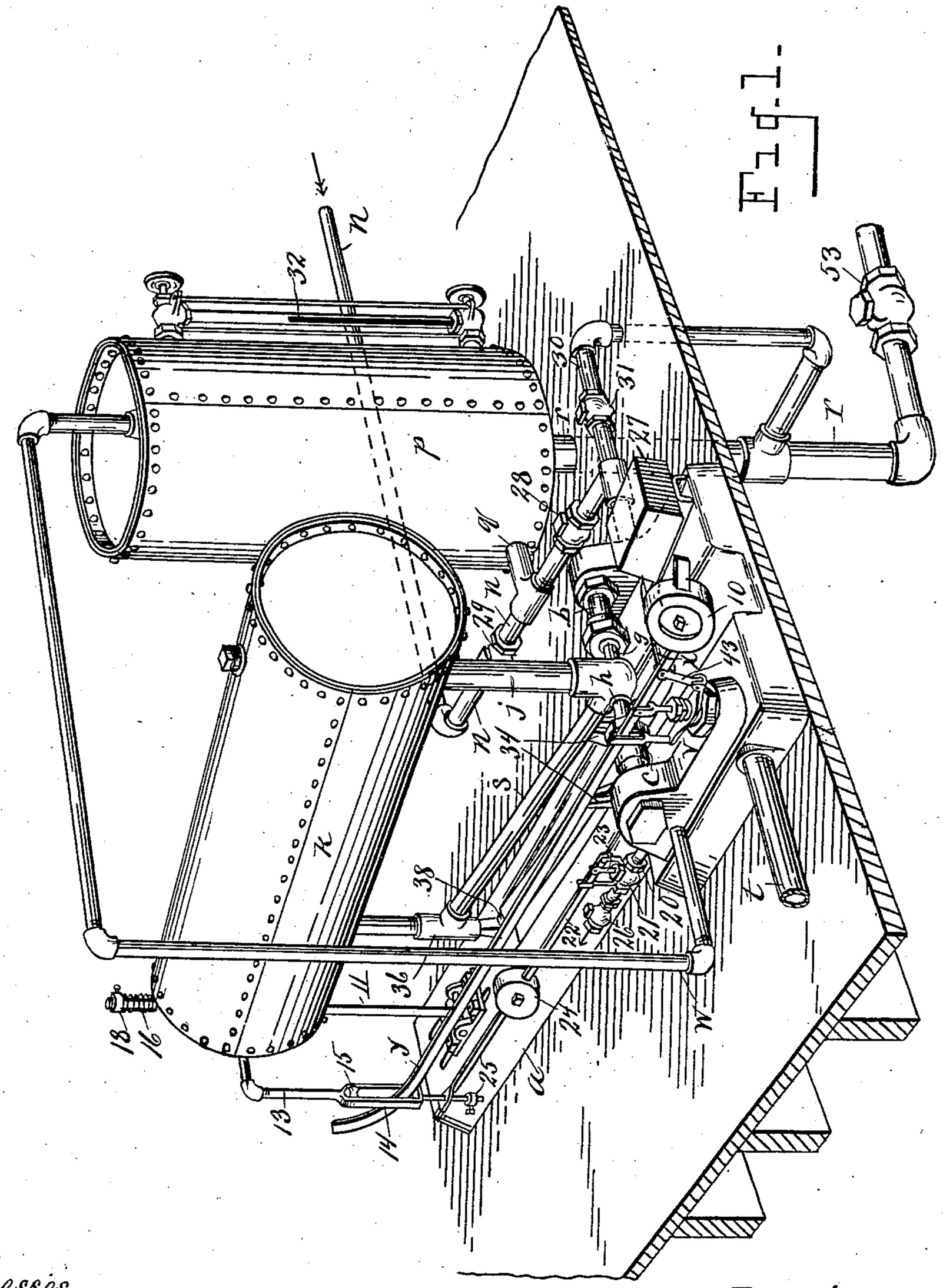
No. 883,825. PATENTED APR. 7, 1908.

J. E. PURSER.

CONDENSED WATER AND STEAM SEPARATOR.

APPLICATION FILED MAR. 8, 1906.

4 SHEETS—SHEET 1.



Witnesses.—
O. B. Baenziger.
E. M. Spielburg.

Inventor.—
James Edward Purser
By his attorney
Newell S. Wright.

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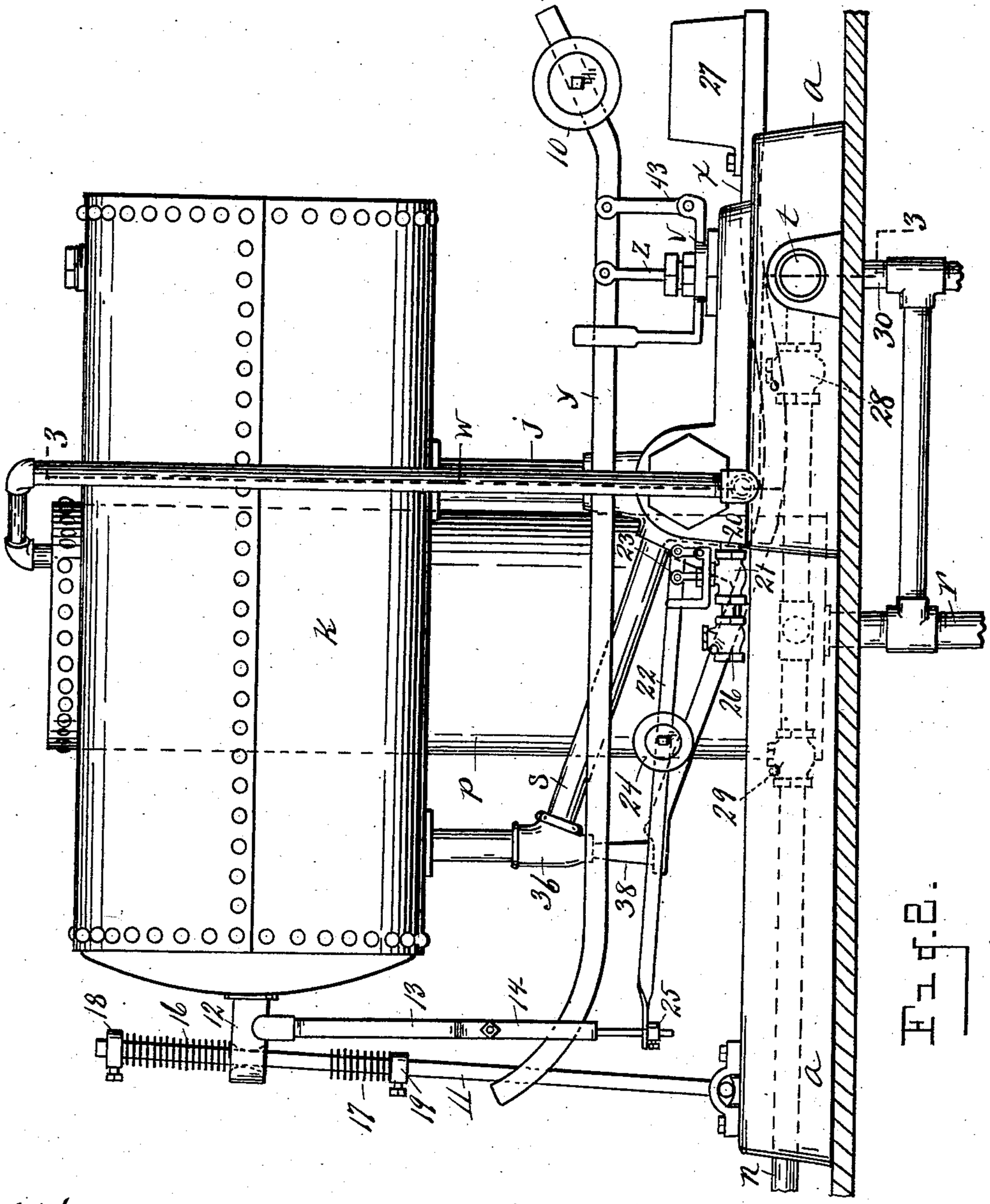

Fig. 2.

Witnesses.-
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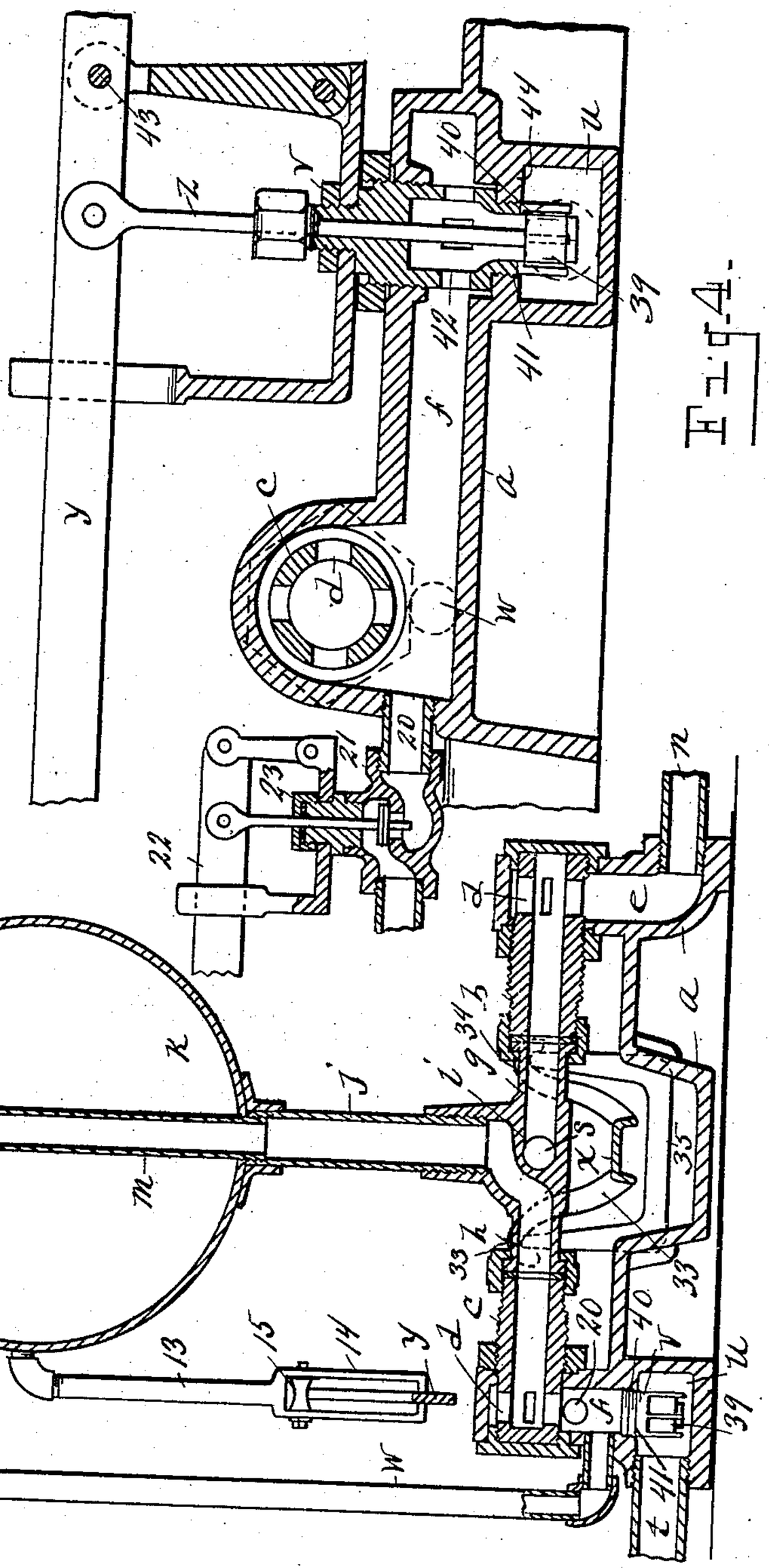

Fig. 4.

Fig. 5.

Witnesses.
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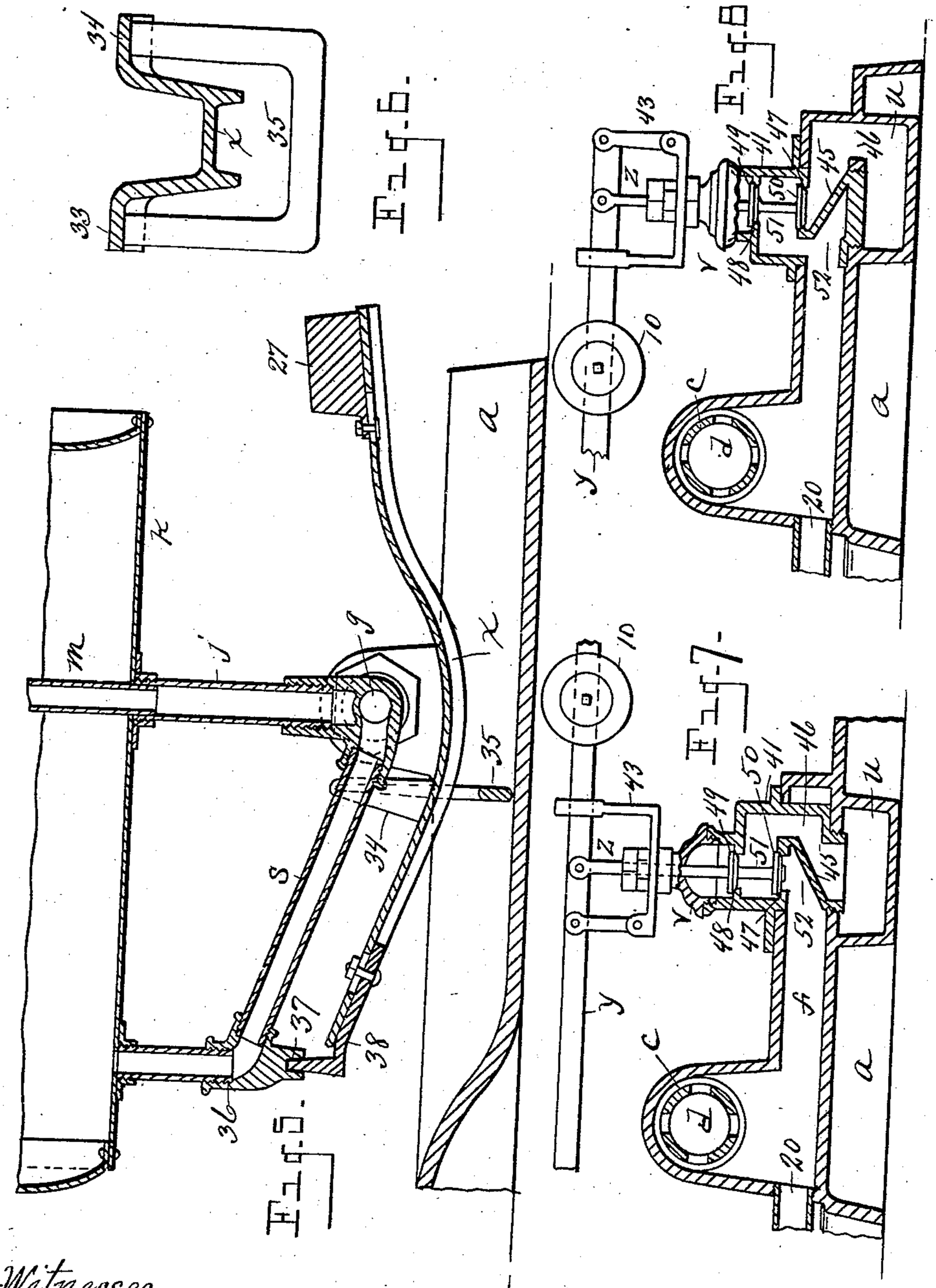

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Inventor.—
James Edward Purser
By his Attorney
Newell S. Wright.

UNITED STATES PATENT OFFICE.

JAMES EDWARD PURSER, OF WINDSOR, ONTARIO, CANADA, ASSIGNOR TO JOHN MOREHEAD, OF DETROIT, MICHIGAN.

CONDENSED-WATER AND STEAM SEPARATOR.

No. 883,825. Specification of Letters Patent. Patented April 7, 1908.

Application filed March 8, 1906. Serial No. 304,981.

To all whom it may concern:

Be it known that I, JAMES EDWARD PURSER, a subject of the King of Great Britain, residing at Windsor, county of Essex, Province of Ontario, Dominion of Canada, have invented a certain new and useful Improvement in a Condensed-Water and Steam Separator, of which the following is a specification, reference being had to the accompanying drawings, which form a part of this specification.

My invention has for its object certain new and useful improvements in a separator, the same being more especially adapted and designed to separate condensation water from steam in a steam system, and also to return the water to the boiler, if desired.

My invention aims to accomplish the results in view in a novel and superior manner.

To these ends my invention consists of the combination of devices and appliances hereinafter specified and claimed and illustrated in the accompanying drawings, in which,

Figure 1 is a view in perspective illustrating features of my invention. Fig. 2 is a view in side elevation. Fig. 3 is a view in section on the line 3—3, Fig. 2. Fig. 4 is a view in vertical section illustrating certain features of the valve mechanism. Fig. 5 is a central vertical longitudinal section illustrating features of my invention. Fig. 6 is a view in cross section through the weighted lever and showing its fulcrum. Fig. 7 is a view in vertical section illustrating a modification in the construction of one of the valves. Fig. 8 is a similar view illustrating still another modification thereof.

One special purpose of my invention is to provide a separator of this nature which will take care of the condensation water in steam systems of any desired capacity or power.

Another feature of my invention is to provide means whereby the condensation water may be discharged from the two tanks or chambers, and whereby also the water may be discharged from one of said tanks or chambers more rapidly or in larger volume, if desired, than from the other tank or chamber, and whereby also steam may be led into the two tanks or chambers, the passage of the steam into the two chambers being controlled preferably by a single valve.

Other features of my invention will appear from the following description in connection with the accompanying illustration of the same.

I carry out my invention as follows: In the drawings *a* represents any suitable base upon which are engaged horizontal pipes *b*, *c*, said pipes preferably having a fixed engagement upon the base, and each being provided towards its outer end with ports *d* as shown. The base is channeled or chambered as indicated at *e* and *f* to communicate through the corresponding ports with the respective pipes. Trunnions and fittings *g* and *h* are connected with the pipes *b*, *c*, a diaphragm or partition *i* closing communication between the trunnions. Supported upon said trunnions is a steam pipe *j* communicating with the trunnion *h* and into a primary tilting receiving tank or chamber *k* supported upon said steam pipe at one side the center of the gravity of said tank as shown. The upright supporting pipe *j* communicates into said tank as by means of an interior pipe *m* leading into one end of the tank above the normal water level in said tank. A water pipe *n* communicates with the condensation water channel or chamber *e* of the base to lead condensation water thereinto. An additional stationary storage tank or receiving chamber is indicated at *p* with which the water pipe *n* also communicates as through a branch pipe *q*. Connected with the base of the storage tank is a discharge pipe *r* to carry the water from said tank to the boiler (not shown). This discharge pipe may be of any desired size. A water pipe *s* leads from the trunnion *g* into the primary tank *k*, preferably toward the end of the tank opposite the trunnions, whereby the water from the pipe *n* may pass through the corresponding chamber *e*, ports *d*, pipe *b* and trunnion *g* into said primary tank. A steam pipe *t* leads into a steam chamber *u* in the base, the chamber *u* being communicable with the auxiliary steam chamber *f*, the communication being controlled by a valve mechanism indicated at *v* in a manner to be hereinafter more fully described. From the auxiliary steam chamber *f* leads a steam pipe *w* into the top of the storage tank *p*. Steam entering through the pipe *t* into the channeled base may thus, evidently, pass into the auxiliary steam

chamber *f* and from thence through the adjacent ports *d* of the pipe *c* into said pipe and through the trunnion *h* and pipes *j* and *m* into the primary tank *k*. At the same time the steam may also pass from the auxiliary steam chamber *f* through the pipe *w* into the top of the storage tank or chamber *p*. By this construction steam may pass into both of said tanks on the top of the water which may accumulate therein so that the same steam pressure is exerted in the top of both of said tanks.

The primary tank *k* being supported at one side of the center of gravity by the pipe *j* upon the trunnions *g* and *h*, will obviously tilt when water has accumulated within the tank *k* sufficient to overcome the normal center of gravity, the normal center of gravity being maintained by means of a weighted lever indicated at *x*, constructed and arranged as more fully hereinafter set forth.

The steam controlling valve mechanism *v* is actuated by means of a lever *y* engaged with the stem *z* of the valve. The lever *y* is shown weighted at one end thereof as at 10. At the rear end of the primary tank *k* is an upright rocking arm 11, the tank being provided with an arm 12 sleeved upon the rocking arm 11. The arm 12 is provided with a dependent arm 13, preferably provided with a yoke or stirrup 14 through which is passed the rear end of the lever *y*, said yoke or stirrup being preferably provided with a roller 15. The rod 11 is preferably provided with springs indicated at 16 and 17 to receive the impact of the arm 12 when the tank *k* tilts. The arm 11 is shown provided with adjustable collars 18 and 19, the one above the spring 16 and the other below the spring 17.

The auxiliary steam chamber *f* is provided with a pipe 20 to provide for the escape of air from the primary tank *k* as condensation water accumulates therein, the air passing through the pipes *m* and *j*, trunnion *h* and pipe *c*, through the ports *d* into the chamber *f*. To govern the discharge of air through the pipe 20 I provide valve mechanism indicated at 21, the same being actuated by means of a weighted lever 22 connected with the valve stem 23 of said valve, said lever being weighted as shown at 24. The rear end of said lever has a sliding engagement upon the lower end of the rod 13, said rod being provided with an adjustable collar 25. The pipe 20 is further provided with a check valve indicated at 26 permitting the discharge of air through said pipe, but preventing the admission of air thereinto. The lever *x* is provided with a weight 27 to govern the amount of water which may be accumulated in the primary receiving tank *k* before the tank shall tilt. The water pipe *n* is provided with a check valve 28, also with a check valve 29. Connecting with the pipe *n* is a branch pipe 30 provided with a check valve 31, said pipe is shown leading into the pipe *r*, whereby water is discharged from the receiving tank *p*. I do not, however, limit myself to leading the pipe 30 into the pipe *r*. It will be evident that the tilting receiving tank *k* and the stationary storage tank *t* have separate discharge outlets, whether the pipe 30, for convenince, is afterwards led into the pipe *r* or otherwise.

The chief features of the invention will now be understood and operate as follows: The condensation water in the pipe *n* passes both into the tanks *k* and *p*, which steam also enters into the top of said tanks in the manner already described, when the steam controlling valve is open. When condensation water has accumulated in the primary receiving tank *k* sufficiently to overcome its center of gravity the tilting of the tank opens the steam controlling valve *v* and closes the air discharge controlling mechanism 21, whereby the steam passes into the top of both of said tanks. The steam pressure thus admitted into the top of the primary tank *k* will drive out the water back through the pipe *s*, trunnion *g* and pipe *b*, and through the ports *d* and chamber *e* into the pipe *n*, the check valve 28 preventing the water from passing backward in the pipe *n*, so that the condensation water passes through the pipe 30 preventing any backflow of the water through the pipe 30. The check valve 29 prevents any back flow of the water from the stationary tank *p*, while the steam admitted into the top thereof forces the water therein out through the pipe *r* to the boiler.

It will readily be seen that the trunnions *g*, *h* and the adjacent pipes *b*, *c* in order to handle a large volume of water effectually, would need to be made of considerable diameter, increasing friction and expense. The pipes *b*, *c* and the trunnions, may, however, be made of comparatively small diameter and still control the condensation water passing into and out of the primary receiving chamber. The storage tank *p* may be provided with a gage glass 32.

Obviously the water will fill the tanks *k* and *p* to the same level. The tank *p* may be made of any desired size to receive any desired proportion of the water entering the two tanks, the primary tilting tank *k* and its mechanism serving to automatically admit steam upon the water in the tank *p* to force the water to the boiler.

The lever *x* is preferably constructed with arms 33 and 34 intermediate its extremities, said arms being fulcrumed upon a yoke 35 secured in any suitable manner upon the base *a*. The rear end of the primary tank rests upon the adjacent end of said lever in any suitable manner. As shown, the pipe *s* is provided with a pipe fitting 36 constructed with a recess 37 resting over the rear end of

the lever, the said lever being preferably provided with an adjustable arm 38 to enable the lever to be more readily located in place in the assembling of the different separators. By this construction and arrangement of the lever, it will be seen that the weight of the lever itself is entirely relieved from the trunnions, thereby relieving the trunnions of so much friction as would be the case if the weighted lever were rigidly secured to the primary tank.

I do not limit myself in this present invention to any particular construction of the valve *v* for controlling the admission of steam into the auxiliary chamber *f* and thence into the tanks *p* and *p*, and I have shown in the accompanying drawings both a single seated and a double seated valve for the accomplishment of this purpose. In Figs. 3 and 4 I have shown a single seated valve, the head of the valve 39 seating upward upon a seat 40 in a valve case or cage 41, said valve case being shown as in Fig. 4 provided with ports 42 opening into the auxiliary steam chamber or channel *f*. The lever *y* is shown fulcrumed to a yoke 43 in a customary manner. As so constructed, it will be seen that the valve opens downward, thereby opening communication between the chambers *u* and *f*, the chamber *u* being below the chamber *f*. Between the chamber *u* and *f* is a diaphragm 44 into which is engaged the case or cage 41, the lower end of the said case or cage projecting into the chamber *u* as shown.

As shown in Figs. 7 and 8, the steam controlling valve is in the nature of a double seated valve. In this modification the case or cage 41 is provided with a diaphragm 45 forming with the walled case a channel 46 opening into the chamber *u*, the case being formed with two valve seats one indicated at 47 and the other at 48, the stem *z* being provided with two valve heads 49 and 50 said valves seating downward, the said valves and case forming between the valves a chamber 51. The diaphragm 45 with the wall of the case also forms an outlet channel 52 communicating with the auxiliary steam chamber *f*. The chamber 51 communicates with the channel 52 when the valve is unseated. It will readily be seen that when the valves 49 and 50 are lifted communication is afforded from the chamber *u* through the channel 46, chamber 51 and channel 52 into the chamber *f*. For certain purposes the direction of the diaphragm 45 in the valve case might be reversed from that indicated in Fig. 7 as shown in Fig. 8. In the form shown in Fig. 7 the double seated valve is obviously an equalized or balanced valve.

The receiving chambers *k* and *p*, it will be understood, are designed to be set at a suitable distance above the water line of the boiler into which the condensed water is to be fed. It will also be understood that steam pressure is exerted in the pipe *n* through which the condensation water is supplied to the receiving chamber. There will be also, of course, a back pressure in the pipe *r* from the boiler, but the boiler pressure of the steam is also exerted upon the water in the two receiving chambers. The back pressure of the steam from the boiler in the pipe *r* is balanced or equalized, thus, by the steam pressure exerted upon the contents of the receiving chambers when steam is admitted into said chambers. The tanks being set above the water line of the boiler at a suitable height, gravity will then of course force the water therefrom into the boiler. The amount of water discharged from the tank *p* will depend upon the size of the pipe *r*. The pipe *r* should be provided with a check valve indicated at 53, so that when the steam is not admitted to said receiving chambers the check valve will be closed by the pressure of steam from the boiler. The check valves all open to the boiler, but the steam pressure from the boiler will close the check valves. I do not limit myself to supporting the primary tank *k* at one side of the center of gravity, as it may be otherwise arranged to tilt within the scope of my invention.

It will be evident that when the primary tank frees itself from condensation water the steam therein will condense and form a partial vacuum, in which case the check valve in the air vent pipe will prevent the air from entering into the primary tank to maintain a partial vacuum therein. It will be evident that the separator is in the nature of a compound separator to separate condensation water from steam. While I have described the steam admitted to the top of the two tanks as being controlled by a single valve, I would have it understood that I do not limit myself solely to the employment of a single valve for the accomplishment of this purpose.

It will be evident that the water of condensation is admitted into the primary and stationary receiving chambers independently the one of the other, and that the steam also is admitted into said chambers independently the one of the other, while, furthermore, the condensation water is discharged from each of said chambers independently the one of the other, the water and steam in one chamber not passing through the other chamber. This construction enables the two chambers to discharge independently into the boiler and it enables the one, as above described, to discharge a greater amount of water to the boiler than that discharged from the other chamber.

What I claim as my invention is:

1. A separator for a steam system comprising a primary tilting receiving chamber and a stationary receiving chamber, each provided with a separate discharge outlet,

means to separately lead condensation water into both of said chambers, means to separately lead steam into both of said chambers, and means to control the steam supply to said chambers, whereby the condensation water will be separately discharged from said chambers.

2. A separator for a steam system comprising a primary tilting receiving chamber and a stationary receiving chamber each provided with a separate discharge outlet, means to separately lead condensation water into both of said chambers, means to separately lead steam into both of said chambers, means to simultaneously control the steam supply to each of said chambers, whereby the condensation water may be separately and simultaneously discharged from said chambers.

3. A separator for a steam system comprising a primary tilting receiving chamber and a stationary receiving chamber each provided with a separate discharge outlet, means to separately lead condensation water into both of said chambers, means to separately lead steam into both of said chambers, and means to simultaneously control the steam supply to both of said chambers, whereby water may be separately and simultaneously discharged from said chambers.

4. A separator for a steam system comprising a primary tilting receiving chamber and a stationary receiving chamber each provided with a separate discharge outlet, means to separately lead condensation water into both of said chambers, means to separately lead steam into both of said chambers, and a valve actuated by the tilting chamber to simultaneously control the supply of steam to both of said chambers.

5. A separator for a steam system comprising a primary tilting receiving chamber and a stationary receiving chamber each provided with a separate discharge outlet, means to separately lead condensation water into both of said chambers, means to separately lead steam into both of said chambers, the stationary receiving chamber having a larger outlet than the tilting receiving chamber, whereby a greater volume of condensation water may be discharged from the stationary receiving chamber than from the tilting receiving chamber.

6. A separator for a steam system comprising a primary tilting receiving chamber and a stationary receiving chamber each provided with a separate discharge outlet, means to separately lead condensation water into both of said chambers, means to separately lead steam into both of said chambers, and a valve independent of the stationary receiving chamber actuated by the tilting receiving chamber to control the supply of steam to both of said chambers.

7. A separator for a steam system comprising a primary tilting receiving chamber and a stationary receiving chamber each provided with a separate discharge outlet, means to separately lead condensation water into both of said chambers, means to separately lead steam into both of said chambers, trunnions upon which the primary receiving chamber is mounted, a base supporting said trunnions into which the steam is led, and a valve supported upon said base to control the steam supply to both of said chambers, said valve actuated by the tilting of the primary receiving chamber upon said trunnions.

8. A separator for a steam system comprising a primary tilting receiving chamber and a stationary receiving chamber each provided with a separate discharge outlet, means to separately lead condensation water into both of said chambers, means to separately lead steam into both of said chambers, a base upon which the tilting receiving chamber is mounted provided with communicating chambers into which the steam is led, and a valve actuated by the tilting of the primary chamber to govern the communication of said chambers, one of said chambers communicable both with the tilting and with the stationary chamber.

9. A separator for a steam system comprising a primary receiving chamber and a stationary receiving chamber each provided with a separate discharge outlet, water supply pipes to separately lead condensation water into both of said chambers, check valves in said water supply pipes and in said discharge outlets to prevent a back flow of the water, means to separately lead steam into both of said chambers, and an automatically actuated valve to simultaneously control the admission of steam into said chambers.

10. A separator for a steam system comprising a primary tilting receiving chamber and a stationary receiving chamber each provided with a separate discharge outlet, means to separately lead condensation water into both of said chambers, means to separately lead steam into both of said chambers, hollow trunnions upon which said tilting receiving chamber is supported, a support in which said trunnions have their bearings, a pipe supporting the tilting chamber upon said trunnions communicating with one of said trunnions and with the tilting receiving chamber, through which condensation water is led into the tilting chamber, an additional pipe communicating with the other of said trunnions and with said tilting receiving chamber through which steam is led into the tilting receiving chamber, and a valve actuated by the tilting receiving chamber to control the admission of steam into both of said chambers.

11. In a separator for a steam system the

combination of a stationary receiving chamber, and an independent tilting receiving chamber, each of said chambers provided with a separate discharge outlet, means to separately admit condensation water into both of said chambers, two steam chambers communicating the one with the other and with both of said receiving chambers, and a valve to control the communication between said steam chambers.

12. In a separator for a steam system the combination of a base formed with a water chamber and with communicating steam chambers, hollow trunnions communicable respectively with the water chamber and with the steam chambers of the base, a tilting receiving chamber communicating with one of said trunnions into which condensation water is admitted, a steam inlet pipe supporting said receiving chamber upon said trunnions, and communicable with said steam chambers, an inlet water supply pipe leading through one of said trunnions into the tilting receiving chamber, a stationary receiving chamber, a water supply pipe to lead condensation water into the stationary chamber, a steam pipe to lead steam into the stationary chamber, a valve to control the admission of steam into both of said chambers actuated by the tilting of the tilting chamber, said receiving chambers provided with separate discharge outlets.

13. In a separator for a steam system the combination of a stationary receiving chamber, a base formed with a water chamber and with a steam chamber, hollow trunnions upon the base communicating respectively with the water chamber and with the steam chamber of the base, a tilting receiving chamber, a steam inlet pipe supporting said tilting receiving chamber upon said trunnions and communicating with the steam chamber and with the tilting receiving chamber, an inlet water supply pipe communicating with the other of said trunnions and leading into the tilting receiving chamber, a steam pipe connecting the steam chamber of the base with the stationary receiving chamber, and a valve to control the admission of steam into both of said receiving chambers actuated by the tilting of the tilting chamber, a water supply pipe to separately lead condensation water into the stationary receiving chamber and into the water chamber of the base, said receiving chambers provided with separate discharge outlets.

14. In a separator for a steam system a base constructed with a water channel or chamber and with a steam channel or chamber, hollow arms having a fixed engagement upon said base and communicating respectively with said water channel or chamber of the base and with said steam channel or chamber of the base, hollow trunnions engaged with said arms, a tilting receiving chamber, a steam pipe supporting said tilting receiving chamber communicating with one of said trunnions and with the tilting receiving chamber, a water pipe communicating with the other of said trunnions and with the tilting receiving chamber, a stationary receiving chamber, a steam inlet communicable with the steam channel or chamber of the base and therethrough with both of the receiving chambers, a valve actuated by the tilting chamber to control the communication of the steam into said receiving chambers, and a separate supply pipe to lead condensation water into the stationary receiving chamber, said receiving chambers provided with separate discharge outlets.

15. In a separator for a steam system a supporting base provided with a steam chamber and with a water chamber, horizontal pipes supported upon the base communicable with said chambers, respectively, hollow trunnions supported upon said pipes, a tilting receiving chamber, a steam pipe supporting the tilting receiving chamber upon said trunnions communicating with the tilting receiving chamber and with said steam chamber of the base, a water inlet pipe communicating with the tilting receiving chamber and with the water chamber of the base, an air vent pipe communicating with the steam chamber of the base, a valve to control the air vent actuated by the tilting of the tilting receiving chamber, and a valve actuated by the tilting of the receiving chamber to control the admission of steam into the steam chamber of the base.

16. In a separator for a steam system a supporting base provided with a steam chamber and with a water chamber, horizontal pipes supported upon the base communicable with said chambers, respectively, hollow trunnions supported upon said pipes, a tilting receiving chamber, a steam pipe supporting the tilting receiving chamber upon said trunnions communicating with the tilting receiving chamber and with said steam chamber of the base, a water inlet pipe communicating with the tilting receiving chamber and with the water chamber of the base, an air vent pipe communicating with the steam chamber of the base, a valve provided with a controlling lever arm to govern the air vent, a valve provided with a controlling lever arm to control the admission of steam into the steam chamber of the base, and an upright arm connected with the tilting chamber arranged to actuate the levers of said valves when the tilting chamber rocks.

17. In a separator for a steam system, a tilting receiving chamber provided with a rearwardly projecting arm, an upright rocking arm upon which said rearwardly projecting arm is movable, said upright rocking arm provided with cushioning springs above and below the rearwardly projecting arm to re-

ceive the impact of the rearwardly projecting arm when the chamber is tilted, and means to govern the tension of said springs.

18. The combination of a movable tank, valve controlled connections for filling and emptying said tank, means operated by the movement of said tank for shifting said valves, an auxiliary tank having filling and discharge connections respectively coupled to the filling and discharge connections of said movable tank whereby both tanks are simultaneously filled and emptied, the capacity of said auxiliary tank being greater than that of the movable tank.

19. A compound separator to separate condensed water from steam comprising a movable tank having filling and discharge connections, an independent auxiliary tank having a discharge connection and a filling connection coupled with the filling connection of the movable tank, a steam connection for admitting steam to both of said tanks, a valve to control said steam connection, means operated by the movement of the movable tank for actuating said valve, whereby both tanks are simultaneously filled and discharged, and check valves in the connections for filling and discharging the tanks.

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

JAMES EDWARD PURSER.

Witnesses:
N. S. WRIGHT,
ETHEL M. SPIELBURG.