No. 682,260. Patented Sept. 10, 1901.

F. A. LITTLEFIELD.

STEAM TRAP.

(Application filed Jan. 9, 1901.)

(No Model.)

Fig. 1a

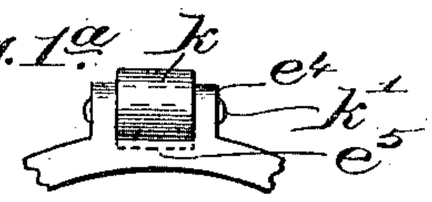

Fig. 1.

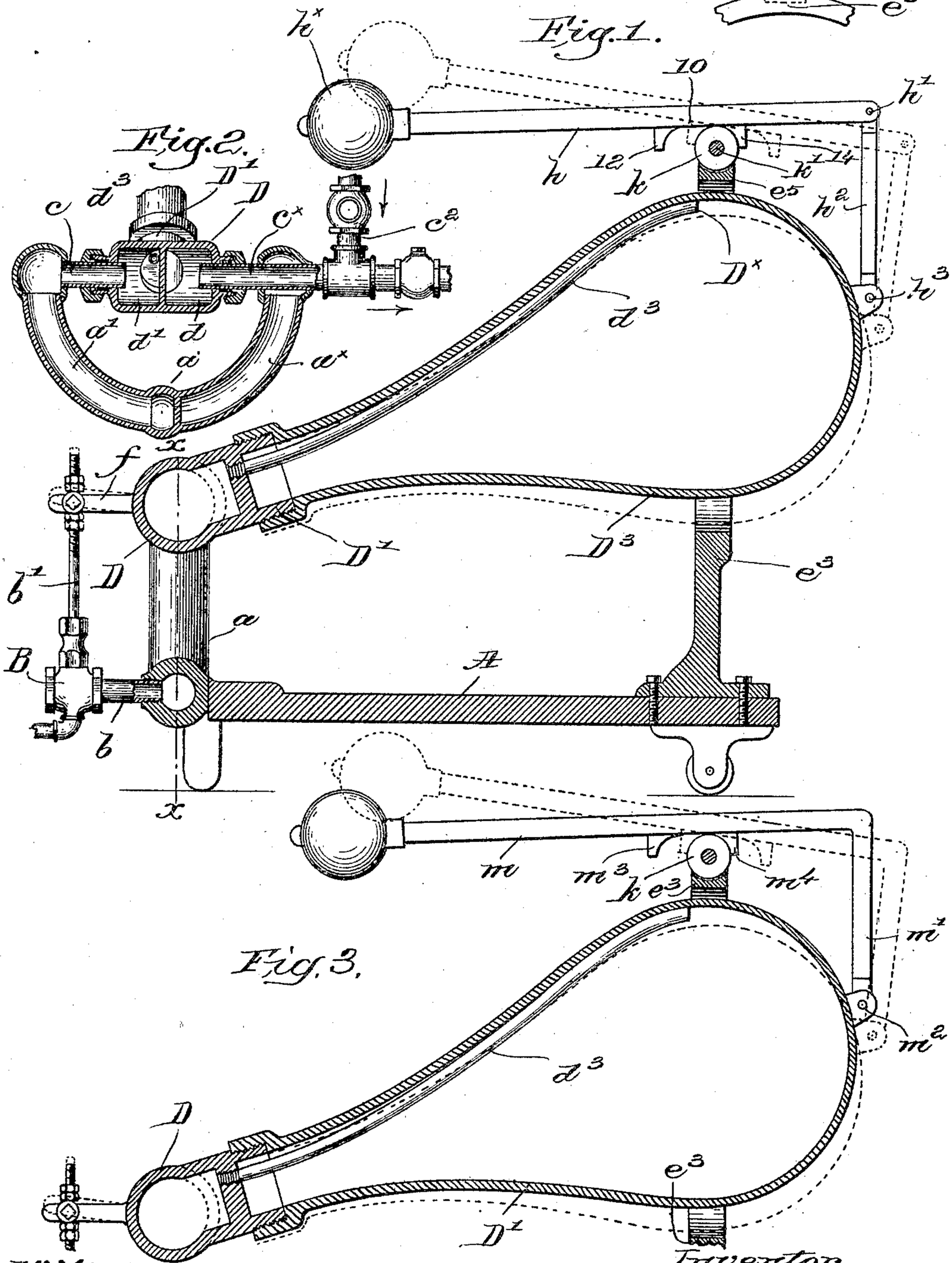

Fig. 2.

Fig. 3.

Witnesses.
Thomas J. Drummond.
Adolph Kaiser.

Inventor.
Frank A. Littlefield,
by Crosby Gregory Attys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FRANK A. LITTLEFIELD, OF NASHUA, NEW HAMPSHIRE, ASSIGNOR TO NASHUA MACHINE COMPANY, OF SAME PLACE.

STEAM-TRAP.

SPECIFICATION forming part of Letters Patent No. 682,260, dated September 10, 1901.

Application filed January 9, 1901. Serial No. 42,606. (No model.)

To all whom it may concern:

Be it known that I, FRANK A. LITTLEFIELD, a citizen of the United States, and a resident of Nashua, county of Hillsboro, State of New Hampshire, have invented an Improvement in Steam-Traps, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to steam-traps of the type wherein the water of condensation is collected in a movable receiver, which latter when filled by a predetermined quantity of water is moved by the weight thereof, such movement actuating a suitable valve or valves to effect the discharge from the receiver of the accumulated water, such a trap being shown in United States Patent No. 513,648, granted to me January 30, 1894. In the said patent the movements of the receiver are controlled or regulated by a counterbalancing-lever connected at one side of its fulcrum with the receiver and at the opposite side sustaining an adjustable weight, the active points of the lever—viz., the point of connection of the lever and the receiver and the center of the weight—being located above the fulcrum and forming an angle therewith of less than one hundred and eighty degrees to thereby accelerate the movement of the lever in either direction. This is effected in practice by providing the lever with a depending arm which is supported at its free lower end on the fulcrum—a fixed block or support. Such construction is well adapted to comparatively small traps, such as have a receiver capacity of, say, ten gallons of water; but much larger apparatus is now demanded, in many instances with a receiver which will hold from one hundred and fifty to four hundred and fifty pounds of water, and the controlling means shown in the patent referred to is not satisfactory with such large traps. It is necessary to fix the leverage of the controlling-lever in proportion to the load in order that the receiver when at full load will drop into discharging position, and the heavier the load the greater the leverage, the latter being increased by lengthening the depending arm of the lever, and when this is done the lever rocks so rapidly as soon as it passes dead-center that the loaded receiver drops with a rush, the shock imparted to the various portions of the apparatus being very objectionable. Inasmuch as a large receiver will itself weigh from two hundred to one thousand pounds or over it will be manifest that with the addition of the water a very considerable moving weight must be controlled, and to operate a water-load weight of three hundred pounds it would be necessary to lengthen the depending arm to about six inches. Not only is the shock produced by the stoppage of the movement of the receiver very harmful, but such lengthening of the depending arm lifts the controlling-lever too much above the apparatus, the construction is not good mechanically, and the space required for the apparatus is made unduly large. Should the weight on the lever be increased instead of lengthening the depending arm, the receiver would be returned to filling position before it had completely discharged its load of water.

My present invention has for its object the production of controlling means for a steam-trap of the type referred to whereby no matter whether the water load of the receiver be moderate or large the movement of the receiver will take place gently and without shock, with complete efficiency in the operation of the apparatus as a whole.

Figure 1 represents in vertical section a steam-trap of the type hereinbefore referred to with one embodiment of my present invention applied thereto. Fig. 1ª is a detail in side elevation of the fulcrum for the controlling-lever. Fig. 2 is a vertical sectional detail on a smaller scale on the line *x x*, Fig. 1, to be referred to. Fig. 3 is a view similar to Fig. 1, but showing a modified form of controlling-lever, a portion of the stand or frame of the apparatus being omitted.

Referring to Figs. 1 and 2, the base A, of suitable shape to support the various parts, has secured to it a U-shaped support *a*, connected with the steam-supply pipe *b*, communicating with the hollow arm *a'*, Fig. 2, and provided with a valve at B, having a vertically-movable stem *b'*, as in Patent No. 513,648, referred to, and as in said patent a pipe *c* establishes communication between the

arm a' and one compartment, as d', of a revolving head D, the other compartment d communicating by a second pipe $c^{\times}$ with the boiler or other receptacle which is to receive the discharged water. A branch c^2, leading into the pipe $c^{\times}$, is connected with the outlet of the steam heating or other system to be drained. The revolving head D is mounted upon the inner ends of the two pipes $c\,c^{\times}$, between the arms of the support a, and suitably packed to prevent leakage, the said head having a neck d', to which is secured the end of an egg-shaped or spherical receiver D^3, which communicates with the compartment d in the head, while the compartment d' is provided with an outlet or steam pipe d^3, following the upper part of the receiver and terminating at or near the point $D^{\times}$. (See Fig. 1.) The head has a rearwardly-extended arm f, connected with the valve-stem b' to operate the valve at B, and the operation of the apparatus so far as described is substantially as set forth in the patent referred to, viz: When the water from the heating or other system entering through the pipe c^2 has sufficiently filled the receiver D^3, the same will overcome the counterbalancing-weight to be referred to and the receiver will drop into its dotted-line position, Fig. 1, thereby opening the valve at B and admitting steam from the boiler through the pipe d^3 into the receiver, above the accumulated water therein, forcing the water out through the pipe $c^{\times}$ and into the boiler, the receiver returning again to its normal position as soon as the water is discharged.

In my present invention a controlling or counterbalancing lever h, Fig. 1, is connected at one end at h' by a link h^2 with the free end of the receiver at h^3, the link being located at one side of the fulcrum of the lever, and at the other side of the fulcrum a counterbalancing-weight $h^{\times}$ is sustained by the lever. The fulcrum is shown as a rotatable roll k, the journals k' of which are mounted in ears e^4 of the head e^5 at the top of the yoke portion e^6, and the lever h rests and rocks upon and is also adapted to travel or shift longitudinally upon the roll k. Upon its under side the lever is provided with an elongated fulcrum-seat 10, the length of which is determined by two stops or projections 12 14, concaved on their inner faces to correspond with the curvature of the roll k, the curved ends of the seat formed thereby constituting two longitudinally-separated fulcrum-points for the lever. The active points of the latter in my present invention are the point h', from which connection is made with the receiver, and the center of gravity of the weight $h^{\times}$, and these points are normally one above and the other below a horizontal plane passing through the fulcrum. In the full-line position of the parts in Fig. 1 the receiver is at its highest point and the lever h is resting on the right-hand fulcrum-point, the active point h' being above the horizontal plane passing through the fulcrum k, and when the water accumulating in the receiver overcomes the weight it will descend. When nearly the full load has thus been received, the lever will be rocked into horizontal position on dead-center, and the completion of the load will carry the lever past dead-center, whereupon the lever will shift or slide longitudinally to the right until the stop 12 engages the fulcrum k, the parts assuming the dotted-line position. This change or shift of the lever from one to the other of its fulcrum-points is effected rapidly; but the distance the receiver drops during such change is so slight that there is no shock whatever to the parts of the apparatus, as with a large receiver having a capacity of several hundred pounds of water the total throw of its free end will be about two and three-eighths inches, and the final movement of the receiver after the lever has shifted will be only about three-eighths of an inch.

It will be manifest that the effective length of the arm of the lever at the right of the fulcrum will have been increased and the effective length of the weight-supporting arm decreased by the shifting of the lever, so that a quick final movement of the receiver is obtained, but without any jar or shock, and the receiver will remain lowered until it is substantially empty. On the other hand, assuming that the receiver has fallen to its lowest position, as the accumulated water is discharged the receiver will rise when the weight can overcome its weight, the lever rocking on its left-hand fulcrum-point in dotted lines, Fig. 1, and the lever will assume a horizontal position or on dead-center just before the receiver has reached the uppermost position, and the lever will be rocked past dead-center, and it shifts longitudinally, but this time to the left, and as it reaches full-line position the empty receiver comes to rest; but the final movement of the receiver upward is so slight that the momentum is insufficient to cause any shock or jar. By the construction described the controlling-lever is brought down close to the top of the main portion of the apparatus. I am enabled to dispense entirely with any long depending fulcrum-arm for the lever, and absolutely all shock and jar are obviated, no matter how large and heavy the receiver may be or its full load of water. The shift of the lever from full to dotted line position prevents the weight from acting to elevate the receiver too soon, as such action would prevent a complete discharge of the accumulated water. The weight is heavy enough when the effective length of its lever-arm is shortened to quietly raise the receiver when empty till the lever is rocked past dead-center, and when the lever-arm at the weight side of the fulcrum is longest the weight of the receiver plus its full load of water is sufficient to overcome it and permit descent of the receiver and movement of the lever to the

dead-center and just past it, whereupon shift takes place and the effective lengths of the lever-arms are changed, as described.

In Fig. 3 I have shown a modification of my invention, the controlling-lever m having an L shape, its downturned portion m' being connected at m^2 with the receiver. A fulcrum-seat is provided as before, the stops m^3 m^4 determining the length of the shift of the lever when it changes from one to the other fulcrum-point; but as there is a horizontal movement of the point m^2 of the receiver as it swings on its trunnions the lever will be slightly moved longitudinally on its fulcrum-roll before it swings past dead-center, owing to the rigid connection of the lever m and its depending arm m', so that the effective lever-arms will be changed somewhat before the main shift takes place. This construction is adapted to the smaller sizes of receivers; but for larger ones and with considerable loads I prefer the construction shown in Fig. 1. In either case the stops on the controlling-lever operate not only to limit the shifting movement of the lever, but also to limit the travel of the receiver, for the parts of the apparatus are in equilibrium in the full-line position, Fig. 1, when the receiver is empty and in dotted-line position when the receiver is full.

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

1. In a steam-trap, the combination with a movable receiver, of a counterbalancing-lever having two longitudinally-separated fulcrum-points and connected at one side of its fulcrum with and to be rocked by the receiver and sustaining a weight at the other side of the fulcrum, and a fulcrum for the lever, rocking of the latter thereupon past dead-center causing the lever to shift longitudinally upon the fulcrum from one to the other of said fulcrum-points.

2. In a steam-trap, the combination with a movable receiver, of a longitudinally-shiftable counterbalancing-lever having an elongated fulcrum-seat, and a fulcrum upon which the lever rocks and shifts, said lever being connected at one side of its fulcrum with and to be rocked by movement of the receiver and sustaining a weight at the opposite side of the fulcrum.

3. In a steam-trap, the combination with a movable receiver, of a shifting counterbalancing-lever connected at one side of its fulcrum with and to be rocked by the receiver and sustaining a weight at the other side of the fulcrum, and a fulcrum for and upon which said lever shifts longitudinally when swung past dead-center by movement of the receiver.

4. In a steam-trap, the combination with a movable receiver, of a shifting counterbalancing-lever connected at one side of its fulcrum with and to be rocked by the receiver and sustaining a weight at the other side of the fulcrum, a fulcrum for and upon which said lever shifts longitudinally when swung past dead-center by movement of the receiver, and means to limit such shifting movement of the lever.

5. In a steam-trap, the combination with a movable receiver, of a shifting counterbalancing-lever connected at one side of its fulcrum with and to be rocked by the receiver and sustaining a weight at the other side of the fulcrum, and a rotatable fulcrum on which said lever rocks and over which it travels longitudinally when swung past dead-center by movement of the receiver.

6. In a steam-trap, a rocking receiver, combined with a rotatable fulcrum-roll mounted in fixed bearings, a counterbalancing-lever supported upon said roll and longitudinally shiftable thereupon, stops on the lever at opposite sides of the roll, to limit the shifting movement of the lever, a weight sustained by the latter at one side of the fulcrum, and a connection at the other side between the lever and the receiver, the active points of the lever being normally above and below the fulcrum, respectively, rocking of the lever by movement of the receiver reversing the position of the active points relatively to the fulcrum and causing the lever to shift when past dead-center.

7. In a steam-trap, a movable receiver, combined with a controlling-lever provided with a weight at one side of its fulcrum and connected at the opposite side thereof with and to be rocked by movement of the receiver, a fulcrum having a convex supporting-surface upon which the lever is free to be rocked and to move longitudinally, the main movement of the receiver in either direction acting to rock the lever to and past dead-center, subsequent shifting of the lever on its fulcrum being simultaneous with the slight final movement of the receiver, and means to limit the shifting movement of the lever and the throw of the receiver.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANK A. LITTLEFIELD.

Witnesses:
EDWARD H. WASON,
NELLY A. COURTNEY.