

No. 653,555.

Patented July 10, 1900.

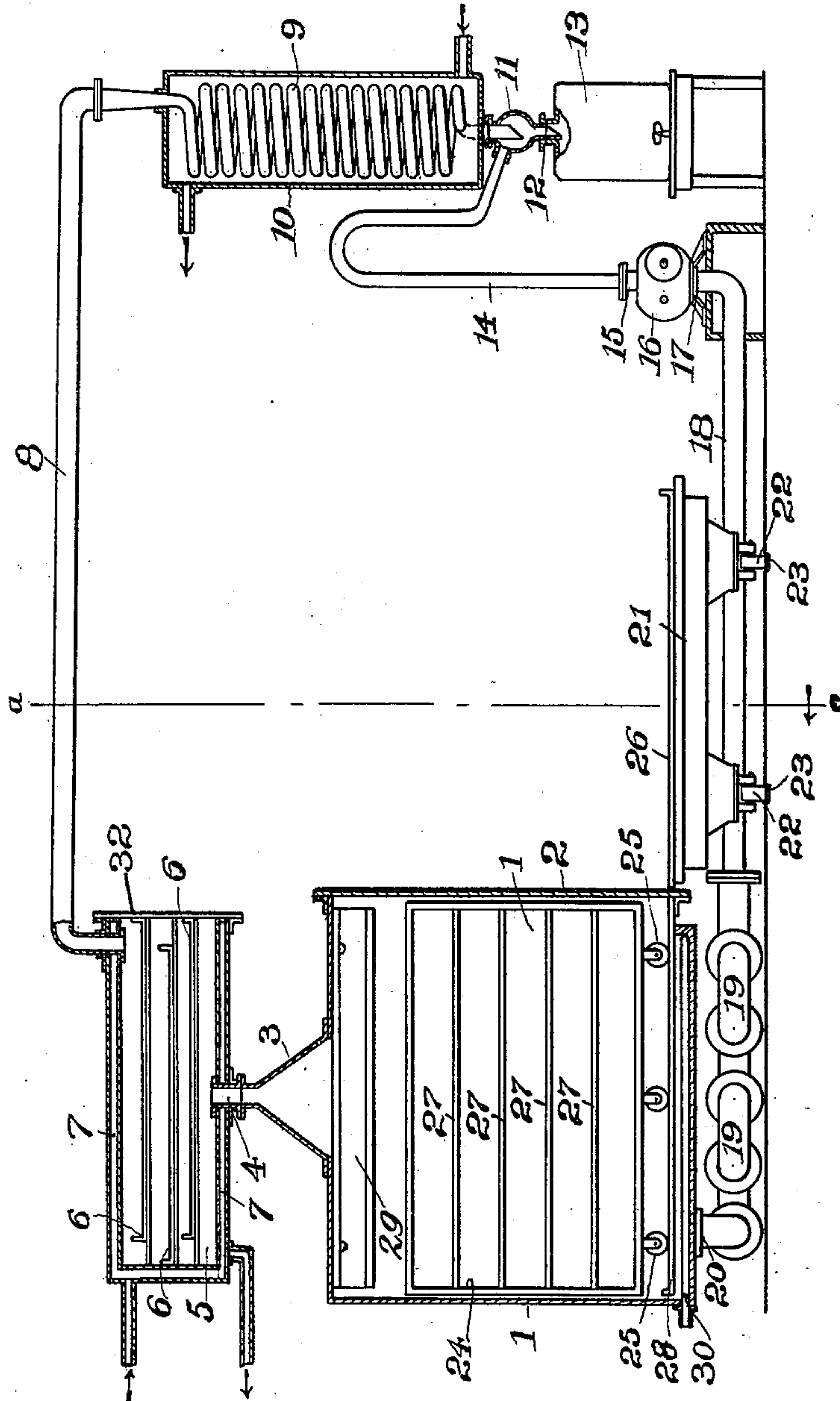
W. B. HART & A. ASHWORTH.
APPARATUS FOR RECOVERING SOLVENTS.

(Application filed Oct. 10, 1899.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.



WITNESSES:

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Fig. 2.

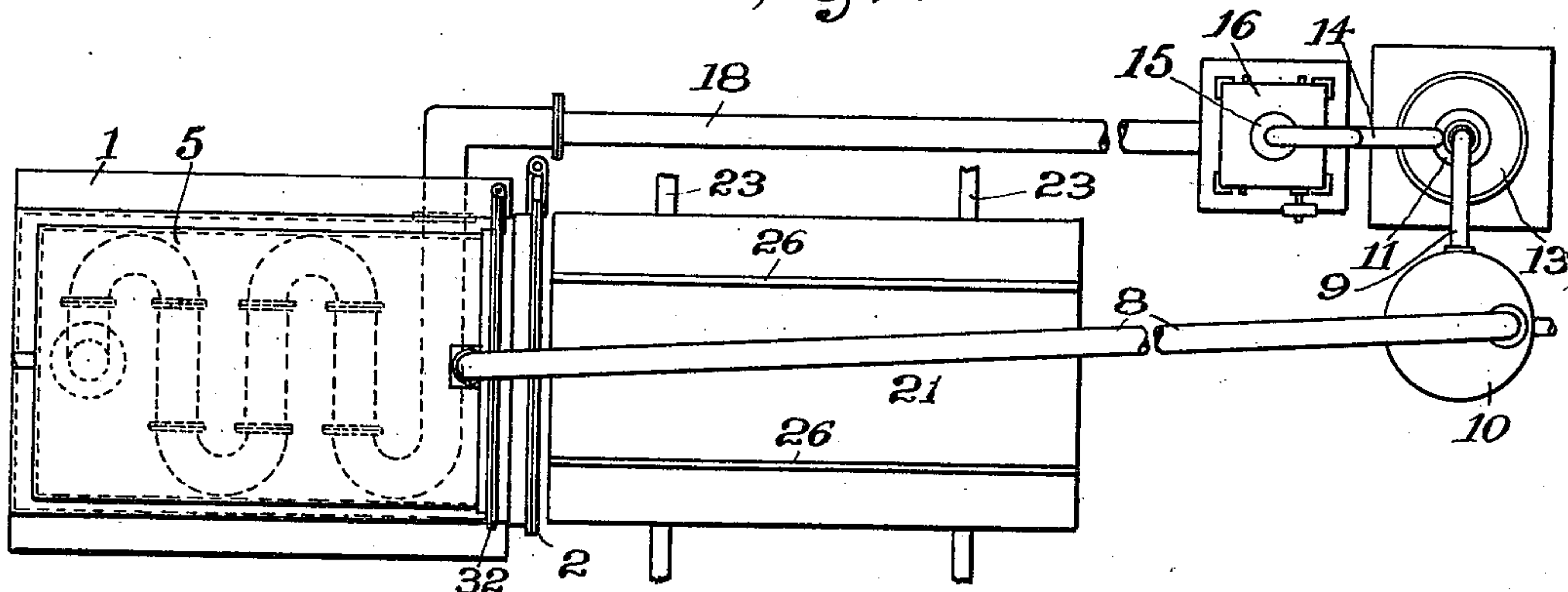
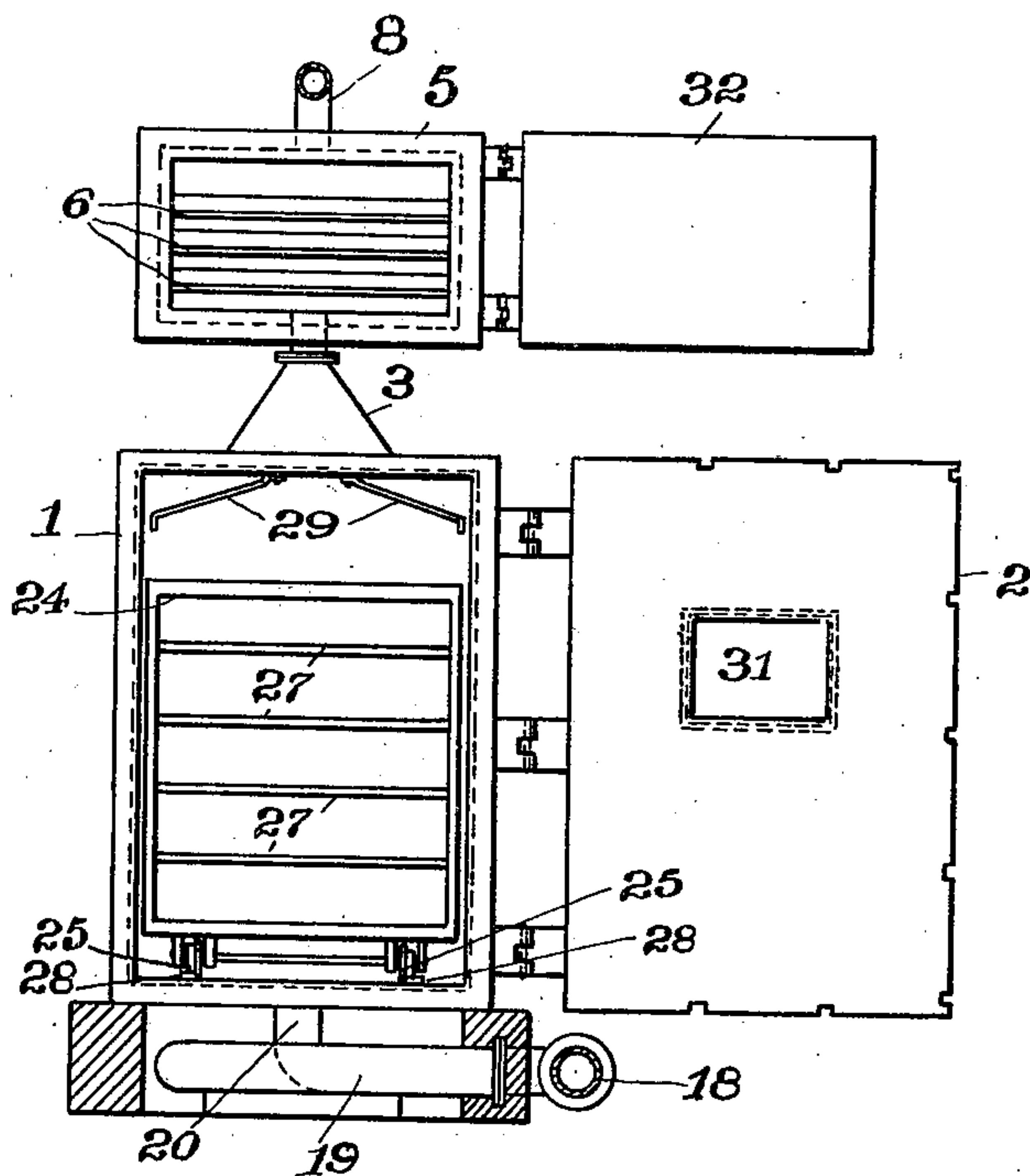


Fig. 3.



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UNITED STATES PATENT OFFICE.

WILLIAM BEAMONT HART AND ADAM ASHWORTH, OF MANCHESTER, ENGLAND, ASSIGNORS TO THE SOLVENTS RECOVERY COMPANY, OF SAME PLACE, AND JAMES MARSHALL, OF FALL RIVER, MASSACHUSETTS.

APPARATUS FOR RECOVERING SOLVENTS.

SPECIFICATION forming part of Letters Patent No. 653,555, dated July 10, 1900.

Application filed October 10, 1899. Serial No. 733,208. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM BEAMONT HART and ADAM ASHWORTH, subjects of Victoria, Queen of Great Britain, residing at Manchester, England, have invented certain new and useful Improvements in the Recovery of Solvents from Stiffened Hat-Bodies and in the Apparatus Employed Therein; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to the recovery of solvents from hat-bodies that have been stiffened and in the apparatus for effecting such recovery, and has for its object to obtain the recovered solvent in a strong condition, so that it can be used repeatedly for further stiffening purposes.

With these ends in view our invention consists in certain methods and in following out certain steps, such as will be hereinafter fully described and then specifically be designated by the claim.

In order that those skilled in the art to which our invention appertains may more fully understand the same, we will now describe it minutely, reference being had by numbers to the accompanying drawings, which illustrate the preferred style of apparatus which we employ for carrying out our invention, and in which—

Figure 1 is a longitudinal section of such apparatus; Fig. 2, a plan view, and Fig. 3 a section at the line *a a* of Fig. 1.

Similar numbers of reference denote like parts in the several figures of the drawings.

In the process of proofing or stiffening of hard hats the hat-bodies are treated with a solution of shellac or other gums or resin or stiffening material in a solvent—such as methylated spirit, wood-spirit, &c.—and the solvent then evaporated. In apparatus used for the purpose of evaporating and recovering this solvent it has been found that when a solvent is used that is miscible with water—such as methylated spirit, wood-spirit, &c.—the recovered spirit is weak and dilute and

after a time it becomes incapable of dissolving shellac, &c. This dilution is due to the presence of water in the hat-bodies, such water being evaporated and condensed with the solvent.

In carrying our invention into effect the proofed hat-bodies while moist are placed in a closed and heated chamber through which hot air circulates. The solvent contained in the hat-bodies is thus evaporated, together with the aqueous moisture, and absorbed by the air and is then carried forward to a solvent-vapor-drying chamber, which can also be heated to prevent condensation of the solvent-vapor. In this solvent-vapor-drying chamber dehydrating or drying material is placed—such as quicklime, potassium carbonate, or substance of a similar nature—by which the aqueous vapor carried over with the solvent-vapor from the hat-body chamber may be arrested, while the heated solvent-vapor thus dried passes on, still in vapor form, to a condenser, where it is condensed and separated in liquid form. The cold air from the condenser is returned by an air exhauster, fan, or pump through a heater into the hat-body chamber, this circulation being continued until the operation is finished.

The apparatus consists of a hat-body chamber 1, constructed of metal or other suitable material and provided with a door 2, so arranged that when closed a tight joint is formed, preventing the escape or admission of air or the escape of solvent-vapor. An outlet 3 in the upper part of this chamber communicates by the pipe 4 with the solvent-vapor-drying chamber 5, provided with solid imperforate shelves 6, containing dehydrating or drying agents—such as quicklime, potassium carbonate, &c.—and which can be heated, as required, by the steam-casing 7. From this chamber 5 a pipe 8 communicates with the condenser 9, constructed of coils of piping or of tubes to obtain efficient condensing-surface and placed inside a casing 10, through which casing a current of cold water flows. The lower end of the condenser-pipe 9 is cut off obliquely and enters for a short distance into a separator 11, which com-

municates at its lower end by a pipe 12 with the collecting vessel 13, in which the condensed solvent is collected. This separator 11 also communicates on one side farthest from the oblique end of the condenser-pipe 9 by a pipe 14 with the inlet-opening 15 of an air exhaust, fan, or pump 16. The pipe 14 rises in an upward direction from the separator 11 for a convenient height and then falls again to the exhauster, so as to prevent any condensed solvent passing forward to the exhauster. The outlet 17 from the exhauster is connected by a pipe 18 with a series of heating-pipes 19, in which the return air is heated before its passage into the hat-body chamber at the inlet 20.

Outside and along the front of the hat-body chamber 1 a movable platform or trolley 21 is arranged to run on wheels 22, preferably on or in rails 23. This platform is constructed level with the floor of the hat-body chamber and carries a light wagon 24 on wheels 25, guided also, preferably, on rails 26. This wagon contains a number of open shelves or supports 27, on which the hat-bodies are placed. On the floor of the hat-body chamber rails 28 are placed, corresponding with the rails on the movable platform 21, so that when the platform is opposite the chamber 1 the wagon 24 can be run from the platform into the chamber 1 or from the chamber 1 onto the platform 21 and thence to any required place.

Inside the hat-body chamber 1, but arranged so as not to interfere with the circulation, a false roof or guard 29 is hung in order to protect the hat-bodies from any falling drops of solvent, &c., these being conveyed to the sides.

When the hat-bodies are impregnated with the proofing solution, they are placed on the shelves or supports 27 of the wagon 24. The latter then runs by the movable platform 21 into the hat-body chamber 1 and the door 2 is secured. By the exhauster 16 the air inclosed in the apparatus is then caused to circulate and is then heated by the heating-pipes 19. The solvent in the hat-bodies then evaporates, and by circulation the hot atmosphere of solvent and aqueous vapors and air is carried through the outlet 3 and pipe 4 to the heated solvent-vapor-drying chamber 5, where the aqueous vapor is absorbed by the dehydrating or drying agent and so removed. The dried solvent-vapor passes on by the pipe 8 to the condenser 9, where the solvent-vapor is cooled and condensed to liquid form, falling through the separator 11 and pipe 12 into the collecting vessel 13. The air passes forward by the side pipe 14 through the exhauster 16 and pipe 18 into a series of heating-pipes 19 and returns to the hat-body chamber by the inlet 20. This circulation is continued until the operation is finished. In this manner one definite volume of air inclosed in the apparatus is caused to circulate through the said apparatus, and to effect the

removal of the solvent-vapor through the solvent-vapor-drying chamber, where the solvent-vapor is dried by removal of aqueous vapor into the condenser, where it is condensed and so recovered.

In order that our improvement may be clearly understood as to all its details, we would state more explicitly the manner of carrying out our process.

In our invention we place the hat-bodies, from which we desire to recover the alcohol or other solvent in a strong condition ready for reuse, in the heated chamber 1, from which chamber (equivalent to a still) the alcohol or other solvent vapor passes in an upward direction into the vapor-drying chamber 5, which is also heated to the desired temperature as required. In this chamber 5 we place a solid drying agent in a number of trays, the bottoms of which trays are not perforated, but solid. These trays are placed one above the other and arranged in such a manner that the vapor passes from chamber 1 over the surface of the drying agent in each tray, one after the other in successive order, from the lowest to the highest tray in an upward direction until it leaves the chamber 5 and passes into the pipe 8, leading to the condenser. The trays containing the solid drying agent are all separate and have no connection with each other. Thus we obtain a very large area of water-vapor-absorption surface, and since in this upward direction the vapor continually meets with fresh or new drying material the water-vapor is practically absorbed, while the alcohol or other solvent vapor thus freed from water-vapor passes on by pipe 8 to condenser 9. The drying-chamber 5 is heated by steam to a higher temperature than the boiling-point of the alcohol or other solvent, so that no condensation of the alcohol or solvent vapor or water-vapor occurs; but the water-vapor is absorbed by and enters into combination with the drying agent used. Thus we have no dropping of liquefied drying agent, no formation of spray, and no solution of the drying agent to treat afterward. If we had any condensation in our apparatus, such condensed liquid would run down into chamber 1, containing the hat-bodies, which latter would then be utterly spoiled, especially by the drying agent contained in this condensed liquid. The now-dried alcohol-vapor in pipe 8 passes into the condenser 9 and is here condensed to a liquid again and collected in the vessel 13 in a strong condition, ready for reuse in the making of proofing solution. The air now passes through the air exhauster or fan 16 and is then sent forward through the heating arrangement 19 into the hat-body oven 1 again, and so on repeatedly until the operation is completed.

If any condensation occurs in the wide pipe 3 after the vapors have left the chamber 1 and before they reach the chamber 5—and this condensation can only be very slight—

such condensed liquid is caught by the false roof 29 and conveyed to the sides of chamber 1; but it must be borne in mind that this condensation, if it occurs, occurs before the vapors pass over the drying agent, and being thus condensed they cause no solution of the drying agent. This condensed liquid in falling to lower parts of chamber 1 is evaporated in evaporation-chamber 1 and passed into chamber 5 and then dried by removal of water-vapor. Therefore our method for the removal of water-vapor from the alcohol or solvent vapor is a dry process, in which we use a dry solid agent for this purpose, not a liquid solution, and we carry this out by passing the vapors over the surface of this drying agent and not through it. We also keep the evaporation operation separate and quite distinct from the water-vapor-absorption operation, yet these two operations proceed simultaneously.

By the fan (also called "exhauster") we cause a circulation of the air inclosed in the whole apparatus. It is true we exhaust the atmosphere of air, water-vapor, and solvent-vapor from the evaporation-chamber, so that we do not reduce or lessen the atmospheric pressure in the evaporation-chamber, nor do we cause the water or the solvent to evaporate at a lower temperature. We only cause these two to evaporate quicker by removing their vapors as fast as they are formed.

It is the water present in the hat-bodies that can cause the dilution of the recovered solvent. The water present in the atmosphere inclosed in the apparatus is only an infinitesimal quantity, and since this same air is confined during the whole operation the quantity of water in the air can for all practical purposes be neglected.

Any suitable drying agent may be employed which will absorb the aqueous vapor as vapor and which will therefore not become liquefied, the object being to absolutely free the solvent-vapor from water in any form before the condensation of such solvent-vapor takes place; but by experiment we have ascertained that the only drying agents which we can use are anhydrous alkaline carbonates, such as potassium carbonate (K_2CO_3) anhy-

drous alkaline sulphates, such as sodium sulphate (Na_2SO_4) or anhydrous alkaline-earth oxides, such as quicklime (CaO) in solid form, either in lump or powder.

Any form of apparatus for heating the air may be employed. It is found a convenient plan to place the hat-body chamber inside the hat-stove in general use in hat-works and to heat the air in a series of pipes placed in the stove. This heat may be supplemented by means of a steam-coil 30, arranged inside the lower part of the hat-body chamber.

A smaller door 31 is fixed on the door 2 of the hat-drying chamber 1, so that the hat-bodies may be quickly removed for examination during the operation. This door is also arranged to fit tightly when closed. Numbers of these hat-body chambers may be worked together, the inlets and outlets for vapor and air being controlled by suitable valves. The solvent-vapor-drying chamber 5 is also provided with a door 32 to shut tightly.

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

In an apparatus for recovering the solvents from stiffened hat-bodies, a hat-body-drying chamber 1, in combination with a series of superposed trays or shelves arranged therein, a tapering outlet from the top of the said chamber, an inclined false roof or guard hung to the under side of the said top and extending under the said outlet where it is provided with an opening discharging into the same, a drying-chamber into which the said outlet discharges and a condenser communicating with the outlet of the said drying-chamber, substantially as set forth.

In testimony whereof we affix our signatures each in the presence of two witnesses.

WILLIAM BEAMONT HART.

ADAM ASHWORTH.

Witnesses as to the signature of William Beamont Hart:

WILLIAM HENDERSON HAWDON,

JAMES KINNACH.

Witnesses as to the signature of Adam Ashworth:

EDWIN ASHWORTH,

HARRY BERESFORD.