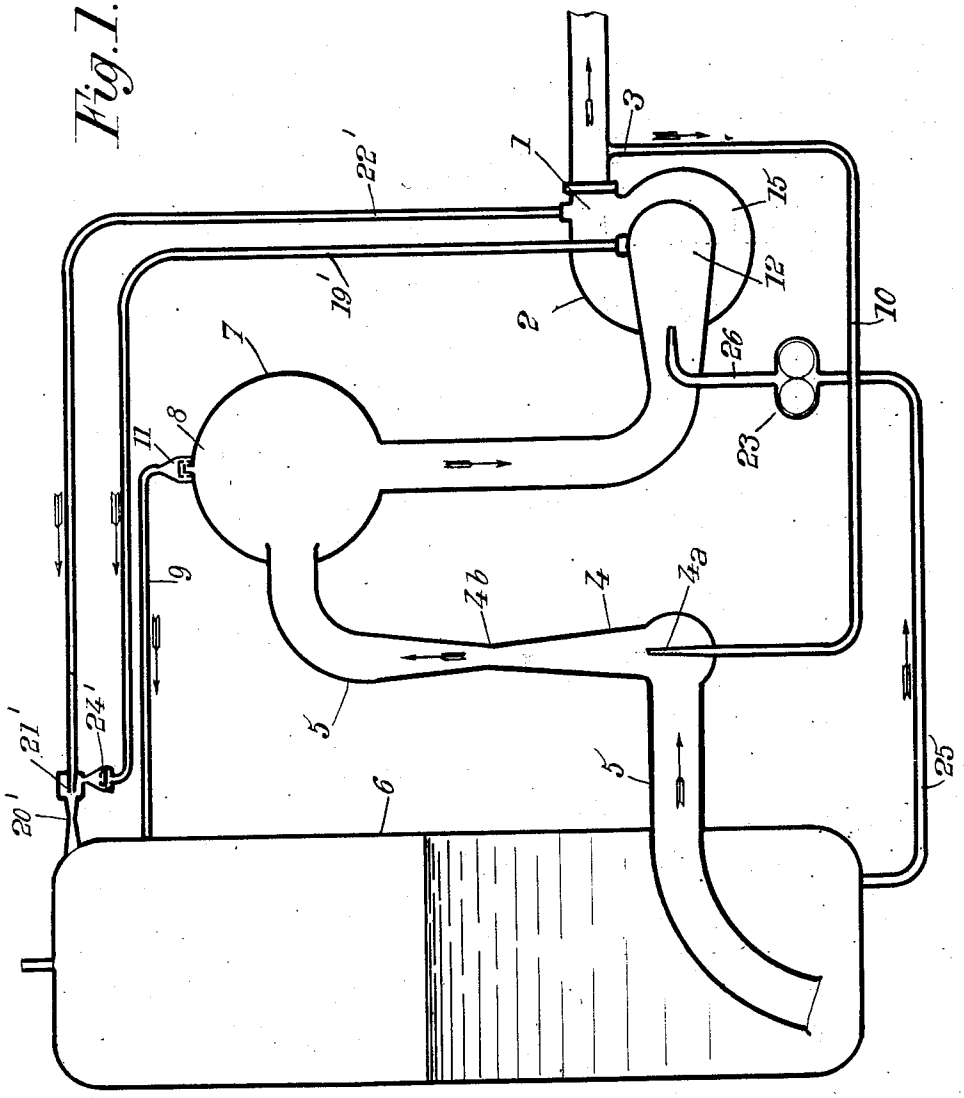
Feb. 18, 1958 R. LEDUC 2,823,613

CENTRIFUGAL PUMP ARRANGEMENT

Filed May 17, 1955 2 Sheets-Sheet 1

Fig. 1.



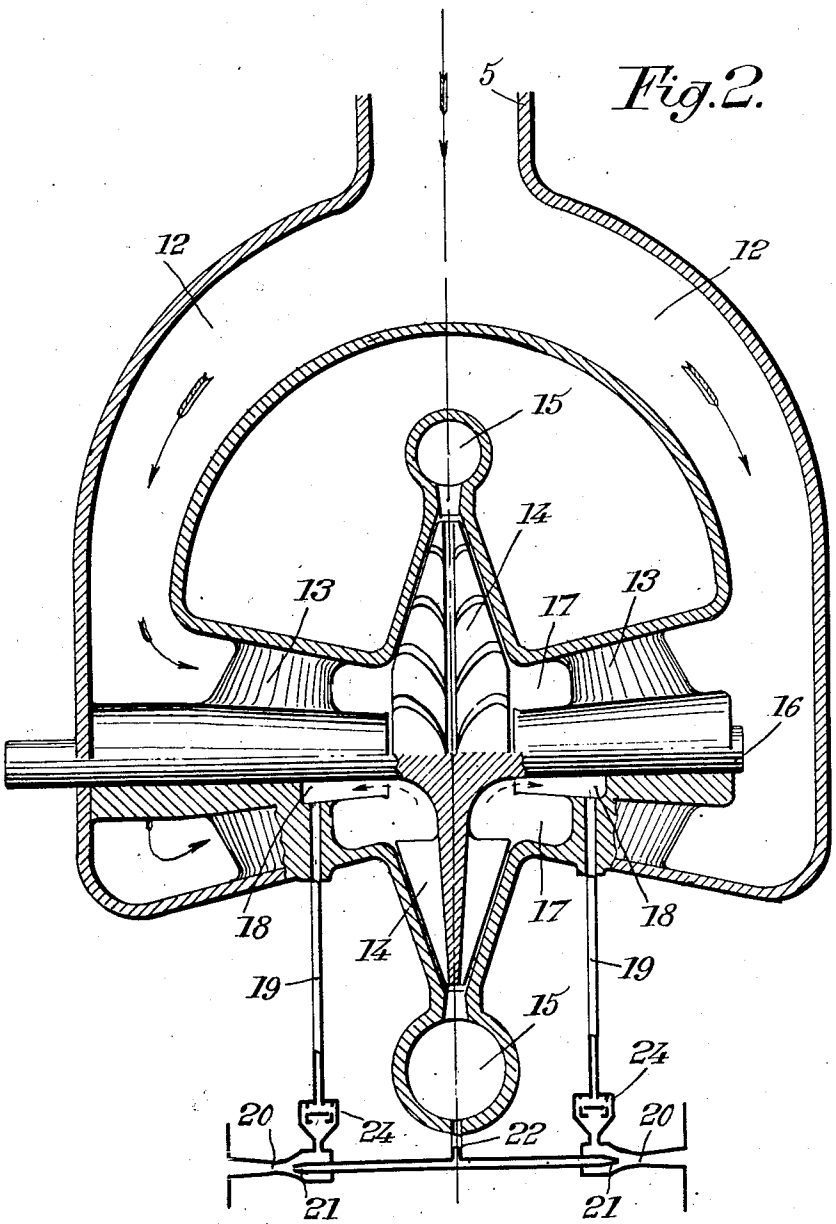
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Fig. 2.



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CENTRIFUGAL PUMP ARRANGEMENT

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4 Claims. (Cl. 103—113)

The present invention relates to a centrifugal pump installation, and more particularly to an installation of this type which is intended to be used at less than atmospheric pressure.

Under certain circumstances, as in modern aircraft, for example, it is necessary to operate centrifugal pumps at low pressures which are substantially less at atmospheric pressure, and under these circumstances the operation of a centrifugal pump is rendered difficult because fluids vaporize very easily at such low pressures and give rise to vapor lock. Furthermore, certain inconveniences arise because of the necessity of priming centrifugal pumps intended to operate under these conditions.

One of the objects of the present invention is to provide a centrifugal pump arrangement which eliminates the possibility of vapor locking.

Another object of the present invention is to provide a centrifugal pump arrangement with a means for carrying away gases and vapors which form within the centrifugal pump as well as within the conduits leading to the pump.

A further object of the present invention is to provide means for automatically priming a centrifugal pump in an arrangement of the above type, as well as for cooling and lubricating the pump when it runs dry.

With the above objects in view, the present invention mainly consists of a fluid means which includes a centrifugal pump having an inlet and an outlet. A supply conduit communicates with the inlet for supplying fluid thereto, and a means communicates with the outlet of the pump and with the supply conduit for injecting into the latter fluid taken from the outlet so as to maintain the inlet of the pump under pressure. The supply conduit includes as part thereof a container in the upper portion of which gases and vapors accumulate, and a conduit leads from this upper portion of the container to an upper portion of a tank which holds the liquid to be pumped so that these gases and vapors flow back to the tank. Furthermore, a means for providing a region of low pressure communicates with the outlet of the pump and a conduit leads from the interior of the pump, at a portion thereof where gases and vapors tend to accumulate to the region of low pressure, to draw such gases and vapors out of the interior of the pump.

This pump of the invention is preferably supplied from a part of a tank which is above the bottom thereof, and a part of the tank lower than the part supplying the centrifugal pump feeds liquid to a displacement pump which communicates with the inlet of the centrifugal pump for priming the latter as well as for cooling and lubricating the centrifugal pump when it runs dry because the liquid level in the tank is too low.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific

embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a schematic illustration of a centrifugal pump arrangement constructed in accordance with the present invention; and

Fig. 2 is a transverse sectional view on an enlarged scale of a pump of the type shown in the arrangement of Fig. 1, the conduits associated with the pump illustrated in Fig. 2 being arranged somewhat differently from the conduits of Fig. 1.

Referring now to Fig. 1, it will be seen that the centrifugal pump **2** has an inlet **12** and an outlet composed of the volute portion **15** which terminates at the outlet portion **1**. This pump is driven by any suitable motor or the like (not illustrated). Part of the liquid delivered by the pump to the outlet **1** is removed from the outlet by the conduit **3** and moves along the conduit **3** to the conduit **10** which forms a continuation of the conduit **3**, this conduit **10** feeding into an injector **4** in the form of a Venturi portion of a supply conduit **5** leading from the tank **6** to the inlet **12** of the conduit **2**. This injector includes, in addition to the Venturi portion **4***b*, a nozzle outlet **4***a* located at the end of the conduit **10** and communicating with the supply conduit **5** just upstream of the Venturi portion **4***b*, nozzle **4***a* feeding into this Venturi portion. An injector of a different construction may also be used with the arrangement of the present invention.

With this arrangement of the parts the supply of fluid to the pump is maintained under pressure. Moreover, this supply pressure may be maintained at a low value. For example, with a centrifugal pump designed to have a discharge in the neighborhood of 20 liters per second at a pressure of 45 kilograms, if the conduit **3** removes from the outlet of the pump in the neighborhood of 10% of its output the inlet pressure can be maintained at 700 grams, and such an arrangement greatly improves the operation and efficiency of the pumps and avoids such inconveniences as vapor lock.

Furthermore, as is illustrated in Fig. 1, a container **7** forms part of the supply conduit **5** and is located in the latter downstream of the Venturi portion **4***b* and upstream of the inlet **12** of the pump **2**. It will be noted that the container **7** is located at a higher elevation than the pump. Thus, any gases and vapors which form accumulate at the upper portion **8** of the container **7** and can be conducted away from this upper portion **8** of the container **7** by a conduit **9** which communicates with the portion **8** of container **7** and with an upper portion of the tank **6**. The conduit **9** can lead to any region where the pressure is lower than the supply pressure, and the tank **6** is one such region. A non-return valve **11** is advantageously located in the conduit **9** at the place where it is joined to the portion **8** of container **7**. This arrangement makes it possible to eliminate the greatest part of the gas which forms during such movement of the liquid in spite of the degasification apparatus placed at the supply conduit **5**.

The details of the pump **2** are illustrated on an enlarged scale in Fig. 2, from which it may be seen that the supply conduit **5** feeds into a pair of inlet portions **12** which communicate with the axis of the stationary housing **13** of the pump **2**. This housing **13** includes the volute outlet **15**, and the impeller **14** is fixed to the shaft **16** which is turnably carried on suitable bearings of the housing **13** and which is driven by any suitable motor, as pointed out above.

The housing **13** is formed with suitable passageways to direct the liquid from the inlet **12** to the impeller **14**, and the spaces **17** at the central portion of the impeller unavoidably form places where gas and vapors tend to accumulate in an undesirable manner.

In accordance with the present invention, the housing 13 is formed with a cutout 18 forming a gas and vapor collection space and preferably having the shape of an annular recess of a length greater than that of the spaces 17. Conduits 19 communicate with the space 18 and lead to a region where the pressure is lower than that prevailing in the space 18, such a region being located, for example, at the throats of the Venturis 20 shown in Fig. 2 and into which liquid is injected from the outlet 15 by the nozzles 21 at the ends of the lateral branches of the conduit 22 which communicates with the outlet 15 in the manner shown in Fig. 2. The Venturis 20 of Fig. 2 may communicate through any suitable conduits with a region such as the upper portion of the tank 6. Non-return valves 24 are advantageously located in the conduits 19 respectively, as indicated in Fig. 2.

The arrangement shown in Fig. 1 for removing gases and vapors from the interior of the pump is identical with that of Fig. 2 except that the conduits 19', which correspond to conduits 19, lead upwardly from the inlets 12 respectively to the Venturis 20' which are shown in Fig. 1 communicating with the upper portion of the tank 6 and which respectively communicate with the conduits 19', non-return valves 24' being provided in the conduits 19' respectively just upstream of Venturis 20' in the same way as in Fig. 2. The conduit 22' of Fig. 1, which corresponds to conduit 22 of Fig. 2, leads from the end 1 of outlet 15 to the nozzles 21' which feed into Venturis 20', respectively, the conduit 22' branching laterally to the nozzles 21' in the same way as in Fig. 2.

Referring again to Fig. 1, it will be seen that an auxiliary priming pump 23 of the displacement type, which may, for example, be a gear pump, is provided to prime the pump 2. This auxiliary pump 23 is much smaller than the pump 2 and communicates through a conduit 25 with a portion of the tank 6 which is lower than that portion thereof which communicates with the supply conduit 5. The outlet conduit 26 of the auxiliary pump 23 is branched to feed into both portions of the inlet 12 of the pump 2, the outlet conduit 26 terminating in nozzles in the manner indicated diagrammatically in Fig. 1. This arrangement of parts provides automatic priming of the pump 2 in a simple way. Furthermore, certain types of aircraft, such as those having thermo-propulsive ducts, are designed to stop the supply of liquid to the pump 2 when the liquid level in the tank 6 falls below a given value. In the example shown, it will be noted that the supply conduit 5 communicates with a part of the tank 6 above its lowermost portion, so that with this arrangement the pump 2 will stop operating when the liquid level approaches the bottom wall of the tank 6. However, it will be noted that the inlet conduit 25 of the auxiliary pump 23 communicates with a still lower part of the tank 6 so that even though the pump 2 continues to run dry the auxiliary pump 23 will nevertheless continue to supply to the pump 2 liquid which is capable of lubricating and cooling the pump 2.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of pump arrangements differing from the types described above.

While the invention has been illustrated and described as embodied in centrifugal pump arrangements, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

What is claimed is:

1. Fluid moving apparatus comprising, in combination, a tank for holding a supply of liquid to be pumped; a first conduit communicating with and leading from said tank for carrying liquid away from the same, said first conduit having a Venturi portion; a centrifugal pump having an inlet communicating with said first conduit downstream of said Venturi portion thereof and having an outlet; a second conduit communicating with said outlet and terminating distant from said outlet in a nozzle communicating with said first conduit upstream of said Venturi portion thereof and feeding into said Venturi portion; a container forming part of said first conduit and located therein downstream of said Venturi portion thereof and upstream of said pump inlet; and a third conduit communicating with an upper portion of said container and an upper portion of said tank for guiding gases and vapors from said container to said tank.

2. Fluid moving apparatus comprising, in combination, a tank for holding a supply of liquid to be pumped; a first conduit communicating with and leading from said tank for carrying liquid away from the same, said first conduit having a Venturi portion; a centrifugal pump having an inlet communicating with said first conduit downstream of said Venturi portion thereof and having an outlet; a second conduit communicating with said outlet and terminating distant from said outlet in a nozzle communicating with said first conduit upstream of said Venturi portion thereof and feeding into said Venturi portion; and a displacement pump communicating with a part of said tank lower than the part thereof communicating with said first conduit and also communicating with said first conduit downstream of said Venturi portion thereof and upstream of said pump inlet for priming said centrifugal pump and for cooling and lubricating the latter when the liquid level in said tank falls below the part thereof communicating with said first conduit.

3. Fluid moving apparatus comprising, in combination, a tank for holding a supply of liquid to be pumped; a first conduit communicating with and leading from said tank for carrying liquid away from the same, said first conduit having a Venturi portion; a centrifugal pump having an inlet communicating with said first conduit downstream of said Venturi portion thereof and having an outlet; a second conduit communicating with said outlet and terminating distant from said outlet in a nozzle communicating with said first conduit upstream of said Venturi portion thereof and feeding into said Venturi portion; a container forming part of said first conduit and located therein downstream of said Venturi portion thereof and upstream of said pump inlet; a third conduit communicating with an upper portion of said container and an upper portion of said tank for guiding gases and vapors from said container to said tank; and a displacement pump communicting with a part of said tank lower than the part thereof communicating with said first conduit and also communicating with said first conduit downstream of said Venturi portion thereof and upstream of said pump inlet for priming said centrifugal pump and for cooling and lubricating the latter when the liquid in said tank falls below the part thereof communicating with said first conduit.

4. Fluid moving apparatus comprising, in combination, a centrifugal pump including a housing formed with an inlet and an outlet for the pump and an impeller turnably carried by said housing within the latter and having a central portion spaced from the housing and defining with the latter a space through which fluid flows from said inlet to said impeller; injector means communicating with said outlet of said pump for creating a region of low pressure outside of said pump; a conduit communicating with said space and said region of low pressure for drawing gases and vapors out of said space; a supply conduit communicating with said inlet of said pump housing for supplying a fluid thereto; means communicating with said outlet of said pump housing and said supply conduit for injecting into the latter fluid taken from said outlet and for maintaining said inlet under pressure; a container forming part of said supply conduit and located in said supply conduit between said inlet and the part of said supply conduit which communicates with said means for injecting fluid taken from said outlet into said supply conduit, so that the acids and vapors accumulate in an

upper portion of said container; and a duct communicating with said upper portion of said container for carrying away the acids and vapors which accumulate therein.

References Cited in the file of this patent

UNITED STATES PATENTS

790,702	Nash	May 23, 1905
1,680,906	Neumann	Aug. 14, 1928
2,124,681	Jauch et al.	July 26, 1938
2,343,486	Stepanoff	Mar. 7, 1944
2,581,828	Adams	Jan. 8, 1952
2,612,844	Grise	Oct. 7, 1952
2,674,189	Lung	Apr. 6, 1954

FOREIGN PATENTS

25,988	Great Britain	of 1898
258,945	Switzerland	June 1, 1949
463,338	France	Dec. 13, 1913