M. LEBLANC.
ELASTIC FLUID COMPRESSOR.
APPLICATION FILED DEC. 5, 1911.

1,035,364. Patented Aug. 13, 1912.

Fig. 2.

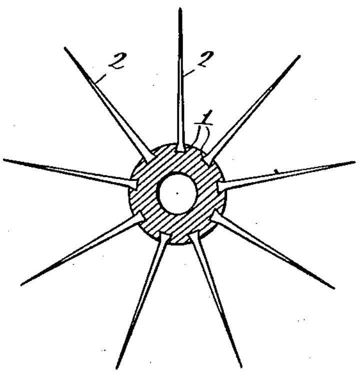


Fig. 3.

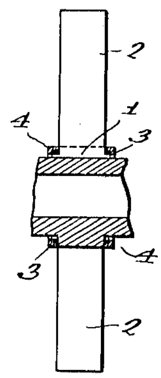


Fig. 6.

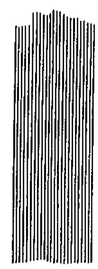
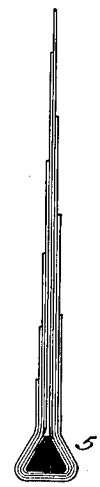


Fig. 5.



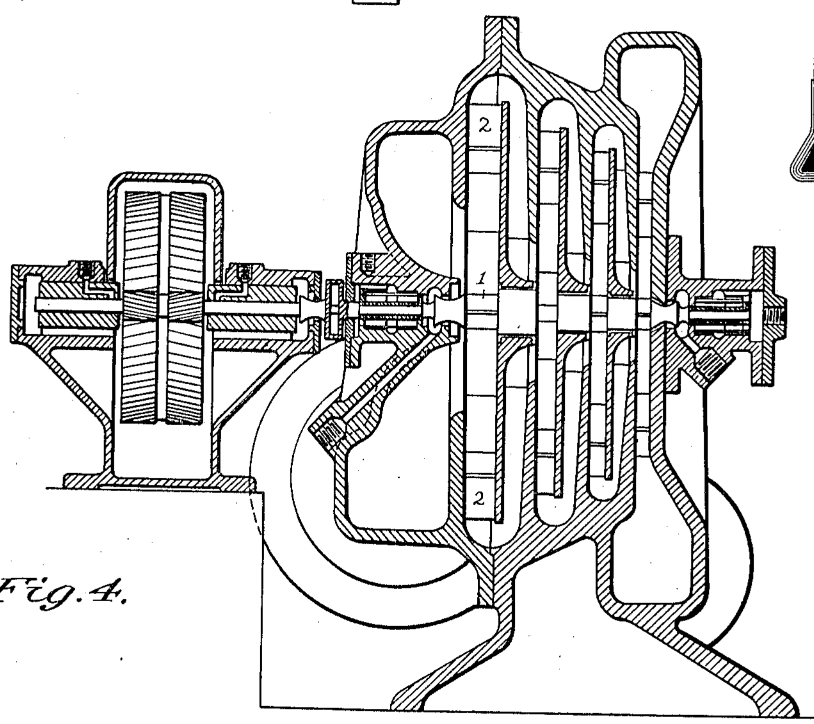


Fig. 4.

Fig. 1.

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UNITED STATES PATENT OFFICE.

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ELASTIC-FLUID COMPRESSOR.

1,035,364. Specification of Letters Patent. Patented Aug. 13, 1912.

Application filed December 5, 1911. Serial No. 664,086.

To all whom it may concern:

Be it known that I, Maurice Leblanc, a citizen of the Republic of France, residing in Croissy, Seine-et-Oise, France, have invented certain new and useful Improvements in Elastic-Fluid Compressors, of which the following is a specification.

This invention relates to an elastic fluid compressor of the rotary type, adapted to be constructed of any power, but particularly applicable to powers of a few horse power only, in which the rotors may be of small dimensions and may acquire a rotary speed of several hundred turns per second. The construction of the compressor is such that its rotors can attain peripheral speeds of several hundred meters per second whatever may be their angular speed, which is necessary if the compressor is to be used not only for compressing air taken in at the atmospheric pressure but also for producing and maintaining a high vacuum in an inclosed space.

The compressor which forms the object of this invention is composed of several compressing units operating by centrifugal force and associated in series. The general arrangement is similar to that of all apparatus of the kind.

The novel feature of the invention resides in the construction of the rotors and in particular the constitution of their blades.

Figure 1 of the accompanying drawings is a longitudinal section through the compressor. Fig. 2 is a transverse section and Fig. 3 a longitudinal section through one of the rotors. Fig. 4 is a diagrammatic representation of one of the blades drawn to an enlarged scale and seen in end view, showing that its profile is such that the blade has uniform resistance. Fig. 5 is an end elevation of one of the blades and Fig. 6 is a fragmentary side elevation thereof. The blade shown is rectangular, in side elevation. It may have any suitable profile provided that the width of the blade diminishes with the distance from the base and that its thickness decreases.

The blade suddenly expands at its base so as to constitute a heel of dove-tail shape. The nave of the rotor is carried by a shaft with which it is cast or forged, as shown in Figs. 2 and 3. Alternatively it may be shrunk hot on to the shaft. Trapezoidal notches 1 (Fig. 2) are made in the periphery of the nave for the purpose of receiving the heels 2 of the blades. To maintain the blades in place laterally, circular cells (Fig. 3) are provided at the ends of the nave on each side of the notch receiving the heel. Into these cells are introduced segments 4, 4, which expand, owing to their elasticity, and are held in place during working against the bottom of the cells by centrifugal force.

The blades constructed according to this invention are made of vegetable fibers, such as hemp, cotton, flax, or preferably ramie, united together by a suitable agglutinant, such as caoutchouc, balata, loréid, viscose, gelatin, a resin or a suitable gum. For the sake of illustration it may be supposed that caoutchouc is used.

The blades are made in the following manner:—A cylinder is covered with a helix of very close turns, consisting of a very homogeneously manufactured thread of the selected vegetable fibers, the winding being under tension. The whole is then painted over with a solution of caoutchouc containing sulfur and the cylinder is introduced into a stove for drying the solution and causing the threads to adhere to each other. This covering is then cut along a generatrix of the cylinder and unrolled. In this manner there is obtained a very thin rectangular band composed of rectilinear threads stretched parallel to each other and contiguous with each other (Fig 6). A number of these bands of different length are now folded over an ebonite wedge, such as that shown at 5 in Fig. 5, the arrangement being such that the super-position of the bands forms a body having substantially a profile of uniform resistance. The assemblage of bands is now introduced into a two part mold, the internal surface of which is stepped so as to follow the form of the blade, and is forcibly pressed therein. The mold is then introduced into the vulcanizing stove. When vulcanization is complete it only remains to remove the blade from the mold. There are thus obtained ebonite blades strengthened by vegetable fibers in the direction of their length but not in the direction of their width. Every precaution should be taken that in the course of the manufacture, the mass of agglutinant used shall be as small as possible compared with that of the vegetable fibers.

The mode of manufacture described above is given only by way of example; it may be varied notably with the nature of the agglutinant selected and with the treatment which determines the selection.

The blades thus made present the following advantages:

1. Their density is close to that of water. The tenacity of the vegetable fibers is sufficiently great to enable them to resist centrifugal force better than the fibers of steel which are seven to eight times as dense. This is a known fact, witness the manufacture of aeroplane propellers of wood instead of metal, owing to the high peripheral angular speeds that they are to attain. This result would not be obtained if the blades were made of bands of cloth in which the threads of the warp were stretched in the direction of their length. The threads of the weft would increase the mass of the blade without adding anything to its resistance in the longitudinal direction. They would give it, it is true, high resistance in the transverse direction, but that is useless, since the blade has no strain to support in this direction.

2. These blades do not suffer appreciably more elongation under the influence of centrifugal force than metallic blades of the same profile do. Moreover, they do not become deformed. This is because the threads have been stretched beforehand and could only become longer if the constituent fibers were themselves to be extended. On the other hand in a cloth fabric the threads are engaged with each other and have a wavy form. When a band of cloth is stretched in the direction of the warp for example the threads of the latter first straighten themselves and are much extended before the constituent fibers are appreciably extended. During this time the waviness of the weft threads is increased and the blade is deformed.

3. The blades have to turn between two metallic plates against which they may rub without injuring them. The blades wear at their edges, being ground to powder, which is immediately thrown outwardly until the friction ceases. If the blades were of metal each rotor would act as a cutter on the plates and would soon put them out of use. Thus the blades may be a little too wide in the first instance and may be turned between the plates at a reduced speed for the purpose of wearing them. The most simple arrangement is to have only extremely small play, this being allowable only in compressors of low power.

4. The blades keep themselves straight, all their fibers remaining perpendicular to the true axis of rotation under the influence of centrifugal force, the elasticity of the agglutinant permitting them to move slightly relatively to each other. The action of the blades cannot develop any appreciable couple on the nave or on the shaft which carries it, as would happen if they were metallic. The flexibility of the blades dispenses with the use of a flexible shaft.

Having thus described my invention and the best means I know of carrying the same into practical effect, I claim:—

1. In a rotary elastic fluid compressor, blades composed of vegetable fibers stretched parallel to each other radially to the rotor and united together by a suitable agglutinant, substantially as described.

2. In a rotary elastic fluid compressor, blades composed of fibrous material extended longitudinally of the blade and united by an agglutinant.

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

MAURICE LEBLANC.

Witnesses:

JULES ARMENGAUD, Jeune,

FERNAND BARRÉ.