

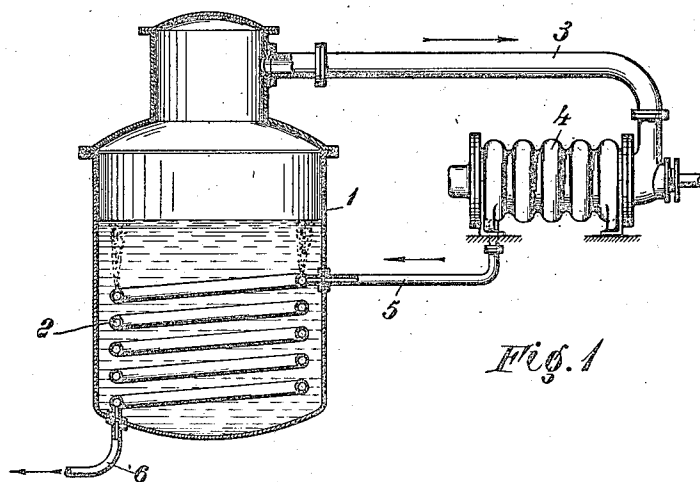
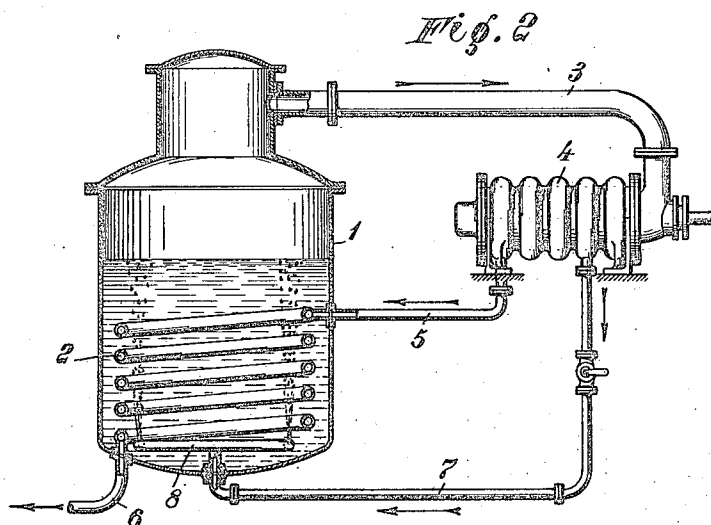
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E. WIRTH-FREY

PROCESS AND APPARATUS FOR EVAPORATING LIQUIDS

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Inventor:

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By *[Signature]*

att.

UNITED STATES PATENT OFFICE.

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PROCESS AND APPARATUS FOR EVAPORATING LIQUIDS.

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(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, ELIAS WIRTH-FREY, a citizen of the Republic of Switzerland, residing at Laurenzenvorstadt, Aarau, Switzerland, have invented certain new and useful Improvements in Processes and Apparatus for Evaporating Liquids, (for which I have filed applications in Germany, Nov. 11, 1917, application No. 29882; in France, Dec. 12, 1918, Patent No. 493794; in Italy, Dec. 16, 1918, Patent No. 80/490; in Germany, Mar. 5, 1918, application No. 30286; in Spain, Jan. 1, 1919, Patent No. 68782; in England, Oct. 20, 1918, Patent No. 123716; in Switzerland, May 8, 1920, Patent No. 87745; in Germany, April 13, 1920, application No. 33277; in Switzerland, May 21, 1920, application No. 5767; in Sweden, June 26, 1920, application No. 3134/20; in Norway, June 30, 1920, application No. 21184/20; in Germany June 14, 1920, application No. 33565; in Switzerland, Mar. 31, 1921, application No. 12123; in Italy, April 4, 1921, application No. 301/1430; and in Canada, June 10, 1921, application No. 255139); and I do hereby declare the following to be a clear, full, 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, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to improvements in a process for improving the working of compressors and of evaporating plants and has particular reference to evaporating plants in which the vapours emanating from the liquid to be evaporated are used in a compressed condition in a closed heating body for heating said liquid. It is a well-known fact that the utilization of compressed vapours for evaporating purposes is only economical if said vapours are compressed to a comparatively low surplus pressure. In such cases, however, the danger exists, that already with small variations in the evaporation the working of the compressor becomes unstable i. e. that a working condition presents itself in which the output of the compressor has diminished to such an extent that the pressure rise caused

in the compressor has reached its maximum amount, so that upon the slightest further decrease in output the pressure rise decreases as well whereby the latter is no longer sufficient for heating purposes so that the evaporation will be completely interrupted.

Although such disturbances might be small during the normal working of an evaporating plant, they may occur in quick succession during short intervals and thus cause a considerable decrease in the specific evaporation figure and thereby in the efficiency of the whole plant.

The object of the present process is to prevent the unfavorable action of such disturbances on the working of the plant. According to the invention part of the vapours emanating from the liquid and then compressed are introduced directly into the liquid to be evaporated. In this way a steady and uniform evaporation is promoted and maintained and an interruption of the evaporation is effectively prevented under any working conditions. A working of the evaporating plant that is free of interruptions and is satisfactory as regards efficiency may in many circumstances only be made possible by the process according to the invention.

It has already been known to conduct small quantities of steam into the liquid to be evaporated. This procedure however, only serves, in lieu of stirring devices or screw conveyors, to impart that strong mechanical motion to the thickened liquid that is necessary for preventing the latter from becoming burnt.

As the quantity of vapors directly introduced into the liquid to be evaporated in the form of open jets for the purpose of improving the working of the compressor and of the evaporating plant circulates through the vessel containing the liquid and through the compressor a certain amount of compression work has to be permanently performed in addition to the work for compressing the vapors utilized in the heating body. In order to decrease that additional compression work, the compression of the part of the vapors that is introduced directly into the liquid may according to another feature of the invention, only be effected to a pressure sufficient to overcome the hydrostatic

head in the vessel at the point of introduction. This means a comparatively important saving in compression work. The vapor directly introduced into the liquid to be evaporated may be compressed in a special auxiliary compressor to the pressure suitable for overcoming the hydrostatic head in the vessel or it may be taken from a lower pressure stage of the main compressor adapted to compress the bulk of the vapors utilized for heating purposes.

The accompanying drawing shows by way of example in a diagrammatic manner two arrangements of apparatus for carrying out the process according to the invention.

Figure 1 is a view partly in section of one form of apparatus, and

Fig. 2 is a like view of a modification.

1 denotes the vessel containing the liquid to be evaporated. The vapors emanating from the liquid are conducted by a conduit 3 to the suction end of a rotary compressor 4, in which they are compressed and discharged through a conduit 5 to a heating body 2 inside the vessel 1. The compressed vapors deliver their heat to the liquid surrounding the heating body, whereby they are condensed, the product of condensation being led off by means of the conduit 6. The heating body 1 is provided with apertures at 9 through which part of the compressed vapors is directly introduced into the liquid to be evaporated in the form of open jets. This arrangement in which the heating body 2 serves at the same time as distributor to the vapors directly introduced into the liquid to be evaporated presents the advantage, that the heating body is vented inasmuch as any air collecting inside said body, which air has a detrimental effect on the transmission of heat, can escape.

The second constructional example illustrated in Fig. 2 differs from that shown in Fig. 1 in as much as a special distributor 8 is arranged inside the vessel 1 through apertures of which the part of the compressed vapors utilized for improving the working of the compressor and of the evaporating plant is directly introduced into the liquid. In the arrangement shown said vapour is led to the distributor 8 through a conduit 7 which is connected up to a lower pressure stage of the compressor 4 (i. e. the second pressure stage of a five stage compressor).

In this way the vapors directly introduced into the liquid are only compressed to a pressure sufficient to overcome the hydrostatic head present in the vessel 1 above the distributor 8, whereas the greater portion of the vapors utilized for heating purposes is passed through all the stages of the compressor 4 and compressed to a higher degree than the vapor led to the distributor 8.

I claim:

1. A process of evaporation of a liquid, comprising with drawing all the vapors emanating from the liquid to be evaporated, compressing them, indirectly heating the liquid by means of a portion of such compressed vapors and liberating a second portion of the compressed vapors within the body of the liquid.

2. A process of evaporation of a liquid, comprising withdrawing all the vapors emanating from the liquid to be evaporated, compressing the greater part of said vapors, indirectly heating the liquid by said compressed vapors, compressing a second portion of said first mentioned vapors to a pressure sufficient to overcome the hydrostatic head in said liquid and freeing such second portion of vapor within the body of said liquid.

3. Apparatus for evaporating liquids, comprising a vessel for containing the liquid to be evaporated, heating means therefor, means for withdrawing and for compressing the vapors from said vessel and for supplying said compressed vapors to said heating means, and means for liberating a portion of the compressed vapors within the lower part of said vessel.

4. Apparatus for evaporating liquids, comprising a vessel adapted to contain the liquid to be evaporated, heating means therefor, means for withdrawing and for compressing the vapors from said vessel and for supplying the greater part of the compressed vapors to said heating means, means for compressing a second portion of said first mentioned vapors to a pressure sufficient to overcome the hydrostatic head in said vessel, and means for liberating such second portion within the lower part of said vessel.

In testimony whereof I have signed my name to this specification,

ELIAS WIRTH-FREY.