

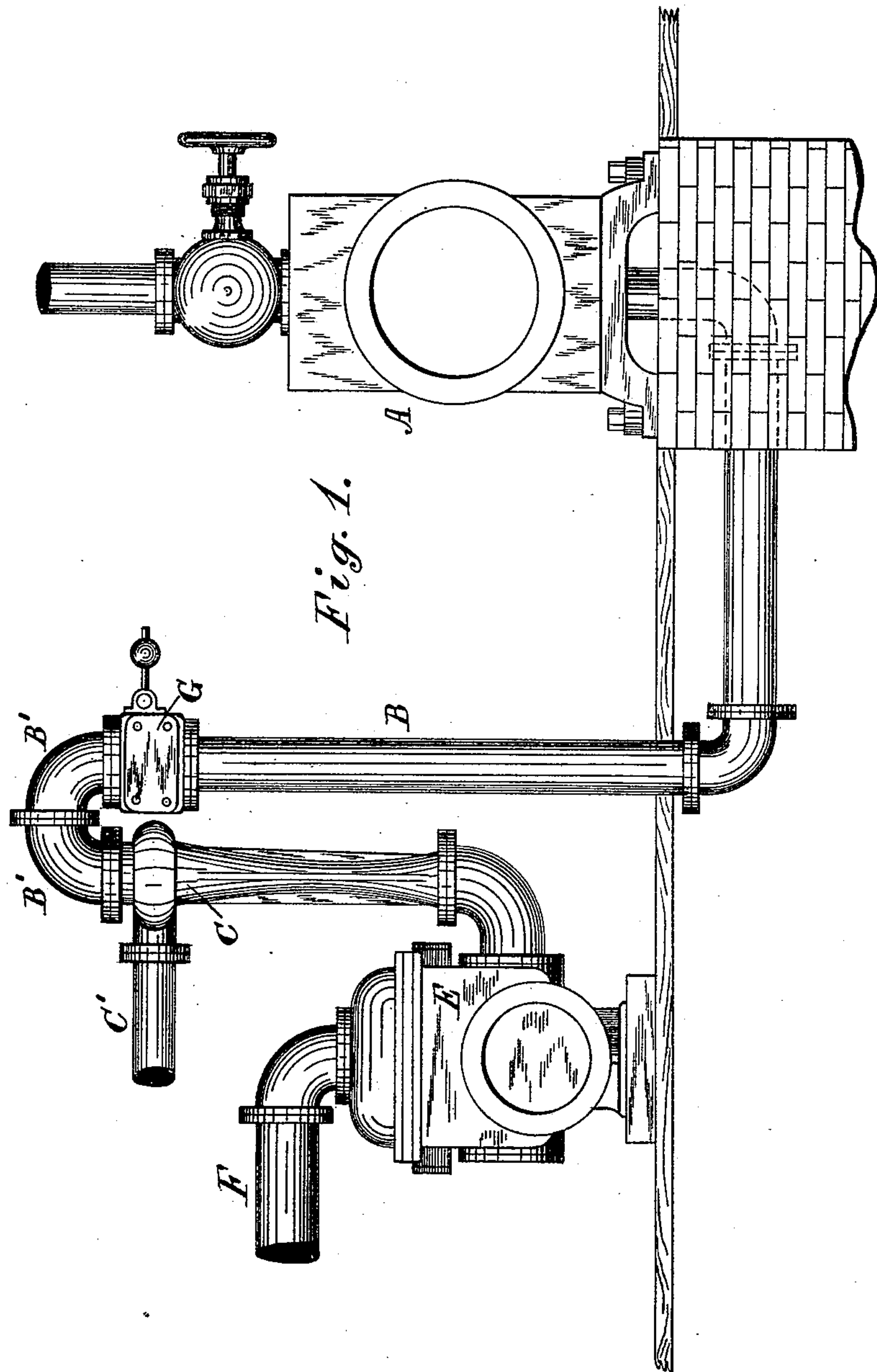
(No Model.)

2 Sheets—Sheet 1.

H. W. BULKLEY.  
CONDENSER EXHAUST SAFETY DEVICE.

No. 547,062.

Patented Oct. 1, 1895.



Attest:  
L. Lee,  
Edw. P. Kinsey

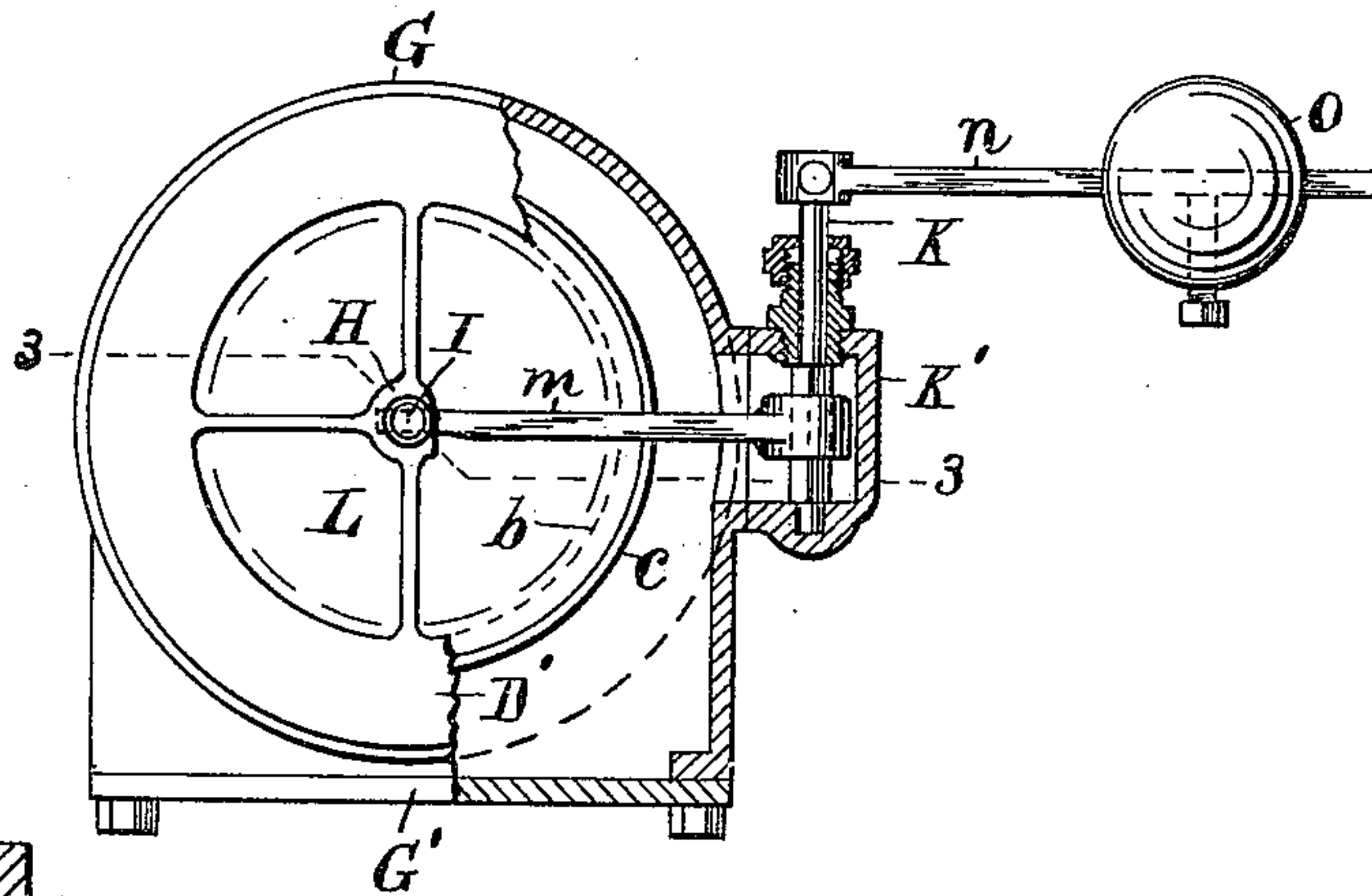
Inventor.  
Henry W. Bulkley,  
per Thomas S. Crane, Atty.

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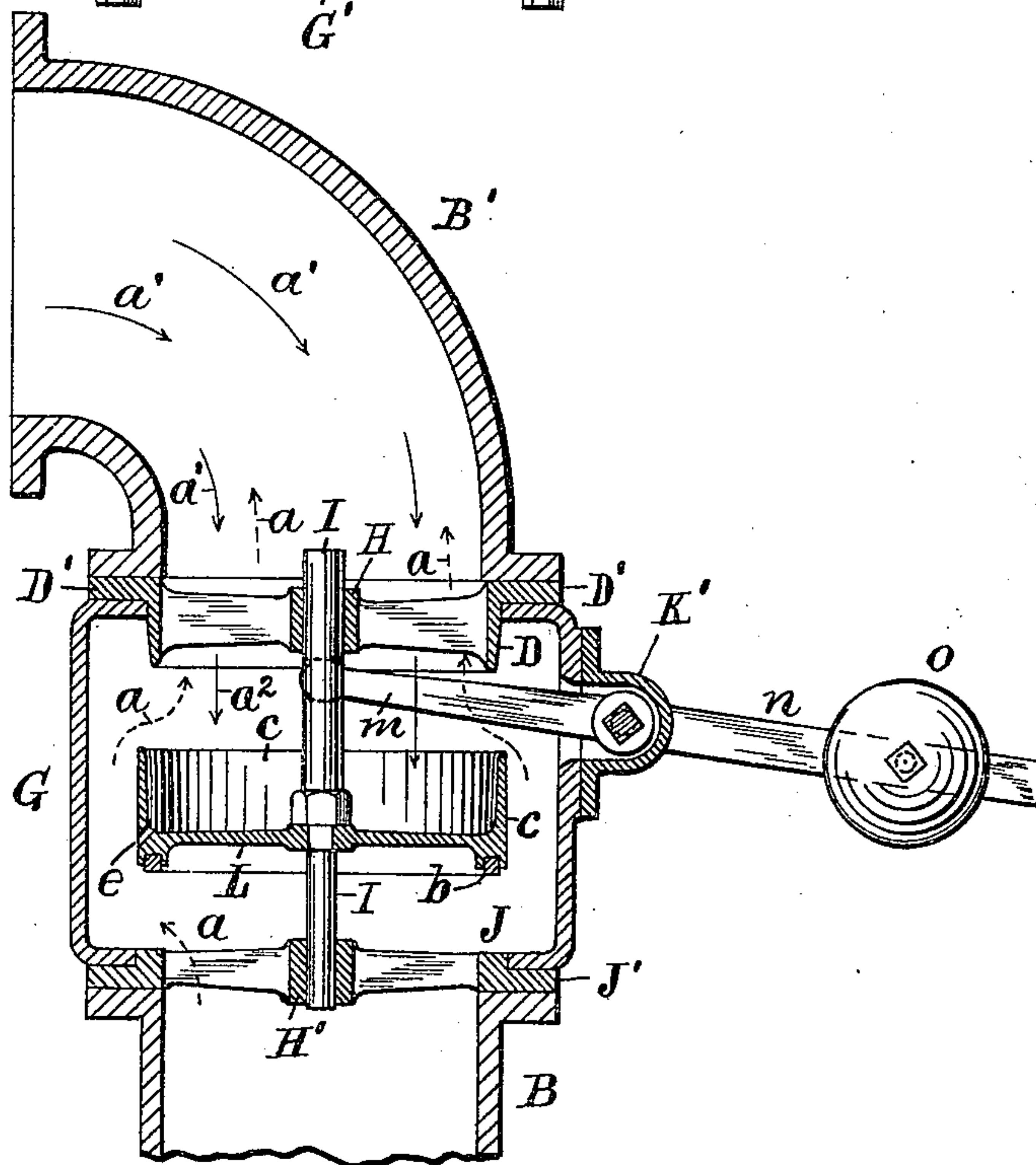
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*Fig. 2.*



*Fig. 3.*



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# UNITED STATES PATENT OFFICE.

HENRY WHEELER BULKLEY, OF EAST ORANGE, NEW JERSEY.

## CONDENSER EXHAUST SAFETY DEVICE.

SPECIFICATION forming part of Letters Patent No. 547,062, dated October 1, 1895.

Application filed January 28, 1895. Serial No. 536,453. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY WHEELER BULKLEY, a citizen of the United States, residing at East Orange, Essex county, New Jersey, have

invented certain new and useful Improvements in Condenser Exhaust Safety Devices, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of the present invention is to furnish a means for preventing the flow of water backward from a steam-engine condenser into the steam-cylinder, which sometimes occurs where the motion of the engine is continued by its fly-wheel after the steam is cut off, thus forming a vacuum in the cylinder greater than that in the condenser. When from any such cause the water of condensation flows into the steam-cylinder while the piston is in motion, great damage is caused to the engine, the piston or cylinder heads being broken in some cases, and in other cases the cylinder being burst. Provision is sometimes made by the insertion of a two-way valve in the exhaust-pipe for cutting off the passage to the condenser and opening the exhaust-pipe to the air, but the suddenness with which the flow of water occurs renders it very difficult to actuate such a valve with sufficient quickness either by hand or by atmospheric pressure. I have therefore devised the present construction, in which the valve is held normally above the seat to avoid any back-pressure upon the exhaust-steam, and is preferably formed with a flange around the edge to prevent the first portion of the water-current from passing the valve before it closes. Where such a valve is used in a vertical exhaust-pipe, I form a hole through the base of the flange to drain the water from the same after it is closed.

A construction embodying my invention is shown in the annexed drawings, in which—

Figure 1 is an elevation of an engine connected with a jet-condenser and air-pump, with the exhaust safety-valve inserted in the exhaust-pipe. Fig. 2 is a plan of the exhaust safety-valve and its attachments, partly in section where hatched, at the center of the shaft K. Fig. 3 is a vertical section of the same parts on line 3 3 in Fig. 2 with the adjacent parts of the exhaust-pipe.

A designates the steam-engine cylinder; B, its exhaust-pipe; C, a jet-condenser having water-supply pipe C', and E the air-pump connected to the outlet of the condenser and provided with overflow-pipe F. The jet-condenser is arranged vertically, with a portion of the exhaust-pipe similarly arranged and connected thereto at the top by return-bend B'. A chamber G is inserted in the vertical passage of the exhaust-pipe and formed at the top and bottom with guides H H' for a vertical valve-stem I. A seat J is formed in the bottom of the chamber transverse to the exhaust-pipe, and the top of the chamber is formed with an opening of the same size as the exhaust-pipe to permit the movement of the exhaust-steam to the condenser, as indicated by the dotted arrows *a*.

Where a vacuum is formed by the movement of the piston, the water from the condenser flows through the condenser-opening into the chamber, and the valve L is attached to the valve-spindle and made of greater diameter than the condenser-opening at the top of the chamber to positively intercept such flow. The valve is formed upon its under side with an annular groove to receive a rubber ring *b* to form a closely-fitting joint with the seat J. The margin of the valve is provided with an upturned flange *c* to form a cup, and a nozzle D is projected downward from the condenser-opening to direct the water which may enter the same into the cup. The flange *c* is formed at its base with a small hole *e*, forming a draining-passage to discharge the water from the valve, as hereinafter set forth.

The guide H is preferably formed in one piece with the nozzle D and a flange D', which is conveniently held between the top of the chamber and the flange of the return-bend B'. The guide H' is preferably formed in one piece with the valve-seat J and the flange J', which is held between the bottom of the chamber and a flange of the exhaust-pipe B. A shaft K is inserted through a hood K' in one side of the chamber and provided with an arm *m*, which is suitably fitted at its inner end to the valve-stem I to move the valve to and from the seat J. A lever *n* is attached to the outer end of the shaft and provided with a balance-weight *o*, which is adjusted



upon such lever so as to balance or overbalance the valve, as shown in Fig. 3, with suitable space above and below the valve for the free passage of the exhaust-steam, as indicated by the dotted arrows *a*. The valve is held normally raised above the seat, and as the flange *c* upon the valve is larger than the nozzle *D*, which forms the condenser-opening, it is obvious that when the current of water flows through such nozzle, as indicated by the arrows *a'*, it will be wholly directed within the cup, as indicated by the arrows *a''*.

The operation of the device is as follows: When the engine is supplying steam to the condenser, the valve is held normally raised, as shown in Fig. 3; but any conditions which produce a flow of water backward through the exhaust-pipe throws the water-current into the cup and forces the valve to its seat before any water can pass the same. The water-current flows in the direction of the arrows *a'* only so long as the vacuum is induced within the steam-cylinder by the motion of its piston, and during such period the cup-valve is held firmly upon its seat. When the conditions are reversed and a greater vacuum is developed in the condenser, the water which has entered the chamber *G* is drawn backward through the return-bend into the condenser, and is thus prevented from reaching the steam-cylinder and causing damage thereto. The water may also be drained from the chamber by any other suitable means, as by a drip-cock. The water contained in the cup drains out through the passage *e*, and thus permits the weight *o* to lift the valve from its seat when the normal conditions are restored. The passage *e* is not, however, of sufficient size to discharge any appreciable amount of water when the current first enters the cup and forces the valve upon its seat.

From the above description it will be observed that the movement of the valve is effected by a current of water, which, owing to its weight and momentum, is much more effective in promptly closing the valve than atmospheric pressure. The device is therefore more quick and certain in operation than anything actuated by a vacuum, and is thus positive and automatic in closing the exhaust-pipe before the water can do any harm to the engine. The chamber *G*, provided with the valve-guides, the valve, and the balancing device, is adapted for sale as a new article of manufacture, and may be readily inserted at a suitable point in any exhaust-pipe by cutting out a section of the latter. I have therefore claimed the same as an article of manufacture. A hand-hole, with cover *G'*, is shown upon one side of the chamber *G*; but the aperture in the bottom of the chamber may be made, as shown in Fig. 3, of suitable size to introduce the valve, and the valve-seat *J* may be constructed to fill such aperture when in use. With such construction the upper valve-guide, and also the nozzle *D*, if one be em-

ployed, may be formed integrally upon the top of the chamber. The nozzle *D* is useful in directing the water within the flange of the cup or valve *L*; but it is not essential to the construction if the cup be made larger than the condenser-opening from the top of the chamber, as herein described.

The essential feature of my invention is the steam-exhaust pipe, having the chamber with a seat transverse to its passage, the valve held normally raised above the seat, and the condenser-opening opposite to the seat, of smaller diameter than the valve, so that the valve may positively intercept the first flow of the water.

Although I have claimed the specific features of my construction, it will be obvious that their form may be materially modified without departing from the invention. As the exhaust-steam operates normally to open the valve, it may be exactly balanced and thus adapted to remain open or shut in whichever position it be placed. By such construction it differs materially from other forms of check-valves, most of which are held closed by their weight. By thus holding the valve in equilibrium it is more readily closed than if overbalanced or held open with any material degree of force.

As a spring is a well-known equivalent for the weight, it is obvious that it may be employed in place of the weight *o*, and may not only be readily adjusted to exactly balance the valve, but offers less inertia to the sudden movement of the valve when closed by the water.

As the exhaust-pipes of steam-engines are in practice led in every direction, it will be understood that the construction may be used with a horizontal or inclined pipe as well as with the vertical exhaust-pipe shown in the drawings.

The invention may also be used with any form of jet-condenser from which the water is liable to flow backwardly.

It will be readily perceived that this device is applicable to the pipe used for connecting a condenser with a vacuum-pan or any other receptacle in which a vacuum is to be produced, and the term "exhaust-pipe" may therefore be understood in this specification to include any such pipe.

Having thus set forth the nature of the invention, what is claimed herein is—

1. The combination, with a steam exhaust pipe, of a valve-chamber inserted therein, with a valve-seat transverse to its passage, and provided with a valve raised normally from the seat, and the condenser-opening of the chamber, opposite to the valve-seat, being smaller than the valve, as and for the purpose set forth.

2. The combination, with a jet condenser and a steam exhaust pipe, of a valve chamber inserted in the exhaust pipe with a valve seat transverse to its passage, and provided with a valve held normally raised from the



seat, and the condenser-opening of the chamber, opposite to the valve-seat, being smaller than the valve, as herein set forth.

3. The combination, with a steam exhaust pipe having a seat transverse to its passage, of a condenser-opening opposite the seat, a check valve movable to and from the seat with a flange at its margin projected toward the condenser-opening, and a draining hole at the base of such flange, as and for the purpose set forth.

4. The combination, with an upright exhaust pipe, of a valve chamber inserted therein with a seat at the lower end and a condenser-opening at the upper end, the cup-valve L of larger diameter than the opening movable to and from the seat, and means to balance the weight of the valve, as and for the purpose set forth.

5. The combination, with an exhaust pipe, of a valve chamber inserted therein with a seat at the lower end and an outlet at the upper end, guides fixed at opposite ends of the chamber, the spindle I fitted to the guides, the cup-valve L with rubber ring secured in the groove upon its outer face and provided with the draining hole *e*, and the spindle I provided with arm to lift the valve, and with weight and lever to counterbalance the valve, the whole arranged and operated as and for the purpose set forth.

6. As a new article of manufacture, an exhaust safety device consisting of the valve chamber G provided with valve seat in the bottom and a condenser-opening in the top, and guides at the opposite ends of the chamber, the spindle I fitted to the guides with the valve L movable to and from the seat, and having flange *c* and draining hole *e*, and means for holding the valve raised normally from the seat, substantially as herein set forth.

7. As a new article of manufacture, an exhaust safety device consisting of the valve chamber G having at the bottom the detachable flange J' carrying the seat J and guide H', and at the top the detachable flange D' provided with nozzle D and guide H, the spindle I carried by the guides, the cup-valve L movable to and from the seat, the hood K' with shaft K having the arm *m* arranged to move the valve and the weighted lever *n* to balance the same, the whole arranged and operated substantially as set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HENRY WHEELER BULKLEY.

Witnesses:

THOMAS S. CRANE,  
EDWARD F. KINSEY.