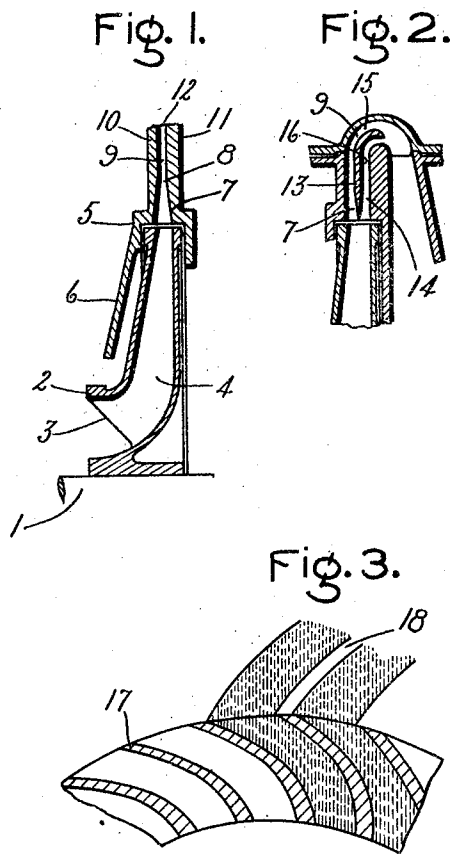


W. KIESER.
ROTARY COMPRESSOR.
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1,056,689.

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Witnesses:

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UNITED STATES PATENT OFFICE.

WALTER KIESER, OF CHARLOTTENBURG, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ROTARY COMPRESSOR.

1,056,689.

Specification of Letters Patent.

Patented Mar. 18, 1913.

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To all whom it may concern:

Be it known that I, WALTER KIESER, a citizen of Switzerland, residing at Charlottenburg, Germany, have invented certain new and useful Improvements in Rotary Compressors, of which the following is a specification.

The present invention relates to rotary compressors for compressing elastic fluids such as air, etc., and has for its object to improve their construction whereby their efficiency will be improved by overcoming certain faults that are now present.

My invention has particular reference to the construction of the annular fluid discharging and directing device that surrounds the impeller and which receives the fluid therefrom and converts its velocity into pressure. As heretofore constructed the fluid passes in this directing device has been either bounded by parallel walls or walls which diverge outwardly. The cross section of the fluid passage gradually increases from the inlet to the outlet so as to transform the velocity of the fluid into pressure. This transformation is accompanied by certain losses whose value increases as the transformation becomes more rapid. To state the matter in another way, these directing devices only act satisfactorily when the density of the fluid does not change suddenly. Tests have demonstrated that such sudden changes in density do occur and that they are the cause of certain losses for the following reasons: First, because the medium leaving the impeller does not enter the directing device in close jets on account of the blades of the impeller having substantial thickness at their outer ends where the fluid escapes, this being necessary to withstand the centrifugal and mechanical stresses, and second because the annular discharging device must have the same width as the impeller to avoid impact of the fluid in passing from one to the other. If the streams of fluid leaving the impeller have spaces between them, it follows that on entering the discharging device the fluid will suddenly expand. Further, in the wide directing passages or channels heretofore used and which extend radially outward, the velocity of the fluid is rapidly transformed into pressure by reason of the large internal

section of the passages. Another prejudicial action is due to the fact that the vane spaces in the impeller are never completely filled with the fluid undergoing compression so that the fluid on leaving said impeller and entering the directing device will suddenly expand in the fluid passages of the latter. To avoid all of these disadvantages, I provide the fluid discharging and directing device with a receiving portion that is sufficiently large to properly receive the fluid and whose cross section is gradually contracted outwardly from the point of admission to what may be termed the throat. The contraction of the passage or opening in the receiving portion may be obtained either by the mutual axial approximation of the walls of the receiving device or by introducing one or more suitably formed partitions, walls, or vanes in the channels or passages contained in said receiving portion. This arrangement prevents a sudden fall in pressure of the fluid undergoing compression prior to the actual transformation of velocity into pressure in said device. The contracted portion not only serves to conduct the fluid at its greatest density as received from the impeller to the directing device proper but also renders it possible to supply fluid to said device without danger of impact losses whereby the transformation of velocity into pressure in said device may take place quite gradually, the latter having fluid passages whose cross section gradually enlarges as the distance from the axis of the impeller increases. This gradual transformation of velocity into pressure is of prime importance.

In the accompanying drawing, which is illustrative of my invention, Figure 1 is an axial section of a part of a compressor; Figure 2 is an axial section of a part of a multistage compressor showing partitions, walls or vanes in the passages in the receiving and directing device; and Fig. 3 is a detail view showing the arrangement heretofore used and which is open to the disadvantages enumerated above.

1 indicates the shaft and mounted thereon is an impeller 2 having vanes 3 between which are outwardly opening passages 4. The periphery of the impeller is turned true and is inclosed by the fluid receiving, direct-

ing and discharging device 5. This device is supported by the wall 6 that may form a part of a diaphragm, the casing or other member of the compressor. It is provided with a receiving portion 7 whose walls converge to the throat 8. At this point the passages 9 in the directing device proper begin. The passages are formed by side walls 10 and 11 and partitions 12. The cross-sectional area of said passages gradually increases as the distance from the shaft increases. The partitions 12 may be of uniform section throughout their length or they may be varied as circumstances dictate. In any event, it will be noted that the space between the pitch centers of the partitions will be greater, measured circumferentially, at the outer than the inner diameter. This arrangement provides a simple and easy way for obtaining the proper increased area of the passages.

In Fig. 2 an arrangement is shown for conveying fluid from the discharge side of one impeller to the inlet of another mounted on the same shaft. The directing device is provided with a receiving portion 7 and a fluid conveying passage 9 connected thereto. In said portion and passage is located a partition 13 that is sharpened at the end adjacent the impeller and as the wall thickens to the point of maximum section a two-part throat 14 is formed, and from said throat to the point of discharge the velocity of the fluid is gradually converted into pressure. When the partitions are used in a multi-stage compressor as shown in Fig. 2, they need not extend inwardly but may stop short of a complete turn as shown, since the section of the passage will gradually decrease as they approach the shaft. Care should be taken to see that the outer end of each partition is tapered to avoid sudden changes in section of the fluid passages. The passages 15 and 16 on opposite sides of the partition gradually enlarge beyond the throat to convert the velocity of the fluid into pressure.

The method of operation is as follows: The fluid on leaving the vane spaces in the impeller is received by the receiver or receiving portion of the directing device 5 and is prevented from expanding by the contracting walls thereof. It is then supplied to the directing device proper wherein the conversion of velocity into pressure takes place. The pressure of the fluid leaving the impeller and that entering the passages 9 should be the same. The height of the constriction is the same as that of the passages in the device communicating therewith so that there will be a gradual transformation of the velocity of the fluid into pressure. By means of the structure illustrated, sudden impacts of the fluid are avoided in passing from the impeller to the directing de-

vice and also the too rapid transformation of the velocity of the fluid into pressure which would cause corresponding losses.

Viewed from one point the walls that form the constricted chamber, passage or passages 7 do not form a part of the fluid directing and discharging device proper and may for that reason be made of separated but united parts. From another point of view, the fluid directing and discharging device may be taken to include the whole structure that acts on the fluid after it leaves the impeller.

In Fig. 3 is illustrated the ordinary construction employed before my invention and which is open to the objections previously noted. It will be observed that the beveled ends of the vanes 17 on the impeller and of the partitions 18 in the directing device are relatively thick which results in a plurality of individual separated fluid streams which, unless the passages in both members register, will strike on the ends of the partitions. It will further be seen that the inlet area of the directing spaces is greater than the outlet area of the impeller spaces and hence there will be an objectionable and sudden change in pressure. In this connection it should be observed that the mouth of each passage in the directing device must be at least as long, measured axially, as the outlet of each vane passage in the impeller since otherwise the fluid undergoing compression will escape. On the other hand, if the partitions in the directing device are thickened to reduce the cross section the trouble incident to the fluid streams striking their ends will be greatly increased.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In a rotary compressor, the combination of an impeller that imparts velocity to the fluid, with a directing device which receives the fluid undergoing compression from the impeller for converting velocity into pressure, said device being provided with a portion containing one or more passages that decrease in cross section as the distance from the impeller increases for the purpose of collecting the fluid, preventing expansion thereof and delivering it to the directing device at the density it had when leaving the impeller.

2. In a rotary compressor, the combination of an impeller that imparts velocity to the fluid with a fluid directing device which comprises an inlet portion having converg-

ing walls forming a passage whose cross-sectional area decreases as it extends in the direction of flow to prevent change in the density of the fluid leaving the impeller and to collect it, and a fluid directing and discharging portion receiving fluid from the passage, said portion having walls and passages between said walls wherein the velocity of the fluid is converted into pressure.

3. In a rotary compressor, the combination of an impeller that imparts velocity to the fluid with a fluid directing device that surrounds it, said device being composed of a portion provided with collecting passages which receive the fluid from the impeller and prevent it from expanding or changing its density, and a discharging portion having passages which receive fluid from the collecting passages and convert its velocity into pressure, and partitions in the

passages of both of said portions which are tapered at their receiving ends to form a throat.

4. In a rotary compressor, the combination of an impeller, with a fluid discharging device which surrounds the impeller and receives the fluid therefrom, the said device comprising two principal portions each having passages with a throat between each two registering passages, one set of passages converging outwardly toward the throat and preventing a change in the density of the fluid leaving the impeller as it passes to said throat and the other diverging outwardly from the throat.

In witness whereof, I have hereunto set my hand.

WALTER KIESER.

Witnesses:

BERNHARD RUHNOW,
HERMANN HILLE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."