U. WEDGE.

CONDENSER FOR VAPORS AND GASES.

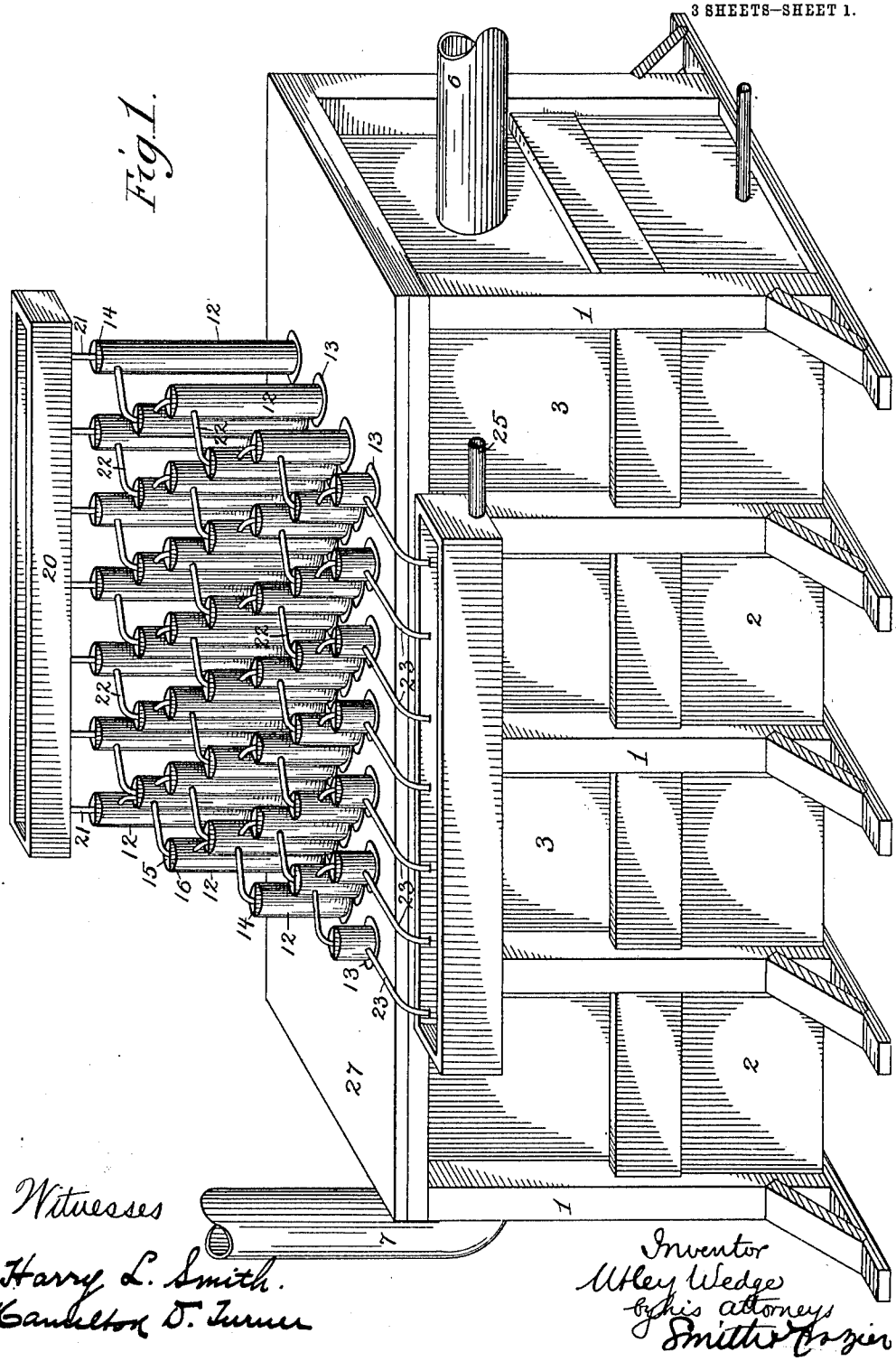
APPLICATION FILED MAR. 18, 1907.

1,012,487.

Patented Dec. 19, 1911.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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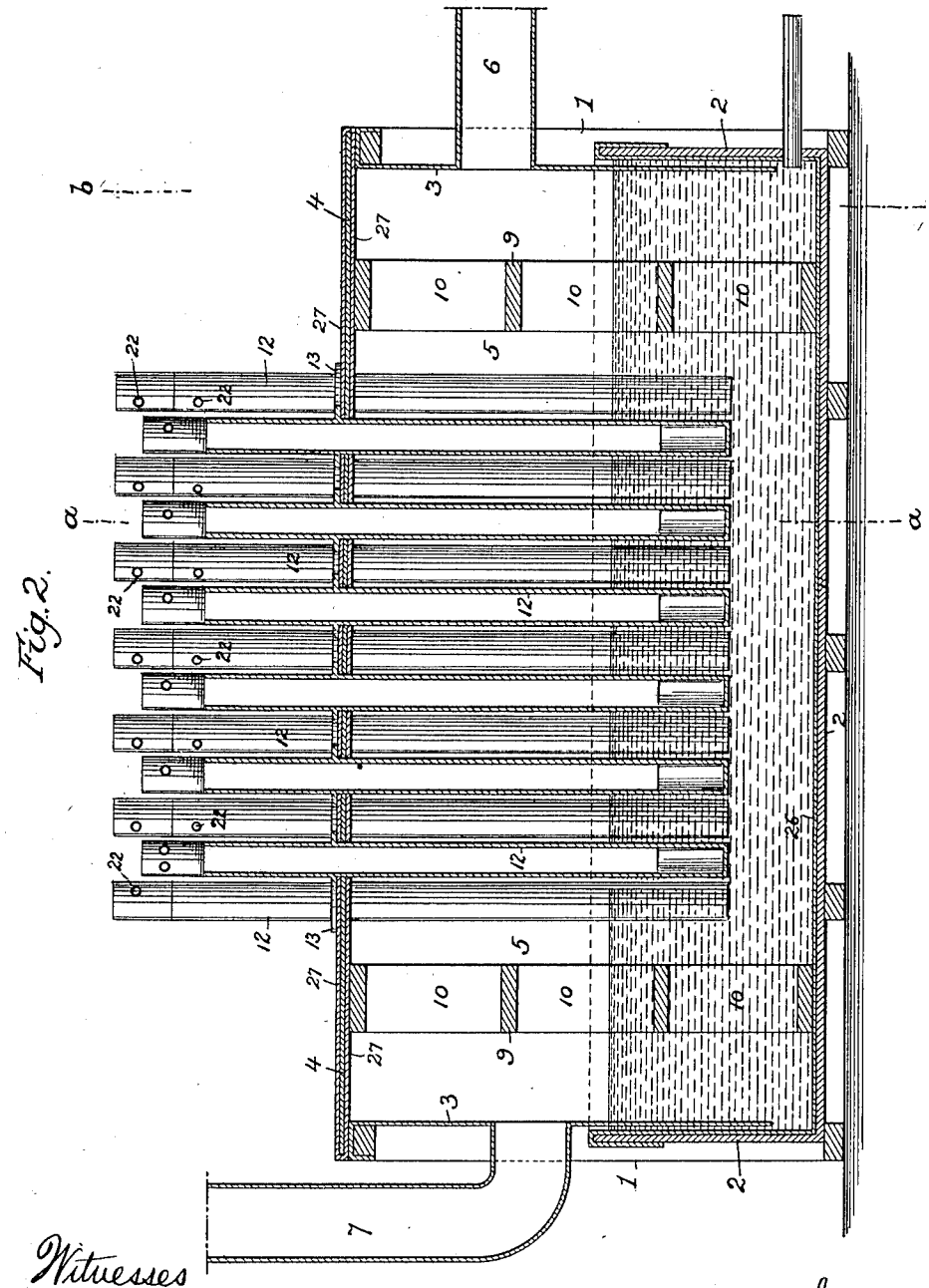

Fig. 2.

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3 SHEETS—SHEET 3.

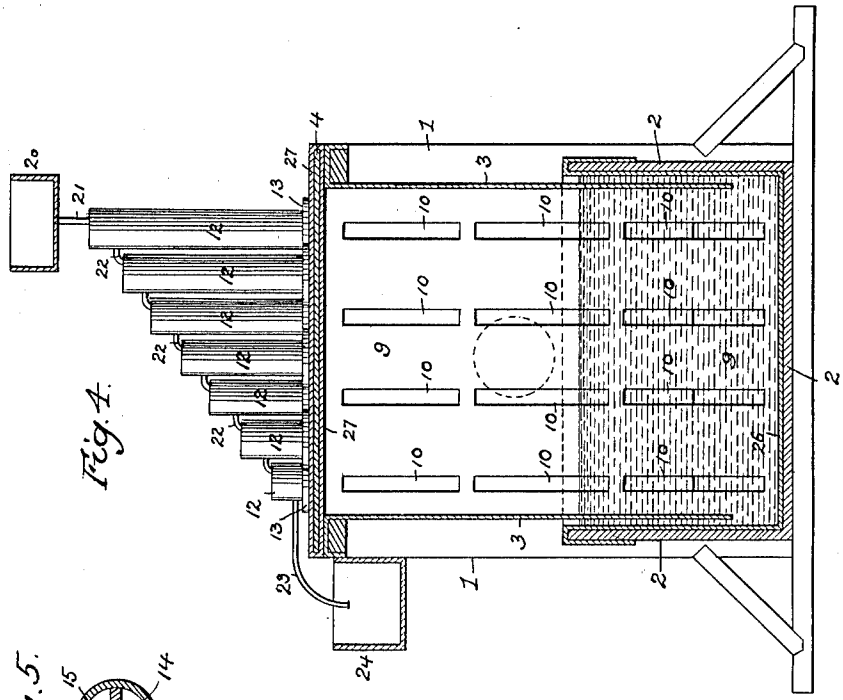

Fig. 4.

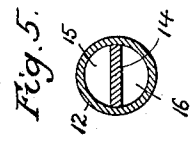

Fig. 5.

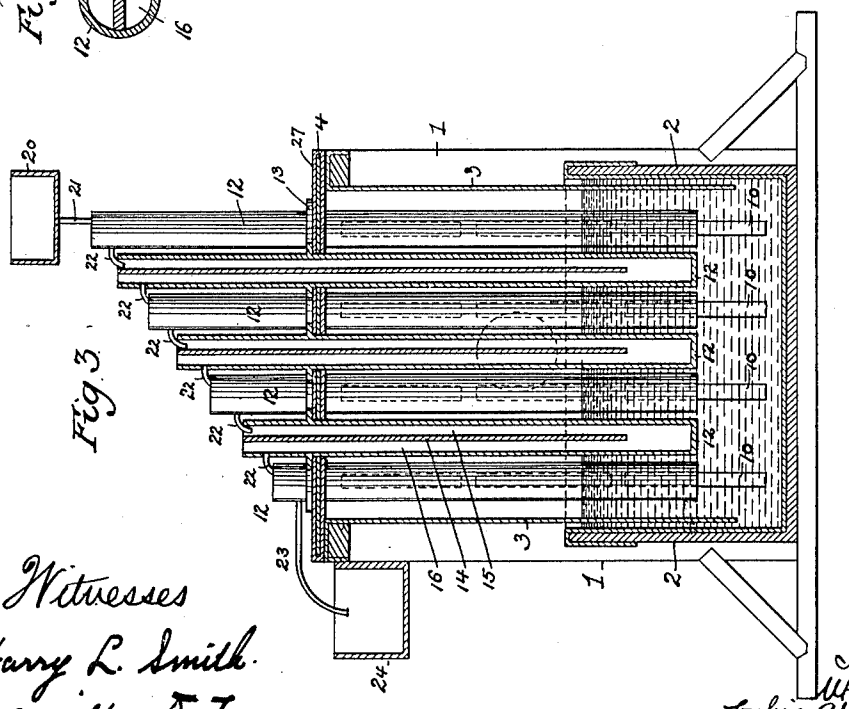

Fig. 3.

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UNITED STATES PATENT OFFICE.

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CONDENSER FOR VAPORS AND GASES.

1,012,487. Specification of Letters Patent. Patented Dec. 19, 1911.

Application filed March 18, 1907. Serial No. 362,935.

To all whom it may concern:

Be it known that I, UTLEY WEDGE, a citizen of the United States, residing in Ardmore, Pennsylvania, have invented certain Improvements in Condensers for Vapors and Gases, of which the following is a specification.

The object of my invention is to so construct a cooler and condenser for vapors or gases, (hereinafter, for convenience, simply referred to as gas) that the same can be cheaply built; that effective and extended contact of the gas with the condensing units will be insured; that a constant circulation of the cooling liquid through said condensing units may be maintained, and that the removal and replacing of any one or more of the cooling or condensing units will be permitted without affecting the others or interfering with the continued operation of the condenser.

In the accompanying drawings: Figure 1 is a perspective view of a condensing device constructed in accordance with my invention; Fig. 2 is a longitudinal sectional view of the same; Fig. 3 is a transverse section on the line *a*—*a*, Fig. 2; Fig 4 is a transverse section on the line *b*—*b*, Fig. 2 and Fig. 5 is an enlarged sectional plan view of one of the condensing units.

The apparatus comprises a suitable framework 1, of any available material, supporting a tank 2, an apron 3, and a lid or cover 4, preferably detachable, the tank serving to receive the liquid products of condensation and the apron 3 and cover 4 forming a chamber through which flows the gas to be cooled or condensed, said chamber being sealed against the escape of gas by reason of the fact that the apron 3, which follows the contour of the tank 2 and is of a length and width but slightly less than those of the tank, extends below the level of liquid in the tank, whereby the latter constitutes a seal for said apron, the condensing chamber 5 being formed between the liquid in the tank and the cover 4. The gas is supplied to one end of the chamber 5 through a pipe 6, and, after passing through the chamber 5, escapes through a pipe 7, said pipes 6 and 7 being suitably connected to the opposite ends of the depending apron 3, as shown in Fig. 2.

In order to prevent direct flow of the gas from one pipe to the other and insure a substantially uniform dissemination of the gas throughout all portions of the condensing chamber I dispose near each end of the latter, and at other points in the chamber, if desired, a spreader consisting of a partition or diaphragm 9 with slots 10 distributed throughout the area of the same, as shown in Fig. 4.

Each of the condensing units of the apparatus consists of a tube 12 closed at the bottom and open at the top, each tube being independent of the others and passing through an opening in the cover 4, so that it can be readily inserted or removed. A simple way of supporting the tubes would be to permit their closed ends to rest upon the bottom of the tank, but, as the tubes expand and contract under the changes of temperature to which they are subjected, this would necessitate stuffing boxes or other sealed joints between the tubes and the cover to prevent escape of gas, and I therefore prefer to so support the tubes that their lower ends will be some distance above the bottom of the tank, each tube being provided with an externally projecting flange 13 whereby it is supported upon the cover 4 of the condenser, escape of gas around the tube being thereby prevented. Each tube is also provided with a central partition 14 extending from the top of the tube to a point some distance above the bottom of the same, whereby there are formed in the tube opposite passages 15 and 16 communicating with each other at their lower ends. By preference, the partition 14 is not secured to the tube but is held in proper position therein by frictional engagement of its opposite edges with the tube so that it can be readily removed or replaced when necessary. (See Fig. 5.)

As many of the condensing tubes 12 will usually be employed as the capacity of the condensing chamber 5 between the opposite spreaders 9 will permit, the tubes being arranged in banks or rows, and those of one row being preferably staggered or disposed in line between the spaces of the tubes of the adjoining rows in order to compel the gas, in its flow through the condensing chamber, to follow a zigzag or circuitous course and thus insure contact of the same with all portions of each of the condensing tubes which are contained within said chamber.

The tubes of the rear row or bank are higher than those of the row or bank in ad-

vance of the same, and these are higher than those of the next row in advance, and so on to the foremost row which is the shortest.

The slots in the partition 9 at the inlet end of the chamber are in line with the condensing units of the first row at that end of the chamber and the slots in the partition 9 at the outlet end of the chamber are in line with the condensing units of the last row, in order to cause the gases or vapors on their inlet to impinge directly upon the condensing units of the first row and to cause said gases or vapors to flow around the condensing units of the last row prior to their escape.

The water or other liquid which constitutes the cooling agent for the condenser is derived from a supply tank 20, and passes therefrom through pipes 21 into the upper ends of the passages 15 of the rearmost and highest row of tubes 12, and after descending in said passages rises in the passages 16 to a point below the top of each tube and escapes from said tube through a pipe 22 into the upper end of the passage 15 of a tube of the next row in which it takes the same course as in the first tube, being then discharged into a third tube of the series, and so on until it finally escapes, through a pipe 23, from the passage 16 of one of the foremost tubes and flows into a receiving tank 24, from which it flows through a pipe 25 to any convenient place of discharge.

Tubes of different heights are not essential, as the cooling fluid might flow from a lip at the top of one tube into an adjoining tube, or each tube might have a supply of such cooling fluid independent of the other tubes.

As the tubes 12 are open at the top the condition of the flow of the cooling agent through each tube can be readily observed, the presence of a leak in either tube being at once indicated by failure or impairment of such flow. The presence of slight leaks can be detected by temporarily stopping the inflow into any one of the tubes and noting the fall of the liquid therein.

Whenever it becomes necessary to remove one of the condensing tubes or units for inspection, repair or other purpose, the flow of the cooling agent is temporarily diverted therefrom, whereupon the tube which is thus put out of the circulation can be readily lifted out of place, and its opening in the cover 4 suitably closed, so that the continuous operation of the condenser will not be interfered with, the tube being as readily replaced when desired, and the circulation of the cooling agent through the same restored.

Tubes of each row are located midway between the tubes of the next lower or succeeding row, so that whenever the tube in one of the latter rows has to be removed, the flow from the tube of the next higher row can be readily diverted into a tube adjoining that which is to be removed, the latter tube being the only one which is out of action.

Quick access to the tank 2 or to the interior of the apron 3 can be gained by removing the cover 4, which will carry with it all of the condensing units suspended therefrom.

When the apparatus is intended for the cooling and condensing of gas having a corrosive or other destructive effect, the various parts of the apparatus subjected to the action of the gas will, of course, be properly protected by being composed of or covered with material which will resist such action, thus, in the apparatus which I have shown in the drawing, and which has been devised for the cooling and condensation of gases or vapors developed in the manufacture of sulfuric acid, the condensing tubes 12 and the apron 3 will be composed of lead, the tank 2 will have a lead lining 26, and the cover 4 will be provided with a lead incasement 27, while if nitric acid gases are to be condensed, the tubes and other parts of the apparatus can be constructed of or faced with tile.

The tank serves as a reservoir or accumulator for the condensed gases, and as these gases when first condensed are of a temperature but little below the boiling point, the projection of the tubes 12 is continued some distance below the level of the liquid in the tank, in order to continue the cooling action as long as possible.

I claim:—

1. A gas cooler or condenser consisting of a casing inclosing a condensing chamber, means for passing the gas through said chamber, a plurality of disconnected condensing units mounted upon but free from attachment to said casing and each vertically removable therefrom but depending into the condensing chamber, said units being disposed in staggered relation to one another, in order to prevent straight flow of the gas through the condenser, and means for causing flow of cooling fluid through said condensing units.

2. A gas cooler or condenser consisting of a casing inclosing a condensing chamber, a plurality of rows of condensing units disconnected from one another, each unit being mounted upon but free from attachment to said casing and vertically removable therefrom but depending into the condensing chamber, means whereby gas is caused to pass through said chamber, and means for supplying cooling fluid to the condensing units of the upper row, the latter discharging into the units of the next succeeding row, and so on, and the units being so disposed that the flow from a unit of one row

can, in the event of the withdrawal of a unit of the succeeding row into which it normally discharges, be diverted to an adjoining unit of said succeeding row.

3. A gas cooler or condenser consisting of a casing inclosing a condensing chamber and having a detachable top, and a plurality of disconnected condensing units mounted upon but free from attachment with said top and vertically removable therefrom.

4. A gas cooler or condenser comprising a box or casing having a condensing chamber therein, gas supply and discharge pipes, a plurality of rows of depending condensing units contained in said chamber, and means at the inlet end of the chamber for directing the gas against the condensing tubes of the first row.

5. A gas cooler or condenser comprising a box or casing having a condensing chamber therein, gas supply and discharge pipes, a plurality of rows of depending condensing units contained in said chamber, the units of some of the rows being in line with the spaces between the units of the rows alternating therewith, and means at the inlet end of the chamber for directing the gas against the condensing tubes of the first row.

6. A gas cooler or condenser comprising a box or casing having a condensing chamber therein, gas supply and discharge pipes, a plurality of rows of depending condensing units contained in said condensing chamber, and means at the discharge end of the chamber for concentrating the outflow in line with the tubes of the last row of the set.

7. A gas cooler or condenser comprising a box or casing having a condensing chamber therein, gas supply and discharge pipes, a plurality of rows of depending condensing units contained in said condensing chamber, the units of some of the rows being in line with the spaces between the units of the rows alternating therewith, and means at the discharge end of the chamber for concentrating the outflow in line with the tubes of the last row of the set.

8. A gas cooler or condenser consisting of a casing containing a condensing chamber, and having as one of its elements a storage tank, and a plurality of condensing units projecting into said chamber and extending below the level of liquid in the tank.

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

UTLEY WEDGE.

Witnesses:
HAMILTON D. TURNER,
KATE A. BEADLE.