

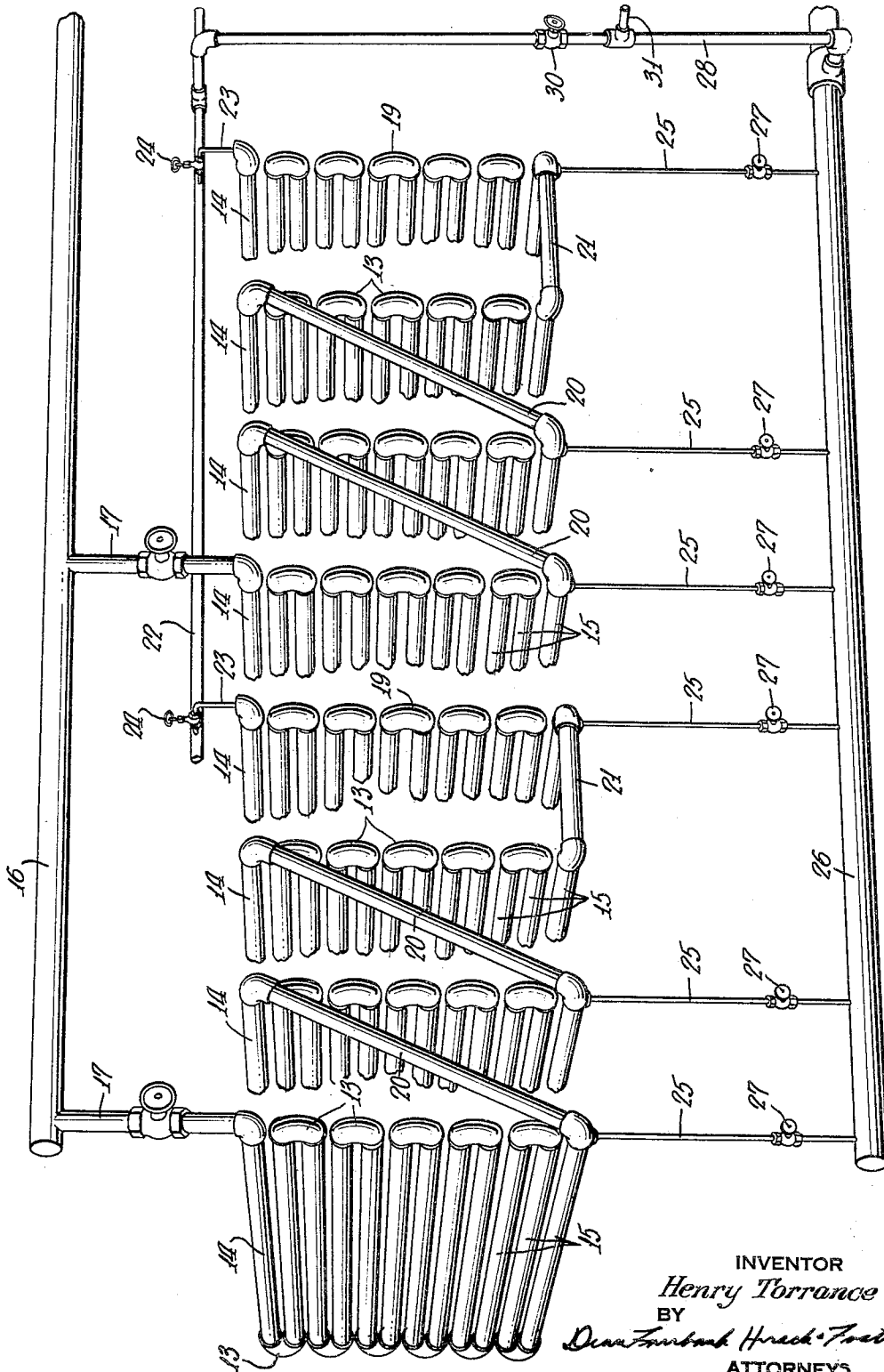
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H. TORRANCE

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CONDENSER

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## UNITED STATES PATENT OFFICE

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## CONDENSER

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The invention is an improvement in condensers for converting gases or vapors into the liquid state by lowering of the temperature, and particularly condensers for refrigerating systems.

My improved condenser unit includes a plurality of horizontally spaced vertical condenser sections, each preferably in the form of a coil having horizontal runs, said sections being connected together in series, whereby the high velocity of gas is maintained, and a corresponding improvement in heat transfer effected. Furthermore, the arrangement reduces the number of control valves.

As one feature of the present invention, the connections to, between and from the successive coils are such that the gas enters the top of the first coil and is made to pass down through the successive runs and thence from the bottom of the coil to the top of the adjoining coil and similarly through all of the coils except the last coil. The gas connection from the bottom of the next to the last coil is to the bottom of the last coil. The uncondensable gases are drawn off from the top of the last coil, while the condensate is drawn off from the bottom of all the coils. Thus the non-condensable gases are swept out of all of the first coils and in the last coil is made to flow countercurrent to such condensate as may form in the last coil.

As another feature of the present invention, drain connections are provided to draw off the condensed ammonia or the refrigerant from each coil into a header maintained a substantial distance below the lowest run of the coil, so that the drain connections and the header remain filled with liquid and form a seal which prevents gases from by-passing between the coils.

In the accompanying drawing, there is shown for the purpose of illustration, a perspective view of a condenser system embodying the present invention, certain of the parts being broken away.

In this specific embodiment of the present invention, there are provided a plurality of atmospheric condenser units, each of which includes a series of vertical coils 14 horizontally spaced and made up of horizontal

runs or pipes 15 connected by return bends 13. The condenser units are supplied with the gas or vapor to be condensed, such as ammonia, from an inlet header 16 having valve control branch connections 17 to the top of the first coil of each unit. The coils are connected in series and in such a manner that the gas is caused to travel downwardly in all of the coils except the last coil of the unit. For that purpose, there are provided pipe connections 20 between the bottom of one coil and the top of the adjoining coil. From the bottom of the next to the last coil, the gas is introduced into the bottom of the last coil 19 by means of a pipe connection 21.

The uncondensable gases are drawn off from the top of the last coil 19 of each unit, there being provided for that purpose an air or foul gas header 22 extending horizontally above the coils, and having branch connections 23 controlled by valves 24, from the top of each coil 19.

Drain connections 25 are provided for drawing off the condensed ammonia from each coil. These connections lead to an anhydrous header 26 extending below the coils, and are controlled by suitable valves 27. The draining of the last two coils of each unit may be effected through a single drain connection as shown. The anhydrous header 26 is disposed at a substantial distance below the bottom of the coils, so that the drain connections 25 and the anhydrous header remain filled with liquid, thus providing a seal which prevents gas from by-passing between adjoining coils.

The header 26 is connected to the foul gas header by means of a pipe 28 having a suitable valve 30 and an outlet 31 from which the condensate is drawn. This outlet is located above the header 26 so that the drain connections 25 and said header are maintained filled with condensate.

The coils may be cooled in any suitable manner, as for instance by mere exposure to the atmosphere, or by spraying or trickling water over them.

I have shown only two units of the condenser, but it will be understood that there may be as many units as desired connected in parallel between the headers.

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

1. A condenser unit including a plurality of horizontally spaced vertical coils having coil to the tops of the next successive coils, in series with the bottom of the next to the last coil connected to the bottom of the last coil, a gas inlet at the top of the first coil, an outlet for the uncondensable gases at the top of the last coil, and outlets for condensate from the bottoms of said coils.

2. A condenser unit including a plurality of horizontally spaced vertical coils having horizontal runs, pipes connecting the bottoms of all of the coils except the next to the last coil to the tops of the next successive coils, and connecting the bottoms of the last two coils, whereby all of said coils are connected in series and the gas flows downwardly through the first coils and upwardly through the last coil, a supply connection at the top of the first coil for the gases to be condensed, a gas outlet connection at the top of the last coil for the uncondensable gases, and pipe connections for drawing off the condensate from the bottoms of said coils.

3. A condenser unit including a plurality of horizontally spaced vertical coils having horizontal runs connected in series, an inlet for the gases to be condensed, an outlet for the uncondensable gases, a header extending below said coils, and drain connections from the bottoms of said coils to said header, said header being at a substantial distance below the bottoms of said coils, whereby said header and said drain connections are filled with condensate, forming a seal for preventing the by-passing of gases between adjoining coils.

4. A condenser unit including a plurality of horizontally spaced vertical coils having horizontal runs, pipes connecting the bottom of each coil except the last two with the top of the next successive coil, and connecting the bottoms of the last two coils, whereby all of said coils are connected in series, an inlet connection at the top of the first coil for the gases to be condensed, an outlet connection at the top of the last coil for the uncondensable gases, a header extending below said coils, and drain connections from the bottoms of said coils to said header, said header being at a substantial distance below the bottoms of said coils, whereby said header and said drain connections are filled with condensate forming a seal preventing the by-passing of gases between adjoining coils.

5. A condenser unit comprising a plurality of horizontally spaced vertical coils connected in series and each having horizontal runs, a gas inlet header extending above said coils, a branch connection from said inlet header to the top of the first coil of said unit, a gas outlet header extending above said coils, a branch connection from said gas out-

let header to the last coil of said unit, a condensate header extending below said coils, and drain connections from the bottoms of the coils to said header, said latter header being at a substantial distance below the bottoms of said coils, whereby said latter header and said drain connections are filled with condensate forming a seal for preventing the by-passing of gases between adjoining coils.

6. A condenser unit including a plurality of horizontally spaced vertical coils connected in series, an inlet for the gases to be condensed, an outlet for the uncondensable gases, a header extending below said coils, and drain connections from the bottom of said coils to said header, said header being at a substantial distance below the bottoms of said coils, whereby said header and said drain connections are filled with condensate, forming a seal for preventing the by-passing of gases between adjoining coils.

7. A condenser unit including a plurality of horizontally spaced vertical condenser sections, pipes connecting said sections in series with the bottom of the next to the last section connected to the bottom of the last section, a gas inlet at the top of the first section, an outlet for the uncondensable gases at the top of the last section, and outlets for condensate from the bottoms of said sections.

8. A condenser unit including a plurality of horizontally spaced vertical condenser sections, pipes connecting the bottoms of each of the sections except the next to the last section to the tops of the next successive sections, and connecting the bottoms of the last two sections, whereby all of said sections are connected in series, and the gas flows downwardly through the first section and upwardly through the last section, a supply connection at the top of the first section for the gases to be condensed, a gas outlet connection at the top of the last section for the uncondensable gases, and pipe connections for drawing off condensate from the bottoms of said sections.

9. A condenser unit including a plurality of horizontally spaced vertical condenser sections, an inlet for the gases to be condensed, an outlet for the uncondensable gases, a header extending below said sections, and drain connections from the bottoms of said sections to said header, said header being at a substantial distance below the bottoms of said sections, whereby said header and said drain connections are filled with condensate forming a seal for preventing the by-passing of gases between adjoining sections.

Signed at Carbondale in the county of Lackawanna and State of Pennsylvania, this 20th day of June A. D. 1932.

HENRY TORRANCE.