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FLUID-WORKING MACHINES

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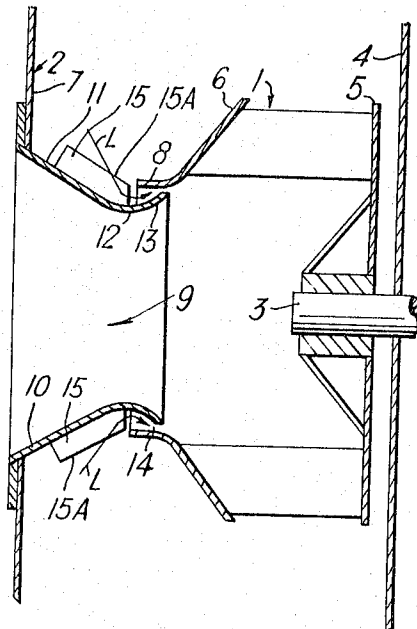


Fig. 1.

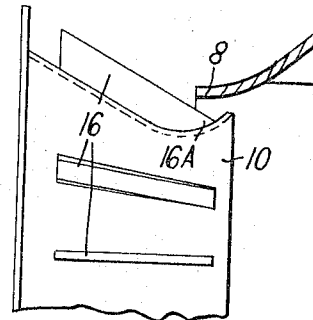


Fig. 2.

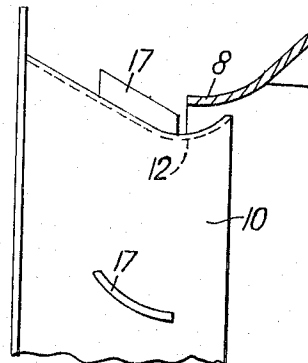


Fig. 3.

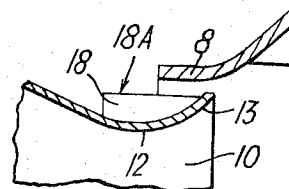


Fig. 4.

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FLUID-WORKING MACHINES

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2 Claims. (Cl. 230-127)

This invention relates to centrifugal machines such as centrifugal mixed flow, single and double inlet fans, and centrifugal blowers, pumps and compressors. The present invention is concerned with the kind of centrifugal machine which comprises a casing having a pair of spaced side walls, an impeller rotatable in the casing between the side walls and having its inlet side spaced from a side wall to define therewith an annular space into which high pressure fluid leaks from the impeller outlet, an inlet opening in said side wall, and an inlet conduit extending within the casing from the inlet opening and at its inner end forming with the impeller inlet an annular leakage orifice, the annular space opening into the annular orifice so that high pressure leakage fluid flows from the annular space axially through the annular orifice into the impeller.

The object of the invention is to improve a centrifugal machine of the aforesaid kind in a simple and inexpensive manner.

According to the present invention, we provide a peripheral series of axially extending guide vanes on the exterior of the inlet conduit to guide and stabilize the leakage flow of fluid through the annular space towards the annular orifice.

Each guide vane may extend axially in a radial plane containing the machine axis, or may be curved or sloped transversely of said plane. It is found that guidance of the leakage flow by the vane means results in an increase in machine efficiency and an increase in the stability of the machine performance curve relating pressure rise to volume flow.

An embodiment of the invention will now be described by way of example with reference to the accompanying diagrammatic drawing in which FIG. 1 is a sectional elevation of a single-inlet centrifugal fan, and FIGS. 2 to 4 are detail views showing modifications of the fan of FIG. 1.

Referring to the drawings:

A single-inlet centrifugal fan consists of a single-suction impeller 1 mounted within a volute casing 2 on a shaft 3 which extends through one side wall 4 of the casing and is secured to the adjacent side wall 5 of the impeller. The other side wall 6 of the impeller 1 is spaced from the other side wall 7 of the casing 2 to define with the wall 7 an annular space S through which high pressure fluid leaks from the impeller outlet towards the impeller inlet. The side wall or shroud 6 of the impeller is of substantially frusto-conical form and is outwardly convergent, terminating at its inner diameter in a cylindrical rim 8 defining the inlet eye of the impeller. The casing side wall 7 adjacent to and spaced from the inlet eye has an entry opening 9 therein, and a venturi-section conduit 10 fixed to the side wall 7 projects inwards from said opening 9 and terminates at its inner end within the cylindrical rim 8 so as to guide entry fluid through the casing 2 to the inlet eye. The conduit 10 may consist of a frusto-conical inlet portion 11, and a radiused portion merging smoothly into the inlet portion and constituting a throat

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12 and flared outlet 13. There is an annular passage 14 between the inner end of the conduit 10 and the bore of the rim 8 of the impeller to permit free rotation of the impeller, and in operation of the fan there is a free leakage flow of high pressure fluid from the impeller outlet, through the space S and annular passage 14 into the impeller, as indicated by the arrows L. A peripheral series of say 3 to 10 equispaced radial guide vanes 15 are secured to the exterior of the conduit 10, e.g. by welding, and extend over a major portion of the conduit length. The vanes' top edges 15A are substantially parallel to the outer face of the conduit 10, and the vanes terminate short of the conduits' inner end so that the inner ends of the vanes are spaced outwards from the end of the rim, as shown.

In the modification according to FIG. 2, the inner ends of guide vanes 16 terminate at or near the inner end of the conduit 10, so that end portions 16A of the vanes lie within the rim 8.

In the modification according to FIG. 3, the guide vanes 17 are relatively short and transversely curved, and are located upstream of the throat 12 of the conduit 10.

In the modification according to FIG. 4, the vanes 18 are relatively short, extending over the throat 12 and flared outlet 13 of the conduit 10, and with their top edges 18A substantially parallel to the fan axis.

In use of the fan, the guide vanes serve to guide and stabilize the leakage flow L of fluid in the zone S of the volute casing 2 around the conduit 10. When used with suitable impellers, the guide vanes in suitable number, shape, and location are found to give a marked increase in the fan efficiency and also an increase in the stability of the fan performance curve relating pressure rise to volume flow.

I claim:

1. In a centrifugal fan comprising a casing having a pair of spaced side walls, an impeller rotatable in the casing between the side walls and having its inlet side spaced from a side wall to define therewith an annular space into which high pressure fluid leaks from the impeller outlet, an inlet opening in said side wall, and an inlet conduit extending within the casing from the inlet opening and at its inner end forming with the impeller inlet an annular leakage orifice, the annular space opening into the annular orifice so that high pressure leakage fluid flows from the annular space axially through the annular orifice into the impeller; a peripheral series of axially extending guide vanes on the exterior of the inlet conduit to guide and stabilize the leakage flow of fluid through the annular space towards the annular orifice.

2. In a centrifugal fan comprising a casing having a pair of spaced side walls; an impeller rotatable in the casing between the side walls and having its inlet side spaced from a side wall to define therewith an annular space into which high pressure fluid leaks from the impeller outlet, and having an inlet which is defined by a cylindrical rim coaxial with the impeller; an inlet opening in said side wall; and a venturi section inlet conduit extending within the casing from the inlet opening and terminating within the cylindrical rim to define therewith an annular passage, the annular space opening into the annular passage so that high pressure leakage fluid flows from the annular space axially through the annular passage into the impeller; a peripheral series of axially extending guide vanes on the exterior of said inlet conduit

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to guide and stabilize the fluid flow through the annular space towards the annular passage.

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