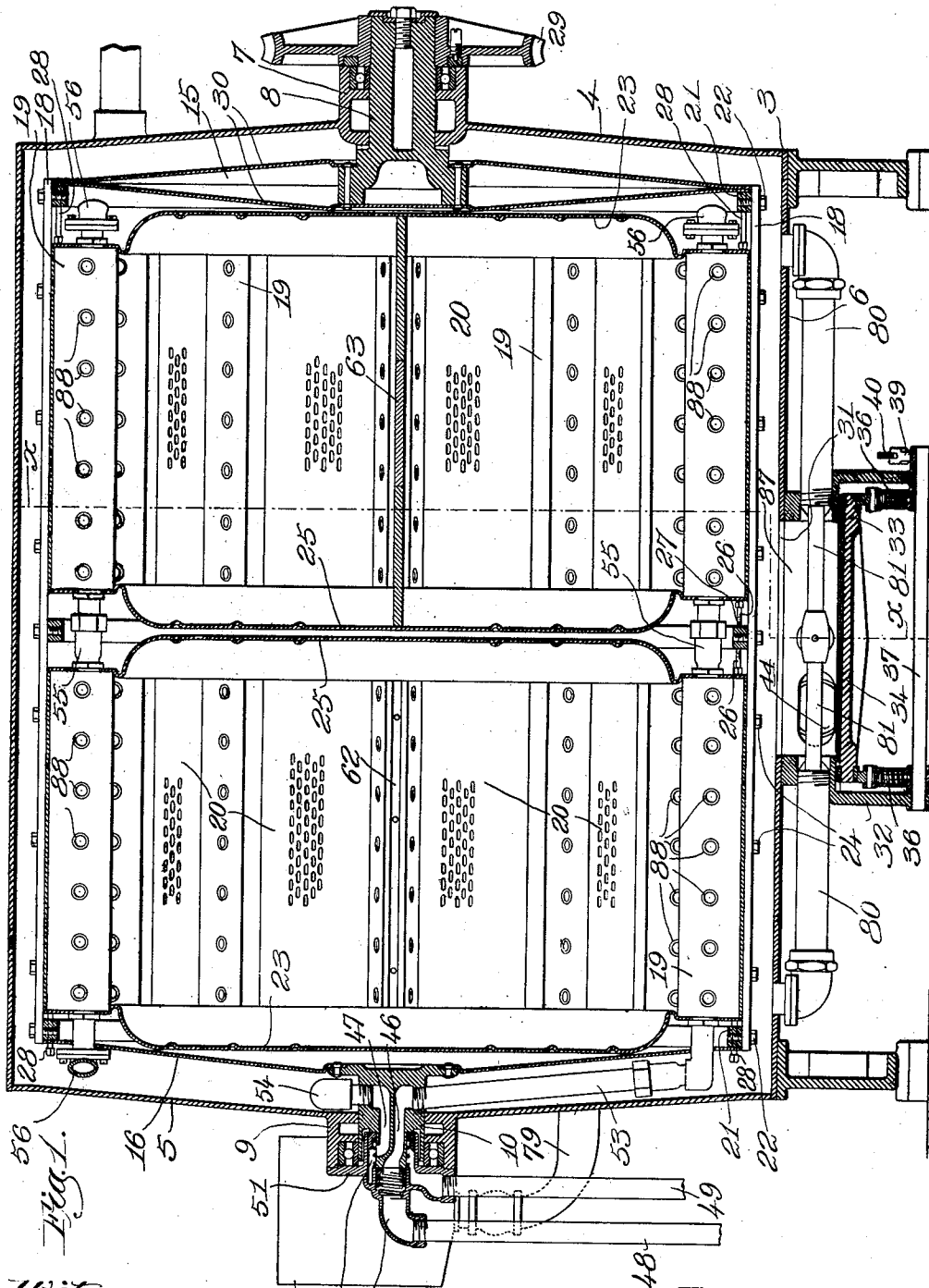


W. A. E. HENRICI.
 COMBINED WASHING AND CLOTHES DRYING MACHINE.
 APPLICATION FILED MAY 26, 1910.

1,109,630.

Patented Sept. 1, 1914.

5 SHEETS—SHEET 1.



Witnesses.
 Thomas Drummond,
 Joseph M. Ward.

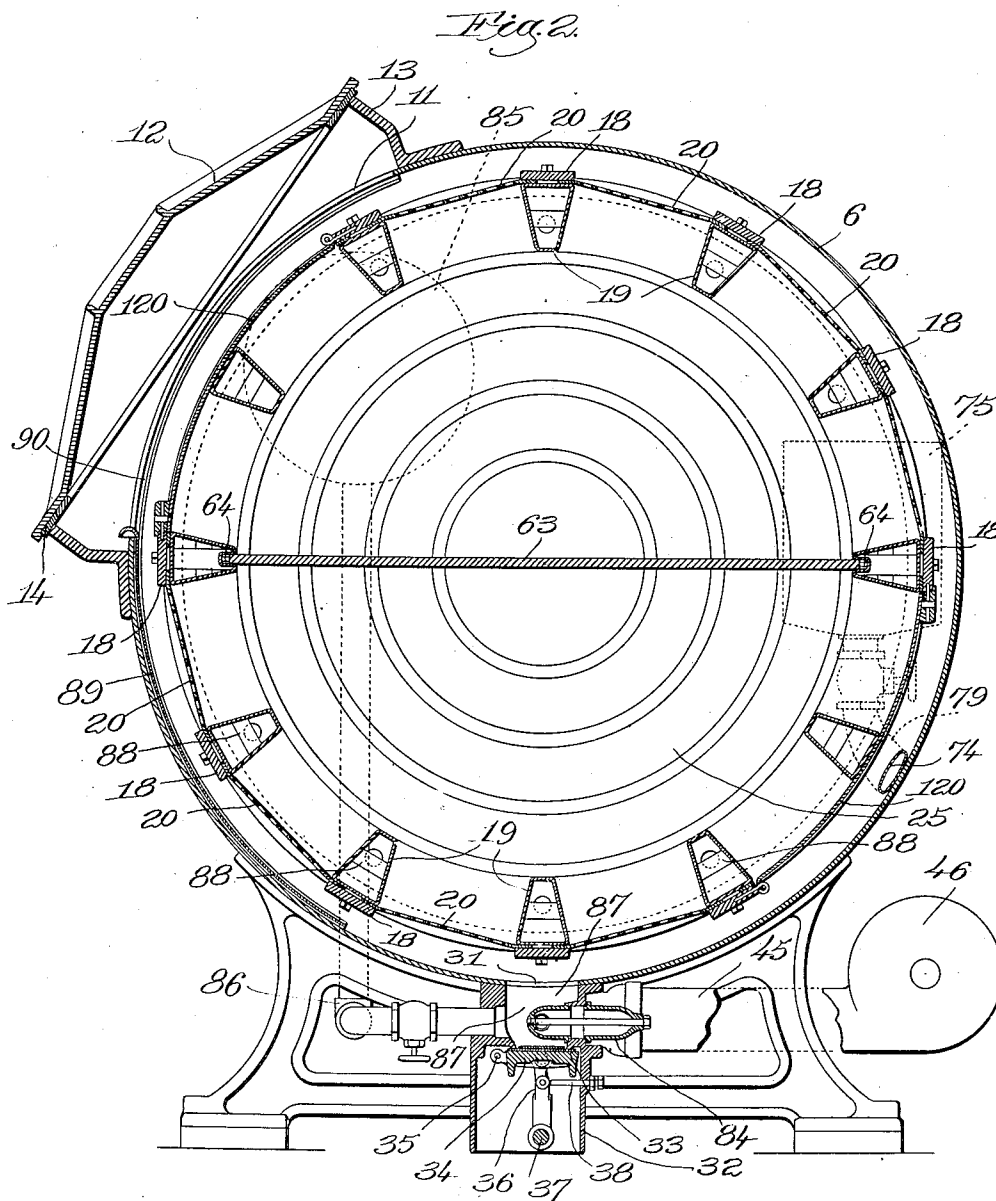
Inventor.
 William A. E. Henrici,
 by Lemly & Gundry Attys.

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5 SHEETS—SHEET 2.



Witnesses:
 Thomas Drummond
 Joseph M. Ward.

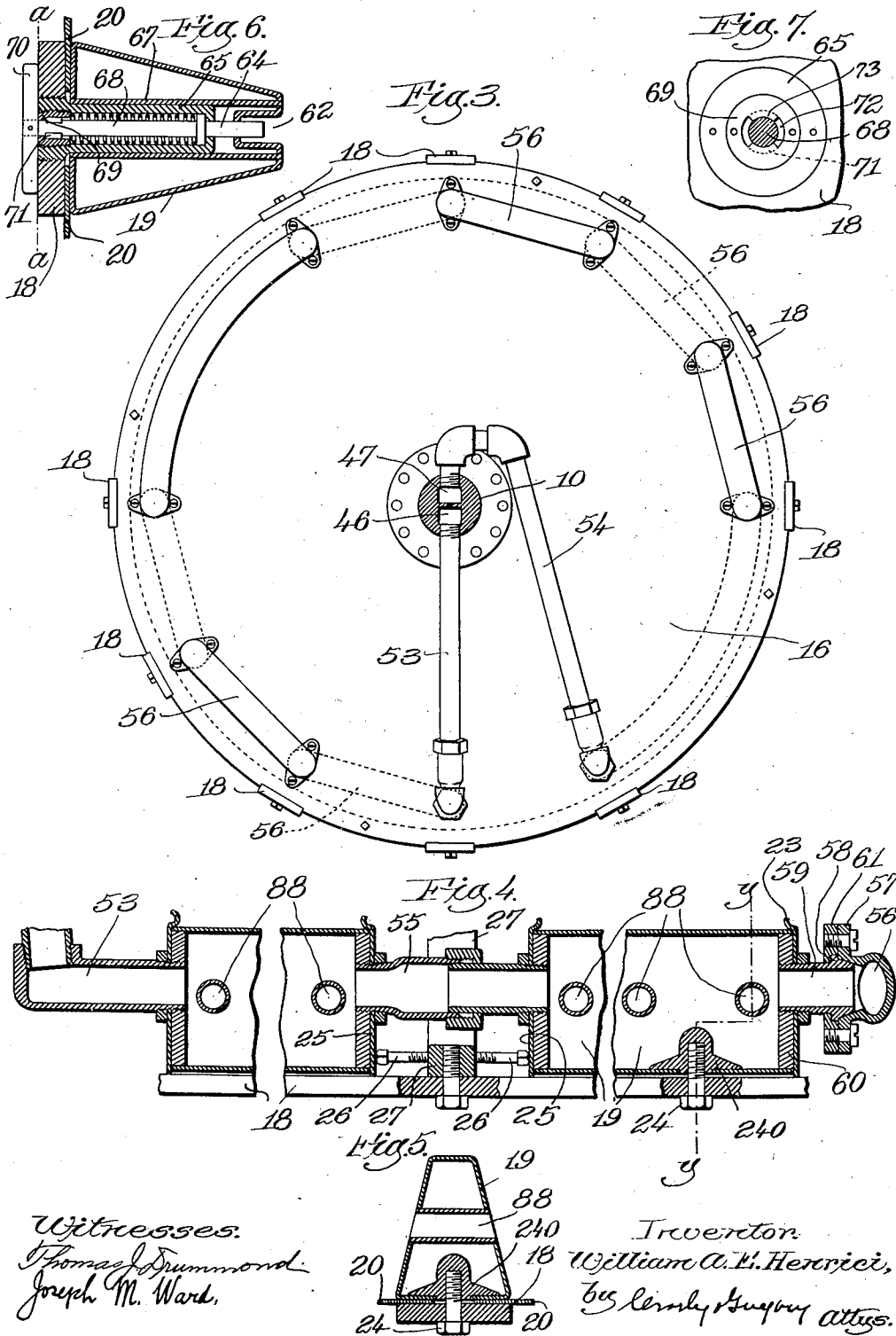
Inventor.
 William A. E. Henrici,
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W. A. E. HENRICI.
 COMBINED WASHING AND CLOTHES DRYING MACHINE.
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5 SHEETS—SHEET 3.



Witnesses:
 Thomas Drummond,
 Joseph M. Ward,

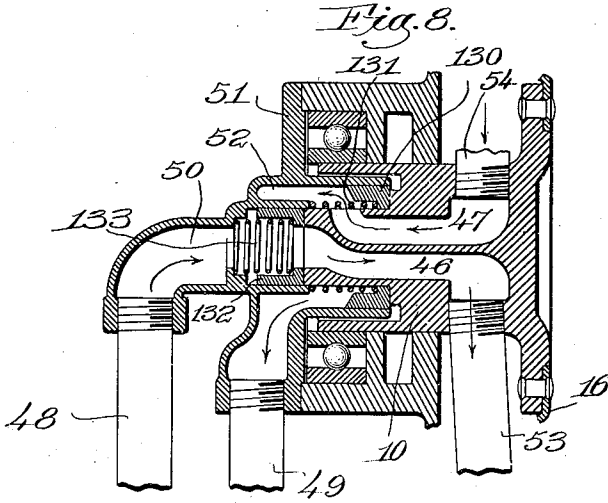
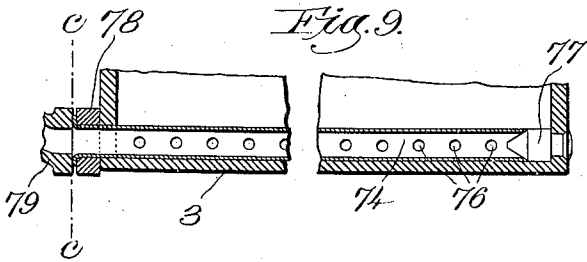
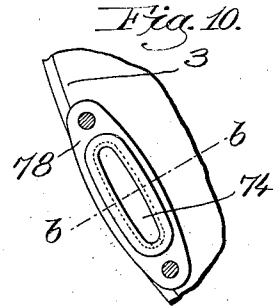
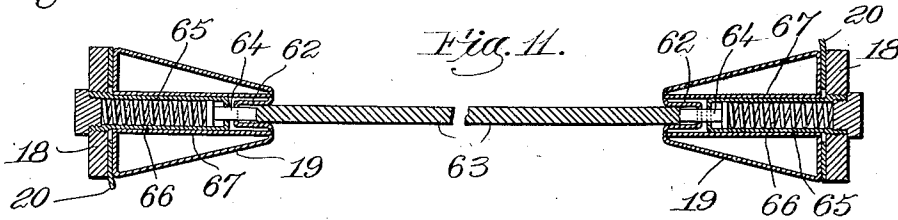
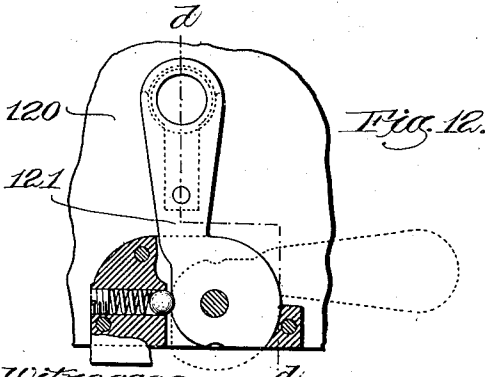
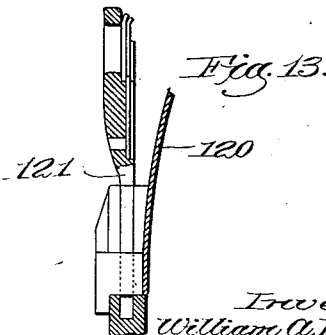
Inventor:
 William A. E. Henrici,
 by Lemly & Sugrue attys.

W. A. E. HENRICI.
 COMBINED WASHING AND CLOTHES DRYING MACHINE.
 APPLICATION FILED MAY 26, 1910.

1,109,630.

Patented Sept. 1, 1914.

5 SHEETS—SHEET 4.



Witnesses.
 Thomas Drummond,
 Joseph M. Ward,

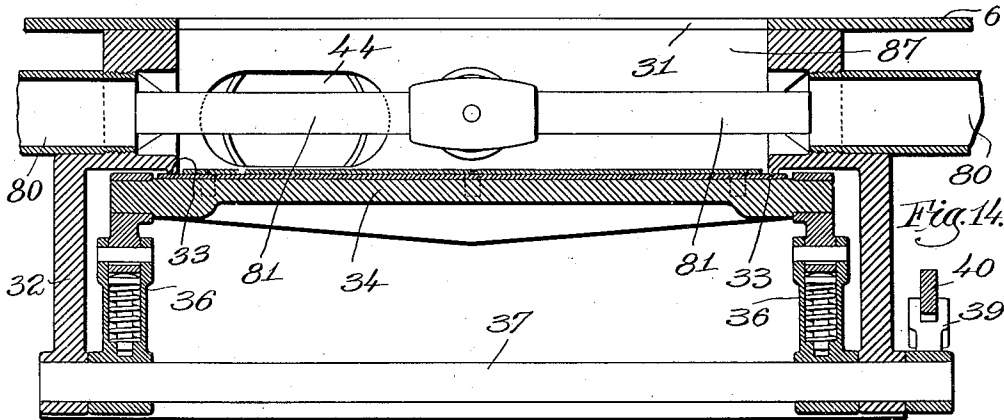
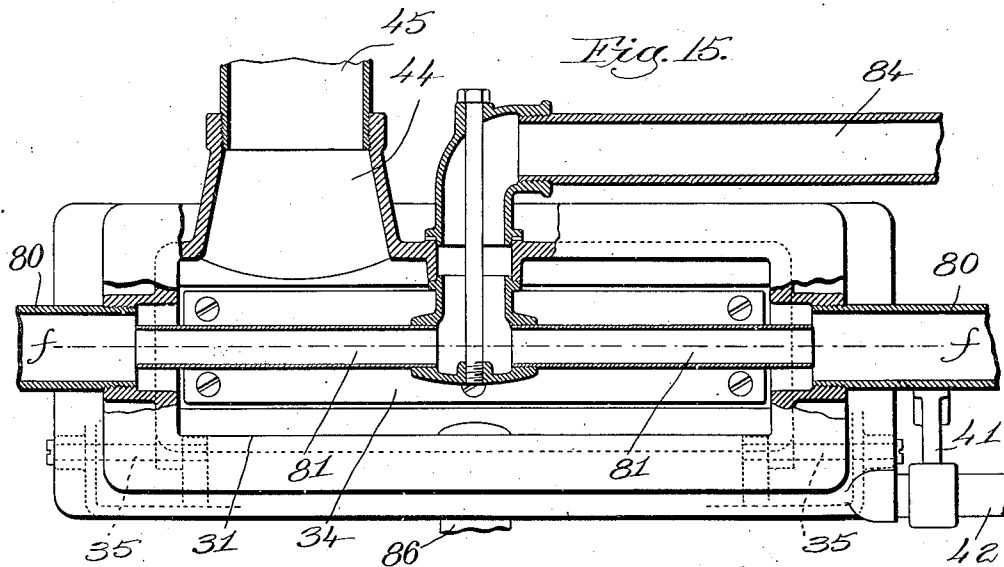
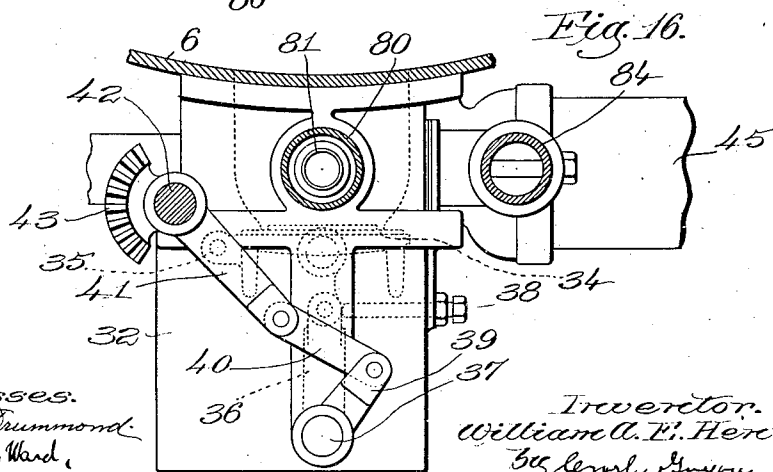
Inventor.
 William A. E. Henrici,
 by Lemly & Gundry Attys.

W. A. E. HENRICI.
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 APPLICATION FILED MAY 26, 1910.

1,109,630.

Patented Sept. 1, 1914.

5 SHEETS—SHEET 5.



Witnesses:
 Thomas Drummond,
 Joseph M. Ward,

Inventor:
 William A. E. Henrici,
 by Henry S. Myers, atty.

UNITED STATES PATENT OFFICE.

WILLIAM A. E. HENRICI, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO LIBERTY TRUST COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS, TRUSTEE.

COMBINED WASHING AND CLOTHES-DRYING MACHINE.

1,109,630.

Specification of Letters Patent.

Patented Sept. 1, 1914.

Application filed May 26, 1910. Serial No. 563,495.

To all whom it may concern:

Be it known that I, WILLIAM A. E. HENRICI, a citizen of the United States, residing at Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Combined Washing and Clothes-Drying Machines, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention has for its object to provide a novel washing machine which is capable not only of washing the clothes but which is also adapted for drying the clothes without removing them from the machine.

All washing machines at present in commercial use to any extent have been designed merely for washing the clothes and after they are washed it is necessary to remove the clothes from the machine and treat them in various ways so as to first extract the water from them and then dry them. These various operations, of course, consume considerable time. Combined washing and drying machines have been attempted but have not proved commercial successes, because they have not fulfilled satisfactorily the purposes for which they were designed. With my invention it is possible not only to wash the clothes in the machine but to extract the water therefrom without removing them from the machine and then to dry or substantially dry the clothes while they are still in the machine and in a very much shorter time than is possible by the old methods. This not only saves time but it saves handling of the clothes and the more or less detrimental wear or tear necessarily incident to the handling of wet clothes in quantity.

In order to give an understanding of my invention I have illustrated herein one embodiment thereof, and in the drawings Figure 1 is a vertical sectional view of a washing machine embodying the invention; Fig. 2 is a transverse sectional view on substantially the line *x-x*, Fig. 1; Fig. 3 is an end view of the clothes drum with one hub or journal shown in section; Fig. 4 is an enlarged sectional view partly broken out taken longitudinally through one of the lifting bars; Fig. 5 is a section on the line *y-y*, Fig. 4; Fig. 6 is a detail sectional view through one of the lifting bars showing the manner in which the partition plates are

locked in position; Fig. 7 is a section on the line *a-a*, Fig. 6; Fig. 8 is an enlarged section through one of the journals of the clothes drum and its bearing; Fig. 9 is a sectional view through the side of the casing on substantially the line *b-b*, Fig. 10; Fig. 10 is a view on the line *c-c*, Fig. 9; Fig. 11 is a detail sectional view showing the manner in which the partition plates are held in position; Fig. 12 is a detail for the lock of the door of the drum; Fig. 13 is a section on the line *d-d*, Fig. 12; Fig. 14 is a vertical sectional view through the discharge valve, said view being taken on substantially the line *f-f*, Fig. 15; Fig. 15 is a plan view of the discharge valve with some of the pipes shown in section; Fig. 16 is an end view of the discharge valve casing.

The present embodiment of my improved machine is similar to other washing machines in that it comprises an exterior casing to contain water and an inner rotatable clothes-receiving drum which rotates within the casing. The outer casing is shown at 3 and it is constructed so that it can be sealed, and while this end might be accomplished in a variety of ways, I have herein shown it as comprising two heads or end plates 4 and 5 and a shell 6 which encircles the heads and forms the sides of the drum. Both the head and the sides are made of sheet metal and they are welded together so that they make practically an integral sheet metal drum. The head 4 is formed with a bearing 7 in which is journaled the trunnion or journal 8 of the clothes drum, and the head 5 is provided with another bearing 9 in which is journaled the hub or trunnion 10 of the clothes drum. The shell of the outer casing is provided with a door opening 11 which is adapted to be closed tight by a door 12. The particular manner in which this door is constructed to secure this sealing is not important, and as herein shown the casing 6 has extending therefrom the flange 13 which surrounds the door opening 11 and on which the door 12 rests and to which it is clamped. The joint between the door and casing can be made air tight by means of a packing 14.

The clothes drum herein illustrated is in some respects similar to that illustrated in my co-pending application Se. No. 411,409, filed January 18, 1908. It comprises two heads or ends 15 and 16 to which the jour-

nals 8 and 10, respectively, are secured and which are connected by tie bars 18, and it also includes the lifting bars 19 that are secured to the tie bars and the perforated plates 20 which are situated between the lifting bars and form the sides of the drum. For securing the tie bars to the heads 15, 16 I propose to weld, attach or otherwise form on the periphery of each head a ring or flange 21 to which the tie bars are secured in some suitable way as by bolts 22. I have also shown the drum as having the end plates 23 which form the ends of the clothes-receiving compartments and which are dished or curved near their periphery to form deflecting surfaces, all as described in my said co-pending application.

The lifting bars 19 are preferably made from sheet metal and are secured to the tie bars by suitable bolts 24 and nuts 240, and the ends of the lifting bars abut against the inner faces of the end plates 23. I have shown herein the drum as provided with a central partition to divide said drum into separate clothes-receiving compartments, and this partition is formed by two circular plates 25 similar to the end plates 23 and arranged back to back and held in their adjusted position by spacing bolts 26 carried by a central ring 27 which is situated inside of and secured to the tie bars. The end plates 23 are backed by adjustable bolts or struts 28 that are carried by the rings 21. Where the drum is thus divided into compartments, the lifting bars are made to extend the length of one compartment only, as clearly seen in Fig. 1, and the inner ends of the lifting bars will, therefore, abut against the peripheries of the central plates 25. The edges of the perforated plates 20 are clamped between the lifting bars and the tie bars. The drum is sustained on the two journals 8 and 10 and is driven from the journal 8 by means of a gear wheel 29 mounted thereon and which meshes with any suitable driving apparatus. With this construction the drum is driven from the head 15, and as said drum is likely to carry considerable weight, I propose to make said head 15 of two plates or disks 30 which are spaced at their central portion, as shown, and are secured to the journal 8, but are united at their periphery. This makes an extremely strong head which will withstand any strain to which it may be put. As stated above, one of the objects of my invention is to provide a novel washing machine which can be used not only for washing clothes but also for removing the water therefrom and drying them.

After the water has been drained out of the machine, the water remaining in the clothes will be removed by first closing the casing and then applying suction means to reduce the atmospheric pressure in the cas-

ing and by heating the lifting bars or some other parts of the clothes drum and by rotating the latter so as to bring the clothes continually into contact with the heated parts. This heating of the clothes will vaporize the water therein, the vaporization point of which has been lowered by the partial vacuum, and the suction apparatus will tend to draw the vapor out from the casing as fast as it is generated. In this way the clothes can be very quickly dried and when they are dried they can be readily removed from the machine without the expenditure of a large amount of labor necessary in removing wet clothes and with very much less liability of their being torn than if they were wet. Any suitable provision for reducing the atmospheric pressure in the casing may be made. I have herein shown the suction apparatus as communicating with the casing through the discharge port. The casing is formed in its lower end with a discharge port or opening 31 which communicates with a valve chamber formed on the inside of a housing 32 that is secured to the casing. This housing 32 is provided with a valve seat 33 on which is adapted to seat the discharge valve 34 which is shown as hinged to the housing at 35. The valve has connected thereto toggle levers 36 which are secured to and operated by a shaft 37 so that when the shaft is turned in one direction the toggle levers will be broken thereby allowing the valve to open while when the shaft is turned in the opposite direction the toggle levers will be straightened thereby closing the valve, as shown in Fig. 2. 38 is a stop to limit the movement of the toggle levers in one direction. The shaft 37 is adapted to be operated by a suitable mechanism, and for this purpose I have shown it as provided with an arm 39, see Fig. 16, which is connected by a link 40 to an arm 41 on another shaft 42. The shaft 42 has a gear 43 thereon which is adapted to be actuated by any convenient means for controlling the valves.

The suction apparatus is shown as being connected to the housing 32 above the valve 34, and for this purpose said housing has a port 44 with which a pipe 45 communicates that leads to any suitable suction apparatus 46.

For drying the clothes, the drum may be heated in any suitable way, either by steam, or any other heating medium. In the illustrated embodiment of my invention I have made provision for heating the lifting bars and have shown for this purpose hollow lifting bars which are steam tight and means adapted to deliver steam to the lifting bars for heating them. Such means is preferably so constructed that the steam may be continually delivered to the lifting bars while the drum is rotating. I wish it under-

stood, however, that my invention in this respect is not limited to the construction shown as I believe I am the first to make provision for heating any part of the drum for the purpose of drying the clothes before they are taken from the drum.

The lifting bars 19 are hollow and are preferably made of sheet metal and I have connected them in series so that steam may be circulated through them. I have also made provision for introducing the steam through the hub or journal 10, and for this purpose said journal is provided with two chambers 46 and 47 and the chamber 46 is connected to a steam inlet pipe 48, while the chamber 47 is connected to an exhaust or discharge pipe 49. The chamber 46 is shown as terminating axially of the hub or journal and in line with a chamber 50 formed in the part 51 which constitutes a cover for the bearing. The chamber 47 in the hub opens out through the side of the hub and communicates with an annular chamber 52 formed in the part 51, which chamber 52 communicates with the exhaust pipe 49. With this construction the chambers 47 and 46 will have constant communication with the pipes 49 and 48 in any position of the drum. A pipe 53 communicates with the chamber 46 and leads into the end of one of the lifting bars and all the lifting bars are connected in series, as above stated, while the last lifting bar of the series is connected by a pipe 54 with the chamber 47. In this way if steam or any other heating medium is delivered through the pipe 48 it will circulate through all of the lifting bars and then will be discharged through the pipe 49, and this can be done whether the drum is stationary or rotating.

As herein shown, there is a set of lifting bars for each of the compartments of the drum, and I have connected the lifting bars in the two compartments that are in alignment with each other by means of a connection 55, see Fig. 4, so that there is a passage from one end of the clothes drum to the other. The end of each lifting bar is connected to the end of the adjacent lifting bar by a pipe or connection 56, as seen best in Fig. 3, one of these connections 56 being on one end of the drum and the next one on the opposite end of the drum. These pipes or connections 56 may be secured to the lifting bars in any suitable way. As herein shown each pipe is formed at each end with a head 57, and is provided with a tapered aperture which fits over the tapered end 58 of a nipple 59 that screws into the plate 60 at the end of the lifting bar, said head 57 being held to the tapered end of the nipple by a clamping plate 61.

In some washing machines a diametrically-arranged partition is employed for sub-dividing the clothes-receiving compart-

ment into smaller compartments. I provide such a partition, but have made it so that it can be readily removed. In this way the partition may be used or not as desired. Further the removable partition can be used temporarily to assist in unloading the machine for when the clothes are ready to be removed the partition may be put in place and then the drum may be turned a half revolution so as to bring the clothes into the compartment above the partition, in which position the clothes can be readily withdrawn through the door of the drum with the expenditure of a minimum amount of labor. In order to thus removably sustain the partition I make two oppositely-disposed lifting bars with grooves 62 in their edges into which the edge of the partition 63 is adapted to be received, as plainly seen in Fig. 11. I also have provided in said figure spring-pressed pins 64 which serve to center the partition 63 but permit it to be readily removed by slipping it endwise into one groove sufficiently so that it can be withdrawn from the other groove. In Fig. 11 each pin projects through the end of a tube 65 which is screwed into the tie bar 18 and contains the spring 66 which acts against the pin. This tube 65 is received within another tube 67 which makes a tight joint with the lifting bar 19 so that the steam which is admitted to said lifting bar will not leak around the pins 64. In the device as shown in Fig. 11 the partition 63 is not locked in place, but is merely held in proper position by the springs 66. In Fig. 6 I have shown a construction by which the partition 63 can be locked firmly in place after it has been inserted. In this embodiment the pin 64 is provided with a stem 68 which projects through a bushing 69 that is carried by the outer end of the tube 65, and said stem has fast thereon a thumb-piece 70 by which it may be turned. The stem is also provided with wings 71 and the bushing 69 is provided with grooves 72 adapted to receive the wings. When the stem 68 is turned to bring the wings into alignment with the grooves then the stem can be withdrawn, thereby withdrawing the pin 64 to permit the partition to be inserted. After the partition is in place then the stem 68 is carried into the position shown in Fig. 6, and upon giving it a partial turn so as to carry the wings 71 out of alignment with the grooves 72 and behind the projections 73, said pin will be locked in position and will thus lock the partition in place. One or more of the centering pins 64 may be provided with a locking device as desired. The partitions will be locked if one pin only is thus equipped. Each partition 63 will preferably be made in sections, as shown in Fig. 1, so as to facilitate its removal.

The washing materials are delivered to

the drum through a conduit 74 which is shown as extending longitudinally of the casing on the interior thereof, and which is connected to a receptacle 75 on the outside of the casing. This conduit 74 is provided with apertures 76, see Fig. 9, through which the washing materials are delivered to the casing. The conduit is in the form of a pipe, one end of which is fitted over a conical-shaped plug 77 carried by the casing, which plug closes the end of the conduit, and the other end of the conduit extends through and is flanged to fit over a plate 78 that is secured to the side of the casing. The receptacle 75 has connected thereto a pipe 79 the end of which is flanged and is bolted to the plate 78.

The steam for heating the water is delivered to two steam pipes 81 which are situated directly above the valve 34 and which lead into the open end of two circulating pipes 80 that lead into the ends of the casing 3. These pipes 80 are larger than the steam pipes 81 and at their inner ends they open into the space above the valve 34. As the steam is delivered from the pipes 81 into the pipes 80 the water which is in the housing 32 above the valve 34 will be carried by the steam through the circulating pipes 80, and there will thus be set up two circulation currents which will result in causing the water to be heated much more rapidly than would be possible if the steam were delivered into water which was not circulated. The steam is delivered to the pipes 81 through a steam pipe 84.

85 indicates a suitable gage for determining the depth of the water in the casing. In order that the indication of this gage may not be affected by any surging or churning of the water in the casing as the drum is rotated, I have connected said gage by a pipe 86 with the space 87 above the valve 32 which is outside of the casing and is, therefore, not affected by the motion of the drum.

In order to increase the washing effect the lifting bars are made with holes there-through through which the water may freely circulate. Since the lifting bars are used for the heating medium this circulation there-through is provided for by means of short pipes 88 which extend through each lifting bar from one side to the other, as clearly seen in Fig. 5.

89 is an auxiliary door slidable in grooves 90 formed in the casing and adapted to close to a greater or less extent the door opening 11. This door is merely to prevent the water from being thrown out through the door opening when the drum is in operation whenever the main door 12 is removed. The drum is provided with one or more doors 120 which are preferably made of stamped metal and formed in one piece and the doors are locked by suitable locks 121.

In order to prevent the air from leaking in through the bearings 7 and 9 when the suction apparatus is applied I prefer to use some suitable packing for making these joints air tight. For instance, in Fig. 8 I have shown a construction for packing one of the journals which comprises a packing ring 130 that fits within the annular recess 52 and also fits the small end of the journal 10, said packing being held in place by a suitable spring 131. I have also shown a packing ring 132 which fits within the end of the central chamber 50 and engages the end of the journal 10, said packing ring being held in place by a spring 133. By using suitable packing material it is possible to make practically an air-tight joint.

It will be understood, of course, that many changes may be made in the constructional details of the parts without departing from the invention.

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

1. In a combined washing and clothes-drying machine the combination with a casing of a clothes containing drum rotatable therein, said drum comprising heads, tie bars connecting the heads, circumferentially disposed perforated plates secured to the tie bars, hollow lifting bars having lateral circulation passages therethrough, a pipe connecting said bars with each other, a trunnion on said drum and connected with said pipe providing means for conducting a heating medium therethrough, and means for creating a partial vacuum in said casing and drum.

2. In a combined clothes washing and drying machine, a drum comprising heads having opposed convex and concave members, a ring welded to each head; and tie-bars secured to said rings.

3. In a combined clothes washing and drying machine, a drum comprising heads having opposed convex and concave members, a ring welded to each head, a ring intermediate said heads, tie-bars secured to said rings, and end plates with clothes deflecting sections therein positioned within and secured to said rings.

4. In a combined clothes washing and drying machine, a drum comprising heads having opposed convex and concave disks, a ring welded to each head, a ring intermediate said heads, tie-bars secured to said rings, an end plate secured to each end ring, a pair of end plates secured back to back to said intermediate ring each plate having a clothes deflecting section therein forming thereby a plurality of clothes containing chambers.

5. In a combined clothes washing and drying machine, a drum comprising heads having opposed convex and concave disks, a ring welded to each head, a ring positioned

intermediate said heads, tie-bars secured to said rings, an end plate secured to each end ring, a pair of end plates secured back to back to said intermediate ring each plate having a clothes deflecting section, forming thereby a plurality of clothes containing chambers, and circumferentially disposed plates provided with oblong perforations secured between said tie-bars.

6. In a combined clothes washing and drying machine, a drum comprising heads having opposed convex and concave disks, a ring welded to each head, a ring positioned intermediate said heads, tie-bars secured to said rings, an end plate secured to each end ring, a pair of end plates secured back to back to said intermediate ring each plate having a clothes deflecting section, forming thereby a plurality of clothes containing chambers, circumferentially disposed plates provided with oblong perforations secured between said tie-bars, and means for delivering the clothes at the door of the drum.

7. In a combined clothes washing and drying machine, a drum comprising heads having opposed convex and concave disks, a ring welded to each head, a ring positioned intermediate said heads, tie-bars secured to said rings, an end plate secured to each end ring, a pair of end plates secured back to back to said intermediate ring each plate having a clothes deflecting section, forming thereby a plurality of clothes containing chambers, circumferentially disposed plates provided with oblong perforations secured between said tie-bars, and longitudinally positioned partitions in said drum.

8. In a combined clothes washing and drying machine, a drum comprising heads having opposed convex and concave disks, a ring welded to each head, a ring positioned intermediate said heads, tie-bars secured to said rings, an end plate secured to each end ring, a pair of end plates secured back to back to said intermediate ring each plate having a clothes deflecting section, forming thereby a plurality of clothes containing chambers, circumferentially disposed plates provided with oblong perforations secured between said tie-bars, and longitudinally positioned partitions in said drum with means for locking said partitions in position.

9. In a combined clothes washing and drying machine, a drum comprising heads having opposed convex and concave disks, a ring welded to each head, a ring positioned intermediate said heads, tie-bars secured to said rings, an end plate secured to each end ring, a pair of end plates secured back to back to said intermediate ring each plate having a clothes deflecting section, forming thereby a plurality of clothes containing chambers, circumferentially disposed plates provided with oblong perforations secured between said tie-bars, longitudinally posi-

tioned partitions in said drum with means for locking said partitions in position, lifting bars in said drum, and seats on said end plates for receiving said lifting bars.

10. In a combined clothes washing and drying machine, a drum comprising heads having opposed convex and concave disks, a ring welded to each head, a ring positioned intermediate said heads, tie-bars secured to said rings, an end plate secured to each end ring, a pair of end plates secured back to back to said intermediate ring each plate having a clothes deflecting section, forming thereby a plurality of clothes containing chambers, circumferentially disposed plates provided with oblong perforations secured between said tie-bars, longitudinally positioned partitions in said drum with means for locking said partitions in position, lifting bars with circulating passages there-through, and seats on said end plates for receiving said lifting bars.

11. In a combined clothes washing and drying machine, a drum comprising heads having opposed convex and concave disks, a ring welded to each head, a ring positioned intermediate said heads, tie-bars secured to said rings, an end plate secured to each end ring, a pair of end plates secured back to back to said intermediate ring, each plate having a clothes deflecting section, forming thereby a plurality of clothes containing chambers, circumferentially disposed plates provided with oblong perforations secured between said tie-bars, longitudinally positioned partitions in said drum with means for locking said partitions in position, lifting bars disposed between the two plates of each pair of end plates, and means for conducting a heating medium through said bars.

12. In a combined clothes washing and drying machine, a drum comprising heads having opposed convex and concave disks, a ring welded to each head, a ring positioned intermediate said heads, tie-bars secured to said rings, an end plate secured to each end ring, a pair of end plates secured back to back to said intermediate ring, each plate having a clothes deflecting section, forming thereby a plurality of clothes containing chambers, circumferentially disposed plates provided with oblong perforations secured between said tie-bars, longitudinally positioned partitions in said drum with means for locking said partitions in position, lifting bars disposed between the two plates of each pair of end plates, means for conducting a heating medium through said bars, and means to create a partial vacuum in said drum.

13. In a combined clothes washing and drying machine, a drum comprising heads, tie bars connecting the same, hollow lifting bars secured to said tie bars, a plurality of the lifting bars provided with partition re-

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ceiving recesses, partitions therein, a yield-
ingly mounted pin in each recessed lifting
bar for removably retaining said partition
in position and means for conducting a heat-
5 ing medium through the lifting bars.

14. In a combined clothes washing and
drying machine, a drum comprising heads,
tie bars connecting the same, opposed end
plates within said drum, each plate having
10 an offset edge section, a clothes deflecting
section intermediate said offset and central
plate sections, hollow lifting bars disposed
between the two opposed end plates, and se-
cured at said offset sections, and means for
15 conducting a heating medium through said
lifting bars.

15. In a combined clothes washing and
drying machine, a drum comprising heads,
tie bars securing the same, opposed plates
20 within said drum, each plate having an off-
set edge section and a clothes deflecting
section between said offset and the central
plate sections, means for adjustably posi-
tioning said plates relatively to said heads,
25 hollow lifting bars secured to said offset
sections, a pipe connecting said lifting bars
with each other, a trunnion on the drum

having a plurality of chambers therein, a
connection between said trunnion and said
bar connecting pipe, a cover for said cham- 30
ber having a plurality of pipe receiving
apertures leading to said trunnion apertures
for conducting a heating medium through
said lifting bars.

16. In a machine for drying textile ma- 35
terial, the combination with a casing, of a
material containing drum rotatable therein,
said drum comprising heads, circumferen-
tially disposed perforated plates carried by
the heads, hollow lifting bars providing, re- 40
spectively, closed heating conduits, means
connecting said bars in circulating series, a
trunnion on said drum, means connecting
the trunnion with the lifting bars for con-
ducting a heating medium therethrough, 45
and means for creating a partial vacuum
in the casing and drum.

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

W. A. E. HENRICI.

Witnesses:

LOUIS C. SMITH,
THOMAS J. DRUMMOND.