No. 676,466. Patented June 18, 1901.

H. C. MOOERS & A. COOKE.

STEAM TRAP.

(Application filed Nov. 8, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

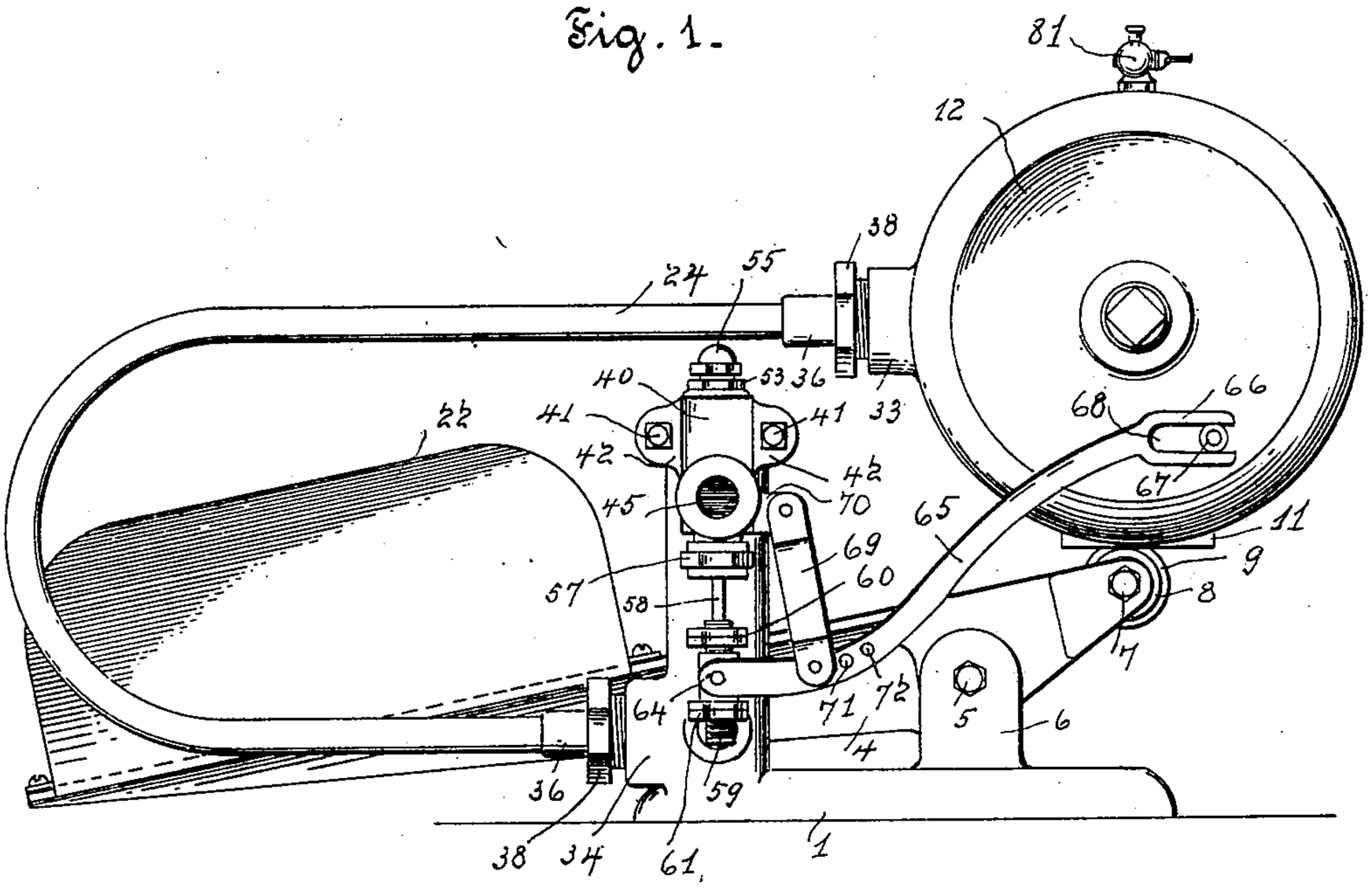

Fig. 2.

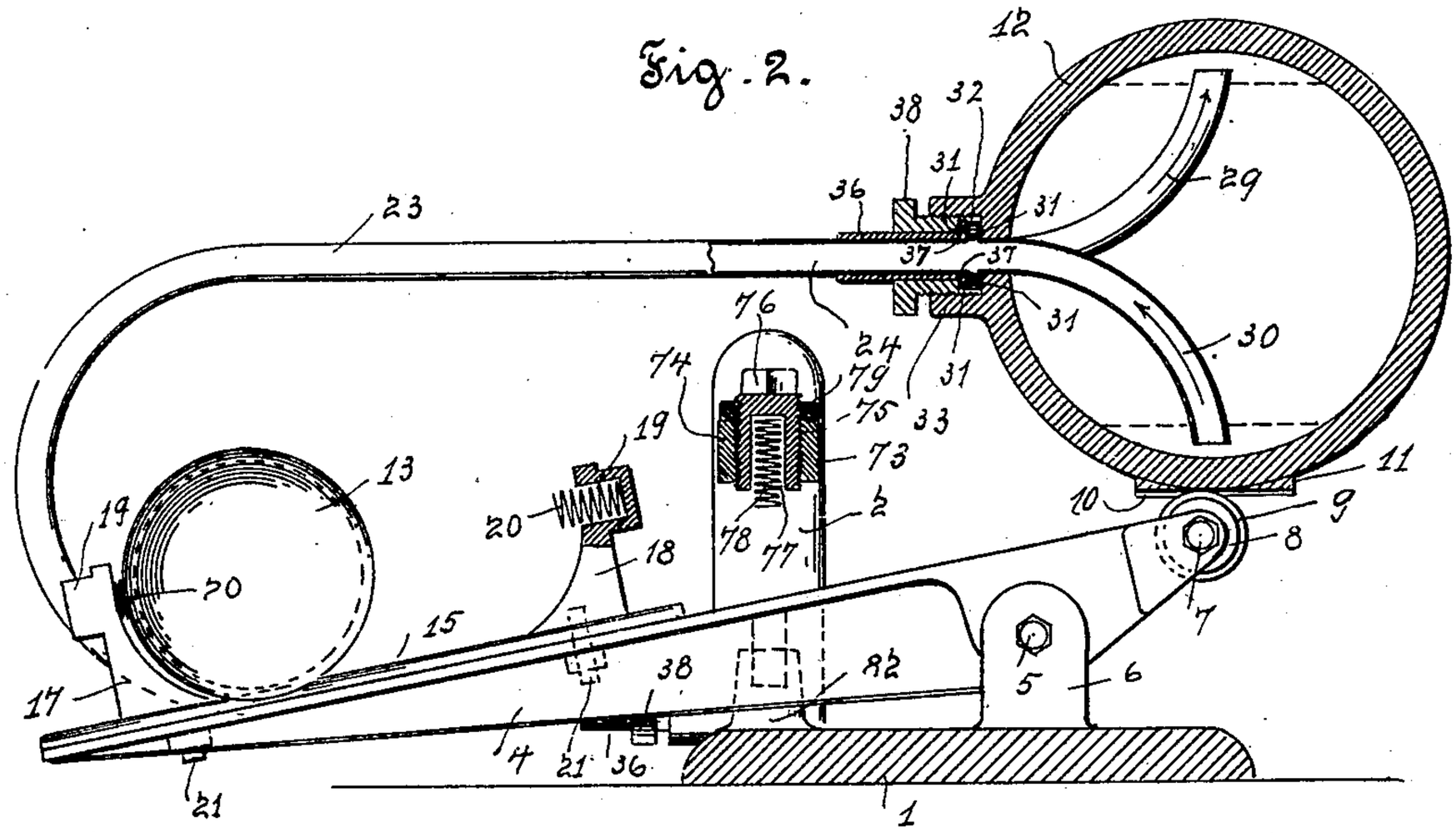

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Fig. 3

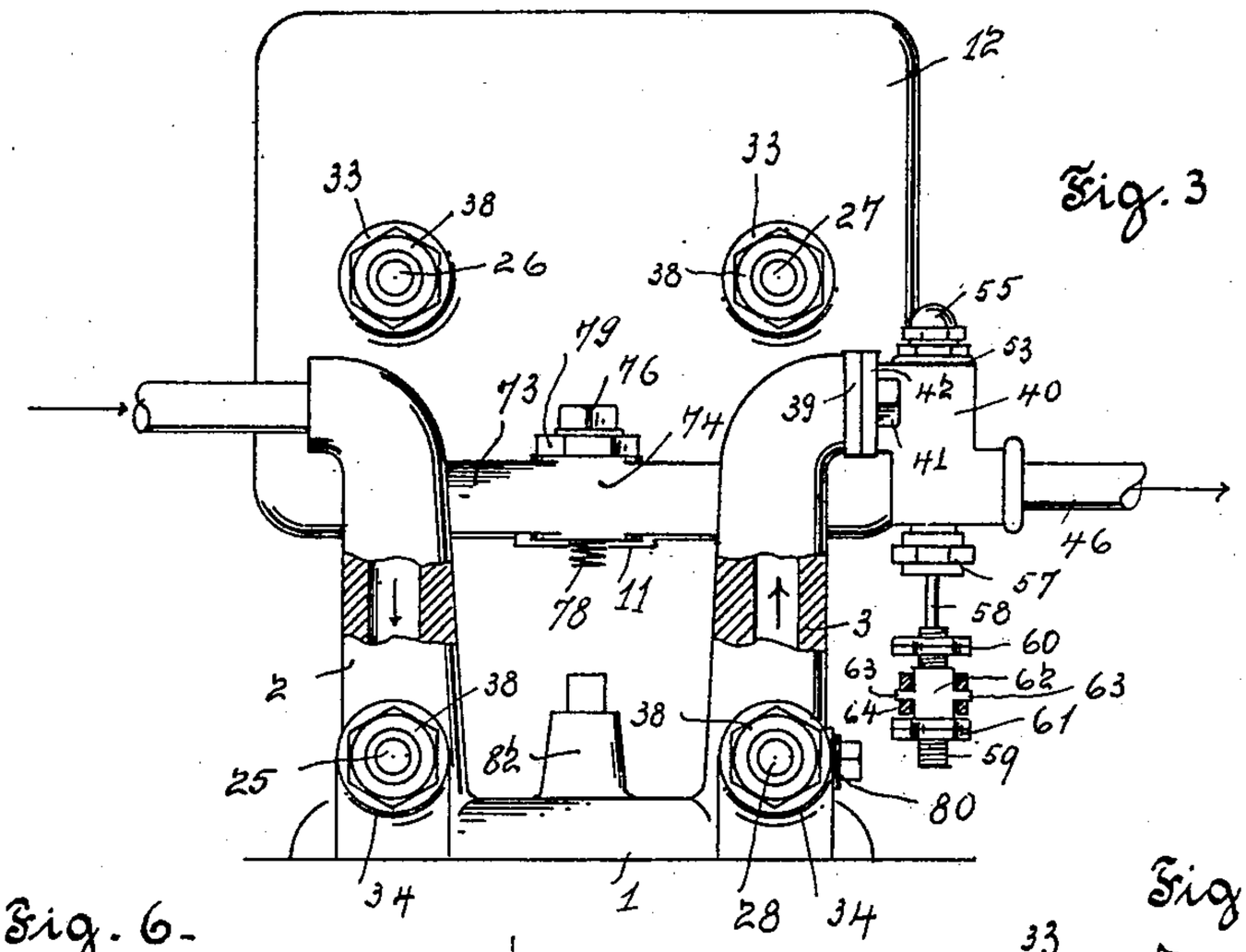


Fig. 6.

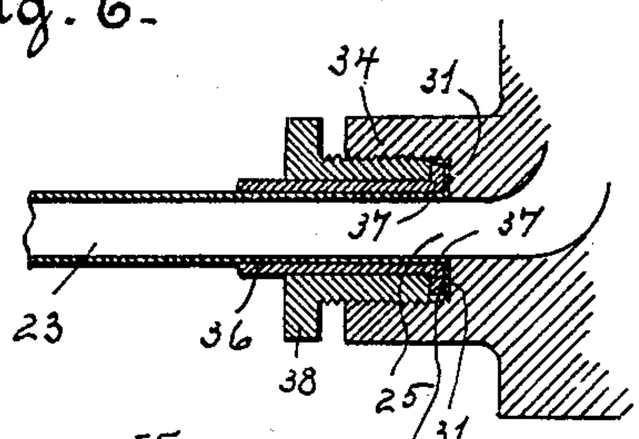


Fig. 5.

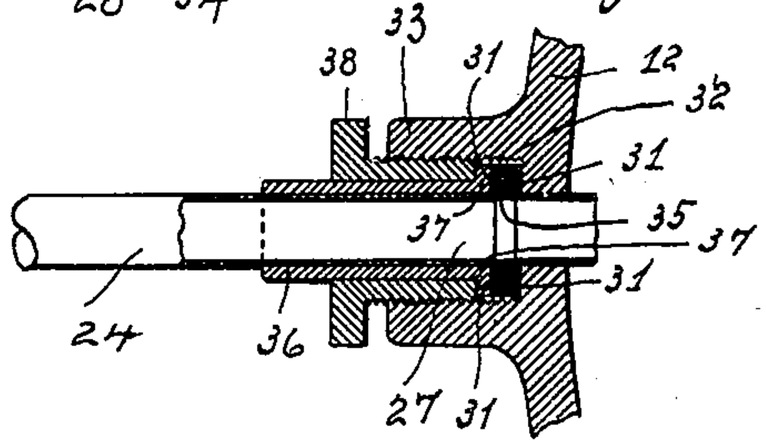


Fig. 4.

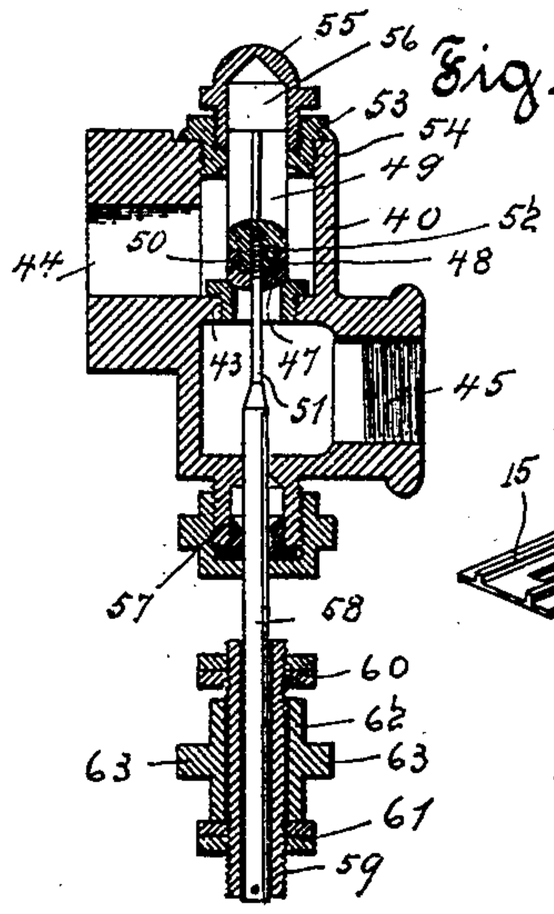


Fig. 7.

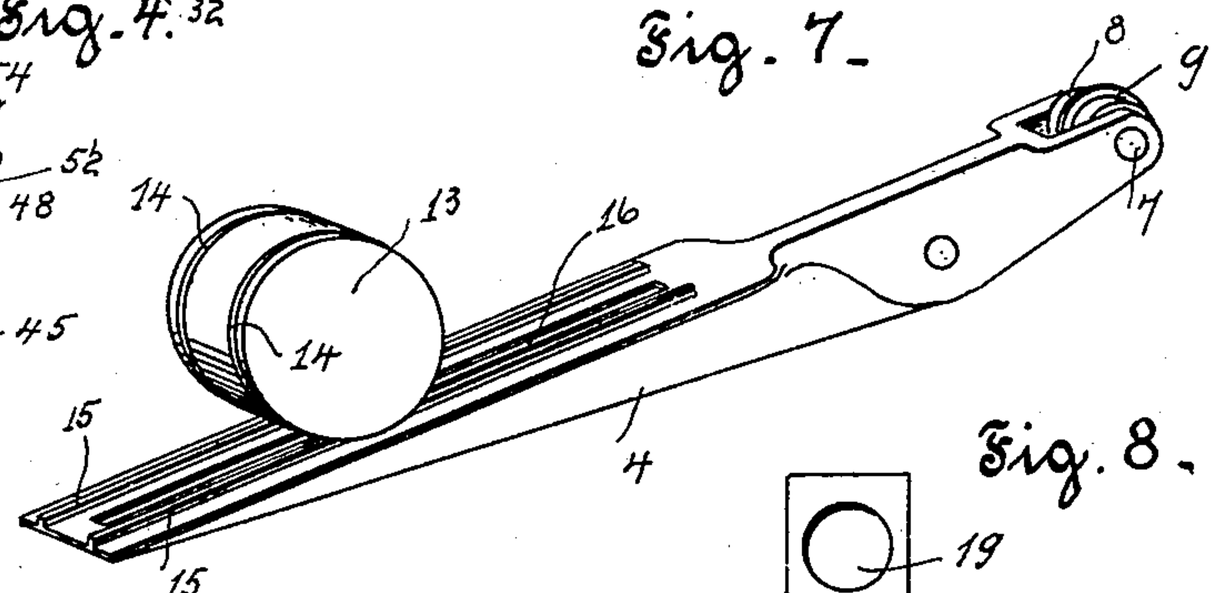
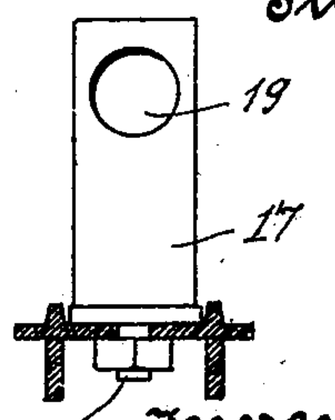


Fig. 8.



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UNITED STATES PATENT OFFICE.

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STEAM-TRAP.

SPECIFICATION forming part of Letters Patent No. 676,466, dated June 18, 1901.

Application filed November 8, 1900. Serial No. 35,797. (No model.)

To all whom it may concern:

Be it known that we, HENRY C. MOOERS and ALBERT COOKE, citizens of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented a new and useful Improvement in Steam-Traps, of which the following is a specification.

Our invention relates to a steam-trap, and has for its object to automatically discharge at intervals liquid accumulated from condensation; furthermore, to utilize a definite weight of liquid accumulated from condensation as a means of effecting its discharge; furthermore, to provide means whereby the trap may be adjusted to operate at any pressure of steam; furthermore, to provide uniformly-sensitive flexible antifriction connections to and from a reservoir, adapting it to be poised and move freely as a balancing-weight on one arm of a balancing-lever and to be underbalanced or overbalanced by a movable counterweight on the other arm, according as the counterweight is automatically shifted thereon by a definite accumulation of liquid in the reservoir or by its discharge therefrom, thereby avoiding the use of packed pivotal joints of sectional connections for the purpose, which create undue friction, retard the movements, and cause leakage; furthermore, to provide automatically-operating means whereby the level of the liquid in the reservoir will always remain below the inlet and above the outlet ports thereof, thereby preventing water-pounding and loss of steam, and, finally, to produce a highly-sensitive, prompt-acting, and reliable steam-trap for discharging liquid accumulated from condensation adapted to long-continued use without attention under widely-varying conditions of steam pressure and condensation. We accomplish these objects in the manner and by the means as hereinafter described, and illustrated in the drawings.

In the drawings, Figure 1 is a side elevation of a steam-trap constructed in accordance with our invention. Fig. 2 is a longitudinal section through the same. Fig. 3 is a rear view of the trap. Fig. 4 is an enlarged section through the valve. Fig. 5 is an enlarged section of a preferred method of connecting the tubes to the reservoir. Fig. 6 is a like section showing the tube connections to the standard. Fig. 7 is an isometric view of the balancing-lever and shifting weight. Fig. 8 is a section through the balancing-lever, showing the method of securing the stops.

In the drawings, 1 designates a base for the apparatus, having integral therewith vertically-projecting tubular standards 2 and 3, which are oppositely disposed upon one end of the base and with the openings at right angles to each other.

4 designates a balancing-lever which is fulcrumed in antifriction-bearings 5, provided therefor in the bifurcated lug 6, integral with the base. The short end of the lever is also bifurcated, and journaled between in antifriction-bearings 7 is a roller 8, having a central projecting tongue 9 to engage a coincident groove 10, formed upon the flat plate 11, located on the under side of the reservoir 12. The reservoir is supported upon the short end of the lever and partially held in position upon the roller by means of the engaging groove and tongue. Upon the long arm of the lever is mounted a rolling counterweight 13, having formed thereon grooves 14, adapted to receive vertically-projecting ribs 15, which form a track for the movable weight. The ribs 15 are integral with the lever-arm, and between the ribs there is formed a slot 16.

17 and 18 designate adjustable stops adapted to limit the travel of the operating-weight, and each of the stops is provided with a pocket 19, into which springs 20 are inserted to start the movement of the weight at either point at the moment of hesitancy as the weights are balancing and also to operate as a cushion for the weight. The stops are of a width to fit between the ribs and are provided with clamping-bolts 21, which project through the slot 16 in the lever-arm and are adjustable from the under side after the track is inclosed in a dust-proof casing 22.

The reservoir is coupled to the tubular standards by means of curved spring or flexible tubes 23 and 24, and which together form inlet and outlet conduits to and from the reservoir, and when so connected the tubes operate to hold the reservoir upon the roller 8, while allowing it to move freely as a weight with the lever 4. The inlet-tube 23 is con-

nected to outlet 25 of the tubular standard 2 and to the inlet-opening 26, formed in the reservoir, and the outlet-tube 24 is connected to outlet-opening 27 of the reservoir and the opening 28 of the tubular standard 3, and thereby form conduits communicating with the interior of the reservoir at the top and bottom by means of tubes 29 and 30, reversely curved. By so constructing the inlet and outlet the cost of the reservoir-casting is not only reduced, but smooth walls are provided for the flow of water, thereby reducing the friction.

In the construction of the couplings the ends of the tubes 23 and 24 and the outer ends of tube 29 and 30 are provided with a flange 31 and inserted into the threaded and counterbored opening 32 in the bosses 33 and 34, which latter are integral with the reservoir and the standards 2 and 3, respectively. At the reservoir-couplings a packing-ring 35 is interposed between the flanges, which packing-ring is omitted in making the coupling of the tubes to the standards.

36 designates glands surmounting the tubes 23 and 24 at their points of connection and provided with a flange 37 of a diameter to enter the bore of the bosses, and 38 designates gland-nuts externally threaded to engage with the internal threads of the bosses, so that by screwing the gland-nuts down tight joints are formed at the points of coupling of the tubes.

The outlet of the tubular standard 3 is formed with a flange 39, to which the valve-body 40 is secured by means of bolts 41, the valve-body having a like flange 42 oppositely disposed upon the sides of the body.

43 designates a diaphragm dividing the interior space of the valve-body into the inlet-port 44 and the outlet-port 45, which latter is internally threaded for pipe-coupling 46. The valve-seat 47 is screw-threaded into the diaphragm and the valve 48 is made sectional and comprises the winged guide 49 and the renewable valve-tip 50. The latter is coupled to the guide by means of the valve-stem 51, having a reduced and screw-threaded portion 52, which passes through the tip of the valve into the guide, and thus coupling the stem to valve 48 the guide is held centrally in a bonnet 53, externally screw-threaded and run into the top 54 of the valve-body, and 55 is a nut run into the bonnet, having an internal bore 56 to receive the winged stem of the valve.

57 designates the packing-glands of the enlarged valve-stem 58, which passes through the under side of the valve-body. At the lower extremity the valve-stem is surmounted by a sleeve 59, the ends of which are screw-threaded to engage the adjusting lock-nuts 60 and 61. Between these nuts there is movably mounted upon the sleeve a collar 62, having diametrically-disposed pins 63, adapted to pivotally engage the bifurcated end 64 of the operating-levers 65. The opposite end 66 of the aforesaid lever is also bifurcated to engage a roller 67, journaled to the end of the reservoir, and the bifurcation 68 is of a length to allow the depression of the reservoir.

69 designates a movable fulcrum for the valve-lever, and the fulcrum is pivotally connected to a projecting tip 70 integral with the valve-body. The other end of the fulcrum is pivotally connected to the lever.

71 72 designate points to which the fulcrum may be shifted upon the valve-lever to operate the valve against different pressures. As shown in the drawings, the valve-lever is adjusted to work against high pressure, by shifting the fulcrum to the point 71 at intermediate pressure and at 72 at low pressure.

The cross-arm 73 is cast integral with the tubular standards and is provided with a central boss 74, having an internally-threaded aperture 75 to receive the adjustable screw-plug 76, adapted to limit the vertical movement of the weight-lever. The plug 76 is formed with a central cavity 77, into which a spring 78 is inserted to prevent shock to the weight-lever by striking the adjusting-plug, and 79 designates a lock-nut for the plug after adjustment.

80 designates a plug run into the standard 3 for blowing off and removing the sediment from the conduits, and the cold air in the trap and pipe system is allowed to escape through a vent 81 at the top of the reservoir.

The downward movement of the long arm of the balancing-lever is limited by a cushioned stop 82.

When the stops 17 and 18 are properly adjusted for operation, the counterweight when against the inner stop will just overbalance the reservoir with enough water in it to seal the opening of the outlet-tube 30, and when against the outer stop will be overbalanced by the reservoir when filled to a certain higher level below the opening of inlet-tube 29. Thus adjusted with a water seal in the reservoir the balancing-lever, reservoir, counterweight, and valve-lever will be in the relative positions shown in Fig. 1, with the valve closed. The operation will then be as follows: The condensation of the steam system will drain through the pipe connection of the trap to and through the tubular standard 2, the flexible tube 23, and the upcurved inlet-tube 29 into the reservoir until at the predetermined upper level the added weight of the accumulation overbalances the counterweight and causes a reversal of the inclination of the lever. At a point in this movement when the outer end of the long arm is slightly above the horizontal the counterweight, under the impulse of gravity and the spring 20, rolls down the long arm to the inner stop 18 with constantly-accelerated speed, thereby increasing the momentum of the descent of the reservoir during the last half of the movement. In its descent the reservoir operates the lever 65 to open the valve 48. As soon as the valve is opened the steam-pressure on the liquid in the res-

ervoir forces its discharge through outlet-tube 30, flexible tube 24, standard 3, valve 48, and its outlet-port 45 until it is reduced in quantity and weight to that of the original water seal, when the counterweight will overbalance the reservoir, shift to the outer stop, and cause a return of the several parts to their original positions, as in Fig. 1. These operations will be repeated as often as the defined limits of accumulation and discharge occur.

It will be noted, as shown in Fig. 4, that the nuts 60 and 61 on the valve-stem are so adjusted that the collar 62, trunnioned on the short end of lever 65, will not come into contact with nut 60 in the reversal movement for discharge until the counterweight has shifted to the inner stop. By this arrangement the increased weight and momentum of the descending reservoir, multiplied by the advantage of the long arm of the lever 65, is utilized to overcome the steam-pressure on the valve, and sufficient power is thereby provided to open the valve under a wide range of pressures. The lever 65 may be specially adjusted for high, low, or intermediate pressures by pivoting the movable fulcrum 69 in the special orifices in lever 65, provided therefor, thereby varying the leverage and opening the valve in proportion to the pressure. The trap may be further adjusted for extreme high or low pressures by substituting valves and seats of diminished or increased area. It is obvious also from the relation of collar 62 to nut 61, after the valve is opened, that the valve will remain fully open until the counterweight has shifted from the inner to the outer stop, which will occur promptly at the moment when the liquid in the reservoir is reduced by discharge to the weight of the original water seal, whereby a prompt and quick closing of the valve is attained in like manner as the opening is effected. By the prompt opening and closing of the valve thus secured the level of the liquid in the reservoir is prevented from rising above or falling below the limits prescribed, thereby preventing water-pounding caused by the submergence of the inlet or loss of steam by the unsealing of the outlet. The quantity discharged at each operation will be measured by the capacity of the reservoir between the prescribed levels plus the accumulation while the valve is open.

By employing flexible tubes for inlet and outlet connections to the reservoir the latter is made better adapted for use as a balancing-weight and is rendered freely responsive to any increase or diminution of the weight of liquid therein and to changed positions of the counterweight. By their use the friction, wear, and leakage incident to packed pivotal joints for the purpose are entirely avoided, and as used in our apparatus, together with the antifriction-bearings of the several working parts and an accurately-turned cylindrical counterweight, we produce a highly-sensitive, prompt-acting, and reliable steam-trap, adapted to long-continued use without attention under widely-varying conditions of steam pressure and condensation.

We claim as new—

1. In a steam-trap, a balancing-lever fulcrumed on a base to form arms of unequal length, a reservoir poised as a weight on the short arm, a shifting counterweight on the long arm, movable by gravity between outer and inner stops thereon, adapted to overbalance the reservoir when empty, flexible pipe connections from a steam system to the reservoir, and from the reservoir to a discharge, adapted to allow the free movement of the reservoir as a weight, a valve in the discharge adapted to open or close it, and means operatively connected to the valve and to the reservoir, adapted to operate the valve to open or close the discharge according as the counterweight is overbalanced and automatically shifted from the outer to the inner stop by the accumulation of liquid in the reservoir, or underbalanced and shifted from the inner to the outer stop by the discharge of the liquid therefrom.

2. In a steam-trap, the combination of a balancing-lever fulcrumed on a base, having a counterweight on one arm adapted to be shifted by gravity between adjustable stops on the lever, and a reservoir poised as a weight on the opposite arm, having flexible tubular connections forming inlet and outlet conduits thereto from a steam system and to a discharge, adapted to allow the free movement of the reservoir as a weight by and with the lever, according as it is underbalanced or overbalanced by the counterweight.

3. In a steam-trap, a balancing-lever fulcrumed on a base to form arms of unequal length, a reservoir poised as a weight on the short arm, a shifting counterweight on the long arm, movable by gravity between outer and inner stops thereon, adapted to overbalance the reservoir when empty, flexible pipe connections from a steam system to the reservoir, and from the reservoir to a discharge, adapted to allow the free movement of the reservoir as a weight, a valve in the discharge adapted to open or close it, having an operating-stem threaded and provided with an outer and inner pair of lock-nuts, forming adjustable shoulders on the stem, a collar surmounting the stem, adapted to shift thereon between the shoulders and alternately contact therewith, and a lever operatively connected to the collar and to the reservoir, adapted to shift the collar to contact with the shoulders of the valve, to open or close it, according as the counterweight is overbalanced and automatically shifted to the inner stop by the accumulation of water in the reservoir, or underbalanced and shifted to the outer stop by its discharge.

4. In combination in a steam-trap, a reservoir having integral bosses 33, provided with

counterbored openings 32, and interiorly-threaded, curved interior inlet and outlet tubes 29 and 30, and flexible exterior inlet and outlet tubes 23 and 24, surmounted by thimbles 36, provided with flanges 37, the exterior and interior inlet and outlet tubes having flanges 31, packing-rings 35 interposed between the flanges 31, and all secured within bosses by gland-nuts 38, in threaded engagement with the bosses, and adapted to be run down and tightly compress the joints thereby formed, substantially as shown and described.

In witness whereof we have hereunto set our hands this 3d day of November, A. D. 1900.

HENRY C. MOOERS.
ALBERT COOKE.

Witnesses:
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HERMAN H. MARTIN.