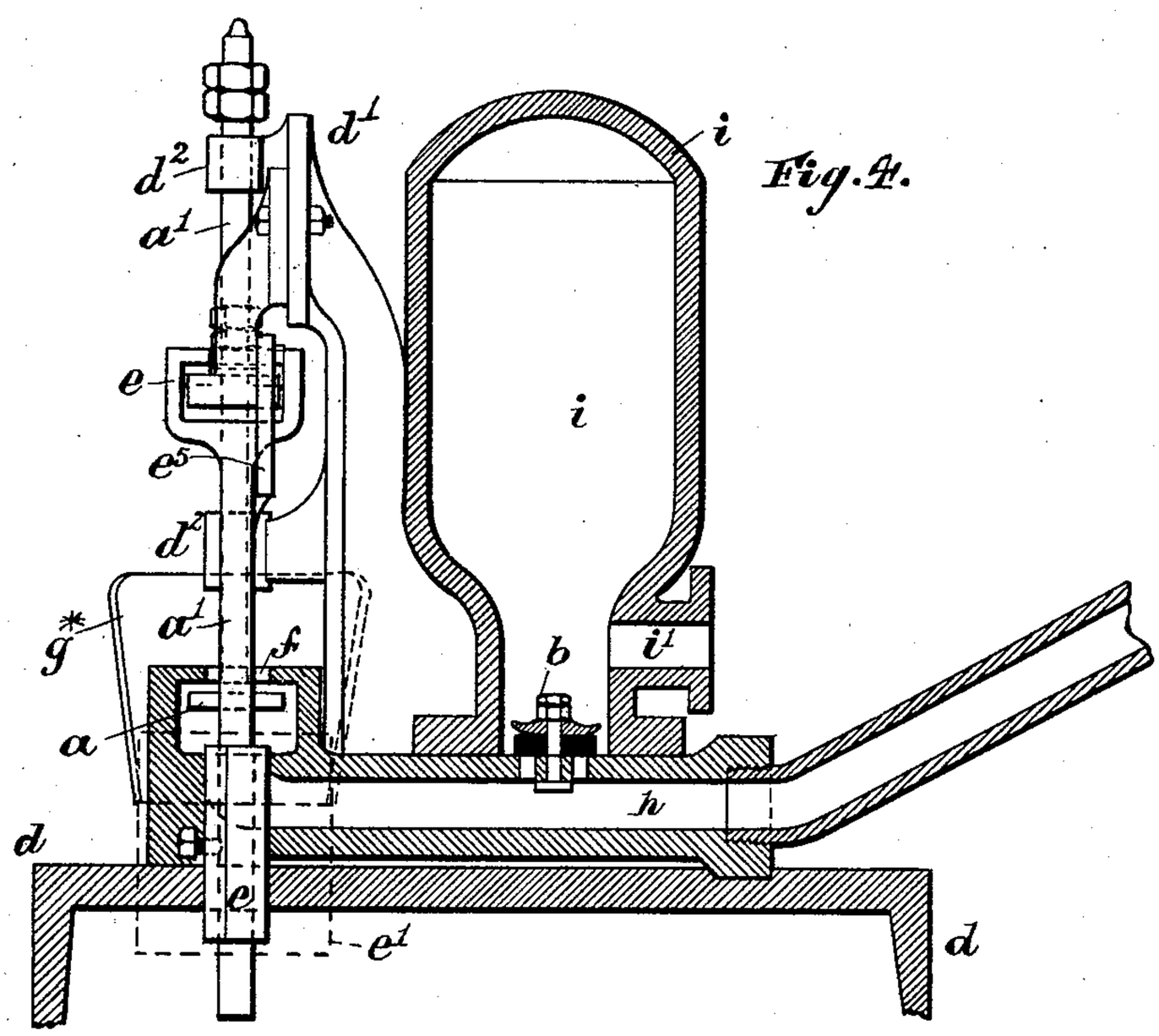

Fig. 4.

Witnesses:
E. C. Fincke.
Nellie Callahan

Inventor:
George Hicks Harris.
by Wm. H. Fincke.
his Atty.

UNITED STATES PATENT OFFICE.

GEORGE HICKS HARRIS, OF WADEBRIDGE, ENGLAND.

HYDRAULIC RAM.

SPECIFICATION forming part of Letters Patent No. 606,715, dated July 5, 1898.

Application filed December 28, 1897. Serial No. 664,045. (No model.) Patented in England May 13, 1897, No. 11,931.

To all whom it may concern:

Be it known that I, GEORGE HICKS HARRIS, a subject of the Queen of Great Britain, residing at Wadebridge, in the county of Cornwall, England, have invented certain new and useful Improvements in Hydraulic Rams, (patented in England May 13, 1897, No. 11,931,) of which the following is a full, clear, and exact description.

My invention consists, primarily, of novel combinations and arrangements of parts of hydraulic rams, whereby the action is of a reciprocating character and the waste or outflow water, after having done duty in the ram, is utilized to make the action of the valves sensitive or more certain or otherwise to make the work of the machine or ram efficient.

My invention is represented in the accompanying drawings, in which—

Figures 1 and 2 are vertical sections, drawn at right angles with each other, of one form of my improved hydraulic ram; and Figs. 3 and 4 are similar views of another form of my improved hydraulic ram in which the valve or valves reciprocate in a vertical direction.

According to my invention I employ two or more beat or waste valves *a* and two or more retaining-valves *b*. The drawings represent an arrangement in which two of each of such valves are employed.

The beat or waste valves *a* are connected together in such way as to equalize each other, and they may be arranged either horizontally or vertically. In the drawings, Figs. 1 and 2, such valves *a* are represented as fixed one to each end of the horizontal bar *a'*, which latter is suspended by springs *c* from a standard *d'*, fixed to the bed *d* of the ram. These springs will be made of length to suit the speed of the machine or ram or the throw of the beat or waste valves *a*.

In the machine represented in the drawings, Figs. 1 and 2, the horizontal bar *a'*, carrying the beat or waste valves *a*, is first actuated by the beat of a suspended bar or pendulum *e*, such beat being regulated by the length of said bar or pendulum, thus giving motion to the waste-valves *a* preparatory to that given by the impulse of the drive-water. The pendulum *e* is actuated by the outflow or waste water which on issuing from the ports *f f* is guided by the guides *g g* onto the plates or floats *e' e'*, adjustably fixed to the pendulum *e*, or floats or fan-pieces e^2 (shown by dotted lines) may be secured directly to the horizontal bar *a'* or to the springs carrying such bar *a'* and waste-valves *a*, in which case the outflow or waste water will act directly on the same after escaping from the machine by the ports *f f* and will then be directed down to the floats *e'*.

The machine shown in the drawings, Figs. 1 and 2, has two drive-pipes *h* and two retaining-valves *b*, each opening into an air vessel *i*. The pendulum *e* is provided with springs e^3 to act against studs or projections a^2, adjustably fixed on the bar *a'* in order to avoid undue shock in the action of the apparatus.

The action of the ram is similar to that of the well-known automatic hydraulic ram, except that, in consequence of the parts (drive-pipe, waste-valve, and retaining-valve) being duplicated and the waste-valves being connected to the same bar and reciprocated by a pendulum, aided by the action of the waste water, one waste-water valve opens while the other is being shut, and the action of the waste-valves is regulated and rendered sensitive.

The air vessels *i* have their outlets connected by pipes *i'* to a common delivery-pipe *j*.

It will be evident that where a large volume of water is used more than one waste-valve *a* may be carried at each end of the bar *a'*, the apparatus in other respects being similar to that above described.

My invention is also applicable to machines or rams in which the valves *a* are arranged vertically, as represented at Figs. 3 and 4. In this case the valves *a* have their rods *a'* mounted in guides d^2 and are suspended from the outer ends of rocking levers *k*, which latter are actuated by adjustable studs e^4 on arms e^5 of a pendulum *e*, and the waste water is directed onto the floats *e'* of the pendulum *e* by guides $g^\times$ in a somewhat similar manner to that described with respect to Figs. 1 and 2.

In Figs. 3 and 4 the apparatus at one side only of the machine or ram is shown. The other side is arranged in a similar manner.

I would also remark that the invention is also applicable to single-valve machines or rams, in which case the arrangement would

be similar to either of those above described, except that the valve or valves at one end of the bar or lever would be dispensed with.

Having thus fully described my invention, what I desire to claim and secure by Letters Patent is—

1. In hydraulic rams, the combination with two drive-pipes, two air vessels, and two retaining-valves, of two waste-valves, and a pendulum pivotally supported between said waste-valves and adapted to receive impulse from the waste water and to operate said waste-valves, simultaneously opening one and closing the other alternately, substantially as described.

2. In hydraulic rams, the combination with two drive-pipes, two air vessels, and two retaining-valves, of two waste-valves connected together, and a pendulum pivotally supported between said waste-valves and adapted to receive impulse from the waste water and to operate said waste-valves simultaneously to open one and close the other alternately, substantially as described.

3. In hydraulic rams, the combination with two drive-pipes, two air vessels, and two retaining-valves, of two waste-valves connected together, a pendulum pivotally supported between said waste-valves, and plates or floats secured to opposite sides of said pendulum and adapted to receive impulse from the waste water thereby to cause said pendulum to operate said waste-valves simultaneously to open one and close the other alternately, substantially as described.

4. In hydraulic rams, the combination with two drive-pipes, two air vessels, and two retaining-valves, of two waste-valves connected together, a pendulum pivotally supported between said waste-valves, plates or floats adjustably secured upon opposite sides of said pendulum, and guides for directing the waste water onto said plates or floats to give impulse to the pendulum thereby to cause said pendulum to operate the waste-valves simultaneously to open one and close the other alternately, substantially as described.

5. In hydraulic rams, the combination of two or more drive-pipes, an air vessel on each of said pipes, a retaining-valve to each air vessel, a waste-valve to each drive-pipe, a bar carrying said waste-valves, springs carrying said waste-valve bar, and a pendulum acting to start the waste-valves and receiving its impetus from the waste water, substantially as herein set forth.

6. In hydraulic rams, the combination of two drive-pipes, two air vessels, two retaining-valves, two waste-valves carried by a bar, a pendulum acting on the waste-valve bar, springs on said pendulum, adjustable studs on the waste-valve bar on which said springs act, and means for causing the waste water to give impetus to said pendulum, substantially as herein set forth.

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

GEORGE HICKS HARRIS.

Witnesses:
B. J. B. MILLS,
CLAUDE K. MILLS.