

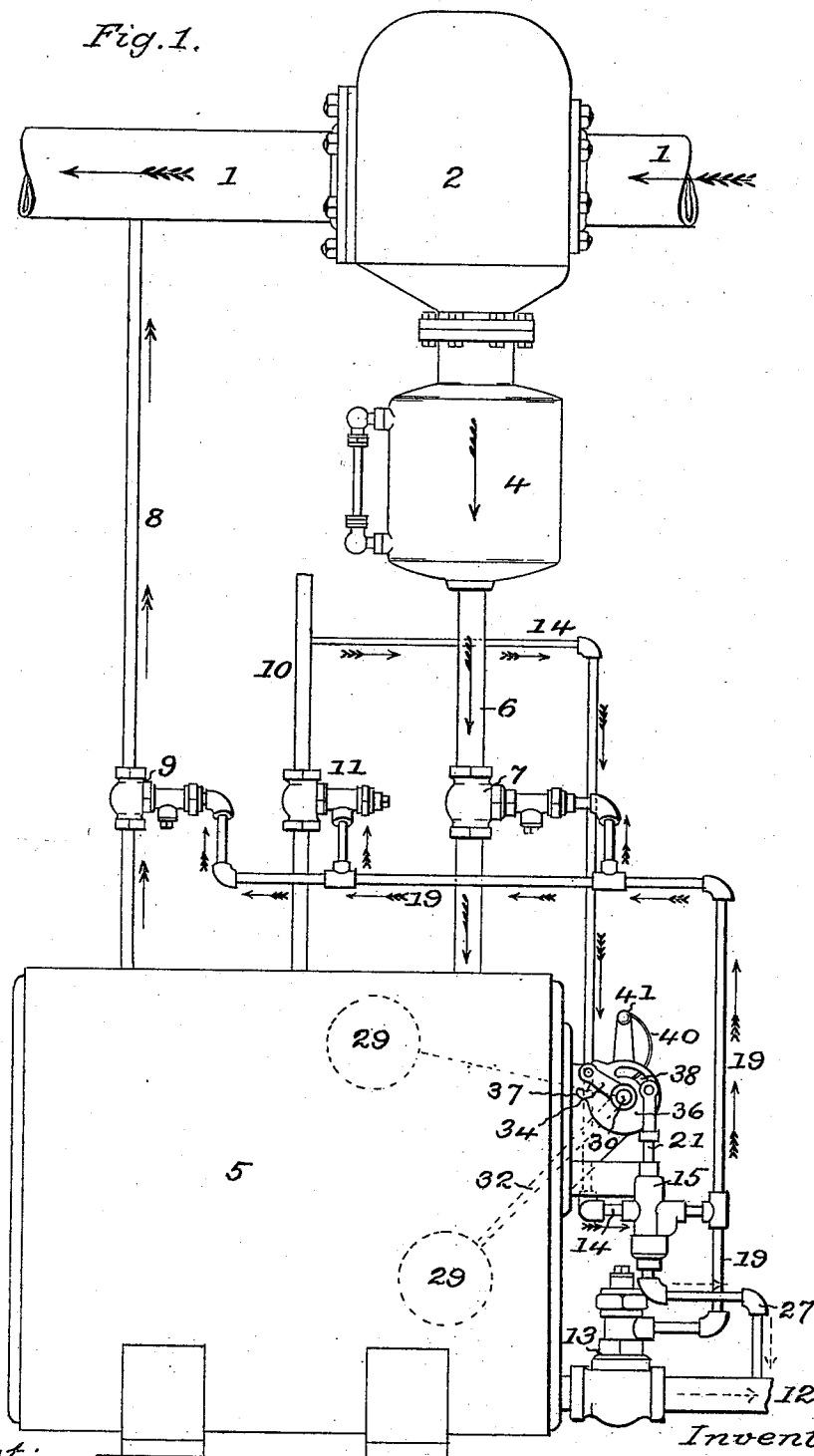
J. ANGELL.
DRAINAGE SYSTEM FOR STEAM PLANTS.

(Application filed Apr. 24, 1901.)

(No Model.)

3 Sheets—Sheet I.

Fig. 1.



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No. 690,546.

Patented Jan. 7, 1902.

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Fig. 2.

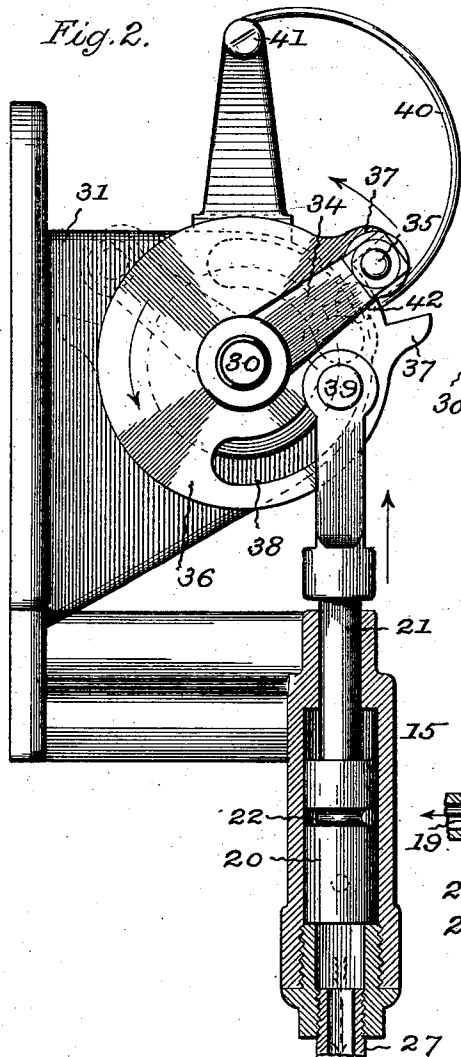


Fig. 3.

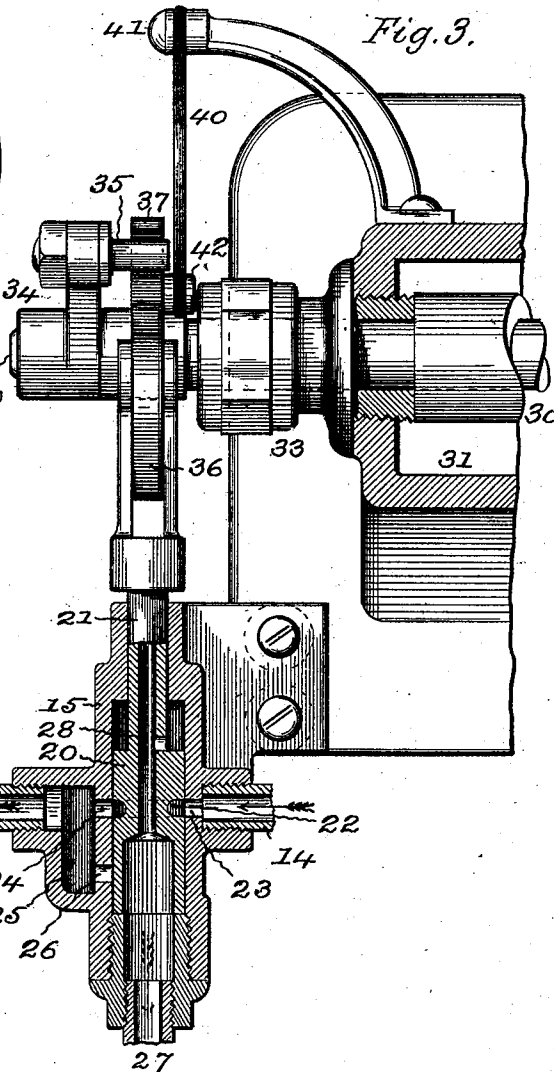
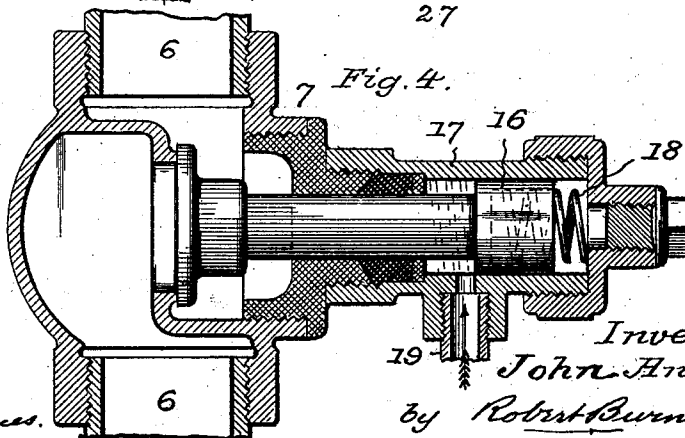


Fig. 4.



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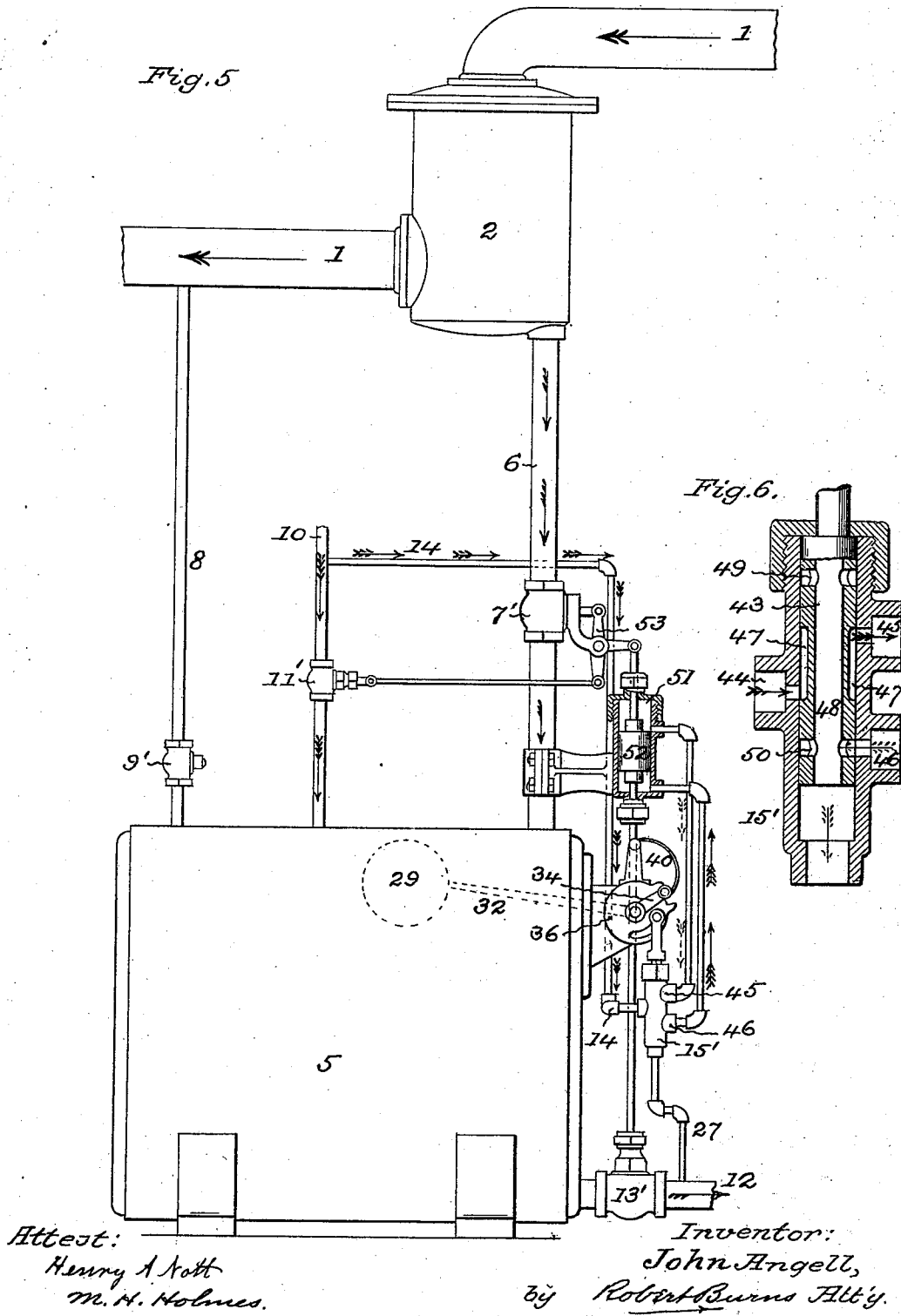
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3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

JOHN ANGELL, OF ST. LOUIS, MISSOURI.

DRAINAGE SYSTEM FOR STEAM PLANTS.

SPECIFICATION forming part of Letters Patent No. 690,546, dated January 7, 1902.

Application filed April 24, 1901. Serial No. 57,164. (No model.)

To all whom it may concern:

Be it known that I, JOHN ANGELL, a citizen of the United States of America, and a resident of St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Drainage Systems for Steam Plants, of which the following is a specification.

The present invention relates to a system of drainage for steam-pipes in steam-engineering plants which is automatic in its operation and is adapted to separate and remove grease and other impurities of entrainment carried more especially by the exhaust-steam in its passage to the condenser.

The present invention has to provide a simple and efficient apparatus adapted to remove and separately discharge the water, oil, &c., of entrainment from the steam or other like elastic fluid under pressure and with an accumulation of such entrainment water, &c., to automatically discharge the same from the receiving-tank of the apparatus without any interference with the normal and continued operation of the other portions of the apparatus, all as will hereinafter more fully appear, and be more particularly pointed out in the claims.

I attain the above object by the construction and arrangement of parts illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of an automatic drainage apparatus embodying the preferred arrangement of my present invention; Fig. 2, an enlarged detail side elevation of the valve and automatic valve-operating mechanism controlling the various pressure, exhaust, and equalizing passages of the system, the valve-casing being shown in section; Fig. 3, an enlarged detail elevation of the same with the valve and other parts in section; Fig. 4, an enlarged detail sectional elevation illustrating the general construction of the valves controlling the different inlet and outlet passages of the present system; Fig. 5, a general side elevation of a modified type of the present apparatus with the motor-engine for the controlling-valve of the drip-pipe and steam-supply pipe in section; Fig. 6, an enlarged detail axial section of the controlling-valve for such engine.

Similar numerals of reference indicate like parts in the several views.

Referring to the drawings, 1 represents a pipe or main through which the exhaust-steam or other gaseous fluid passes and in which is arranged a separator 2, of any usual and approved construction and which is adapted to remove the water, oil, &c., from the passing volume of steam and direct the same into the drip-well 4 of the separator and from thence to the main receiver or drip tank 5 through the drip-pipe 6.

7 is a valve in the drip-pipe controlling communication between the separator 2 and the main receiver 5 and adapted to be automatically operated as hereinafter set forth.

8 is an equalizing-pipe connecting the main receiver 5 with the exhaust-steam pipe 1 and adapted to equalize the pressure therein and permit a free downflow through the drip-pipe 6 from the separator into said main receiver.

9 is a valve in the equalizing-pipe controlling the passage therethrough and adapted to be automatically operated, as hereinafter set forth.

10 is a steam-supply pipe connecting with the top portion of the main receiver 5 and adapted to introduce a supply of steam into the same in the operation of discharging or "blowing off" said tank of its accumulated contents.

11 is a valve in the steam-supply pipe controlling the passage therethrough and adapted to be automatically operated, as hereinafter set forth.

12 is an outlet or blow-off pipe connected to the lower portion of the main receiver 5.

13 is a valve in said outlet controlling the passage therethrough and adapted to be automatically operated, as hereinafter set forth.

14 is a steam-supply pipe, preferably a branch of the steam-supply pipe 10 and connected thereto above its controlling-valve 11, as shown, and extending to the main automatic valve 15, by which the various valves 7, 9, 11, and 13, heretofore mentioned, are governed and controlled.

In the fluid-actuated systems of valves illustrated in Figs. 1, 2, 3, and 4 the various valves 7, 9, 11, and 13 will be of the usual puppet type, as shown in Fig. 4, and in the present particular type of apparatus will each have its respective valve-stem formed with piston-

head 16, moving in a piston-casing 17, preferably forming a part of the valve-casing, as shown in Fig. 4. In the case of the valve 7 of the drip-pipe 6 and the valve 9 of the equalizing-pipe 8 steam-pressure will be introduced into the respective piston-casings 17 of the said valves at the outer ends of the same, so as to effect a positive closure of said valves, the said valves being held normally open by suitably-arranged springs or other equivalent means, while in the case of the valve 11 in the steam-supply pipe 10 and the valve 13 in the blow-off pipe 12 the steam-pressure will be introduced into their respective piston-casings 17, near the inner end of the same, to effect a positive opening of the same, the valves being held normally closed by a spring 18 or other equivalent means.

19 is a steam-pipe extending from the main automatic controlling-valve 15 to the various piston-casings 17 of the before-mentioned valves and connected thereto in the manner heretofore mentioned.

The main automatic controlling-valve will comprise a construction as follows:

20 is a piston-valve moving in a cylindrical bore of the valve-casing 15 and provided with an operating-stem 21, connected, as hereinafter described, to the automatic operating mechanism.

22 is an annular passage in the periphery of the piston-valve adapted to register the opposed ports or passages 23 and 24 of the valve-casing, such ports or passages being in communication, respectively, with the branch steam-supply pipe 14 and with the pipe 19, which extends to the various controlling-valves 7, 9, 11, and 13, so that with such passages 23 and 24 in register steam-pressure will pass to the various valves to simultaneously operate the same.

25 is a branch passage connecting the passage 24 with a lower port or opening 26, that is adapted to be uncovered when the valve 20 is in a raised position. The construction is such that with the valve raised the register between the ports 23 and 24 is broken and the supply of steam is shut off from the series of controlling-valves before described, and the port 26 is opened to permit of the escape of the steam-pressure from the piston-chambers of said valves and permit the same to return to their normal position, heretofore described.

27 is an exhaust-pipe connection extending from the lower end of the valve-casing 15 to the outlet-pipe 12 at a point outside the valve 13 and adapted to carry away the exhaust from the piston-chambers of the various steam-actuated valves of the system.

28 is an axial passage through the valve 20 and opening laterally above the same and adapted to permit the free escape of any air or motive fluid from the upper valve-chamber as said valve moves upward.

The automatic means for actuating the

aforsaid controlling-valve will comprise mechanism as follows:

29 is a float arranged within the main receiver 5 and adapted to move in unison with the fluctuations in the level of the drainage fluid collecting therein.

30 is a rock-shaft journaled in a shaft-housing 31, secured to the side of the tank 5 and operatively connected to the float 29 by a rock-arm 32, so as to move in unison therewith. In the present construction one end of the rock-shaft 30 will pass out through a stuffing-box 33 in a steam-tight manner for connection to the intermediate mechanism between said rock-shaft and the main controlling-valve 20.

34 is a rock-arm secured fixedly to the outer end of the rock-shaft 30 and provided with a lateral stud 35.

36 is a disk loosely journaled on the rock-shaft 30 and having intermittent operative connection with the lateral stud 35 of the rock-arm 34 by a separated pair of abutments or lugs 37 and a like intermittent operative connection with the stem or rod 21 of the valve 20 by a segmental slot 38, in which a lateral pin 39 on said valve-stem is adapted to engage.

40 is a curved spring journaled at its upper end upon an axis 41 in vertical alinement with the axis of the rock-shaft and at its other end to a pivot-axis 42 on the loosely-journaled disk 36 at a point removed from the axis thereof.

In the modified type of the apparatus illustrated in Figs. 5 and 6 the same general arrangement and construction of parts as that heretofore described in connection with Figs. 1, 2, 3, and 4 will be preserved, the differences being wholly in detail and will comprise as follows:

9' is a check-valve in the equalizing-pipe 8 and adapted to act as a substitute for the steam-actuated valve 9 employed in the former construction.

7', 11', and 13' are ordinary closure-valves arranged in the respective drip-pipe 6, steam-supply 10, and outlet-pipe 12 and adapted to act as substitutes for the steam-actuated valves 7, 11, and 13 of the former construction and to be operated in unison by mechanical connections, as hereinafter described.

15' is a valve-casing, and 43 is a piston-valve moving therein and operated by a float mechanism identical in construction with the float mechanism described in the former construction, and in the present connection such valve and valve-casing will constitute the reversing-valve for an actuating-engine, hereinafter described, for the valves of the present apparatus, and to this end the valve-casing 15' will be provided with a central steam-inlet passage 44, receiving steam from the branch steam-pipe 14, and with a pair of outlet-passages 45 and 46, communicating with the respective ends of the before-mentioned actuating-engine. The valve 43 will be formed with the usual elongated annular pas-

sage 47, adapted in accordance with the position of such valve to register the steam-supply passage 44 with one or the other of the outlet-passages 45 or 46 and with the usual axial exhaust-passage 48, having top and bottom ports 49 and 50, individual to the respective outlet-passages 45 and 46 and adapted in accordance with the position of the valve to register one or the other of the said passages 45 or 46 with the exhaust or outlet passage from the valve-casing 15'.

51 is the cylinder of the before-mentioned actuating-engine, the respective ends of which have pipe connections, as shown, with the passages 45 and 46 of the controlling-valve 15'.

52 is the piston of the said engine, the piston-rod of which has operative connection at its lower end with the valve 13' in the outlet or blow-off pipe 12 and at its upper end with one arm of a T-shaped lever 53, the other arms of which are connected, respectively, with the valve-stems of the valves 7' and 11' to operate said valves in unison.

The operation of the main form of the present apparatus, as illustrated in Figs. 1, 2, 3, and 4, is as follows: With gradual accumulation of the separated water, &c., in the main receiver 5 the float 29 gradually rises with the rise of the liquid-level therein, and as such float nears a predetermined height the arm 34 of its rock-shaft 30 carries the loose disk 36 around with it against the resistance of the spring 40. The two parts have movement in unison until the lower pivot-axis 42 of spring 40 is carried a short distance past a vertical line drawn through the axis of the rock-shaft 30, after which the tension of the spring will impart additional movement to the said disk independent of the rock-shaft and float to cause a sudden reversal of the controlling-valve into its downward position. (Shown in Figs. 2 and 3 of the drawings.) The construction of parts is such that as the lower pivot-axis 42 of the spring nears the before-mentioned vertical line an end of the segmental slot 38 will be brought into contact with the lateral pin 39 of the valve-stem 21 to form an operative connection between the disk 36 and said stem. Previous to such engagement the segmental slot moves independently upon the lateral pin, so that the initial movement of the disk 36 will not affect the position of the controlling-valve. With the controlling-valve 15 in its downward position, as just described, the annular passage 22 of the piston-valve 20 registers the steam-supply passage 23 with the passage 24, and steam-pressure passes into the branch pipe 19 and through the same to the steam-actuated valve 7 in the drip-pipe 6 to close the same, to the steam-actuated valve 9 in the equalizing-pipe 8 to close the same, to the steam-actuated valve 11 in the steam-supply pipe 10 to open the same and admit steam-pressure into the upper portion of the main receiver to force out the contents of the same,

and into the steam-actuated valve 13 in the outlet-pipe 12 to open the same and permit of the outward flow of the liquid contents of the main receiver 5. With a lowering of the liquid-level in the main receiver to a predetermined point the float 20, as it moves downward, will impart to its rock-shaft 30 and arm 34 a corresponding movement in a direction opposite to that heretofore described, and by the engagement of the rock-arm 34 with the loose disk 36 will carry the same around with it against the resistance of the spring 40 until the lower pivot-axis 42 of the said spring is carried a short distance past the vertical, after which the tension will effect the further movement of the loose disk 36 independent of the rock-shaft and float to cause a reversal of the controlling-valve 15 and a movement of the same into its upward position. With the controlling-valve in such upward position the register of the annular passage 22 with the passages 23 and 24 is broken and steam is cut off from the branch pipe 19 at the same time the lower end of the piston valve or head 20 uncovers the exhaust-port 26 to permit of the exhaust of the steam from the pipe 19 and the piston-chambers of the different valves of the system, and with such escape of the steam from the same the valve 7 of the drip-pipe and valve 9 of the equalizing-pipe will both open, while the valve 11 of the steam-supply pipe and the valve 13 of the outlet-pipe 12 will both close, ready to resume a fresh cycle of the operations just described.

The operation of the modified form of the apparatus illustrated in Figs. 5 and 6 will be substantially the same as above described, the only difference consisting in the mechanical operation of the valves of the system by a single operating-engine instead of the independent pressure-operating means for each valve, as set forth in the foregoing operation of the apparatus.

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

1. In a drainage system for steam plants, the combination of a steam-pipe, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage, a steam-inlet to said tank, a valve arranged in said inlet, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, and a float in said tank controlling said operating means, substantially as set forth.

2. In a drainage system for steam plants, the combination of a steam-pipe, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage, an equalizing-passage connecting the steam-pipe and drain-tank, a valve arranged in said passage, a steam-inlet to said tank, a valve arranged in said inlet, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, and a float in said tank

controlling said operating means, substantially as set forth.

3. In a drainage system for steam plants, the combination of a steam-pipe, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage, a steam-inlet to said tank, a valve arranged in said inlet, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, a main valve controlling said operating means, and a float in said tank controlling said valve, substantially as set forth.

4. In a drainage system for steam plants, the combination of a steam-pipe, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage, an equalizing-passage connecting the steam-pipe and drain-tank, a valve arranged in said passage, a steam-inlet to said tank, a valve arranged in said inlet, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, a main valve controlling said operating means and a float in said tank controlling said valve, substantially as set forth.

5. In a drainage system for steam plants, the combination of a steam-pipe, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage, a steam-inlet to said tank, a valve arranged in said inlet, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, and a float in said tank controlling said operating means, substantially as set forth.

6. In a drainage system for steam plants, the combination of a steam-pipe, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in such passage, an equalizing-passage connecting the steam-pipe and drain-tank, a valve arranged in said passage, a steam-inlet to said tank, a valve arranged in said inlet, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, and a float in said tank controlling said operating means, substantially as set forth.

7. In a drainage system for steam plants, the combination of a steam-pipe, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage, a steam-inlet to said tank, a valve arranged in said inlet, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, a main valve controlling said operating means, and a float in said tank controlling said valve, substantially as set forth.

8. In a drainage system for steam plants, the combination of a steam-pipe, a water or grease separator connected thereto, a drain-

tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in such passage, an equalizing-passage connecting the steam-pipe and drain-tank, a valve arranged in said passage, a steam-inlet to said tank, a valve arranged in said inlet, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, a main valve controlling said operating means, and a float in said tank controlling said valve, substantially as set forth.

9. In a drainage system for steam plants, the combination of a steam-pipe, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage, a steam-inlet to said tank, a valve arranged in said inlet, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, a main valve controlling said operating means, and a float in said tank connected to the controlling-valve and adapted as it nears the limit of its upward or downward stroke to operate said valve, substantially as set forth.

10. In a drainage system for steam plants, the combination of a steam-pipe, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in such passage, an equalizing-passage connecting the steam-pipe and drain-tank, a valve arranged in said passage, a steam-inlet to said tank, a valve arranged in said inlet, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, a main valve controlling said operating means, and a float in said tank connected to the controlling-valve and adapted as it nears the limit of its upward or downward stroke to operate said valve, substantially as set forth.

11. In a drainage system for steam plants, the combination of a steam-pipe, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage and adapted to be closed by steam-pressure, a steam-inlet to said tank, a valve arranged in said inlet and adapted to be opened by steam-pressure, a blow-off outlet from said tank, a valve arranged in said outlet and adapted to be opened by steam-pressure, a controlling-valve adapted to admit steam-pressure to said valves to operate the same in unison, and a float in said tank controlling said valve, substantially as set forth.

12. In a drainage system for steam plants, the combination of a steam-pipe, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage and adapted to be closed by steam-pressure, an equalizing-passage connecting the steam-pipe and drain-tank, a valve arranged in said passage and adapted to be closed by steam-pressure, a steam-inlet to said tank, a valve arranged in said inlet and

adapted to be opened by steam-pressure, a blow-off outlet from said tank, a valve arranged in said outlet and adapted to be opened by steam-pressure, a controlling-valve adapted to admit steam-pressure to said valves to operate the same in unison, and a float in said tank controlling said valves, substantially as set forth.

13. In a drainage system for steam plants, the combination of a steam-pipe, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage and adapted to be closed by steam-pressure, a steam-inlet to said tank, a valve arranged in said inlet and adapted to be opened by steam-pressure, a blow-off outlet from said tank, a valve arranged in said outlet and adapted to be opened by steam-pressure, a controlling-valve adapted to admit steam-pressure to said valves to operate the same in unison, and a float in said tank connected to the controlling-valve and adapted as it nears the limit of its upward or downward stroke to operate said valve, substantially as set forth.

14. In a drainage system for steam plants, the combination of a steam-pipe, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage and adapted to be closed by steam-pressure, an equalizing-passage connecting the steam-pipe and drain-tank, a valve arranged in said passage and adapted to be closed by steam-pressure, a steam-inlet to said tank, a valve arranged in said inlet and adapted to be opened by steam-pressure, a blow-off outlet from said tank, a valve arranged in said outlet and adapted to be opened by steam-pressure, a controlling-valve adapted to admit steam-pressure to said valves to operate the same in unison, and a float in said tank connected to the controlling-valve and adapted as it nears the limit of its upward or downward stroke to operate said valve, substantially as set forth.

15. In a drainage system for steam plants, the combination of a steam-pipe, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage, a steam-inlet to said tank, a valve arranged in said inlet, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, a main valve controlling said operating means, and a float in said tank connected to the controlling-valve and adapted as it nears the limit of its upward and downward stroke to operate said valve, the connection to the controlling-valve comprising a rock-shaft operated by said float, a disk loosely journaled on the rock-shaft and provided with separated lugs and a segmental slot, an arm fixed on the rock-shaft and provided with a lateral pin engaging between the separated lugs of

the loose disk, the valve-stem of the controlling-valve having a lateral pin engaging the segmental slot of such disk, and a spring journaled at its upper end upon an axis vertically above the axis of the rock-shaft and at its lower end to an axis removed from the axis of the loose disk, substantially as set forth.

16. In a drainage system for steam plants, the combination of a steam-pipe, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in such passage, an equalizing-passage connecting the steam-pipe and drain-tank, a valve arranged in said passage, a steam-inlet to said tank, a valve arranged in said inlet, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, a main valve controlling said operating means, and a float in said tank connected to the controlling-valve and adapted as it nears the limit of its upward or downward stroke to operate said valve, the connection to the controlling-valve comprising a rock-shaft operated by said float, a disk loosely journaled on the rock-shaft and provided with separated lugs and a segmental slot, an arm fixed on the rock-shaft and provided with a lateral pin engaging between the separated lugs of the loose disk, the valve-stem of the controlling-valve having a lateral pin engaging the segmental slot of such disk, and a spring journaled at its upper end upon an axis vertically above the axis of the rock-shaft and at its lower end to an axis removed from the axis of the loose disk, substantially as set forth.

17. In a drainage system of the character herein described the combination of a pipe or main, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, and a float in said tank controlling said operating means, substantially as set forth.

18. In a drainage system of the character herein described the combination of a pipe or main, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in such passage, a vent-inlet to said tank, arranged in said inlet, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves in unison, and a float in said tank controlling said operating means, substantially as set forth.

19. In a drainage system of the character herein described the combination of a pipe or main, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage, a blow-off

outlet from said tank, a valve arranged in said outlet means for operating said valves in unison, a main valve controlling said operating means, and a float in said tank controlling said valve, substantially as set forth.

20. In a drainage system of the character herein described the combination of a pipe or main, a water or grease separator connected thereto, a drain-tank receiving the drainage therefrom, a connecting drip-passage, a valve arranged in said passage, a blow-off outlet from said tank, a valve arranged in said outlet, means for operating said valves

in unison, a main valve controlling said operating means, and a float in said tank connected to the controlling-valve and adapted as it nears the limit of its upward or downward stroke to operate said valve, substantially as set forth.

Signed at St. Louis, Missouri, this 17th day of April, 1901.

JOHN ANGELL.

Witnesses:

EDGAR C. PARKER,
CHARLES K. PICKLES.