No. 825,831. PATENTED JULY 10, 1906.

C. L. HEISLER.

CONDENSER.

APPLICATION FILED JAN. 6, 1904.

2 SHEETS—SHEET 1.

Fig. 2.

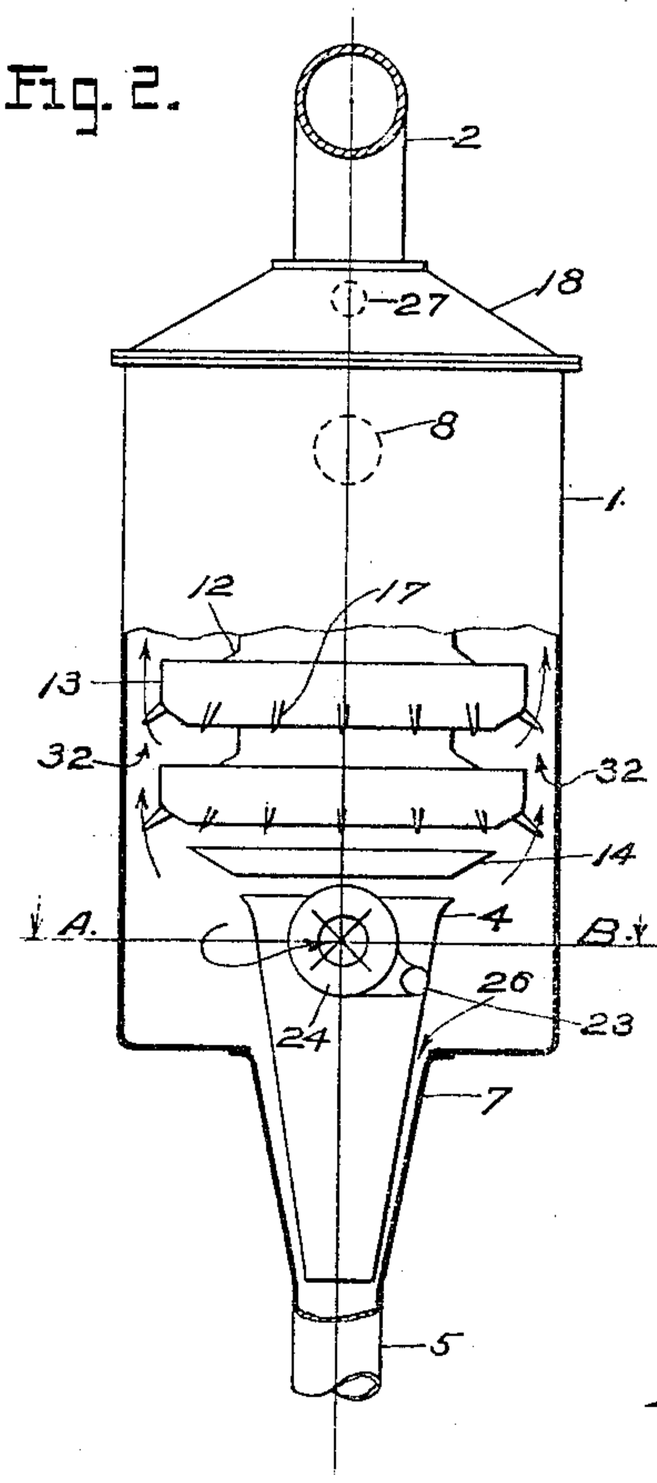


Fig. 1.

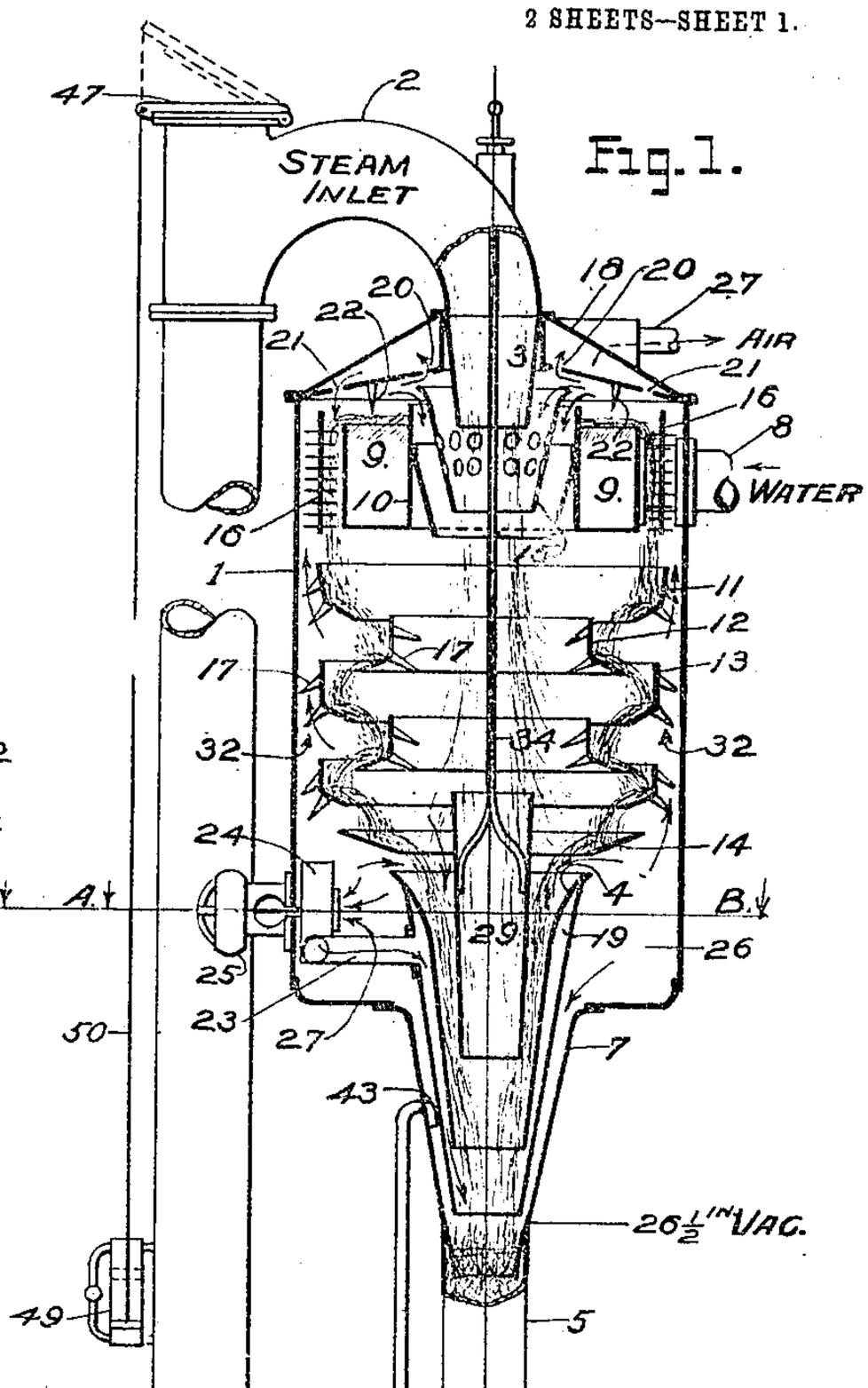
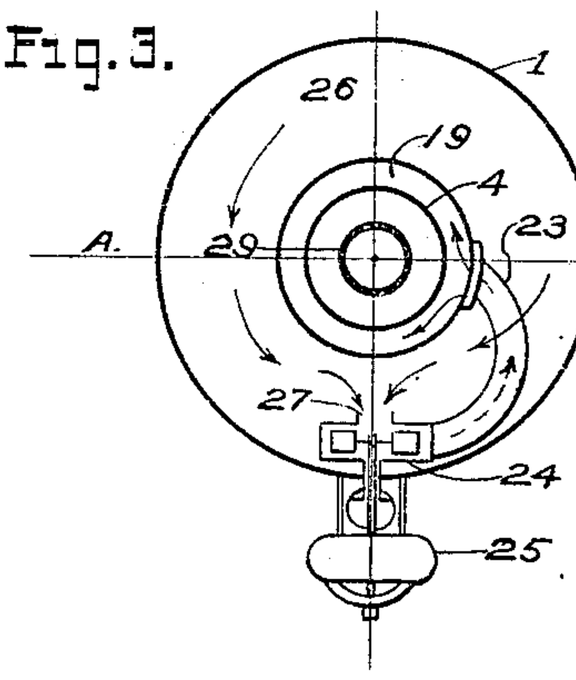
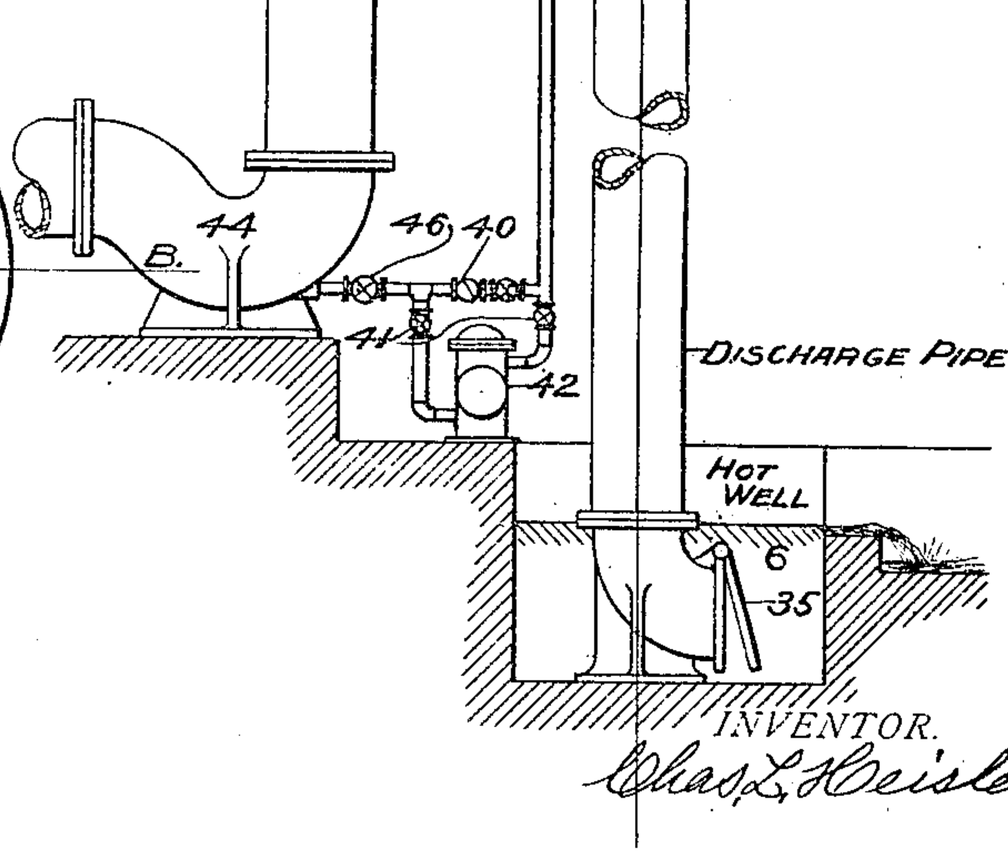


Fig. 3.





WITNESSES:

Henry L. Doering

A. A. Styslinger

INVENTOR.

Chas. L. Heisler,

No. 825,831. PATENTED JULY 10, 1906.

C. L. HEISLER.

CONDENSER.

APPLICATION FILED JAN. 6, 1904.

2 SHEETS—SHEET 2.

Fig. 4.

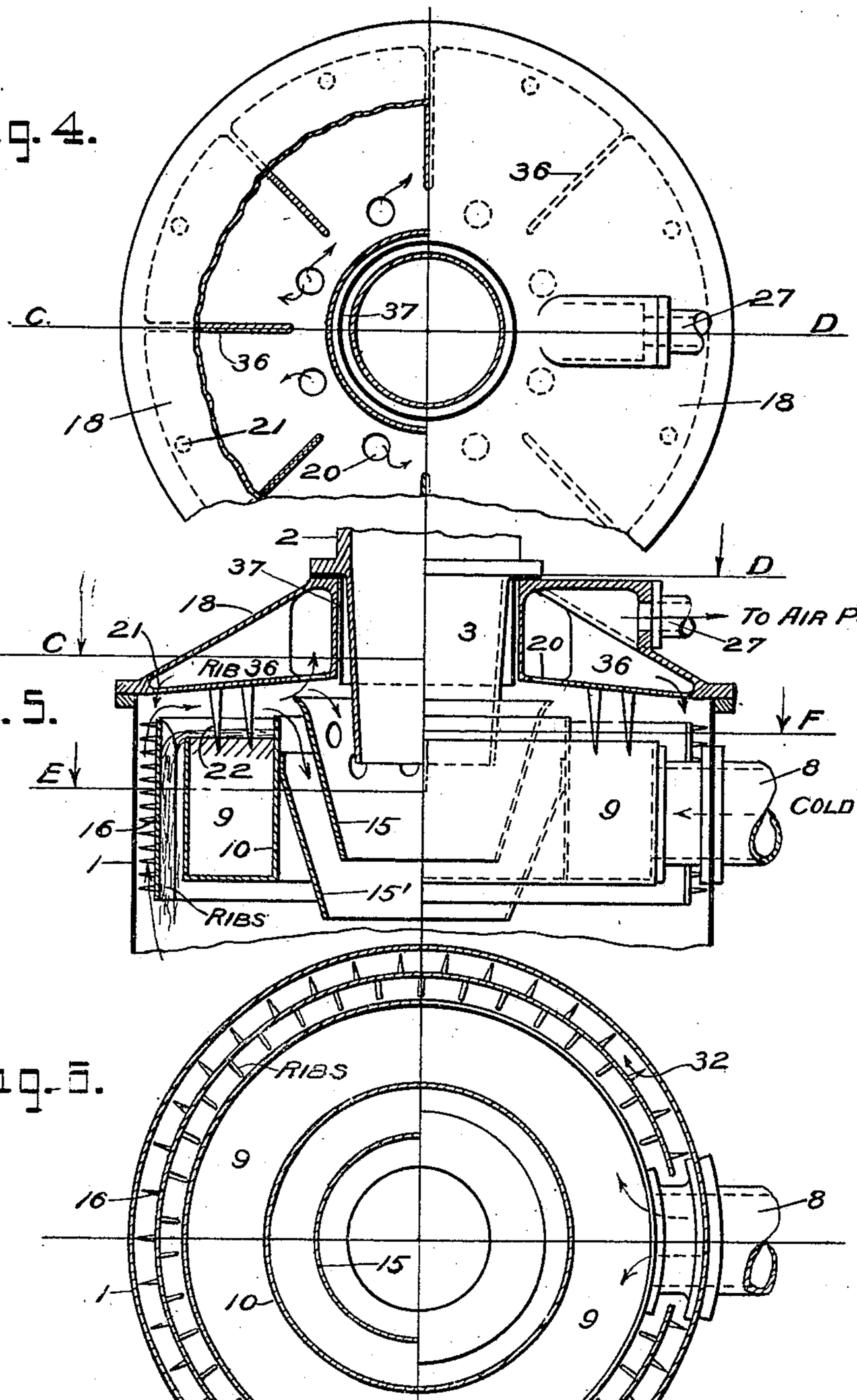


Fig. 5.

WITNESSES:

Henry L. Doering

A. A. Styslinger

INVENTOR.

Chas L. Heisler

UNITED STATES PATENT OFFICE.

CHARLES L. HEISLER, OF PITTSBURG, PENNSYLVANIA.

CONDENSER.

No. 825,831. Specification of Letters Patent. Patented July 10, 1906.

Application filed January 6, 1904. Serial No. 187,989.

To all whom it may concern:

Be it known that I, CHARLES L. HEISLER, of the city of Pittsburg and State of Pennsylvania, have invented a new and useful Improvement in Steam-Condensers, as described and shown in the following specification and drawings.

My invention relates, primarily, to that type of condensers in which the coldest condensing-water comes in direct contact with the coldest steam or vapor that is being condensed, the entering steam coming first into contact with the hottest condensing-water the instant before the latter finds an exit from the condensing-chamber.

The purpose of my invention is to apply within a large and roomy condensing-chamber the principle of an induced or forced counter-current circulation of vapors, which has proved so effective in cooling-towers, thereby causing a very rapid condensation, a wide range of capacity, and a very economical use of condensing-water. Furthermore, the induced counter-current circulation carries the slightest remnant of air upward into direct contact with the coldest water and specially-formed radiating-surfaces, separating it from the liquids and steam, so it may be drawn away by any suitable air-pump through a moisture-trap arranged in the top of the condensing-chamber.

My invention further provides a special means whereby a great volume of air can be quickly removed from the condenser. Thereby the workings of the condenser is assured, when the sudden starting of large engines instantly throws large volumes of air into the condenser, as will be described hereinafter. An arrangement is also provided within the condenser whereby the water of condensation is readily separated and precipitated from the uncondensed vapors. The latter is then carried into contact with the colder condensing-water surfaces.

In the drawings, Figure 1 shows a sectional view of the condenser connected with a suitable barometric tube. Fig. 2 shows the arrangement of the fan within the condenser. Fig. 3 shows a sectional view looking down on the line A B. Fig. 4 is a view on line C D in Fig. 5, the latter showing an enlarged detail of the moisture-trap. Fig. 6 is a view on section E F of Fig. 5 looking down.

The steam enters the top of the large vacuum condensing-chamber 1 through the steam-pipe 2, the discharge-opening 3 of which is slightly reduced to give a jet action, and the mixture of steam, air, and hot water is precipitated directly into the bell-mouthed opening 4 and 29 of the barometric or discharge tube 5, the lower end of which terminates these, as usual, in a hot-well 6 or any suitable pump. The cold-condensing-water pipe 8 enters the condensing vacuum-chamber and carries the water into the annular trough 9. The inner wall 10 of this trough being higher, consequently the water spills over the outer circular edge nearest the outer walls of the condensing-chamber 1 and falls against the circular cold finger or ribbed air-cooling plate 16 and then drops into the annular spill-tray 11, from which it continues falling, forming circular cascades in its downward course over the several annular spill-trays 12, 13, and 14, respectively, until when at its highest temperature it combines with the hottest steam in the funnel-mouth 4 of the barometric tube 5, where it meets the direct impact of the steam-jet. By making the spill-trays of large diameters and placing them nearest the outer shell of the condensing-chamber a very large cooling contact water-surface is obtained and a free and direct central passage for the steam from the nozzle 3 to the hottest water in the mouth of the barometric tube at 4. The siphoning action in the funnel or conical bell-mouths 4, 7, and 29 of the barometric or discharge tube will naturally cause it to carry away much of the free air which may collect in the lower zones of the condenser. The siphoning action due to the downward flow of the exhaust-steam through the sleeves 15 and 15′ will produce a highly-rarefied zone in the vicinity of the perforated sleeve 15 and sleeve 15′ and directly above the cold water in the trough 9, which will cause a circulation upward through the annular passage 32 of the cold uncondensed steam and air about the cold-water cascades and cold fingers 16 and colder zones, as shown by the darts, thereby getting the much-desired effect common to induced counter-currents as applied in cooling-towers. The cold fingers 16 give a decided advantage, in that they cool the air and abstract moisture instead of charging it with moisture, as when heretofore this air is made to pass directly through water cascades. To further increase the condensing capacity, additional cold fingers 17 are cast directly upon the spill-trays 11, 12, and 13.

The air-pipe 27 leads from 18 to any suit-

able dry-air vacuum-pump and takes the cooled air from the moisture-trap 18, the latter forming a cover for the large vacuum condenser-chamber 1. The air passes from the coldest zone of the condenser, which is above the trough 9, and enters the moisture-trap 18 through the holes 20. The entrained moisture flows toward the outer periphery of the trap and drops into the condenser through the drip-holes 21. This arrangement of moisture-trap forming the top of the condensing-chamber gives a very simple, compact, and effective construction, avoids the use of extra piping, and makes a very strong cover. The trapped water is drained directly into the condenser. Suitable cold fingers 22 project from the air-trap into the cold water to further reduce the temperature of the outgoing air. Ribs 36 are formed within the trap to break up any strong air-currents that might carry moisture. Suitable non-conducting sleeve or wall 37 (shown in Figs. 4 and 5) is arranged between the exhaust-pipe 2 and nozzle 3 and the colder metals of the moisture-trap 18, to which it is bolted. This construction prevents the outgoing air from absorbing heat.

In the lower end of the large condensing-chamber 1 is formed a large reserve air-collecting reservoir 26. The annular openings 4, 7, 19, and 29 place it in direct communication with the barometric tube 5. The annular space 19 is connected by the tube 23 to the fan 24, which is driven by any suitable motor, as 25, arranged exterior of the condensing-chamber 1. The fan 24 collects the air through an opening 27 from the reservoir 26 and forces it down into the barometric tube 5 through the funnel 19, thereby causing it to be carried by the downward flow of the condensing-water to the hot-well. This provides an efficient means of instantly disposing of a large volume of air which may be suddenly exhausted into the condenser, as when starting an engine, and thereby avoiding a sudden reduction or entire loss of the vacuum. The fan must evidently be discharged near enough to its inlet 27, so the difference in vacuum or pressure will not be greater than the capacity of said fan. The hollow funnel 19 evidently assists the fan in its work of exhausting the reservoir 26. The vertically-adjustable tube 29 is arranged within the funnel-mouth 4 and is suspended by the adjusting-rod 34, by which this tube can be set to suit the service conditions. The water from the condenser can be discharged through the check-valve 35 into a suitable hot-well 6 (shown in Fig. 1) or through a pump, as is frequently done.

From the drawings it will be seen that between the peculiarly-arranged spill trays 12, 13, and 14 and the exterior walls 1 of the condensing-chamber is formed an annular space 32, thereby giving a natural passage for the upward current of uncondensed vapor and the small remnant of air that is not collected by the fan 24. This space and the reservoir 26 also gives the remnant of water or moisture that may be held suspended in the uncondensed vapor ample time and opportunity to separate, the water dropping downward and the uncondensed vapors rising upward and coming into contact with the colder liquids and condensing-surfaces, being drawn into the colder upper zones by the suction of the steam-jet, as already described. From the construction of the apparatus and arrangement of the water cascades it will be seen that practically a solid water curtain intervenes between the steam-jet and the annular space 32 back of the spill-trays, so the line of least resistance to the flow of the uncondensed vapors referred to will be upward, as stated and indicated by the darts shown in the drawings. From the foregoing it will be clear that this arrangement of the passage 32 and the reservoir 26 provides an excellent separating device which precipitates the water of condensation into the reservoir 26, while the upward current in the passage 32 slowly lifts the uncondensed vapors to the colder upper zones, thereby further increasing the capacity and efficiency of the condenser. The wide range of capacity is again extended by the effective means of instantly expelling sudden charges of air by means of the fan and several funnels arranged in the air-collecting reservoir 26, located immediately above the barometric tube 5.

The peculiar wall of the water formed by the cascades is not unlike that of the telescopic accordion bellows, and likewise it may have a rectangular or circular cross-section, as shown. This form of cascades gives a very large water-contact surface which is continually changing, thereby materially improving the condensing efficiency of the apparatus.

At the lower end of the vertical exhaust-pipe is arranged a suitable entrainer 44, as shown in Fig. 1. The water collecting in this entrainer is extracted by means of any suitable pump 42 or ejector 46, or both, arranged, as shown, in the pipe 45, which connects the entrainer 44 with the barometric or discharge tube 5 at a considerable distance above the hot-well-pool level 6. The discharge-opening 43 is made to project downward. By this arrangement the pressures are nearly the same at 43 as at 44. Therefore there will be no tendency for air to enter the exhaust-pipe system, as in case the pump or ejector discharged into the atmosphere. Furthermore, the lift of the pump in nearly all cases of installation will be very much reduced.

Arranged upon the exhaust-pipe 2 is a trap or relief valve 47 of usual construction, which is connected, by means of any suitable rod 50,

to a dash-pot 49, secured to the vertical exhaust-pipe, as shown, this arrangement preventing the undesirable fluttering of the relief-valve 47 when exhausting through it into the atmosphere and compels the relief-valve to close quietly and open when from some abnormal condition the vacuum is lost in the condenser.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a condenser, the combination of a condensing vacuum-chamber 1 provided with suitable cold-water inlet 8 a discharge-outlet, 5, and a steam-jet 3 3 discharging downward through said chamber and centrally through a series of water cascades 11, 12, 13, and 14, which form a curtain between said steam-jet and a vapor-passage, arranged that said steam-jet will produce a circulation and impel the colder uncondensed vapors to the coldest zones and bring them in contact with the coldest water and radiating-surfaces, for the purpose set forth.

2. In a condenser, the combination of a condensing vacuum-chamber, provided with suitable cold-water inlet, a discharge-outlet, and a steam-jet entering the condenser at the top and jetting downward into the mouth of the discharge-tube, in combination with means forming part of the condenser and arranged to cause a circulation and impel the colder uncondensed vapors to the coldest zones and in contact with the coldest water and radiating-surfaces for the purpose set forth.

3. In a condenser, the combination of a condensing-chamber, provided with suitable cold-water inlet, a discharge-outlet, a steam-jet entering the condenser and jetting centrally downward through a series of cooling-water cascades; the lowest cascades formed of the hottest water joining the steam-jet in the mouth of the discharge-tube, in which is arranged a series of siphoning-funnels or bell-mouths, in the manner and for the purpose described.

4. In a condenser, the combination of a condensing-chamber, provided with suitable cold-water inlet, a discharge-outlet, and a steam-jet entering the condenser and jetting centrally downward through a series of cooling-water cascades; the lowest cascades formed of the hottest water joining the steam-jet in the mouth of the discharge-tube, said cascades forming a water curtain between said steam-jet and a suitable vapor-passage which conducts uncondensed vapor upward to the coldest water or zones, in the manner and for the purpose described.

5. In a condenser, the combination of a condensing-chamber, provided with suitable cold-water inlet, a discharge-outlet, and a steam-jet entering the condenser from the top and jetting downward, and a trap or separator for trapping moisture from the air, said trap arranged within said condensing-chamber mainly above the condensing-water cascades or sprays and encircling said steam-jet as described.

6. In a condenser, the combination of a condensing-chamber, provided with suitable cold-water inlet, a discharge-outlet, and a steam-jet entering the condenser and jetting downward centrally through a cylinder or inverted cone, formed by a series of cooling-water cascades and means for trapping moisture from the outgoing air, arranged within said condensing-chamber above the water cascades, and a suitable air-pump arranged externally to take said air from the moisture-trap for the purpose set forth.

7. In a condenser, the combination of a condensing-chamber, provided with suitable cold-water inlet, a discharge-outlet, and a steam-jet entering the condenser and jetting downward and means for trapping moisture from the outgoing air, arranged within said condensing-chamber mainly above the condensing-water cascades or sprays and suitable cold fingers attached to said trap and projecting downward into the cooling-water, for the purpose set forth.

8. In a condenser, the combination of a condensing vacuum-chamber, provided with a suitable cold-water inlet, a discharge-outlet, and a steam-jet entering the condenser, in combination with means causing said jet to produce a circulation and impel the colder uncondensed vapors to the coldest zones and in contact with the coldest water and radiating-surfaces and means arranged within the condenser for separating the water of condensation from the said uncondensed vapor when on their way to the said coldest zones, for the purpose set forth.

9. In a condenser, the combination of a condensing vacuum-chamber, provided with suitable cold-water inlet, a discharge-outlet, and a steam-jet entering the condenser, in combination with means causing said jet to produce a circulation and impel the colder uncondensed vapors to the coldest zones and in contact with the coldest water and radiating-surfaces and suitable cold fingers projecting into the passage of said uncondensed vapors, said cold fingers being reduced in temperature by the coldest water, for the purpose set forth.

10. In a condenser, the combination of a condensing-chamber, provided with a suitable cold-water inlet, a discharge-outlet, and a steam-jet entering the condenser and jetting downward into the apex of an inverted cone or cylinder, formed by a series of cooling-water cascades and suitable cold fingers projections formed on spill-trays, arranged to form the said pyramid, or cylindrical series of water cascades, for the purpose set forth.

11. In a condenser, the combination of a condensing-chamber, provided with a suit-

able cold-water inlet, a discharge-outlet, and a steam-jet entering the condenser, a series of cooling-water cascades and a discharge-tube below said water cascades, and a fan or other means for forcing the air from said reservoir 26, downward through the discharge-outlet or tube, for the purpose set forth.

12. In a condenser, the combination of a condensing vacuum-chamber, provided with a suitable cold-water inlet, a discharge-outlet, and a steam-jet entering the condenser, in combination with means causing said jet to produce a circulation and impel the colder uncondensed vapors to the coldest zones and in contact with the coldest water and radiating-surfaces and an auxiliary air-collecting reservoir arranged at the bottom of said condensing-chamber and means for exhausting said reservoir, arranged as described.

13. In a condenser, the combination of a condensing vacuum-chamber, provided with a suitable cold-water inlet, a discharge-outlet, and a steam-jet entering the condenser, in combination with an auxiliary air-reservoir, arranged at the bottom of said condensing-chamber, and a suitable means for forcing the air from said reservoir, into the hollow siphon-funnel 19, for the purpose set forth.

14. In a condenser, the combination of a condensing vacuum-chamber, provided with a suitable cold-water inlet, a discharge-outlet, and a steam-jet entering the condenser, in combination with means causing said jet to produce a circulation and impel the colder uncondensed vapors to pass through an annular passage, arranged between the cylindrical wall, formed by the series of water cascades and the condensing-chamber walls, inclosing said condensing device, for the purpose set forth.

15. In a condenser, the combination of a condensing-chamber, provided with suitable cold-water inlet, a discharge-outlet, and a steam-jet entering the condenser and a series of cooling-water cascades, and a discharge-tube arranged below said water cascades, and a fan driven by a suitable motor; said fan attached to, or arranged within, said condensing-chamber, designed to exhaust the chamber and discharge the air and uncondensed vapor into the discharge tube or outlet, at a point near enough to the condensing-chamber, so the difference in vacuum or pressure, will not exceed the capacity range of said fan, for the purpose set forth.

16. In a condenser, the combination of the cold-water trough 9 and the cold finger-plate 16, arranged adjacent thereto as shown, for the purpose described.

17. In a condenser, the combination of the exhaust-inlet 3, a conical or encircling shell 15 arranged to form a suction-gill by the action of the entering exhaust-steam jetting through said conical shell, and a passage for the purpose of conducting uncondensed vapors or air to and through said suction-gills in such a manner as to induce a circulation of said vapors within the condensing-chamber mainly toward the colder zones in the manner and for the purpose described.

18. In a condenser, the combination of the exterior wall of the condensing-chamber, the cold finger-plate 16, the annular water-trough 9, and the exhaust jet-nozzle 3, all arranged concentric with each other over a series of water cascades, for the purpose described.

19. In a condenser, the combination of the air-trap 18, arranged on the top of the condensing-chamber 1, the nozzle 3 passing centrally through said trap; the annular water-trough 9 and cold finger-plate 16, arranged directly under the trap; the spill-trays, 11, 12, 13 and 14, located between the water-trough and discharge-tube 5, for the purpose described.

20. In a condenser, the combination of an outer condensing-chamber wall 1, and annular air-passage 32, a series of circular water cascades, and a centrally-located steam-jet, all concentrically arranged in the order as given, for the purpose described.

21. In a condenser, the combination of the water-trough 9, the nozzle 3, the series of spill-trays, 11, 12, 13 and 14, arranged as shown above the siphon-funnels, 4, 19 and 7; said funnels forming within the discharge-outlet over the barometric tube 5, and an adjustable sleeve 29, arranged within said funnels, for the purpose described.

22. In a condenser, the combination of the water-inlet 8, exhaust-steam inlet 3, a suitable discharge-outlet, and a moisture-trap 18, arranged with suitable ribs 36, for the purpose described.

23. In a condenser, the combination of the water-inlet 8, a suitable discharge-outlet, and a moisture-trap 18, having an air-outlet 27, arranged on top of the condensing-chamber 1, and an exhaust-inlet passing vertically and centrally through said moisture-trap, and air-inlets 20 and drips 21, suitably formed and arranged for the the purpose described.

24. In a condenser, the combination of the water-inlet 8, a suitable discharge-outlet, and a moisture-trap 18, having an air-outlet 27, arranged on top of the condensing-chamber 1, and an exhaust-inlet passing vertically and centrally through said moisture-trap, and air-inlets 20 and drips 21, suitably formed and arranged, and a non-conducting well 37 arranged between the said moisture-trap and exhaust-steam inlet 2 and 3, for the purpose described.

25. In a condenser, the combination of a condensing-chamber, a discharge-tube 5, a condensing-water inlet, an exhaust-pipe fitted with a suitable entrainer 44, a pipe 45 connecting said entrainer with the discharge-tube 5 at some distance above the hot well,

and means for forcing the entrained water through said pipe 45 to the discharge-tube 5, for the purpose set forth.

26. In a condenser, the combination of a condensing-chamber 1, having a suitable cold-water inlet and discharge-outlet, an exhaust-steam inlet and exhaust-pipe connected therewith, a relief-valve arranged upon said exhaust-pipe, and a dash-pot 49 connected with said relief-valve, for the purpose described.

CHARLES L. HEISLER.

Witnesses:
A. A. STYSLINGER,
P. W. SOUKATSCHOFF.