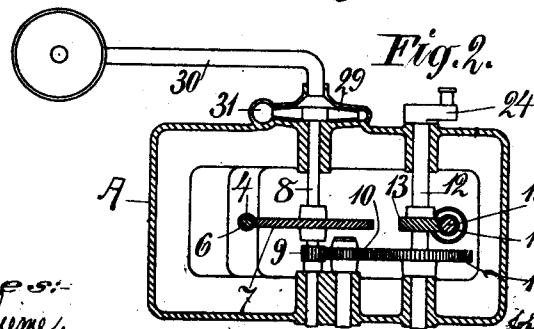
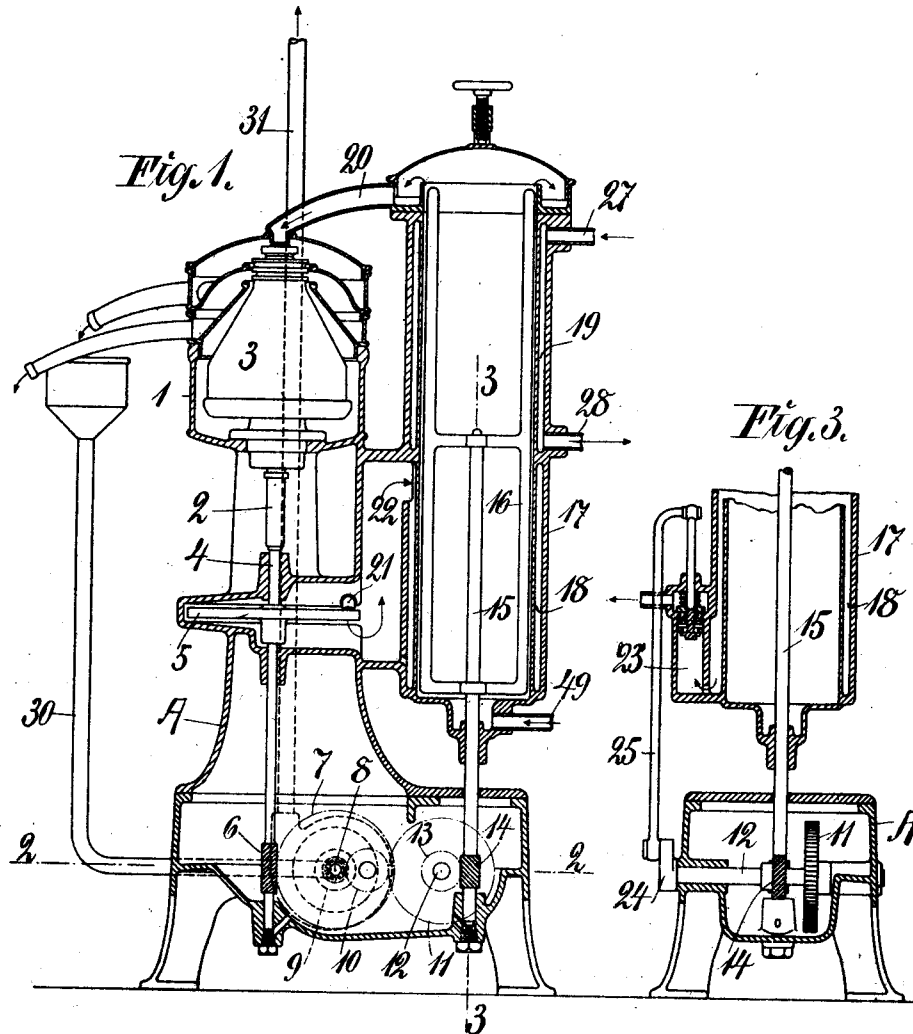


J. V. M. RISBERG.  
 COMBINED STEAM TURBINE CENTRIFUGAL LIQUID SEPARATOR AND LIQUID HEATER.  
 APPLICATION FILED APR. 20, 1912.

1,062,853.

Patented May 27, 1913.

2 SHEETS—SHEET 1.



Witnesses:  
 Henry B. Thome.  
 George Barry.

Inventor:  
 Johannes Valdemar Martin Risberg  
 by his attorney  
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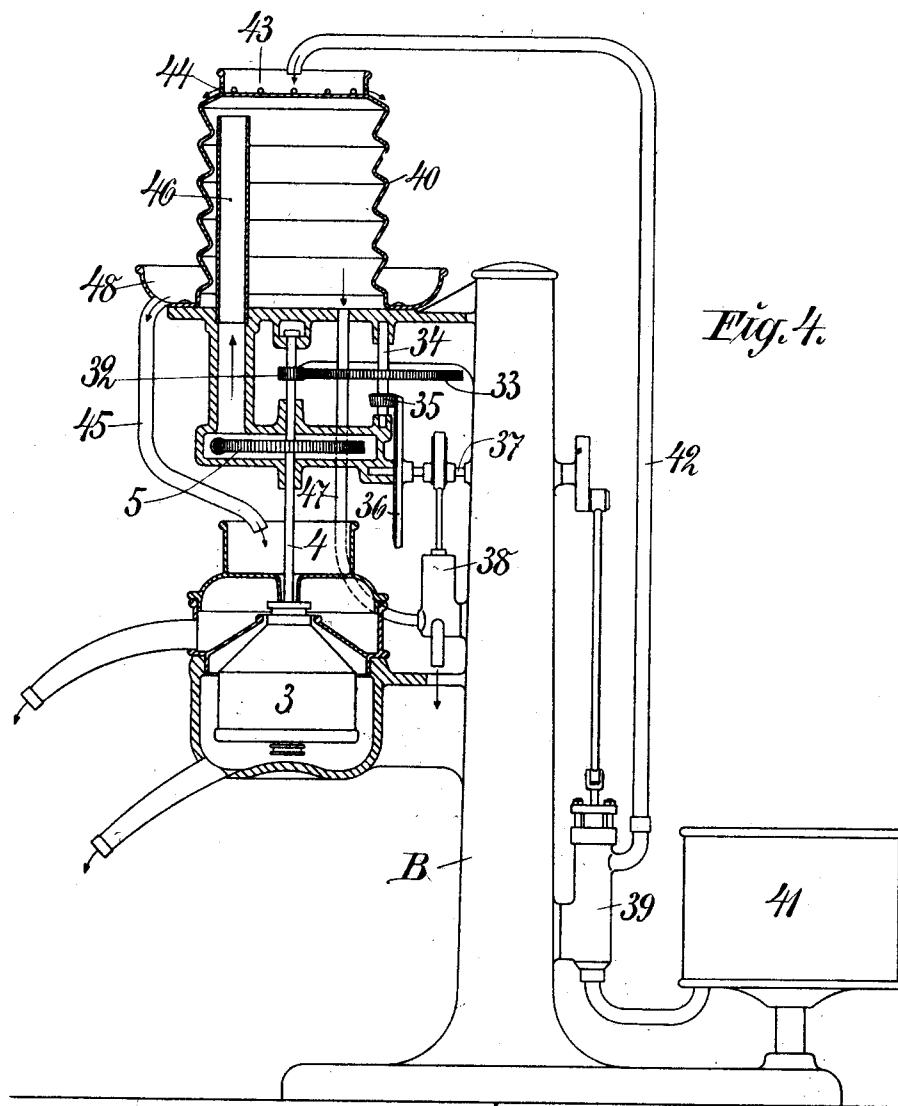


Fig. 4.

Witnesses:  
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# UNITED STATES PATENT OFFICE.

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COMBINED STEAM-TURBINE CENTRIFUGAL LIQUID-SEPARATOR AND LIQUID-HEATER.

1,062,853.

Specification of Letters Patent.

Patented May 27, 1913.

Application filed April 20, 1912. Serial No. 692,142.

*To all whom it may concern:*

Be it known that I, JOHANNES VALDEMAR MÅRTEN RISBERG, a subject of the King of Sweden, and resident of Fridhem, Södertelje, in the Kingdom of Sweden, have invented certain new and useful Improvements in Combined Steam-Turbine Centrifugal Liquid-Separators and Liquid-Heaters, of which the following is a specification, reference being had therein to the accompanying drawings.

In a great many dairies, in which a few hundredths of liters of milk are treated by the day, a manually operated centrifugal liquid separator is generally used for the skimming of the milk, and for the heating of the milk previously to the skimming operation steam is used delivered by a steam-generator of simple construction, generally a so called "steam-pot", generating steam of low pressure. Turbine-centrifugal-milk-separators, which are very suitable for the treating of small quantities of milk, can not be used for the purpose just mentioned for the reason that steam of high pressure is required for their actuation.

The object of this invention is, therefore, to so arrange the turbine-separator and the milk-heater, that the turbine can be actuated by steam of low pressure. This object is gained by shutting off the steam chamber or jacket of the milk heater from the exterior air, so that air can not enter the same, and by the exhaust steam of the turbine being led into the said chamber and condensed in the same, while delivering its heat to the milk, not only the water of condensation but also air and steam contained in the said steam chamber being then pumped out, so that vacuum is created in the chamber and consequently in the casing of the turbine. The steam generated by the steam-pot and entering the turbine through the nozzle of the same will then expand from the atmospheric pressure to the same pressure as prevails in the steam chamber of the milk heater or the condenser, so that the velocity of the steam jet, escaping through the said nozzle, is substantially the same as the velocity of steam expanding in a high-pressure turbine from a certain pressure above atmospheric, for instance four atmospheres, to the atmospheric pressure. Furthermore, the wheel of the turbine op-

erates in a vacuum, so that losses caused by friction and the fanning operation of the blade wheel, are obviated. Owing to the said fact the steam jet is able to deliver the energy necessary for the driving of the turbine. Owing to the fact that there is a vacuum in the steam chamber of the milk heater, the temperature in the said chamber is only 50° to 60° centigrade, but the said temperature is entirely sufficient for the heating of the milk to a temperature suitable for the skimming operation, which generally is not higher than 40° to 50° centigrade. The advantage gained by the arrangement stated above consists in the expensive hand-power for the driving of the separator being obviated, at the same time as the motive power is provided, practically, gratis, because steam under all circumstances must be generated for the heating of the milk. A further advantage gained by the said arrangement consists in the owner of the dairy being spared from the instructions, which generally must be observed in the installation of a steam generator for high pressure, and besides low pressure steam generators are cheaper and managed more easily.

In the accompanying drawings Figure 1 is a vertical section of a combined turbine-centrifugal-milk-separator and milk-heater arranged in accordance with this invention. Figs. 2 and 3 are sections on the lines 2-2 and 3-3 respectively in Fig. 1. In Figs. 1 to 3 inclusive the invention is shown applied to a turbine-separator, in which the centrifugal drum of the separator is mounted on the top end of its spindle and the driving mechanism is located below the said drum. Fig. 4 is a vertical section and partially a side elevation of a turbine-separator with milk-heater, arranged in accordance with this invention, in which the driving mechanism is located above the separator drum, which is suspended to the lower end of the shaft of the turbine. The milk heater shown in Fig. 4 has no stirrer and the milk flows down a corrugated cylinder of sheet metal or the like, the interior of which forms the condensing chamber.

A, Figs. 1, 2 and 3 is the frame of the apparatus.

1 is the centrifugal liquid separator. The spindle 2 of the centrifugal drum 3 is con-

nected directly with the shaft 4 of the turbine 5. The said shaft 4 rotates by means of a worm gear 6, 7 an intermediate shaft 8, which by means of a gear 9, 10, 11 actuates a second intermediate shaft 12, which in its turn by means of a worm gear 13, 14 rotates a shaft 15, carrying the stirrer 16 of the milk heater. The stirrer 16 is not shown in Fig. 3. The said heater consists of a receptacle 17, in the wall of which two (or more) steam chambers or jackets 18, 19 are provided, one separated from the other. The milk enters the receptacle 17 through a pipe 49 located at the bottom of the receptacle, and leaves the same in a heated state through a pipe 20 communicating with the top part of the receptacle and with the centrifugal liquid apparatus 1. The low-pressure steam generated in a steam-pot (not shown) passes into the turbine through the nozzle 21 and the exhaust steam from the said turbine is led through a passage 22 into the jacket 18, in which it is condensed by being cooled by the milk contained in the heater 17. The steam jacket 18 communicates at its bottom with a piston pump 23, actuated by the shaft 12 by means of a crank 24 and a pitman 25. The said pump is of the ordinary type used in combination with condensers and removes from the steam jacket 18 not only the water of condensation but also the air and steam, which possibly has not been condensed, so that vacuum is created in the jacket 18 and consequently also in the casing of the turbine. This results in such a great velocity being imparted to the steam jet, acting upon the blade wheel of the turbine, that the said jet is able to rotate the turbine and the parts driven by the same. The exhaust steam of the turbine has a temperature of about 50° to 60° centigrade, which is sufficient to heat the milk in the receptacle 17 to a temperature suitable for the centrifugal operation. Consequently, the steam, hitherto used only for the heating of the milk, is used also for driving the centrifugal apparatus, the stirrer of the milk-heater and also the pump effecting the vacuum in the steam jacket 18 of the said heater. The pump may be of any suitable construction, for instance a piston pump, as shown in the drawings, or a centrifugal pump adapted for the purpose, which, for instance, may be connected directly with the shaft of the turbine, as easily understood by those skilled in the art. Two pumps may, evidently, be used, one for removing the water of condensation from the steam jacket 18 of the milk-heater serving also as a condenser, and the other for removing air and steam from the said jacket. The water of condensation may, if wanted, be returned to the steam-pot.

As stated above, the milk heater is provided with two steam jackets 18 and 19.

The top jacket 19 which we term a supplemental jacket, may be connected directly with the steam pot through a pipe 27 for the supplying of fresh steam, which then escapes through a pipe 28. The said steam jacket 19 is provided for the heating of the milk; if necessary, to a temperature higher than that effected in the condenser, for instance to the sterilizing temperature viz. 80° centigrade. If no such heating is desired, the steam jacket 19 is dispensed with. A milk pump 29, consisting for instance of a centrifugal pump, as shown in the drawings, is connected directly with the intermediate shaft 8 and forces the skimmed milk, leaving the centrifugal apparatus and passing to the pump through a pipe 30, upward through a pipe 31, communicating with a cooling apparatus, a tank or the like (not shown).

In the combined turbine-centrifugal-milk-separator and milk-heater shown in Fig. 4 the parts are mounted on a frame B. The centrifugal drum 3 is suspended directly to the shaft 4 of the turbine 5. The said shaft 4 rotates by means of a gearing 32, 33 at its top end a vertical intermediate shaft 34, which by means of a pair of bevel wheels 35, 36 rotates a horizontal intermediate shaft 37. The said shaft 37 operates a condenser pump 38 and a milk pump 39, which pumps are of any suitable construction.

The milk heater consists of a corrugated cylinder 40 of sheet metal or the like, resembling the ordinary surface milk cooler, except that the inner chamber of the cylinder is shut off from the exterior air. The milk is forced by the pump 39 from a tank 41 through a pipe 42 to a cup 43, provided on the top of the milk heater 40. The milk passes through openings 44 to the outer surface of the heater 40 and is spread on the same in a thin layer, while running downward to an assembling cup 48. The heated milk passes from the cup 48 last mentioned through a pipe 45 into the centrifugal apparatus. The chamber of the cylinder 40 communicates at its top part through a pipe 46 with the exit opening of the turbine and at its bottom with the condenser pump 38 through a pipe 47. Consequently, the water of condensation and the air are removed by the pump 38 from the milk heater 40 as in the apparatus shown in Figs. 1 to 3 inclusive, so that the apparatus operates in the same manner as the combined turbine-centrifugal-apparatus first described. If the milk tank 41 is located at a sufficiently high level, so that the milk flows by itself to the cup 42, the milk pump 39 may, evidently, be dispensed with. The invention may, evidently, be applied to the heating and separating of other liquids than milk. It is obvious that additional supplemental steam jackets similar to the steam jacket 19, may

be used, depending on the degree to which the milk is to be heated. If desired to heat to a lower degree, only one of these jackets may be used, and if to a higher degree, additional jackets may be used.

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

1. The combination of a steam turbine for a centrifugal liquid separator, a liquid heater, a steam chamber for said heater and communicating with the exhaust of the turbine, the said steam chamber being shut off from the exterior air, and a pump device communicating with the said steam chamber and removing water of condensation, air, and it may be, steam from the same for the creating of a vacuum in the chamber and in the casing of the turbine, substantially as described.

2. The combination of a steam turbine for a centrifugal liquid separator, a liquid heater, a steam chamber for said heater and communicating with the exhaust of the turbine, the said steam chamber being shut off from the exterior air, a pump device communicating with the said steam chamber and removing water of condensation, air, and, it may be, steam from the same for the creat-

ing of a vacuum in the said chamber and in the casing of the turbine, a supplemental steam chamber in the liquid heater, and means for supplying fresh steam to the chamber last mentioned, substantially as described and for the purpose set forth.

3. The combination of a steam turbine for a centrifugal liquid separator, a liquid heater, a steam chamber for said heater and communicating with the exhaust of the turbine, the said steam chamber being shut off from the exterior air, a pump device communicating with the said steam chamber and removing water of condensation, air and, it may be, steam from the same for the creating of a vacuum in the chamber and in the casing of the turbine, and a motion transmitting device connected with the shaft of the turbine and actuating the said pump device, substantially as described and for the purpose set forth.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

JOHANNES VALDEMAR MÅRTEN RISBERG.

Witnesses:

GRETA PRICE,

ROBERT APELGREN.