

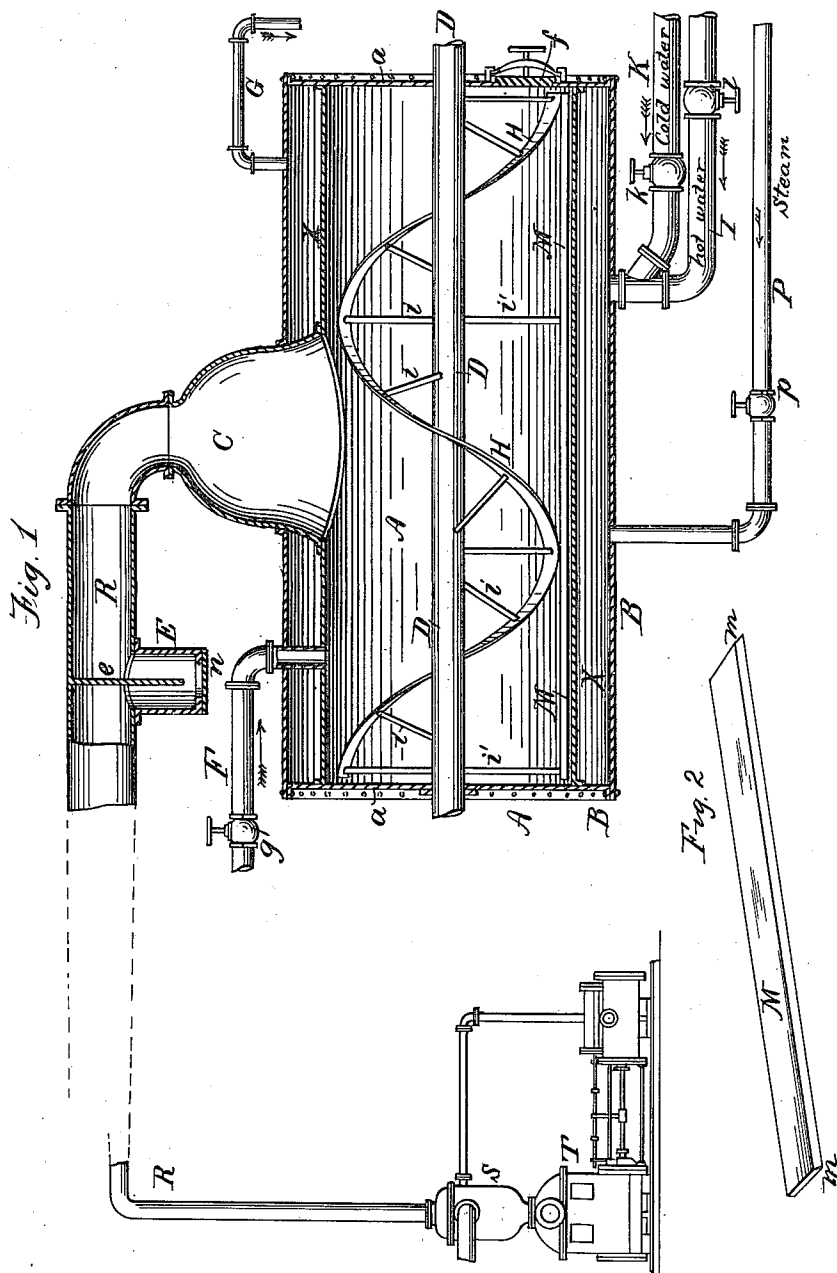
(No Model.)

J. H. HANCOCK.

VACUUM EVAPORATING APPARATUS.

No. 357,481.

Patented Feb. 8, 1887.



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UNITED STATES PATENT OFFICE.

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VACUUM EVAPORATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 357,481, dated February 8, 1887.

Application filed August 10, 1886. Serial No. 210,561. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. HANCOCK, a citizen of the United States, and a resident of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Vacuum Evaporating Apparatus, of which the following is a specification.

This invention relates to improved vacuum apparatus for evaporating liquids or semi-liquid substances and reducing them to a dry and granular condition at a comparatively low and readily-regulated temperature.

In the concentration of sirups or sugar solutions and liquid or semi-liquid dietetic compounds it is customary to employ a vacuum-pan containing steam-coils and with a part of its lower half enveloped in a steam-jacket. It is found in practice that when the liquids or semi-liquids are evaporated to the dry or granular condition in ordinary pans they are liable to become discolored and given a disagreeable flavor and incrustated upon the steam-coils, and the batch thus be spoiled in consequence of the high temperature of the steam employed.

The object of this invention is to avoid these defects; and in carrying out my invention I provide a cylindrical vacuum-vessel, surrounded circumferentially by a water-jacket for the circulation of hot water, so that a uniform and readily-controlled heat of the desired temperature may be applied to all sides of the fluid or mass to be evaporated, and connect with such jacket supply-pipes for hot and cold water and steam and an exhaust or overflow pipe. I also provide the evaporating-cylinder with a central longitudinal shaft having a connected spiral agitator and a longitudinal scraper-blade arranged to scrape the entire inner periphery of the cylinder, whereby fluid and semi-fluid substances may be so agitated as to prevent cohesion or agglutination into an unmanageable mass, and be readily brought to a powdered or granular condition.

The evaporating-cylinder is connected with the usual condenser and exhaust-pump used with vacuum-pans.

The matter constituting my invention will be defined in the claims.

I will now more particularly describe my

invention with reference to the accompanying drawings, in which Figure 1 represents a vertical longitudinal section of my improved evaporator and the condenser and exhaust-pump in elevation. Fig. 2 represents a detached perspective view of the scraper-blade.

The cylindrical evaporating-chamber A may be made of copper or other suitable metal, and has riveted to its ends the heads *a*, which are of larger diameter and project circumferentially a sufficient distance to connect with the larger outer cylinder or jacket, B, to which they are riveted by an outwardly-turned flange. The jacket B is enough larger than cylinder A to form between them a circumferential water-space, X, of several inches, more or less, depending upon the size of the apparatus. The dome C is arranged centrally at the top of the evaporator, and is riveted to the inner and outer cylinders and connects with the exhaust-vapor pipe R, leading to the usual condenser, S, and pump T. Pipe R is provided with the usual overflow-chamber E and depending stop-plate *e*, and chamber E has at the bottom a removable closing plate or door, *o*. The head *a* is provided with an opening near the bottom of cylinder A, closed by a door, *f*, having means for tightly securing it to its seat. This opening serves for the removal of the dried contents of the evaporator. An opening and door may be provided in each head of the cylinder. A hot-water-supply pipe, I, having valve *l*, connects with the under side of jacket B, and a cold-water-supply pipe, K, having valve *k*, connects, by a bent portion inclined toward the jacket, with pipe I. A steam-supply pipe, P, having valve *p*, also connects with the jacket. Overflow-pipe G connects with the upper side of the jacket for the escape of water to keep up the circulation in the jacket. A liquid-supply pipe, F, having valve *g*, projects through the jacket and connects with cylinder A.

The shaft D of the agitator passes centrally through the heads *a* in suitable stuffing-boxes and extends longitudinally through cylinder A. It is provided with the radial arms or spokes *i*, arranged spirally from end to end, and such spokes stop, preferably, several inches short of the inner surface of cylinder A, and have secured to their outer ends the spi-

rally-twisted blade H, which may be either wider or narrower than represented in the drawings. One or more agitator-blades may be secured to the spokes *i*, inside of blade H and nearer to shaft D, and one or more blades may be spirally twisted around the shaft in the opposite direction to the blade D shown, so as to form a double spiral agitator, operating to carry changing portions of the liquid or material under treatment in opposite directions at the same time. It is apparent that with a single spiral blade changing portions of the liquid or other material will be positively forced toward an end of the cylinder and then back by counter or return currents. In addition to the spiral blade or blades I provide one or more straight (or, if desirable, slightly curved) scraper-blades, M, secured to the outer ends of spokes *i* so as to almost touch the inner surface of cylinder A from end to end and operate to keep its entire surface clear of adhering particles, which are liable to accumulate without such scraper. The blade M is beveled at its outer edge, so as to readily cut through any hard or gummy portions which it might encounter.

The scraper is an important feature in connection with the agitator in my evaporating and drying cylinder, having its entire inner surface heated, as it uniformly removes heavy particles which would otherwise accumulate and adhere to the hot surface and most likely become overheated and discolored, giving objectionable color and flavor to the finished product. The shaft D is to be provided at one or both ends with a cog or belt wheel, and connect with suitable operating-gearing.

I gain important advantages by entirely surrounding the evaporating and drying cylinder with a water-heating jacket, as I thus subject the liquid or other material to a uniform low temperature on all sides, which will act efficiently and rapidly, but not injuriously.

In operation hot water is admitted in regulated quantity to the annular space X by pipe I, and in order to heat or maintain the water at a higher temperature steam may be admitted to the jacket by pipe P. Should the temperature in the evaporator rise too high, cold water is admitted to the jacket in regulated quantity by pipe K. It is evident that both hot and cold water may be simultaneously admitted in graduated quantities or proportions to the jacket by pipes I and K, and the excess be gradually conducted off at the top by overflow-pipe G, which will be provided with a controlling-valve. Since the water is admitted under pressure at the bottom, and is taken off at the top, the space X between the cylinders is kept full and imparts heat to the entire surface of cylinder A. When it is desired to cool the contents of cylinder A, the steam and hot water are shut off, and cold water alone is circulated through the jacket-space.

The dome is to be provided with a sight-opening and glass, and the necessary gages,

indicators, and testing devices are to be applied to the apparatus.

The evaporating-vessel may be of other form than cylindrical, such as spherical or oval, and when a cylindrical body is retained the heads may be made bulging or outwardly convex, and whether plain, as shown, or convex such heads may be provided with water-jacket spaces.

The water and steam supply pipes may connect with the jacket above its bottom; but the arrangement should be such that the water will circulate through the jacket-space and flow off at the top.

Under some circumstances fire heat, as flame and hot products of combustion, might be applied directly to the water-jacket in lieu of using steam for keeping the water hot which is circulated in the jacket.

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

1. A vacuum evaporating-vessel having a surrounding water-jacket and the connected water supply and discharge pipes arranged to maintain a circulation of water in the jacket around the evaporating-chamber, in combination with means for keeping the circulating water hot, and the exhaust or vacuum apparatus, as and for the purpose described.

2. In combination with an evaporating-vessel having a surrounding water-jacket, the water discharge and supply pipes suitably connected, as described, to maintain a circulation of water in the jacket around the evaporating-chamber, and a steam-supply pipe connecting with the jacket for keeping the circulating water hot, as described.

3. In combination with an evaporating-vessel having a surrounding water-jacket, a hot and a cold water supply pipe having valves and connecting with such jacket below its top, and overflow-discharge pipe leading from the top of such jacket for maintaining a circulation of water therein.

4. A water-jacketed cylindrical vacuum evaporator having a shaft and spirally-twisted agitator-blade, whereby all portions of the liquid or other material under treatment may be subjected to a gentle heat on all sides.

5. A cylindrical vacuum evaporator having a shaft and spirally-twisted agitator-blade and a scraper secured adjacent to the inner surface of the cylinder upon arms projecting from the agitator-shaft.

6. A horizontal cylindrical vacuum evaporator having an agitator and a scraper blade connected to the shaft and placed adjacent to the inner surface of the cylinder for keeping it clear of adhering particles, as described.

7. A cylindrical evaporator having a surrounding water-jacket, whereby the evaporator and its contents may be heated on all sides, in combination with a revolving scraper-blade connected with a central shaft.

8. A cylindrical evaporator having a sur-

rounding water-jacket and means for maintaining a circulation of hot water in such jacket, in combination with a spiral agitator and a connected vacuum apparatus, for the
5 purpose described.

In testimony that I claim the foregoing as my invention I have signed my name, in pres-

ence of two witnesses, this 6th day of August, 1886.

JOHN H. HANCOCK.

Witnesses:

J. G. P. HOLDEN,
C. H. BUCK.