C. J. SNOW.

STEAM CONDENSER.

APPLICATION FILED AUG. 6, 1909.

956,211. Patented Apr. 26, 1910.

2 SHEETS—SHEET 1.

Fig. 2.

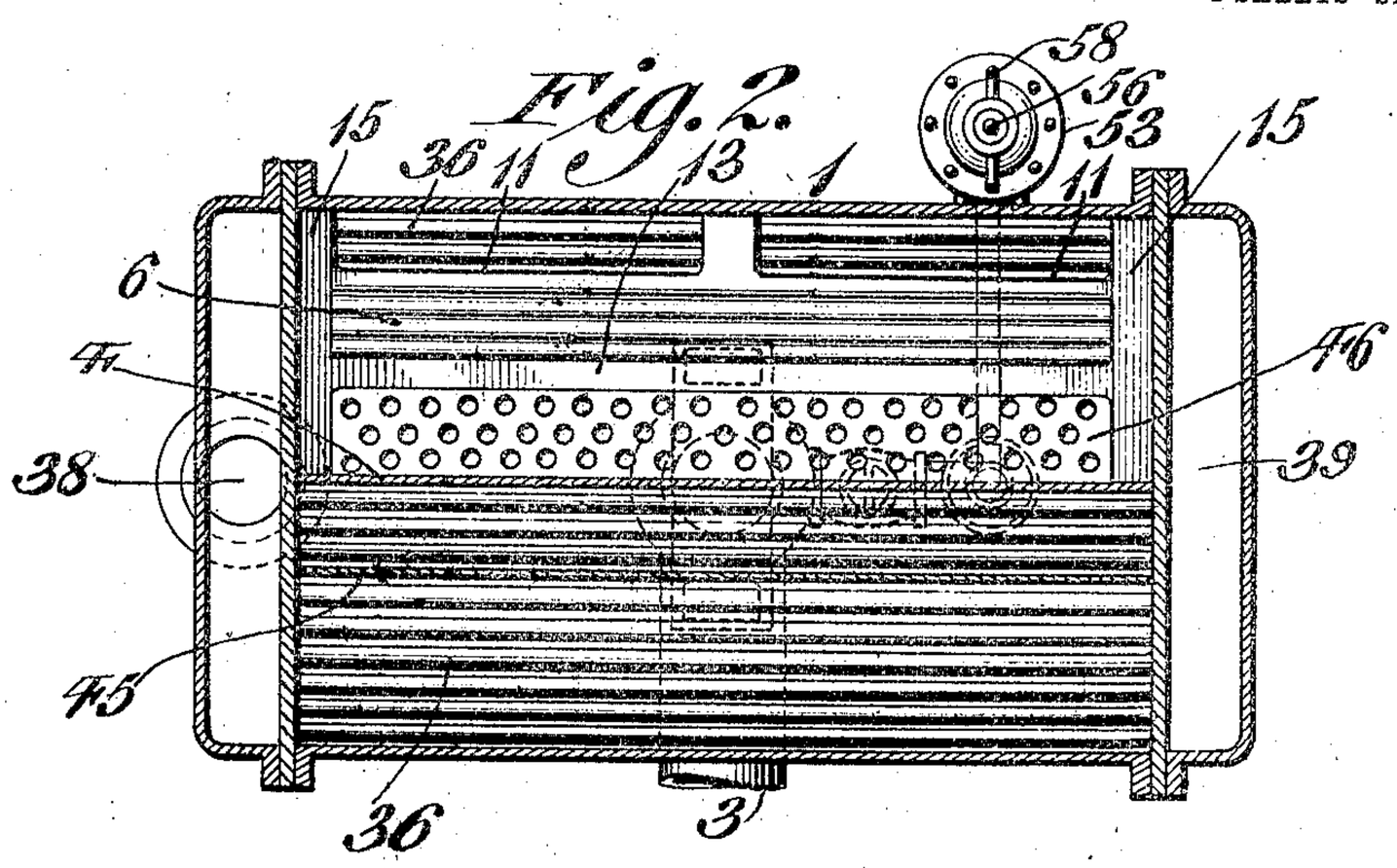
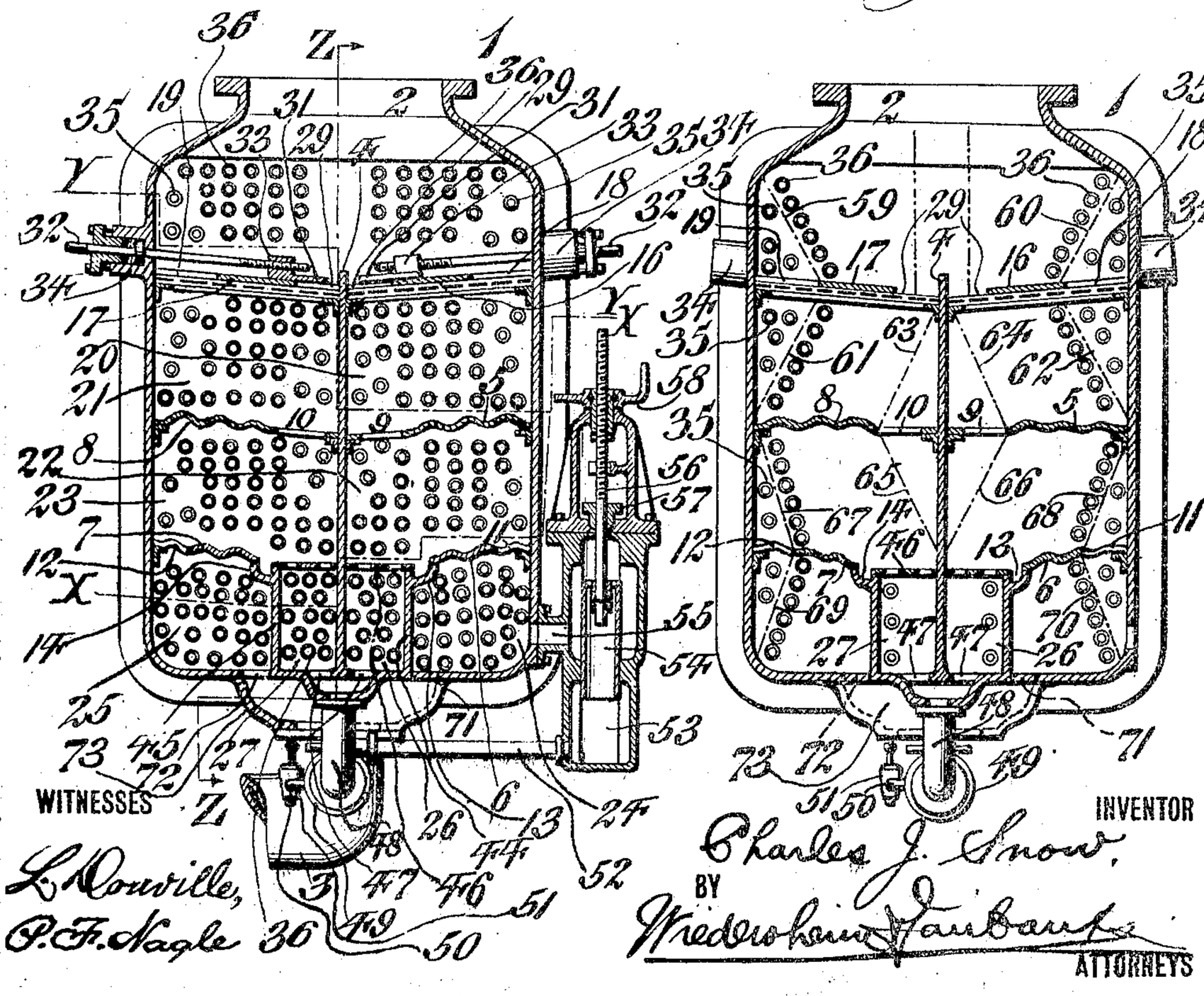


Fig. 1.

Fig. 2.



C. J. SNOW.

STEAM CONDENSER.

APPLICATION FILED AUG. 6, 1909.

956,211.

Patented Apr. 26, 1910.

2 SHEETS—SHEET 2.

Fig. 4.

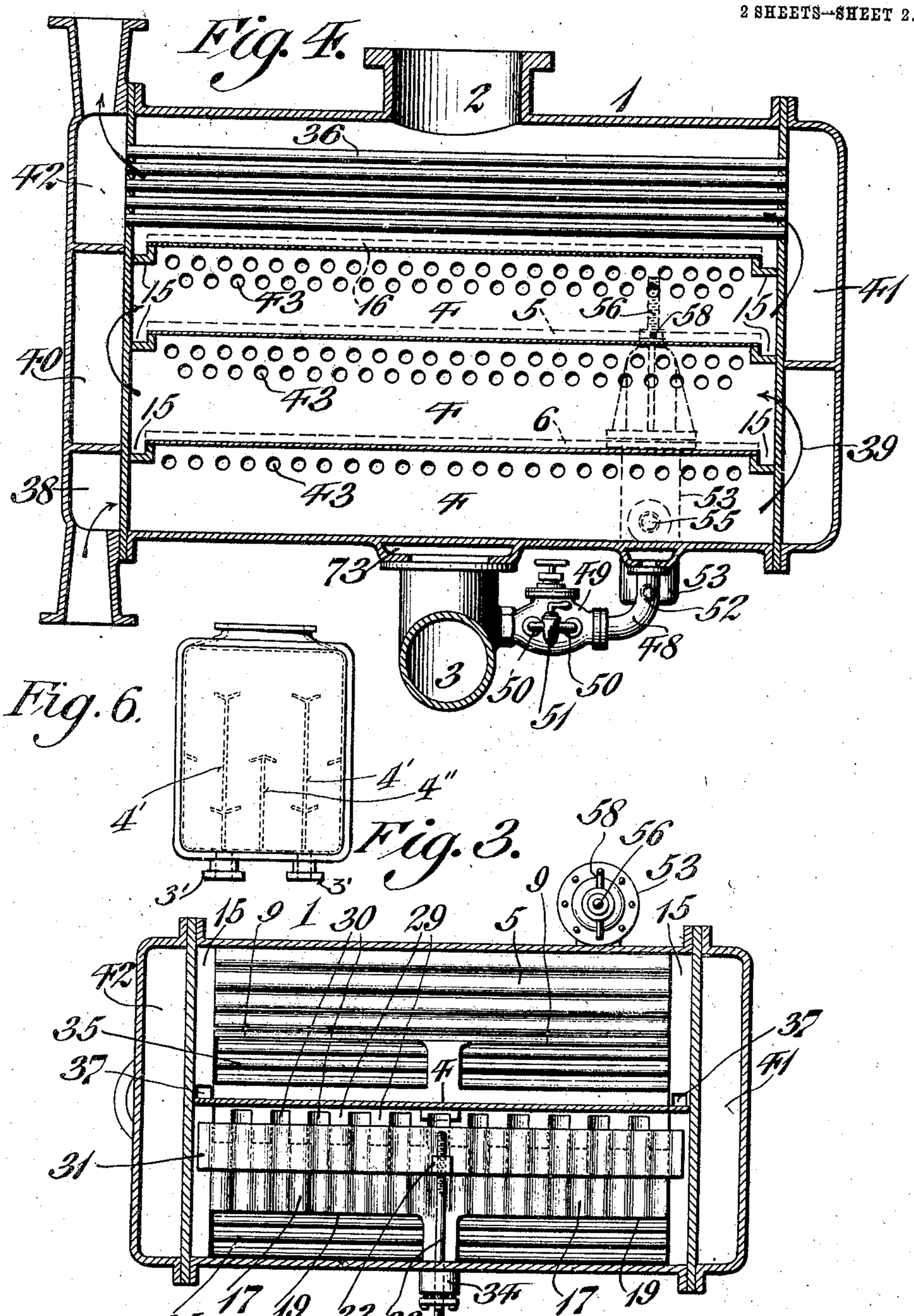


Fig. 6.

Fig. 3.

WITNESSES

L. Coville,

P. F. Nagle.

INVENTOR

Charles J. Snow.

BY

Mederhein Fairbanks.

ATTORNEYS

UNITED STATES PATENT OFFICE.

CHARLES J. SNOW, OF LANSDOWNE, PENNSYLVANIA.

STEAM-CONDENSER.

956,211. Specification of Letters Patent. **Patented Apr. 26, 1910.**

Application filed August 6, 1909. Serial No. 511,504.

To all whom it may concern:

Be it known that I, CHARLES J. SNOW, a subject of the King of Great Britain, residing at Lansdowne, county of Delaware, State of Pennsylvania, have invented a new and useful Steam-Condenser, of which the following is a specification.

My invention relates to an improved steam condenser having special water cooling features.

The purpose of my invention is to provide an adjustable supplemental path for the flow of steam in a steam condenser preferably of multiple flow type having a longitudinal division wall and to cool the water in the said condenser.

A further purpose of my invention is to combine with a sinuous line of flow a large width of section of flow and a short length of flow through the various nests and to present water-removing surfaces at every point of change of direction of flow of the steam.

A further purpose of my invention is to remove the water from the steam during a sinuous, preferably duplicate, path of flow and at short intervals therein and to collect this water free from the line of steam flow to prevent subsequent entrainment thereof.

A further purpose of my invention is to free water draining from a baffle from the action of the steam passing between drainage points.

A further purpose of my invention is to make use of a preferably central longitudinal division wall and corrugated baffles connected therewith, to provide apertures therein at intervals corresponding to the spacing of the corrugations or a multiple thereof and preferably in the high parts of the corrugations and to provide for the closing of these openings to any desired degree from the outside.

A further purpose of my invention is to make use of corrugated baffles, either longitudinal or transverse or both, within a preferably longitudinally centrally divided condenser and to make use of depressions or gutters in the corrugations to conduct the condensed water, at the same time that they protect against entraining of water by steam passing thereover, and to reduce the exposed film surface of water upon the baffles by concentrating the water.

A further purpose of my invention is to divide the steam in its passage through the nests of cooling pipes in such a way as to equalize the rate of condensation of steam throughout the nests by admitting some steam to the lower nests which has not passed through the usual channels in the upper nests, preferably by providing a short cut for the steam.

A further purpose of my invention is to take advantage of the momentum of steam flow through a condenser and of the sinuous path of direction given to the steam to separate the water particles from the steam and to deposit same upon baffles and surfaces arranged in its line of flow and to drain the water so removed and in such manner as to prevent possibility of subsequent entrainment.

A further purpose of my invention is to use a portion of the condenser for water cooling or steam condensation at will, and in any proportion which may be desirable, and to withdraw the water from the botfom thereof, with return if desired, and to maintain any required height of water in said portion.

A further purpose of my invention is to provide a compartment capable of use for water collection and cooling and to provide means by which it may have direct air suction to more efficiently make use of it for steam condensation, by preventing uncondensable gases accumulating therein.

A further purpose of my invention is to provide for direct drain of separately collected water in a steam condenser into the vapor and air exhaust pipe and to permit this water to pass into the air and vapor exhaust, or, at will, into the condenser outside the water collector therein, with definite control of the height of water maintained in the collector, and to withdraw the coolest water without employing any special means

inside the condenser. I also protect against excessive flow of water from the receiver into the exhaust.

A further purpose of my invention is to vary the spacing of the tubes in proximity to the passages through the baffles by inserting tubes therein in any desired multiples of the same pitch obtaining throughout the rest of the tube nest, in order to avoid throttling of steam thereby, at the same time preserving as great a width of baffle plate as possible, to obtain a desirable angle of steam direction, without departure from normal condenser shapes, and to provide more uniform velocity of the steam therethrough.

A further purpose of my invention is to provide for approximately the same cross section of space for steam flow throughout its passage while distributing the tubes over practically the entire tube plates.

It further consists of other novel features of construction, all as will be hereinafter fully set forth.

For the purpose of illustrating my invention, I have shown in the accompanying drawings one form thereof which is at present preferred by me, since the same has been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described.

Figure 1 is a vertical central section of one structure embodying my invention. Fig. 2 is a section of Fig. 1 taken upon line *x*—*x* thereof. Fig. 3 is a section of the structure shown in Fig. 1 taken upon line *y*—*y* thereof. Fig. 4 is a section of the structure shown in Fig. 1 taken upon line *z*—*z* thereof. Fig. 5 is a skeleton sectional illustration of the structure of Fig. 1 for the purpose of further explanation thereof. Fig. 6 is a diagrammatic representation of a structure embodying a plurality of my longitudinal division walls and a consequent plurality of pairs of sinuous lines of steam flow.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings:—For the purpose of securing a high rate of efficiency from the whole of the cooling surface within my condenser, I utilize a high and controllably uniform velocity for the steam throughout the various tube compartments. Where high velocities are employed, the condensed water particles and drops are carried forward by the momentum of the steam, and where the lines of steam flow are transverse the direction of movement of the water particles often approaches the horizontal. To prevent these water particles from being carried forward across a large number of tubes as would be the case where the length of flow through the tube nest is long, I insert one or more vertical and longitudinal water removing and steam directing surfaces within the condenser. The vertical surfaces shorten the flow of the steam in any one horizontal direction to any desired length and with the horizontal baffles, present water removing surfaces at every point of change of direction.

Where I employ the same pump for withdrawing the air and water from the condenser I can appreciably increase its vacuum producing effect by cooling down the water of condensation before allowing same to enter air pump. I provide a combined water cooler and subsidiary steam condenser in base of the condenser which is cheap and simple in construction yet possesses many valuable properties and without departing from my distinct and separate lines of steam flow. It will be further seen that owing to the effective baffling carried throughout the condenser and the collection of water at the cooler the last compartment will act as an effective gas densifier or air cooler.

The form shown of my invention, as applied to a rectangular horizontal condenser 1, may evidently be applied to a condenser of practically any character and form.

In the form illustrated I provide inlet steam opening 2 and outlet air suction pipe 3 with longitudinal partitions or division walls 4, having function both to separate the water from the steam and to guide the steam and water independently, and which extend nearly to the top and substantially to the bottom of the structure illustrated. I show also longitudinally extending baffles 5, 6, 7 and 8 longitudinally corrugated and apertured at opposite sides with respect to the division plate, baffles 5 and 8 being apertured at 9 and 10 respectively, whereas the baffles 6 and 7 are apertured at 11 and 12 and guttered at 13, 14. All of these baffles are preferably longitudinally corrugated and are sloped toward the center plate and provided with gutters 15 at the ends as best illustrated in Figs. 2 and 4 for the withdrawal of water which accumulates within the corrugations. I provide also other baffles 16 and 17 also of corrugated form but preferably corrugated transversely, and also sloped toward the center plate 4. Within these baffles 16 and 17 I provide apertures 18, 19, preferably on the outer sides of the same, so that steam passing within the inlet may flow directly down to and through these openings, again across to and through the openings 9 and 10 respectively and again across to and through the openings 11 and 12, resulting in a serpentine movement of

the steam through the compartments between these baffles and each other and between them and the center plate and casing of the condenser.

In order to avoid frictional losses due to excessive relative steam velocities through the tubes in any part of my condenser resulting usually in impaired vacuum, I make provisions for a part of the steam to take a short cut, as it were, down through the compartments 20 and 21 without engaging the same number of or the same cooling tubes 36, so that this quantity of steam shall be added with comparatively slight cooling to the quantity of steam which would otherwise be delivered from compartments 20 and 21 to compartments 22 and 23.

While I could take care of steam through compartments 22 and 23 into compartments 24 and 25 in much the same manner I prefer in the present instance to take care of it in the manner indicated by making the compartments 24 and 25 smaller than any of the other compartments and using the additional space represented by what would otherwise lie within these compartments for a pair of water cooling compartments 26 and 27 which can be made use of for steam condensing purposes if desired as hereinafter more fully set forth.

I accomplish the short cuts of the steam through compartments 20 and 21 preferably by providing apertures 29 in the ends of the corrugations of the baffles, cutting them preferably in the upper or higher parts of the corrugations so that steam can pass through without interfering with the draining of water in the lower parts of the corrugations as at 30, and its draining down wall 4 and over perforated plate 46 for further distribution thereby. I prefer to make these openings 29 adjustable so that this feature can be used with discretion according to the action of the condenser under the particular duty required of it, and I close these openings to any desired degree by means of corrugated closures 31 which rest upon the corrugated baffles and act as valves therefor, being operated by means of threaded rods 32 and nuts 33 maintained in operative relation therewith by any suitable means. Evidently other means could be provided for operation of these, and other forms of valve might be made use of, depending in a measure upon the shape and character of baffle and condenser selected. It is also equally evident that the same operating means might be made to move both of these valves.

It will be noted that by operating the corrugated closures 31 I can control the proportion of steam to uncondensable gases or air present in compartments 24 and 25, thus enabling the condenser to be worked to the best advantage under varying conditions; and I may use these compartments almost solely as air coolers without departing from my separate and distinct lines of steam flow whereby no surface is left inactive as it is in direct line of steam flow toward final outlets.

I have shown conventional glands 34 to provide for the passage of the operating rods through the casing of the condenser without allowing leakage therethrough.

I have provided other cooling pipes 35 within the various spaces and compartments as seen in the illustrations and have placed these pipes preferably at a greater distance apart, upon approach to and departure from the openings within the baffles or between them and the casing thus obtaining a considerable advantage, for, by spacing the tubes in the manner described, I obtain a flow of steam which is approximately at right angles to central division plate at the same time employing, as effectively as possible, the available tube space in the condenser and without departing from the conventional construction of the walls of the condenser. It will be further seen that by this arrangement, in conjunction with the controllable steam inlet at center of condenser, tubes 35 can be either withdrawn or inserted even after the condenser is constructed thus obtaining some latitude for the design of the condenser.

Another important result obtained by the adjustable supplementary steam port is that the various nests of tubes may be equally divided, thus preserving a uniform velocity in the tubes for the circulating water and yet obtain a uniform velocity for the steam through between the tubes. The tubes in the lower compartments will thus more nearly approximate in efficiency those in the upper nests.

I provide for the circulation of the water within these pipes by means of end compartments, comprising, in the illustration shown, the inlet compartment 38, the receiving and discharge compartment 39 at the opposite end of the condenser, corresponding receiving and discharge compartments 40 and 41, alternately placed at different ends of the condenser, and outlet compartment 42, so that there shall be a continuous flow of water back and forward within the various pipes.

The partition wall 4 is preferably provided with apertures 43 to insure the perfect equalization of pressures and temperatures between the two sides of my condenser as divided by the said partition wall.

In the bottom of my condenser I preferably form longitudinal partitions 44 and 45 with a suitably perforated distributing plate 46 thereover and with temperature equalization passages 43 in the central wall thereof. The compartment thus formed is filled with

tubes 36 and can be used almost solely for the purpose of condensing steam or, in view of the fact that the perforated plate 46 distributes the water supplied by gutters 13 and 14 over said tubes, giving a partial cooling effect on the water, this compartment may be used solely for the purpose of cooling the condensed steam water before allowing same to enter the air pump suction pipe. This feature is of extreme value where this type of condenser is used on shipboard for, where the engine or turbine is running at less than normal load, or, where the sea temperature is low, the cooler would not be necessary to assist the air pump in maintaining the desired vacuum by cooling the condensed steam water and thus the air dealt with by the air pump. In this case the cooler should be emptied by the by-pass cock and the valve connecting cooler to suction pipe should be opened; thus no dead weight of water need be carried in cooler unnecessarily and the tubes will then come into action to the same degree of efficiency for condensing steam as obtains throughout the remainder of the condenser, as it will be noted that I provide for direct discharge to the main suction pipe for the uncondensable gases.

Very little movement of water is caused in the cooler by the rolling of the ship as the cooler is placed in a position least affected by this motion, namely, in my preferred form, in the horizontal center of the condenser, and always in a part only of the width of my condenser, whereas in coolers extending over the whole of the bottom of the condenser this objectionable feature is considerably accentuated.

When the number of horizontal planes of baffles used is even, as contrasted with the odd number shown in Fig. 1, the lines of steam flow naturally converge toward the center of the bottom of the condenser with the result that the air cooling chamber naturally belongs there with a water cooling compartment on each side of it. This results from the sinuosity of the travel of the steam and the fact that it is removed from the condenser at a different point in this sinuous line.

Owing to the low specific gravity of the hot condensed steam water dropping into cooler when the cooler is flooded the hottest water will always be at the top and the coldest water will always be at the bottom. As the water is withdrawn from the bottom no special means are necessary to insure that the water at its lowest temperature in the cooler is passed to air pump. In order to make use of this preferably central and longitudinal compartment for both purposes, I provide for direct drainage of this compartment through apertures 47 into pipe 48 which empties into the air pump suction pipe 3, but which evidently may be independently pumped, at the same time making provision for shutting off this drainage opening by means of valve 49, and making provision also for gradual drainage by means of a by-path or by-pass 50 controlled by cock 51, so that when this valve and by-pass are closed the water cannot pass into the air pump suction 3 but must back up through pipe 52 into valve casing 53 where the valve 54, open at the top, determines by the position of this top the height to which the water can accumulate in the compartments 26 and 27 before the water shall flow through the pipe 52, valve casing 53, valve 54 and inlet 55, admitting the cold water into the compartment 24 and outlet 71 and thence to the main air suction pipe 3.

I arrange for operation of the valve 54 without leakage by any suitable means as by rod 56 which is protected by any suitable gland or packing 57 and which is operated by means of wheel or lever 58.

In the illustration of Fig. 5 I have shown the limits of the several spaces by dotted lines; thus the lines 59 and 60 divide off the space filled with uniformly distributed tubes from the space in proximity to the opening in the baffles, where the tubes are to be separated or divided into any desired multiples of the same pitch. Again the lines 61 and 62 divide off the receiving space below the upper baffles, indicating where the tubes are to be spaced more freely. Again the dotted lines 63 and 64 divide off the delivery space above second baffles, and the lines 65 and 66 indicate the receiving spaces in proximity to the passages between these baffles, where the tubes are to be placed at greater distance from each other than throughout the rest of the space. Lines 67, 68, 69 and 70 likewise indicate the limits of the delivery and receiving spaces in proximity to the passages through the lowest baffles, where the water tubes are to be spaced at greater distance than in the rest of the compartments within which these lines lie.

In Fig. 6 I have illustrated diagrammatically an outer casing of the same general type as that illustrated in Fig. 1 but with a plurality of longitudinal division walls 4′, 4″, providing for a plurality, in this case two pairs of transverse sinuous lines of steam flow and with a corresponding number of outlets at 3′ corresponding to the number of pairs of lines. I have considered further illustration of other combinations to produce a greater number of pairs of lines of flow to be unnecessary as this further construction will be perfectly obvious to those skilled in the art.

It will be evident that the water drops down the central wall 4 from the baffles 16 and 17 in a number of distinct streams corresponding to the number of the depres-

sions or corrugations in the baffles, and is then distributed over the tubes 36 in cooler by the perforated plate. Also the water from baffles 5 and 8 flows into end ducts 15 which form supports for the baffles 5 and 8, and thence through openings 37 in ducts 15 to the ducts immediately underneath and which also form supports for the baffles 6 and 7; this water is then collected by gutters 13 and 14 and thus distributed over perforated plate 46. The water can be completely drawn from this compartment and fed into the air suction pipe as fast as formed, if desired, simply by opening the valve 49. In this case the tubes within the two compartments formed in the center at the bottom of the condenser would act as air and steam cooling and condensing tubes and air and vapor would also be drawn off through the pipe 48. When it is desired to start this condition of affairs with the compartments 26 and 27 filled with water the by-pass should be opened and the water allowed to flow out gradually so as not to flood the vacuum pump and the valve is opened after the withdrawal of this water by these means.

When it is desired to use the compartments 26 and 27 as water cooling compartments the valve 49 is closed and the water is allowed to bank up through pipe 52 into the valve 53, finding its way through passage 55 into the lower side compartments whence it is drawn through apertures, 71, into bowl 73 and thence, along with the air and vapor, out through pipe 3. The height of water maintained in this central compartment will evidently be that of the top of the valve 54.

Evidently the variation of the height of water in this central compartment will result in a variation in the number of pipes used for water cooling and in a consequent reverse variation in the number of pipes used for steam condensation.

It will be evident that a range of temperatures can be obtained for the condensed steam water from the limit of that of the vacuum temperature to within a few degrees of that of the injection water at inlet to condenser.

A portion of the benefit of my invention, and particularly of that part thereof relating to the water cooling compartment in the lower part of the condenser, can be attained even where the use intended requires a condenser of such special form as to be most desirably made without baffles.

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

1. In a device of the character stated, outer walls, a longitudinal division wall extending throughout a considerable part of the height of the condenser, corrugated baffle plates supported upon the outer walls and division wall and cooling pipes between the baffles.

2. In a device of the character stated, an outer casing, a longitudinal division wall, corrugated baffles between the casing and division wall, supports for said baffles forming a duct at each end of said casing, and common to all said corrugations and cooling pipes between the baffles.

3. In a device of the character stated, an outer casing, a water cooling compartment in the bottom of the casing, cooling pipes therein, an air cooling compartment also in the bottom of the casing, controlled means for withdrawing the cooled water from the bottom of said water cooling compartment, and directing it into the air cooling compartment.

4. In a device of the character stated, an outer casing, a plurality of baffle walls forming a longitudinal compartment in the bottom of the condenser, connections for withdrawing water from said compartment, a valve in said connections, and an auxiliary connection outside of said compartment for directing the coldest water from said compartment back into the condenser when the valve is closed.

5. In a device of the character stated, an outer casing, a plurality of converging baffles therein directing water toward the center thereof, a plurality of longitudinal walls forming a central longitudinal compartment therein provided with an opening at the bottom, means for withdrawing water, a connection outside of said compartment for directing water from said compartment back into the condenser and means for adjusting the height at which water in said compartment will be maintained and beyond which the coldest water will flow into the condenser.

6. In a device of the character stated, an outer casing, a longitudinal partition wall therein, a plurality of baffles on each side of the partition wall having openings directing the steam into sinuous movement therein, and means for controllably allowing steam to pass through one of the baffles at a second point to vary the movement of part of the steam from said sinuous direction.

7. In a device of the character stated, an outer casing, a longitudinal division wall, a plurality of baffles on each side of said division wall, the baffles first engaged by the steam being corrugated to form transverse ribs and gutters, means for supporting the baffles and cooling pipes between the baffles.

8. In a device of the character stated, an outer casing, longitudinal division wall, and a plurality of corrugated baffles upon each side thereof, baffles upon the same side of the division wall differing in direction of corrugation.

9. In a device of the character stated, an

outer casing having top inlet and bottom air suction outlet openings, a longitudinal division wall therein, top corrugated baffles sloped toward the division wall, apertured in proximity to the outer casing and in proximity to the central division wall, means for adjusting the opening in proximity to the division wall at will, and a second baffle at each side sloped toward the division wall and apertured in proximity to said division wall.

10. In a device of the character stated, an outer casing having top inlet and bottom air suction outlet openings, a longitudinal division wall therein, top corrugated baffles sloped toward the division wall, apertured in proximity to the outer casing and at the top of the corrugations in proximity to the central division wall, a plate matching the corrugations of the baffle, means for moving the plate over the apertures in proximity to the central division wall, and a second baffle on each side sloped toward the division wall and apertured in proximity to said division wall.

11. In a device of the character stated, an outer casing having top inlet and bottom air suction outlet openings, a longitudinal division wall therein, top corrugated baffles, sloped toward the division wall, apertured in proximity to the central division wall, a corrugated plate fitting the corrugations of the baffle, a rod in operative connection therewith, a gland sealing the passage of the rod through the outer casing, and a baffle on each side sloped toward the division wall and apertured in proximity to it.

12. In a device of the character stated, an outer casing, walls forming a compartment near the bottom thereof, baffles sloped toward the center and draining water into said compartment, an air suction discharge pipe connecting with the condenser outside of the compartment, a pipe connecting with the compartment and feeding into the air suction discharge, a valve in said pipe and means between said valve and said compartment, for receiving the water from said pipe and discharging it into the condenser outside of the compartment.

13. In a device of the character stated, an outer casing, walls forming a compartment near the bottom thereof, baffles sloped toward the center and draining water into said compartment, an air suction discharge pipe connecting with the condenser outside of the compartment, a pipe connecting with the compartment and feeding into the air suction discharge, a valve in said pipe between said discharge and said compartment, and a valve controlling the height at which the coldest water in the compartment will flow into the condenser.

14. In a device of the character stated, an outer casing, walls forming a compartment near the bottom thereof baffles sloped toward the center and draining water into said compartment, an air suction discharge pipe connecting with the condenser outside of the compartment, a pipe connecting with the compartment and feeding into the air suction discharge, a valve in said pipe between said discharge and said compartment, a receiver for the water from said second pipe apertured to connect with the condenser outside of the compartment a valve in said receiver open at its top, and means for moving the valve vertically to vary the point at which overflow from said compartment shall take place into the condenser when the first valve is closed.

15. In a device of the character stated, an outer casing, walls therein forming a compartment in the lower part of the condenser, converging baffles in said condenser draining into said compartment, air suction exhaust connection from the condenser, water draining connection from the compartment into said suction, a valve in said connection, and a by-pass to said valve providing controlled drainage for said compartment.

16. In a device of the character stated, an outer casing, an interior longitudinal wall therein forming with the outer casing a compartment in the lower part of said casing, said compartment communicating at its top with the condensing chamber and having water cooling pipes therein, a plurality of baffles in said casing draining toward said compartment, and a gas densifying compartment by the side of said first named compartment.

17. In a device of the character stated, an outer casing, longitudinally extending corrugated baffles upon each side of the middle thereof converging toward the center and apertured to provide a sinuous line of fluid flow, in combination with a compartment receiving the water from said baffles, and means for directing the water from said compartment into the main air suction pipe or condenser, at will.

18. In a device of the character stated, an outer casing, longitudinally extending corrugated baffles upon each side of the middle thereof converging toward the center and apertured to provide a sinuous line of fluid flow, in combination with a compartment receiving the water from said baffles, means for directing the water from said compartment into the main air suction pipe or condenser at will, and means for maintaining the height of water within said compartment at any desired point by providing a static head of water outside of said compartment, to balance the water inside of said compartments.

19. In a device of the character stated, an outer casing, a compartment near the bottom therein, discharging at the bottom thereof,

means for draining water into said compartment, cooling tubes in said condenser, and in said compartment, air suction exhaust at the bottom of the condenser, a connection for draining the water from the compartment into said air suction discharge, and a valve in said connection.

20. In a device of the character stated, an outer casing, a compartment therein near the bottom extending the length of the condenser and a part of the width of the condenser and discharging at its bottom, means for concentrating the drainage of the water into said compartment, cooling devices in said condenser, and in said compartment, air suction exhaust for the condenser, a connection from said compartment into said air suction discharge a valve in said connection and a by-path around said valve.

21. In a device of the character stated, an outer casing, a compartment near the bottom of said casing, cooling devices in said casing and in said compartment, means for controlling the height of water in said compartment by withdrawal from the bottom to use all or any part of said devices for water cooling or steam condensation at will and additional means for withdrawing air and water from the bottom of said compartment when the first stated means is not operated.

22. In a device of the character stated, an outer casing, a compartment therein approximately at the bottom thereof, cooling devices in said compartment means for directing water of condensation into said compartment, means for controlling the height of said water in said compartment and means for withdrawing the coolest water from said compartment independently of the height of water therein.

23. In a device of the character stated, an outer casing, a compartment therein approximately at the bottom thereof, cooling devices in said casing and in said compartment; means for directing water of condensation into said compartment, means for withdrawing the coolest water from said compartment independently of the height of water therein and means for maintaining the water at any desired height in said compartment, making use of the submerged portion thereof for water cooling and any portion thereof not submerged for steam condensation.

24. In a device of the character stated, an outer casing, apertured baffles therein providing a sinuous line of steam flow, a plurality of uniformly spaced cooling devices within the path of flow of the steam, and a plurality of cooling devices in proximity to the apertures of the baffles and spaced at a greater distance than the first named water cooling devices.

25. In a device of the character stated, a water cooling compartment having cooling pipes therein, a gas cooling compartment by its side in the bottom of the condenser, and cooling pipes in the gas cooling compartment.

26. In a device of the character stated, two gas cooling compartments having cooling pipes therein and a water cooling compartment between the gas cooling compartments and also having cooling pipes therein, the water and gas cooling compartments having different outlets.

27. In a device of the character stated, a plurality of baffles apertured to provide a transverse sinuous line of steam flow, means for admitting the steam thereto, and means for admitting a portion of the steam to join the sinuous path of steam flow at an intermediate point.

28. In a device of the character stated, a plurality of apertured baffles providing a transverse sinuous path of steam flow, means for admitting steam to the beginning of said path, means for admitting steam at an intermediate point in said path and cooling pipes placed within the sinuous line of steam flow.

29. In a device of the character stated, side limiting surfaces, a plurality of baffles therebetween reversely apertured to provide a sinuous transverse path of steam flow, cooling pipes between the baffles and spaced from the limiting surfaces, means for admitting steam at the beginning of the sinuous line of flow, and means for passing steam through one or more of the baffles and the free space adjacent a side surface admitting it at an intermediate point in the transverse sinuous flow.

30. In a device of the character stated, limiting surfaces, a plurality of baffles providing a sinuous transverse line of steam flow, and controllable means for admitting a portion of the steam through one of the baffles outside of the sinuous line of flow.

31. In a device of the character stated, limiting surfaces, a plurality of baffles therein apertured to provide a sinuous transverse line of steam flow, cooling pipes between the baffles and spaced from the surfaces to allow an open space therebetween, and means for controllably admitting steam to the open space through a baffle without passing through the apertures which provide the transverse sinuous line of flow.

32. In a device of the character stated, a plurality of reversely apertured baffles providing a sinuous line of steam flow, cooling pipes in nests between the baffles, means for admitting steam to and causing it to pass across the pipes of successive nests, and means for causing a portion of the steam to reach one of the later nests in the progress of the steam without passing across the pipes of the next earlier nest.

33. In a device of the character stated, an outer casing and a plurality of baffles therein with means for providing two paths of steam flow one of which is transverse and sinuous and both of which are combined in the sinuous path of flow.

34. In a condenser, limiting surfaces, a baffle between, apertured in proximity to opposite edges thereof, the apertures being of different sizes, and means for varying the effective size of the smaller of the apertures.

35. In a device of the character stated, outer walls, a longitudinal compartment near the bottom of the condenser, cooling means therein, means for directing water of condensation into said compartment and means for varying the height of water in said compartment by withdrawing water from the bottom to vary the number of tubes submerged and reversely to vary the number of tubes allowable for steam condensation.

36. In a condenser, an outer casing, a plurality of baffles at different heights therein, air cooling compartments upon opposite sides of the condenser, a water cooling compartment between the air cooling compartments, and means for withdrawing the water of condensation from the water cooling compartment.

37. In a device of the character stated, an outer casing, apertured baffles therein providing a sinuous line of steam flow, a plurality of uniformly spaced cooling devices within the path of flow of the steam, a plurality of cooling devices in proximity to the apertures of the baffles and spaced at a greater distance than the first named cooling devices in combination with a controllable steam port varying movement of steam through a baffle to depart from the sinuous path.

38. In a device of the character stated, an outer casing, baffles having alternate openings directing the steam into sinuous movement therein, and a plurality of valved openings for allowing the steam to pass through one of the baffles at a second locality in a number of distinct streams to vary the movement of part of the steam from said sinuous direction.

39. In a device of the character stated, outer walls, a water compartment therein, and means including a connection between the bottom of the compartment and the remainder of the condenser located partly outside of the compartment walls, for balancing and regulating the height of the water in the compartment by a controlled static head.

40. In a device of the character stated, an outer casing, a water cooling compartment in the bottom thereof, baffles draining into said compartment, a connection between the bottom of the compartment and the rest of the condenser outside of the condenser, for directing cooled water back into the condenser and means for withdrawing air and water from the bottom of said compartment and from the remainder of the condenser through the bottom thereof.

41. In a device of the character stated, an outer casing, a water cooling compartment in the bottom thereof, baffles draining into said compartment, a connection between the bottom of the compartment and the rest of the condenser outside of the condenser for directing the cooled water back into the condenser when using the water cooling compartment for that purpose, and additional means for withdrawing air and uncooled water from said compartment when it is not used for water cooling.

CHARLES J. SNOW.

Witnesses:
W. T. JACKSON,
C. D. MCVAY.