No. 849,944. PATENTED APR. 9, 1907.

W. VAN DEN HEUVEL.

SECTIONAL CONDENSER.

APPLICATION FILED JUNE 13, 1905.

2 SHEETS—SHEET 1.

Fig. 1

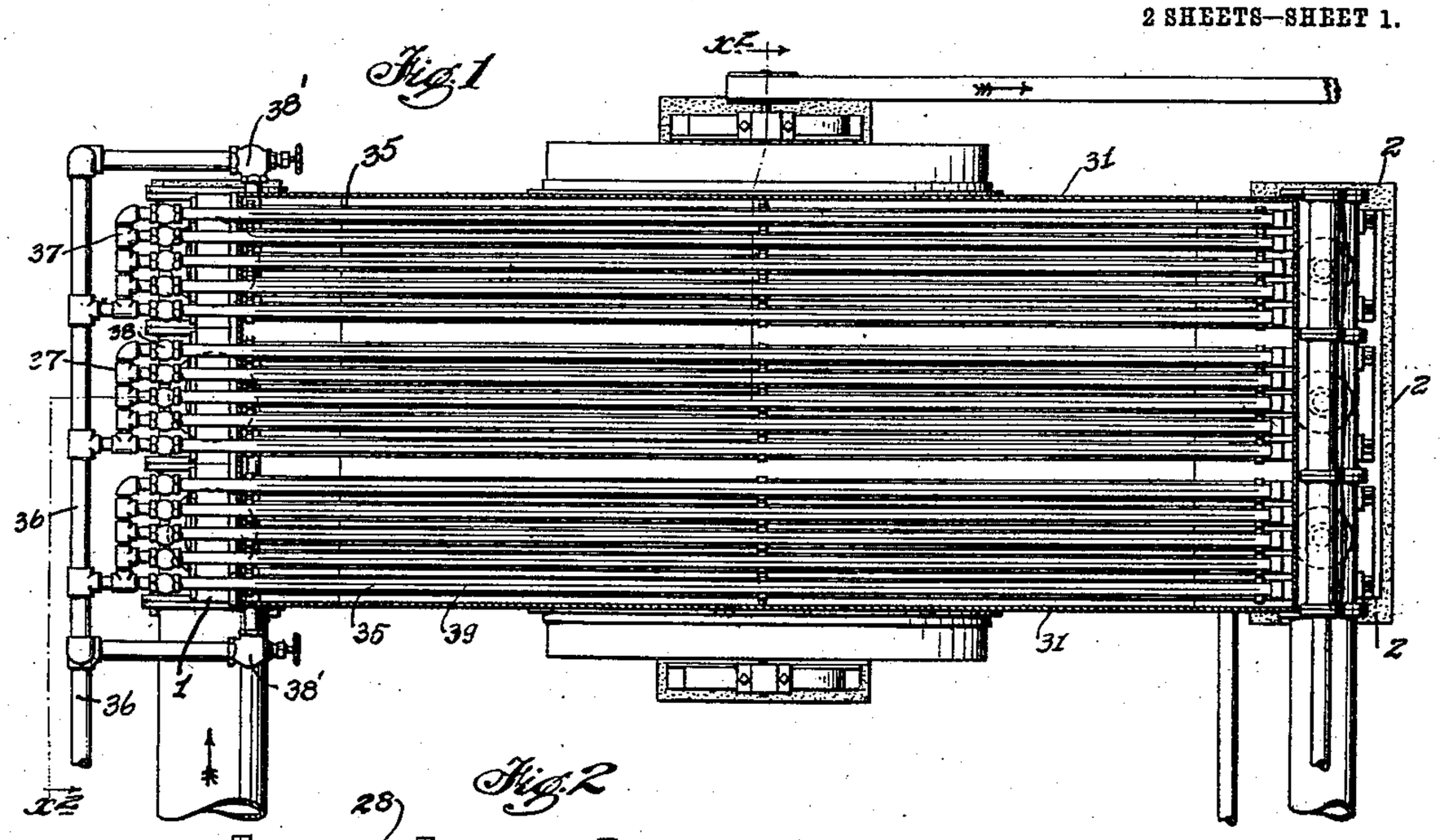


Fig. 2

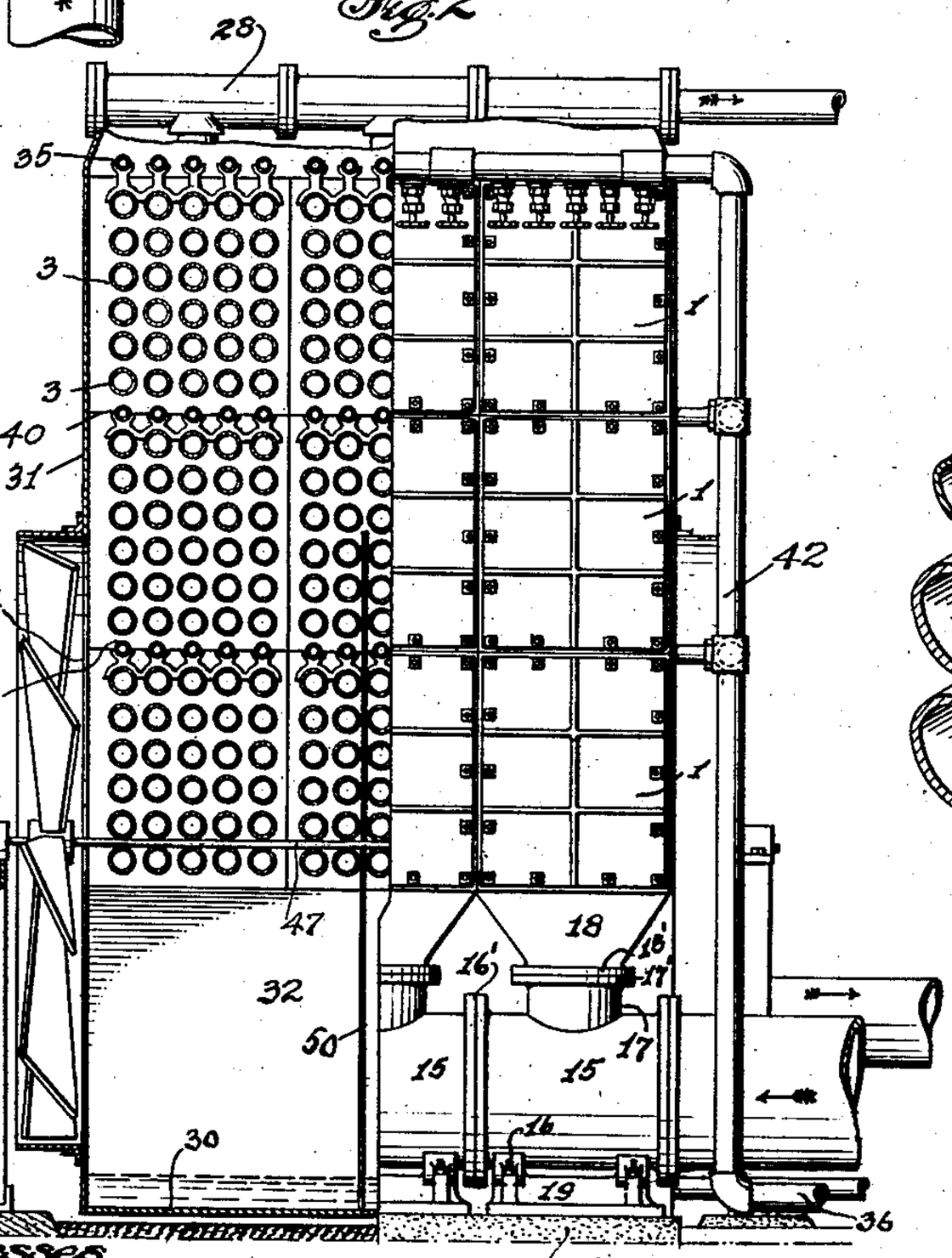
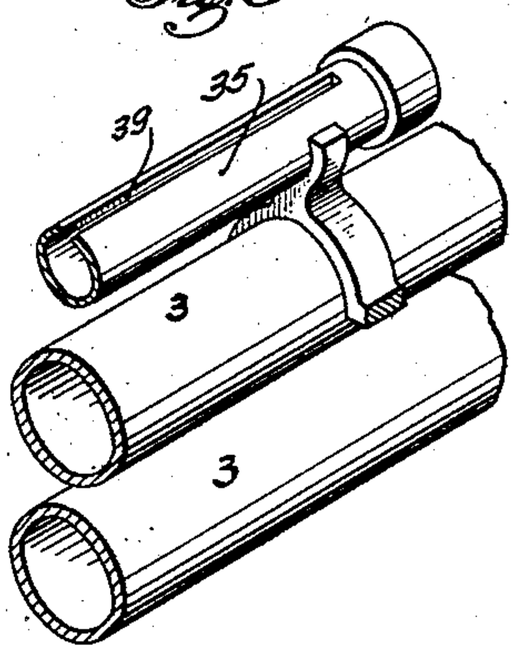


Fig. 3



Witnesses
Jamansfield
J. Townsend

Inventor
William van den Heuvel
by James R. Townsend
his Atty

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2 SHEETS—SHEET 2.

Fig. 6

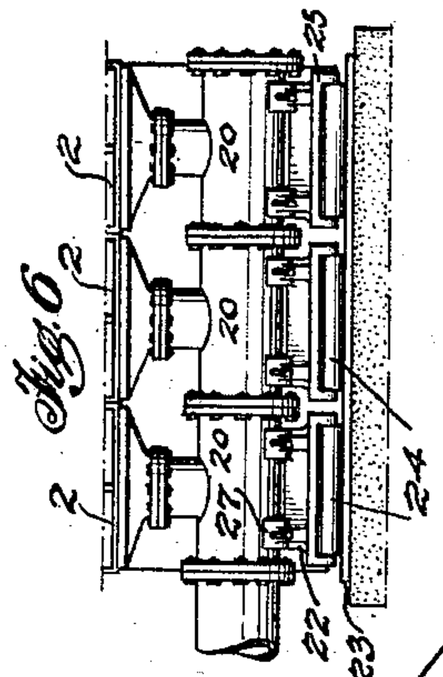

Fig. 4

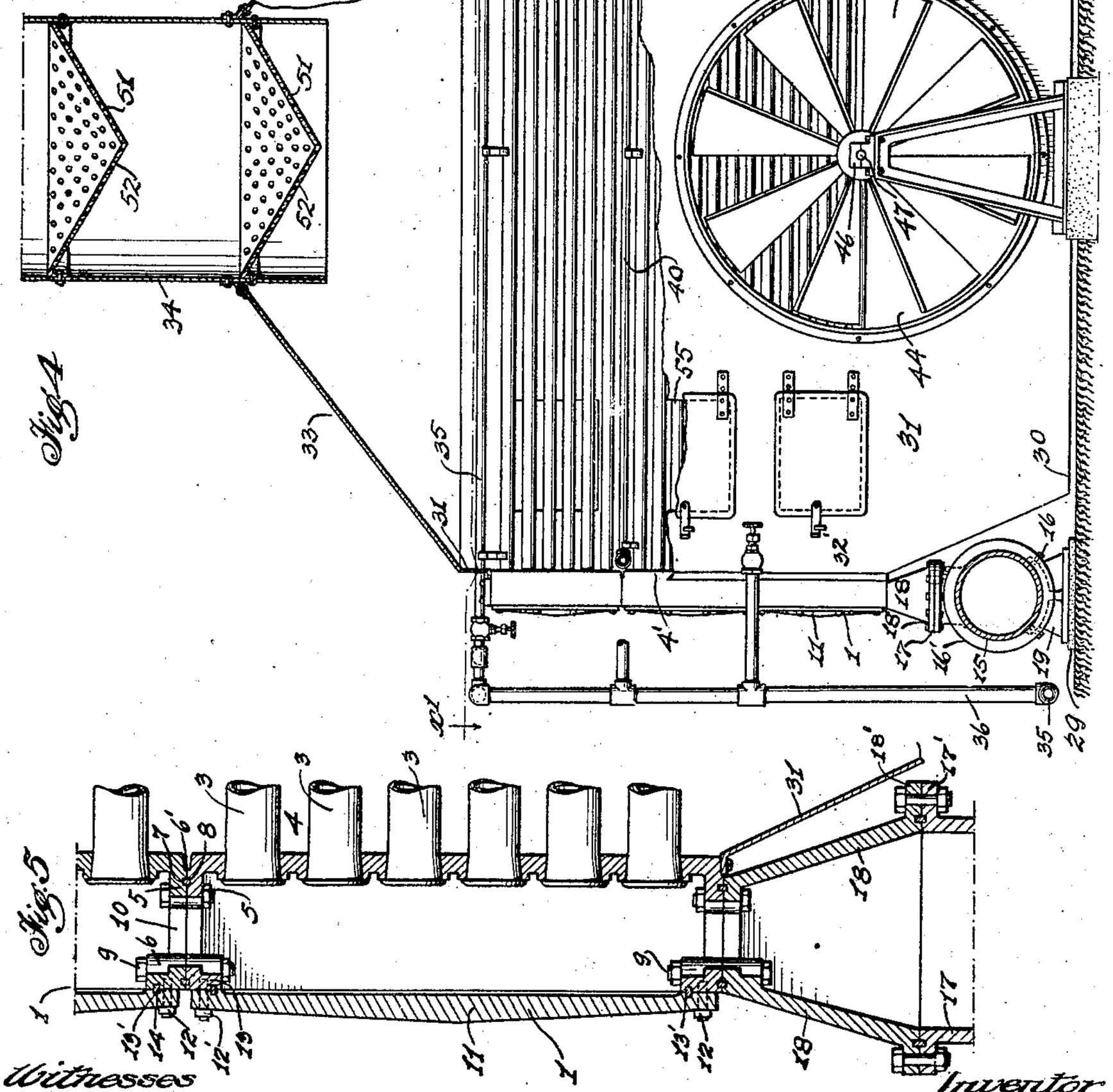

Fig. 5

Witnesses
Fauncefield
S. Townsend

Inventor
William van den Heuvel
by James R. Townsend
his Atty.

UNITED STATES PATENT OFFICE.

WILLIAM VAN DEN HEUVEL, OF LOS ANGELES, CALIFORNIA.

SECTIONAL CONDENSER.

No. 849,944. Specification of Letters Patent. Patented April 9, 1907.

Application filed June 13, 1905. Serial No. 265,022.

To all whom it may concern:

Be it known that I, WILLIAM VAN DEN HEUVEL, a subject of the Queen of the Netherlands, (who has declared his intention of becoming a citizen of the United States,) residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Sectional Construction for Condensers, &c., of which the following is a specification.

This invention relates particularly to a surface condenser wherein the condenser-surfaces are kept cool by the evaporation of water applied thereto and subject to the evaporative action of a current of air.

An important object of the invention is to provide a condenser or construction of this nature which without variation in its design can be built of any desired size or capacity and can be enlarged when required with a minimum of trouble and expense. This object I attain by constructing the condenser of units or sections substantially identical in form and construction.

A further object of the invention is to provide for uniform distribution of the cooling-water over the condenser-surfaces.

Another object of the invention is to provide for supporting the condenser in such manner as to eliminate strains thereon resulting from expansion and contraction.

Other objects and features of the invention will appear in the following description.

The invention is herein described as a "condenser;" but some of the features are applicable generally in the construction of heat-interchangers or apparatus comprising headers connected by a plurality of tubes.

The accompanying drawings illustrate the invention.

Figure 1 is a sectional plan of the invention on line x' x', Fig. 4. Fig. 2 is a partial end elevation and partial vertical section on the line x^2 x^2, Fig. 1. Fig. 3 is a perspective of fragments of the condenser and spray-tubes. Fig. 4 is a side elevation with part of the casing and stack in section. Fig. 5 is a vertical section of one of the headers with the connecting devices. Fig. 6 is a fragmentary end elevation of a movable support for the rear end of the condenser.

The condenser is built up of units, each comprising a front header 1, a rear header 2, and tubes 3, connecting said headers. The headers 1 and 2 are or may be substantially identical in construction, being each preferably formed as a box-header having a perforate back or rear wall 4 to receive the condenser or cooler tubes 3 and having flanges 5 extending at right angles to rear wall 4 and forming side, top, and bottom walls for the header for attachment to and communication with the adjacent headers. Each of said flanges is formed with a projecting surfaced part or face 6′ on its outside to abut or contact with the corresponding face of the adjacent header, and said contacting parts may have grooves 7 for the reception of packing (indicated at 8) to seal the joint between the headers. The rear, side, top, and bottom walls of the headers are integral. The headers are held together by bolts 9, passing through the flanges 6, said bolts being wholly within the box-shaped headers, so that there can be no leakage along the bolts from the inside to the outside of the headers. Openings 10 in said flanges 6 establish communication between the adjacent headers.

11 designates the caps or closure-plates for the headers, the same being detachably fastened to the box-headers by screw-studs 12, screwing into flanges 13 on the outer ends of the inturned flanges 6 and nuts 12′ on said studs, said flanges 13 being provided with grooves 13′ for the reception of packing 14.

The condenser units, formed as above described, are arranged one above the other columnwise, and their supporting and supplying means are also formed in sections corresponding to the respective columns, said means comprising T members 15 of a length corresponding to the width of the sections and having end flanges 16′ for attachment to the corresponding flanges of the T member for the next adjacent column. The top branch 17 of said T member is flanged, as at 17′, for attachment to a similar flange 18′ on a tubular fitting 18, abutting the bottom of the lowermost condenser unit and communicating therewith. The T member 15 rests on the saddle or base 19, being lined up thereon by screws 16. Saddles 19 rest on piers 29.

At the rear end of the condenser the headers 2 rest on T members 20 similar to T members 15, above described, and communicating with the said headers, the said T members 20 being secured together end to end in a continuous line to form the bottom outlet-header for the entire condenser. Suitable connections (not shown) lead from this bottom outlet to the wet-air pump.

22 designates saddles on which the T mem-

bers 20 rest, each of said saddles having a bearing plate or track 23 resting on rollers 24, mounted on suitable bearings or supports 25 on pier 26.

27 designates screws for lining up the bottom members 20 on the saddles. An upper rear header 28 is provided, made in sections corresponding to the respective columns.

Any desired number of the columns of sectional units formed as above described may be arranged side by side according to the capacity of the condenser desired and amount of space available, and when the units are so arranged the box-headers at their respective ends will abut one another both vertically and horizontally in such manner as to form a continuous closure or wall at each end of the condenser, the headers at each end being arranged edge to edge in one plane. The condenser so formed is inclosed at the ends by said wall formed of the headers and is further inclosed by sheet-metal casing surrounding the same on the bottom, sides, and top, so as to form a drainage or condensation pan 30 at the bottom, walls 31 at respective sides, and upwardly-tapering hood 33 at the top, the casing members 30, 31, 32, and 33 being secured at their ends to the outer walls of the boxes 1 and 2 by flanges 32′, fastened by screws to the depressed portion 4′ of the box-headers. The hood or top member of the casing 33 leads upwardly into a stack 34, which serves to carry away the vapor and air from the condenser. The condenser is preferably provided with means for applying water to the tubes thereof and means for subjecting the water so applied to the action of the current of air, which passes out through the stack.

35 designates water-supply pipes which are connected to a main 36, the connection being made through headers 37 and valves 38. There is a water-supply pipe 35 for each vertical tier of condenser-tubes 3, and each pipe 35 has a valve 38 for controlling communication thereto individually. Pipes 35 are closed at their rear ends, and each pipe is provided with a longitudinal slot or opening 39, which preferably flares upwardly, as shown in Fig. 3. Pipes 35 are arranged at the top of the condenser above the uppermost condenser-tubes, so that the water dripping therefrom will fall on the top condenser-tubes and running down on each side thereof will fall on the inclosed lower tubes, and so on down. It is desirable that the film of water so produced on the tubes should be comparatively thin, so as to increase the evaporative (and as a consequence the cooling) effect. Such a thin film of water will be exhausted or completely evaporated after passing over a certain number of the tubes, and supplement water-supply pipes 40 41 are therefore provided, located at points intermediate the height of the condenser—for example, at the top of each sectional unit—said pipes being arranged similar to the water-supply pipes 35 and connected to the main 36 by risers 42, and valves 38′ being provided for the respective pipes. Distributing or supply pipes 35 40 41 rest on saddle-racks, which in turn rest on the condenser-tubes, so that the latter support the distributing-tubes.

The condenser-casing is provided with an opening 44 in each side wall 31, through which air is forced into the casing by means of a blower or fan, (indicated at 45,) one of said blowers being located at each side of the casing at the opening aforesaid and being driven in such direction as to force the air into the casing.

46 designates bearings for the fans, and 47 the shaft thereof, which extends through the casing from side to side and carries both of the fans. Each fan is surrounded by a sheet-metal ring or casing 48, attached to the side wall 31.

49 designates a pulley or driving means on the fan-shaft 47. To prevent interference or conflict of the air-currents from the two fans, a baffle-plate or partition 50 is provided extending vertically parallel to the side walls of the casing and at a point about half-way between said side walls, so as to deflect or direct the current from the respective fans upwardly toward the stack. Baffle means are preferably provided within the stack, consisting, for example, of funnels 51, perforated, as at 52, in such manner as to allow comparatively free egress of the air-current, but exposing sufficient metallic surface to arrest any water-spray or unevaporated particles of water that may have been carried up into the stack by the force of the air-current. Such particles of water collecting on the funnels will run down to the point of the funnels and will drip therefrom in sufficiently large masses to insure their falling onto the condenser-tubes below.

The condenser-casing is preferably provided at one side with manholes or hand-holes 55, on opening which access can be obtained to the interior of the casing for the purpose hereinafter set forth.

The condenser is used as follows: The parts being coupled up as above described, steam passes from the supply-header formed by T members 15, upwardly through the fittings 18, and then upwardly in succession through the superimposed box-headers 1 at the front of the condenser. From these headers the steam passes in parallel currents rearwardly through the condenser-tubes to the rear headers 2. The condenser is preferably tipped rearwardly, as indicated, so that the condensation in each condenser-tube will run to the rear header and will fall into the outlet-header 20, by which it is withdrawn

by the wet-air pump. To effect the cooling necessary to this condensation, the water-supply is turned on by valves 38 38′, so as to allow water to flow into each of the pipes 35, 40, and 41 and to run through the outlet-slots at the top of said pipes, the water running down each way from the outlet over the outside of the pipe 35, &c., and then falling into the condenser-tube directly below said pipe and running down on each side of same and so on down until it is evaporated by the combined action of the heat and of the air-currents, the water being supplied to the pipes below by means of the supplementary water-pipes 40 41. Any excess water (water that is condensed on the walls of the casing) will run down into the bottom pan 30 of the casing and can be drawn off through outlet pipe or connection 56. The condenser is preferably tipped or inclined slightly upward, so that the condensation thereof will run to the rear end and also to facilitate the distribution of the cooling-water on the outside of the tubes, as the water will run along the tubes longitudinally as well as downwardly.

The amount of water passing to the distributing-pipes 35 40 41 for each section is regulated by means of valves 38 38′ aforesaid, so as to reduce or increase the amount of water for the respective sections, as may be required by the conditions of practice. The water flowing through these distributing or outlet pipes cannot clog the outlet-sections, as the upward flare thereof insures that any particles that can enter the bottom of the outlet will pass out at the top and will not stick in the outlet. The evaporation of this cooling-water will leave a deposit or scale on the outside of the condenser-tubes, and this can be removed from time to time by removing the caps from the headers and inserting suitable devices of well-known character for dislodging the scale by vibration, then opening the doors in the sides of the casing and inserting suitable instruments, such as bars or scrapers, for knocking off or scraping off the scale.

If at any time it is desired to enlarge the condenser, it is only necessary to remove the casing at one side, perforate the flanges 6 of the headers of that side, and then add on one or more additional columns of unit-sections. The bottom of the condensation-pan and the hood leading to the stack will of course have to be extended, and the side wall will be replaced to form a casing completely inclosing the condenser.

What I claim is—

1. A unit-section for heat-interchanging apparatus comprising two rectangular box-headers, and a plurality of tubes connecting said headers, each header having a rear wall, two side walls and top and bottom walls formed integrally with the rear wall, and each header provided with inwardly-extending flanged extensions at their front ends, and a cover-plate fastened to said flanged extension, the top and bottom walls of each header being similarly perforate and the aforesaid tubes being connected to and extending through the rear walls of the headers.

2. An evaporative surface condenser comprising tubes, water-supply tubes arranged above the condenser-tubes, and supporting means resting on the condenser-tubes and supporting the water-supply tubes, said water-supply tubes having outlets to deliver water onto the condenser-tubes.

3. An evaporative surface condenser comprising tubes, and water-supply tubes arranged above the condenser-tubes, and having longitudinal slots in the top thereof to deliver water onto the condenser-tubes.

4. An evaporative surface condenser comprising tubes, and water-supply tubes arranged above the condenser-tubes, and having upwardly-flaring longitudinal slots in the top thereof to deliver water onto the condenser-tubes.

5. The combination of a plurality of superimposed sections of substantially identical construction, each section comprising two box-headers with a plurality of tubes connecting the same, each box-header comprising a rear wall, side walls and top and bottom walls, all formed integrally with the rear wall, the adjoining top and bottom walls of adjacent headers having registering openings, bolts extending through the top and bottom walls of adjacent headers and extending from the inside of one header to the inside of adjacent header to fasten the headers together, and cover-plates removably fastened to the front of the walls of each header.

6. The combination of sectional units, each formed of end headers with connecting-tubes, said headers formed as boxes having a rear wall to which the tubes are connected, walls extending from said rear wall and provided with flanges extending inwardly therefrom, the top and bottom walls of adjacent headers abutting one another bolts extending through said abutting walls and securing the headers together, the ends of the bolts being wholly within the headers, and said top and bottom walls having openings for communication between said adjacent headers, and cover-plates secured to the inwardly-extending flanges by bolts independent of the bolts for fastening the headers together.

7. The combination of sectional units, each formed of end headers with connecting-tubes, said headers formed as boxes having a rear wall to which the tubes are connected, walls extending from said rear wall and provided with flanges extending inwardly therefrom, the top and bottom walls of adjacent headers abutting one another, bolts extending through said abutting walls and securing the headers together, the ends of the bolts

being wholly within the headers, and said top and bottom walls having openings for communication between said adjacent headers, cover-plates secured to the inwardly-extending flanges by bolts independent of the bolts for fastening the headers together, and packing between the cover-plate and header, located inwardly from the fastening-bolts for the cover-plate.

8. The combination of sectional units, each formed of end headers with connecting-tubes, said headers formed as boxes having a rear wall to which the tubes are connected, walls extending from said rear wall and provided with flanges extending inwardly therefrom, the top and bottom walls of adjacent headers abutting one another, bolts extending through said abutting walls and securing the headers together, the ends of the bolts being wholly within the headers, and said top and bottom walls having openings for communication between said adjacent headers, and cover-plates secured to the inwardly-extending flanges by bolts independent of the bolts for fastening the headers together, and packing between the cover-plate and header, located inwardly from the fastening-bolts for the cover-plate, and packing between the adjacent walls of the headers.

9. An evaporative surface condenser comprising tubes, water-supply tubes arranged above the condenser-tubes and having longitudinal slots in their top to deliver water onto the condenser-tubes, said slots being flared upwardly.

10. An evaporative surface condenser comprising tubes arranged in vertical series, water-distributing pipes extending over the top of the series to distribute water on the top of the tubes, and supplementary water-distributing pipes intermediately located in the vertical series to distribute water on the lower tubes of the series.

11. The combination of a tubular supply-header, a support therefor, superimposed box-headers resting on the supply-header, condenser-tubes connected to said box-headers, superimposed outlet-headers connected to said condenser-tubes, a tubular outlet-header connected to and supporting the last-named headers, and a base member whereon said outlet-header is movably supported to allow for expansion and contraction of the condenser-tubes.

12. The combination of a tubular supply-header, a support therefor, superimposed box-headers resting on the supply-header, condenser-tubes connected to said box-headers, superimposed outlet-headers connected to said condenser-tubes, a tubular outlet-header connected to and supporting the last-named headers, a base member whereon said outlet-header is movably supported to allow for expansion and contraction of the condenser-tubes, the movable support comprising a roller-bearing.

13. A surface condenser comprising end headers and connecting-tubes arranged in vertical and horizontal series, a casing surrounding said tubes and having an outlet at its top and opening in opposite sides, blowers located at the side openings, and a partition within the casing parallel to the aforesaid side walls and intermediate the blowers.

14. A condenser-comprising end headers placed edge to edge to form end walls, tubes connecting the same, a casing surrounding said tubes and extending under same to form a drainage-pan and extending to the said end walls, and a stack connected with the top of said casing.

15. An evaporative surface condenser comprising end headers and connecting-tubes, a casing surrounding said tubes, a stack leading from the top of said casing and provided with inclined obstructing-plates, and water-supply means within the casing to distribute water on the aforesaid tubes the said obstructing-plates discharging the moisture condensed thereon directly back into the casing.

16. An evaporative surface condenser comprising end headers and connecting-tubes, a casing surrounding said tubes, a stack leading from the top of said casing and provided with perforate funnels, and water-supply means within the casing to distribute water on the aforesaid tubes the said obstructing-plates discharging the moisture condensed thereon directly back into the casing.

17. The combination of end headers with connecting-tubes, inlet and outlet tubes communicating with and supporting said end headers, and saddles provided with lining-up screws supporting said inlet and outlet headers.

18. The combination of end headers arranged edge to edge in a plurality of adjacent columns, tubular inlet and outlet headers extending under said headers and formed as T members of length equal to the width of the end headers, the top branch of the T members communicating with and mechanically connected to said box-headers, and the T members of adjacent columns being detachably connected and communicating with each other to form a continuous header extending under the several columns of end headers.

In testimony whereof I have hereunto set my hand, at Los Angeles, California, this 1st day of June, 1905.

WILLIAM VAN DEN HEUVEL.

In presence of—

ARTHUR P. KNIGHT,

JULIA TOWNSEND.