O. H. MUELLER.

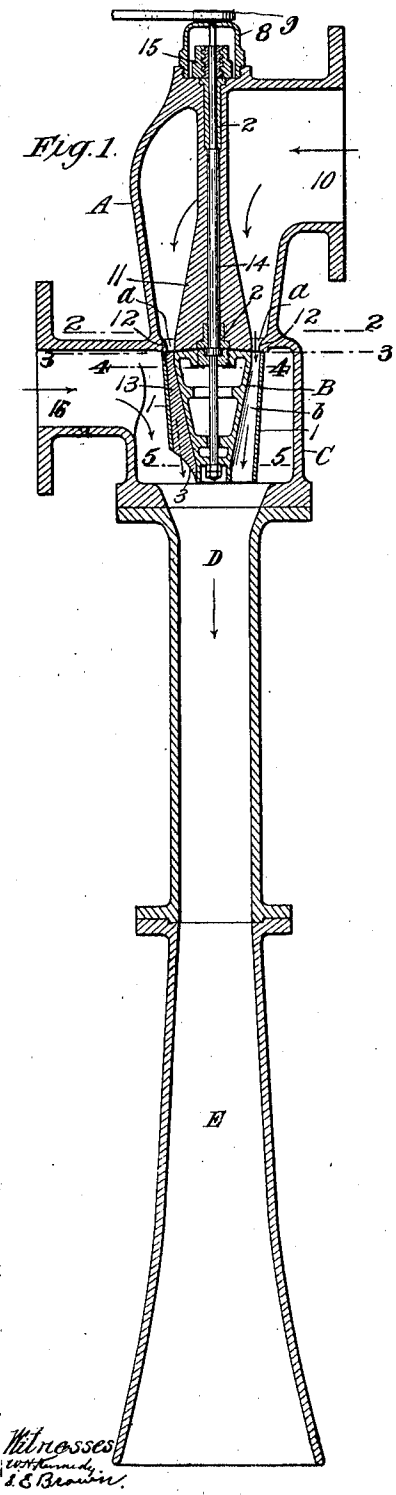
HYDRAULIC AIR COMPRESSOR OR PUMP.

APPLICATION FILED AUG. 14, 1909.

1,031,143.

Patented July 2, 1912.

Fig. 1.



Witnesses
W. H. Kennedy
J. E. Brown.

Fig. 2.

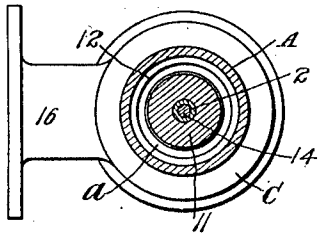


Fig. 3.

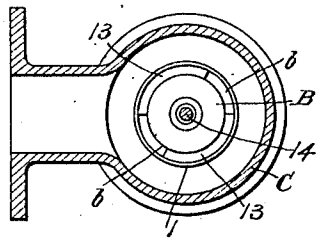


Fig. 4.

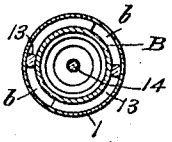


Fig. 5.

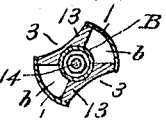
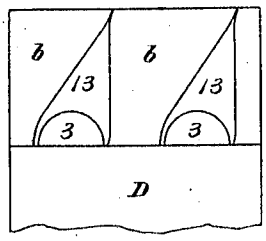


Fig. 6



Inventor.

Otto H. Mueller

by his Attys:

Philip Lawrence Rice & Kennedy

UNITED STATES PATENT OFFICE.

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HYDRAULIC AIR COMPRESSOR OR PUMP.

1,031,143. Specification of Letters Patent. Patented July 2, 1912.

Application filed August 14, 1909. Serial No. 512,776.

To all whom it may concern:

Be it known that I, OTTO H. MUELLER, a subject of the German Emperor, residing at Camberwell, county of Kent, England, have invented certain new and useful Improvements in Hydraulic Air Compressors or Pumps, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to a compressor or pump of that type in which a liquid is used for entraining and compressing or condensing the gaseous fluid, the especial object of the invention being to provide an improved apparatus of this class adapted especially to be used as an air compressor or vacuum pump.

In accordance with the present invention, the liquid enters the apparatus in a water jet of annular section, which may be produced by any suitable pump or other liquid supply. This annular water jet is split up by a wheel into a plurality of rotating jets, the wheel passages being arranged approximately parallel with the axis of the wheel, so that the liquid enters at one end of the wheel or cylinder and is delivered at the opposite end. The rotating jets from the wheel are received in a cylindrical or annular nozzle and the air or other gaseous fluid to be compressed is admitted at the inlet end of the nozzle passage, so as to be carried through the nozzle and compressed by the liquid jets from the wheel. The wheel is preferably driven by the pressure liquid, being provided with suitable vanes which secure this result and form the liquid passages.

The compressing nozzle may deliver into a diverging nozzle in which the velocity of the liquid is further decreased and the pressure of the air increased, and which may deliver into a barometric stand pipe or otherwise, or the compressing nozzle may be of such length and design as to complete the desired compression.

The water may be cooled so as to be used over and over again, if desired, and a plurality of the compressors or pumps may be used in series, so that each does only part of the compressing.

The invention may be applied, also, to condensing vapor.

In the accompanying drawings forming a part of this specification, there is shown for the purpose of illustration an apparatus embodying the invention in a simple and preferred form, especially adapted for use as an air compressor or vacuum pump, and this apparatus will now be described in detail and the invention then pointed out in the claims.

In the drawings:—Figure 1 is a vertical central section of the apparatus. Figs. 2, 3, 4 and 5 are cross sections on, respectively, the lines 2, 3, 4 and 5 of Fig. 1. Fig. 6 is a diagram showing the wheel passages and nozzle developed into a plane.

Referring to the drawings, A is the inlet chamber connected with the pressure liquid supply through inlet 10, and provided with a central circular core 11 forming with the shoulder 12 on the inlet chamber an annular jet opening *a*. Below the annular jet opening *a* and core 11 is mounted the wheel B having vanes or partitions 13, two being shown in the present case, between which are formed the water passages *b*, the upper ends of which at or near the inlet end of the wheel B are in line with the jet opening *a*. The passages *b* are not open radially to the periphery of the wheel but are closed by plate or cover 1 outside the passages.

The vanes 13 preferably have one of their sides inclined to the direction of the jet, so as to rotate the wheel by the pressure liquid. The vanes 13 thus widen toward the outlet end of the wheel and this construction is preferable as it permits the vanes 13 and cover 1 to be cut away near the wheel outlet so as to form air openings 3 by which the air is admitted in line with the outlet end of the wheel and between the liquid passages *b*. With this construction, the passages *b* gradually contract in width toward the outlet of the wheel, but they are preferably increased correspondingly in radial depth as shown, so that the combined area of the passages *b* at the outlet end of the wheel is the same, or nearly the same, as for the wheel opening at the inlet end of the wheel. While the rotation of the wheel is preferably secured by the pressure liquid, as

above described, the wheel may be rotated independently of the liquid and the latter do only the compressing work. In that case the inclining of one side of the vanes 13 to the direction of the jet is not necessary, but the vanes will nevertheless preferably be formed as shown, the air openings 3 thus being provided for and the construction being simple, compact, and especially efficient.

The wheel B may be mounted in any suitable manner, but is shown as carried by the shaft 14 extending through the hub 11 and supported in collar bearing 15 at the top of chamber A, being guided in bushes 2 at the top and bottom of the core 11. The shaft 14 is shown as extending above cap 8 and provided with a belt pulley 9 driven by belt 10 by which the wheel may be driven independently of or aided by the pressure liquid.

The wheel B is inclosed within an air chamber C to which air is admitted so as to surround the outlet end of the wheel through inlet 16, which is connected with the condenser or other chamber to be evacuated or with the supply of air for compressing.

Below the air chamber C and wheel B is a nozzle D in which the air is carried forward and compressed by the water jets from the wheel B. This nozzle is shown as having a flange mounted on the bottom of the air chamber C.

The nozzle D is shown as delivering into an expanding single chamber nozzle E, in which the velocity of the liquid is decreased and the pressure of the air increased, but it will be understood that the nozzle D may be of such length and form as to deliver without the diverging nozzle, or may deliver to a barometric stand pipe, or otherwise, as desired.

The operation of the apparatus will be understood from the above and brief description.

The water entering the wheel B from the annular jet opening *a* passes through the wheel at a high velocity and axially of the wheel. The vanes 13 being set at an angle to the jet, the wheel is rotated by the water, but as the wheel offers practically no resistance to the water, the direction of the water is not changed substantially, but the water is split up into a plurality of rotating jets, two jets in the present case. The liquid jets from the wheel B pass into the nozzle D past which they rotate, and the wheel jets are thus combined in the single chamber of nozzle D. The air admitted through inlet 16 to chamber C and surrounding the discharge end of the wheel B above the nozzle D is carried into the upper end of the nozzle D by the water, so that the water and air enter alternately, the air being thus entrained by the water and pushed downward, so as to be compressed by the water passing down the nozzle. The pressure on the discharge side of the nozzle being more than on the inlet side, the velocity of the water is naturally reduced as it passes through the nozzle and the pressure of the air increased, and this reduction of velocity and increase of pressure of the air is continued in the diverging nozzle E, if the latter be used. The nozzle D is shown as cylindrical, but may have a central core forming an annular passage. The continuous cylindrical or annular passage in which the wheel jets are combined into a single body secures an increased efficiency as compared with nozzles divided into a series of passages.

While the apparatus is preferably arranged vertically, and the rotation of the wheel is preferably secured by the pressure liquid, it will be understood that the broader features of the invention are not thus limited, but that the apparatus may be arranged for the flow of liquid otherwise than vertically, and that other modifications may be made in the apparatus shown within the invention defined by the claims.

The term air herein is intended to include gaseous or aeriform fluids generally.

What I claim is:—

1. The combination with a liquid supply and an annular jet inlet, of a wheel provided with a plurality of passages rotating in line with the jet inlet and extending through the wheel longitudinally of the wheel axis whereby the annular jet is divided into a plurality of rotating jets, a nozzle in line with the wheel passages in which the wheel jets are combined, and an air inlet for admitting air to the inlet end of the nozzle.

2. The combination with a liquid supply and a vertical annular jet inlet, of a wheel rotating on a vertical axis and provided with a plurality of vertical passages rotating in line with the jet opening by which the annular jet is divided into a plurality of rotating jets, a vertical stationary nozzle in line with the wheel passages in which the wheel jets are combined, and an air inlet for admitting air to the inlet end of the nozzle.

3. The combination with a liquid supply and an annular jet inlet, of a wheel having its axis within and concentric with the jet and provided with a series of vanes inclined to secure the rotation of the wheel by the water and forming passages by which the jet is divided into a plurality of rotating jets, a stationary nozzle in line with the wheel passages in which the wheel jets are combined, and an air inlet for admitting air to the inlet end of the nozzle.

4. In an apparatus of the class described, a wheel provided with a plurality of liquid passages extending through the wheel longitudinally of the wheel axis, in combina-

tion with a single compressing passage in line with the wheel passages and air inlets for admitting air to the compressing passage for compression by the liquid from the wheel passages.

5. In an apparatus of the class described, a wheel provided with a plurality of liquid passages extending through the wheel longitudinally of the wheel axis, in combination with a single cylindrical compressing passage in line with the wheel passages and air inlets for admitting air to the compressing passage for compression by the liquid from the wheel passages.

6. The combination with annular liquid inlet *a*, of wheel B having vanes 13 extending longitudinally of the wheel axis and forming liquid passages *b*, said vanes increasing in width toward the outlet end of the wheel, of a compressing nozzle in line with the liquid passages *b*, and an air inlet for admitting air to the inlet end of the nozzle.

7. The combination with annular liquid inlet *a*, of wheel B having vanes extending longitudinally of the wheel axis and forming liquid passages, a compressing nozzle in line with said liquid passages, and air inlets 3 formed in the outlet ends of the vanes between said liquid passages.

In testimony whereof, I have hereunto set my hand, in the presence of two subscribing witnesses,

OTTO H. MUELLER.

Witnesses:
F. L. RAND,
G. P. PHILLIPPS.