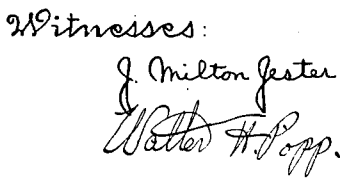


991,905.

2 SHEETS—SHEET 1.



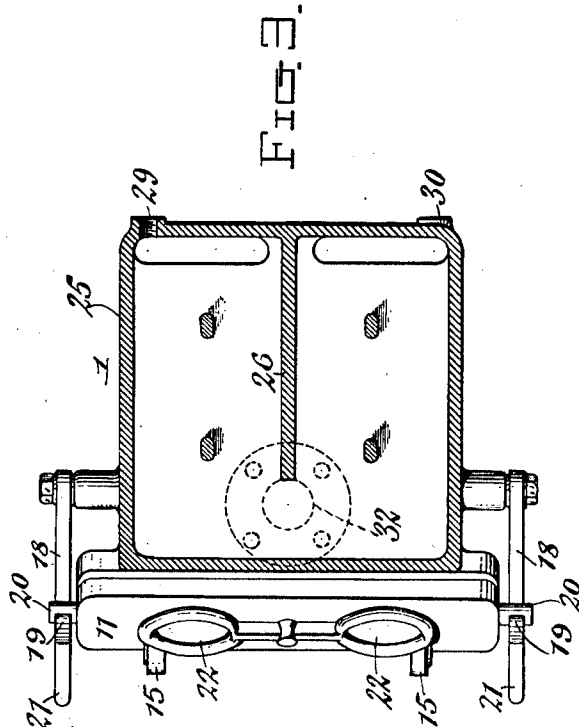
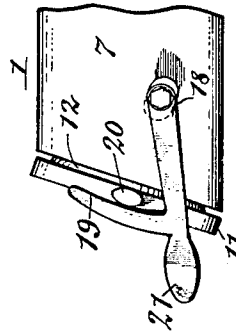
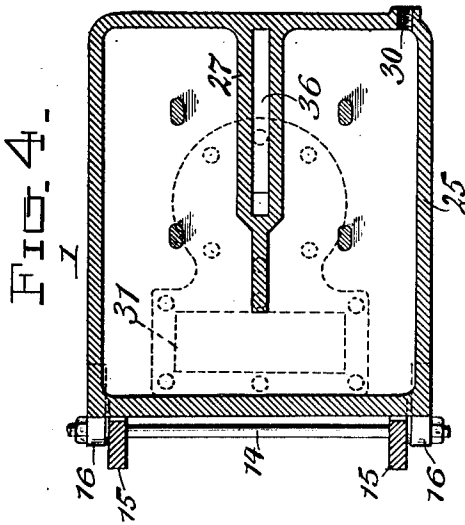
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 DRIER AND CONDENSER.
 APPLICATION FILED JULY 14, 1909.

991,905.

Patented May 9, 1911.

2 SHEETS—SHEET 2.



Witnesses:

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UNITED STATES PATENT OFFICE.

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DRIER AND CONDENSER.

991,905.

Specification of Letters Patent.

Patented May 9, 1911.

Application filed July 14, 1909. Serial No. 507,515.

To all whom it may concern:

Be it known that I, OLIVER S. SLEEPER, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Driers and Condensers, of which the following is a specification.

This invention relates to a combined drier and condenser which is more particularly designed for use in chemical laboratories, drug houses, experimental plants, and various other places where a small drier and condenser is required for testing comparatively small quantities of liquids or plastic material.

It is the object of this invention to produce a drier and condenser for this purpose which is very simple, convenient and compact in construction, which permits of readily drying various substances to be tested under the application of heat and vacuum, which permits of conveniently observing the operation of the condenser and effecting the recovery of the condensation, and in which all of the parts are readily accessible for cleaning, inspection and repairs.

In the accompanying drawings consisting of 2 sheets: Figure 1 is a vertical longitudinal section of my improved drier and condenser. Fig. 2 is a vertical section taken in line 2-2, Fig. 1, looking forwardly. Figs. 3 and 4 are horizontal sections taken in the correspondingly numbered lines in Fig. 1. Fig. 5 is a fragmentary side elevation of the shell of the drier, the door for closing the inlet of the drying chamber and one of the clamping levers or hooks for holding the door in its closed position.

Similar letters of reference indicate corresponding parts throughout the several views.

In its general organization my improved drier and condenser comprises an upper section or head 1 which embodies the apparatus whereby the material to be tested is dried, an intermediate section or column 2 which carries the head at its upper end and forms part of the condenser whereby the vapors are condensed, and a base 3 which supports the column at its lower end and which is provided with means for collecting and drawing off the liquid yielded by the condenser.

The upper section or head of the apparatus comprises a shell which contains the

drying chamber 4 and which has a horizontal top 5 and bottom 6, upright side walls 7, an upright rear wall 8, an inlet or opening 9 at its front end through which the material to be dried and tested is introduced into the drying chamber, and a vapor outlet 10 which is arranged centrally in the upper rear wall at the top thereof and through which the vapors are withdrawn from the drying chamber by an exhausting device which operates to produce a partial vacuum in the drying chamber and thus permit the drying of the material to be effected more expeditiously and at a lower temperature. During the drying operation, the inlet of the drying chamber is closed by a door or cover 11, a tight joint being produced between the door and the chamber by means of a packing or gasket 12 of rubber or other elastic material arranged in a groove in the face of the door and engaging with the face 13 of the drying chamber around the inlet thereof. This door is preferably pivoted at its lower edge to the shell below the inlet of the chamber by means of a horizontal rod or pintle 14 passing transversely through corresponding perforated ears 15, 16 on the adjacent edges of the door and shell, this pivotal connection being loosely constructed so as to permit the door not only to swing vertically into its open and closed positions but also to move in a substantially straight line toward and from the face 13 of the drying chamber to permit the packing of the door to bear uniformly against said face and form an air tight joint between these parts. This slack or looseness between the door and drying chamber or shell is preferably effected by elongating the openings 17 in the lugs of the door through which the pivot bolt or pintle passes, as shown in Fig. 1.

The face of the shell 13 around the inlet of the drying chamber is preferably beveled or inclined so that the same recedes from its lower end toward its upper end, as shown in Fig. 1, whereby the door will hang in a pendent open position when swung downwardly, but when the same is swung upwardly into its closed position against the face of the drying chamber it will be inclined rearwardly and thus be held in its closed position by gravity. For the purpose of tightening the cover against the inlet of the drying chamber and compressing the packing between the same for producing an air

tight joint after the material has been introduced into the drying chamber, a clamping device is provided which thus secures the door and which also automatically releases itself from the door when the latter is drawn more tightly toward the shell or drying chamber upon producing a vacuum therein. The preferred means for this purpose shown in the drawings consists of two vertically swinging clamping levers or hooks 18 which are pivoted at their rear ends to opposite sides of the drier shell and which are provided at their front ends with upwardly projecting bills 19 adapted to engage with the front sides of lugs or shoulders 20 projecting laterally from opposite lateral edges of the door. The operative rear faces of the bills of these hooks are made slightly eccentric relative to the pivots of these hooks so that the same operate as wedges or cams upon engaging with the lugs of the door and force the latter toward the face of the drying chamber. At their front ends these clamping hooks are provided with handles 21 for manipulating the same. As the exhausting device produces a partial vacuum in the drying chamber to promote the drying of the material therein, the door is drawn toward the face of the shell around the inlet of the drying chamber to a greater extent than was imparted to it by the action of the cam or wedge faces of the clamping hooks. When this occurs, the hold of the clamping levers or hooks on the shoulders or lugs of the door is lost causing these hooks to drop by gravity out of engagement from the lugs of the door. Thereafter the door is held air tight in its closed position by atmospheric pressure only but as the same is no longer engaged by the clamping levers or hooks, it is free to fly open and automatically relieve the drying chamber if the pressure within the latter exceeds the external atmospheric pressure and thereby prevent injury to the apparatus. This preponderance of the internal pressure within the drying chamber over the atmospheric pressure is liable to occur when the material being dried generates more vapor than the condenser will accommodate and also when drying materials which are liable to explode during the drying operation, such as gun powder.

Windows are provided for the operations inside of the drying chamber to be observed from the exterior. For this purpose two windows are preferably arranged side by side in the door of the drying chamber, each window comprising a circular glass pane 22 arranged in a correspondingly shaped opening in the door and bearing with its outer side against an internal annular flange or shoulder 23 around the outer end of said opening and an external threaded clamping screw ring 24 engaging with the internally threaded inner part of said opening and

bearing against the inner side of the glass pane.

To facilitate the drying operation, heat is applied to the exterior of the shell, this being preferably effected by a jacket 25 extending along the top, bottom and rear wall of the shell and forming a heating space or chamber between the same through which a heating medium of any suitable character may be conducted for heating the material within the drying chamber. Arranged lengthwise and centrally in this heating chamber is a partition which has an upper section 26 extending from the rear wall of the jacket forwardly between the top of the shell and the top of the jacket and terminating short of the front ends of these parts, a lower section 27 extending from the rear wall of the jacket forwardly between the bottom of the drying chamber and the lower side of the jacket and terminating short of the front ends of these parts, and an upright rear section 28 which extends vertically between the rear walls of the drying chamber and the jacket and connects with the rear ends of the upper and lower partition sections. On diagonally opposite corners of the rear wall of the heating jacket the same is provided with an upper nipple 29 and a lower nipple 30 one of which is adapted to serve as an inlet for the live heating agent which is to be conducted into the heating chamber while the other serves as an outlet for the dead or spent heating agent after the same has given off its heat for raising the temperature in the drying chamber. This heating agent may be steam, hot water, hot air, a gas flame or the like. When steam is utilized as the heating medium, the same is admitted through the upper nipple 29 and after spending itself within the heat chamber for raising the temperature within the drying chamber, the same is discharged through the lower nipple 30, but when hot water or similar medium is utilized as the heating agent, the same is admitted into the heating chamber through the lower nipple and discharged through the upper nipple. As the steam enters the upper nipple, it divides, one part passing forwardly through the upper part of the heating chamber on one side of the upper partition section, thence rearwardly on the opposite side of the same partition section, and thence downwardly on the corresponding side of the upright partition section to the lower nipple, while the other part of the steam passes downwardly from the upper nipple through the vertical part of the heating chamber on the corresponding side of the vertical partition section, thence forwardly through the lower part of the heating chamber on the corresponding side of the lower partition section, and thence forwardly through the lower part of the heat-

ing chamber on the opposite side of the lower partition section to the lower nipple. By this means, the heating medium is compelled to take a circuitous course or path through the heating chamber and distribute itself uniformly over the top, bottom and rear side of the drying chamber and exert the maximum heating effect upon the material within the drying chamber before it can escape. When using hot water or hot air as the heating agent which is admitted through the lower nipple 30, the same distributes itself in like manner over the shell of the drying chamber but in a reverse direction before it can escape through the upper nipple.

When the steam, hot water, hot air or the like are not available for circulating heat through the heating jacket, the same may be heated by admitting the flame of a gas burner through an opening 31 into the lower part of the heating jacket at the front end thereof, this flame passing rearwardly through the lower part of the heating chamber, thence upwardly through the rear part of this chamber, thence forwardly through the upper part of this chamber on opposite sides of the partition between these parts, and thence upwardly through an outlet opening 32 in the top of the upper part of the heating jacket at the front end thereof, which outlet may be connected by a flue or otherwise with a chimney so as to carry off the products of combustion. The lower and upper openings 31, 32 are closed by plates or covers 33, 34, secured thereto by screws 35 or otherwise when these openings are not utilized and the heating of the drying chamber is effected by the circulation of steam, hot water or the like through the heating chamber.

The vapors drawn off through the outlet of the drying chamber are conducted centrally to the underside of the heating jacket by a vapor outlet conduit 36 which extends from said vapor outlet 10 downwardly between the rear walls of the drying chamber and heating chamber, thence forwardly between the bottoms of the drying and heating chambers, and thence downwardly through the bottom of the jacket, this conduit being preferably formed in the rear and lower sections of the partition which divides the heating chamber lengthwise, as shown in Figs. 1, 2 and 4.

The column which supports the head containing the drying apparatus comprises a hollow upright cylindrical post or shell 37, a cap 38 screwed on the upper end of the tubular shell and secured centrally to the underside of the heating jacket, and a lower cap 39 screwed onto the lower end of the tubular shell. The lower cap is connected with an inlet pipe 40 through which water or other cooling medium is admitted into

the lower end of the column for use in condensing the vapors which are withdrawn from the drying chamber while the upper cap is connected with an outlet or waste pipe 41 through which the spent water is discharged from the upper part of the column. Within the column is arranged a spiral condensing coil or pipe 42 which has its upper end connected by a screw joint with the upper cap so as to communicate with the lower end of the vapor outlet conduit 36 while the lower end of the coil is provided with a straight downwardly projecting portion 43 which passes downwardly through a stuffing box 44 in the lower cap of the condensing column.

As the vapors pass downwardly from the drying chamber through the condensing coil, the same are condensed by reason of the water of lower temperature in the column surrounding the condensing coil. So much of the vapor as is condensed drips from the lower end of the condensing coil into a condensation receiving chamber 45 into the upper part of which the lower end of the condensing coil projects. This receiving chamber or receiver is formed within a base or pedestal 46 which is secured at its upper end to the lower cap of the column and is adapted to rest with its underside upon the ground or floor so as to form a stand for supporting the condenser and drier at the proper height from the floor.

At a point above the bottom of the condensation receiver, the same is provided with an outlet nipple 47 which is adapted to be connected with an exhausting device of any suitable character for forcibly drawing the vapors from the drying chamber through the condenser coil and out of the receiver and produce a vacuum in these spaces. Means are provided for permitting the working of the condenser to be observed from the exterior. These means preferably consist of two glass window panes 48 arranged in openings on opposite sides of the receiving chamber in line with the lower end of the condenser coil, each of these panes bearing with its inner side against an outwardly facing shoulder 49 formed within the bore of the respective opening and being held in place by means of a clamping ring 50 having an external screw thread engaging with the threaded bore of the respective opening and bearing against the outer side of said pane. By looking across the receiving chamber from one observation window thereof to the other, the drops of condensation falling off the lower end of the condensing coil may be observed.

The stuffing box between the water column and the condensation receiver through which the lower end of the condenser coil passes prevents the cooling water leaking from the column into the receiver, thereby

insuring gathering in the latter only such materials as have been evaporated and condensed. When the receiver has received all of the condensation of the vapors of the material being tested, or when the condensation accumulates in the receiver so as to reach up to the windows or glasses, the same may be withdrawn by means of an outlet valve or cock 51 connected with the receiver at the bottom thereof.

Inasmuch as this drier and condenser rests directly upon the ground or floor, the same requires no separate support for this purpose, and owing to the fact that the condenser is arranged underneath the drier, the construction as a whole is not only very simple and compact but is also very neat in appearance and convenient in use.

I claim as my invention:

1. A drier comprising a shell having a drying chamber, an inlet through which the material to be dried is placed in the chamber and an outlet for the vapors, a door for closing said inlet, and fastening means which engage said door and hold the same shut under normal pressure in the chamber but which automatically release the door when a vacuum is created in the chamber.

2. A drier comprising a shell having a drying chamber, an inlet through which the material to be dried is placed in the chamber and an outlet for the vapors, a door for closing said inlet, and fastening means which engage said door and hold the same shut under normal pressure in the chamber but which automatically release the door when a vacuum is created in the chamber, said fastening means comprising shoulders or lugs arranged on one of said members, and hooks pivoted on the other member and adapted to engage with said shoulders or lugs.

3. A drier comprising a shell having a drying chamber, an inlet through which the material to be dried is placed in the chamber and an outlet for the vapors, a door for closing said inlet, and fastening means which engage said door and hold the same shut under normal pressure in the chamber but which automatically release the door when a vacuum is created in the chamber, said fastening means comprising a pair of hooks pivoted on opposite sides of the shell and provided at their free ends with upwardly projecting bills which are adapted to engage with lugs or shoulders on opposite sides of the door.

4. A drier comprising a shell containing a drying chamber, an outlet for the vapors and an inlet for the introduction of the material to be dried into the chamber, said inlet having an inclined or beveled face which recedes from its lower part toward its upper part, and a door adapted to engage said face for closing said inlet and pivotally connected at its lower end with the corresponding part of said shell.

5. A drier comprising a shell containing a drying chamber, an outlet for the vapors and an inlet for the introduction of the material to be dried into the chamber, said inlet having an inclined or beveled face which recedes from its lower part toward its upper part, a door pivoted loosely at its lower end to the shell, and a packing mounted on the door and engaging said face of the shell.

6. A drier comprising a shell containing a drying chamber, an outlet for the vapors and an inlet for the introduction of the material to be dried into the chamber, said inlet having an inclined or beveled face which recedes from its lower part toward its upper part, a door adapted to engage said face for closing said inlet and pivotally connected at its lower end with the corresponding part of said shell and provided with transparent windows.

7. A drier comprising a shell containing a drying chamber, a vapor outlet for said chamber arranged at the rear end thereof and an inlet at the front end thereof through which the material to be dried is introduced into the chamber, a door for closing said inlet, and a heating jacket arranged at the rear, top and bottom of said shell but disconnected from said drying chamber and adapted to receive a heating medium.

8. A drier comprising a shell containing a drying chamber, a vapor outlet for said chamber arranged at the rear end thereof and an inlet at the front end thereof through which the material to be dried is introduced into the chamber, a door for closing said inlet, and a heating jacket arranged outside of the shell but disconnected from said drying chamber and having an inlet for the live heating medium, an outlet for the spent heating medium, and baffles arranged between said inlet and out of the jacket and forming a circuitous passage for said heating medium.

9. A drier comprising a shell containing a drying chamber, a vapor outlet for said chamber arranged at the rear end thereof and an inlet at the front end thereof through which the material to be dried is introduced into the chamber, a door for closing said inlet, and a heating jacket having an upper wall arranged above the shell, a rear wall arranged in rear of the shell and a lower wall arranged below the shell, a partition or baffle having an upper section extending centrally forward from the rear jacket wall between the upper jacket wall and the top of the shell and stopping short of the front ends of the upper jacket wall and shell, a rear section arranged centrally and vertically between the rear walls of the shell and the jacket, and a lower section extending centrally forward from the rear jacket wall and between the lower jacket wall and the bottom of said shell, an inlet

for the live heating medium and an outlet for the spent heating medium communicating with the diagonally opposite parts of said jacket at the rear thereof.

5 10. A drier comprising a shell containing a drying chamber which has a top, bottom, side walls and a rear wall, an inlet at its front end through which the material to be dried is introduced into the chamber, an
10 outlet conduit for the vapors extending from the rear end of the chamber downwardly to the bottom thereof and a heating jacket surrounding the drying chamber but disconnected therefrom.

15 11. A drier comprising a shell containing a drying chamber which has a top, bottom, side walls and a rear wall, an inlet at its front end through which the material to be dried is introduced into the chamber, and
20 an outlet conduit for the vapors extending from the rear end of the chamber downwardly and forwardly to the central part of the bottom thereof.

12. A drier comprising a shell containing
25 a drying chamber having an inlet at its front end through which the material to be dried is introduced into the drying chamber, a door for closing said inlet, a heating jacket arranged adjacent to the top,
30 bottom and rear of the chamber and having an inlet for the live heating medium and an outlet for the spent heating medium, a partition arranged centrally in said jacket and terminating at opposite ends short of
35 the front ends of the top and bottom of the drying chamber and jacket, and an outlet passage for the vapors arranged in said partition and extending from the upper rear part of the drying chamber to the central
40 lower part of the jacket.

13. The combination of a shell containing a drying chamber and a vapor conduit leading from the chamber, a hollow column which supports said shell and is provided
45 with an inlet and an outlet for a cooling medium, a condensation receiver which supports said column and is provided at its

bottom with a condensation outlet and adapted to be connected above said outlet with an exhausting device, and an upright
50 condenser coil arranged in said column and having its upper end connected with said vapor conduit while its lower end opens into the upper part of said receiver.

14. The combination of a shell containing
55 a drying chamber and a vapor conduit leading from the chamber, a hollow column which supports said shell and is provided with an inlet and an outlet for a cooling medium, a condensation receiver which sup-
60 ports said column and is provided at its bottom with a condensation outlet and adapted to be connected above said outlet with an exhausting device, a stuffing box arranged between the lower end of the column
65 and the top of the receiver, and an upright condenser coil arranged in said column and connected at its upper end with said vapor conduit while its lower end passes through said stuffing box into the upper part of said
70 receiver.

15. The combination of a shell containing a drying chamber and a vapor conduit leading from the chamber, a hollow column which supports said shell and is provided
75 with an inlet and an outlet for a cooling medium, a condensation receiver which supports said column and is provided at its bottom with a condensation outlet and adapted to be connected above said outlet
80 with an exhausting device, an upright condenser coil arranged in said column and having its upper end connected with said vapor conduit while its lower end opens into the upper part of said receiver, and windows
85 arranged on opposite sides of said receiver in line with the lower end of said coil.

Witness my hand this 2nd day of July, 1909.

OLIVER S. SLEEPER.

Witnesses:

E. M. GRAHAM,
RICHARD SOMMER.