June 3, 1930. E. GROSS 1,762,121

HYDRAULIC MACHINE

Filed Feb. 29, 1928 2 Sheets-Sheet 1

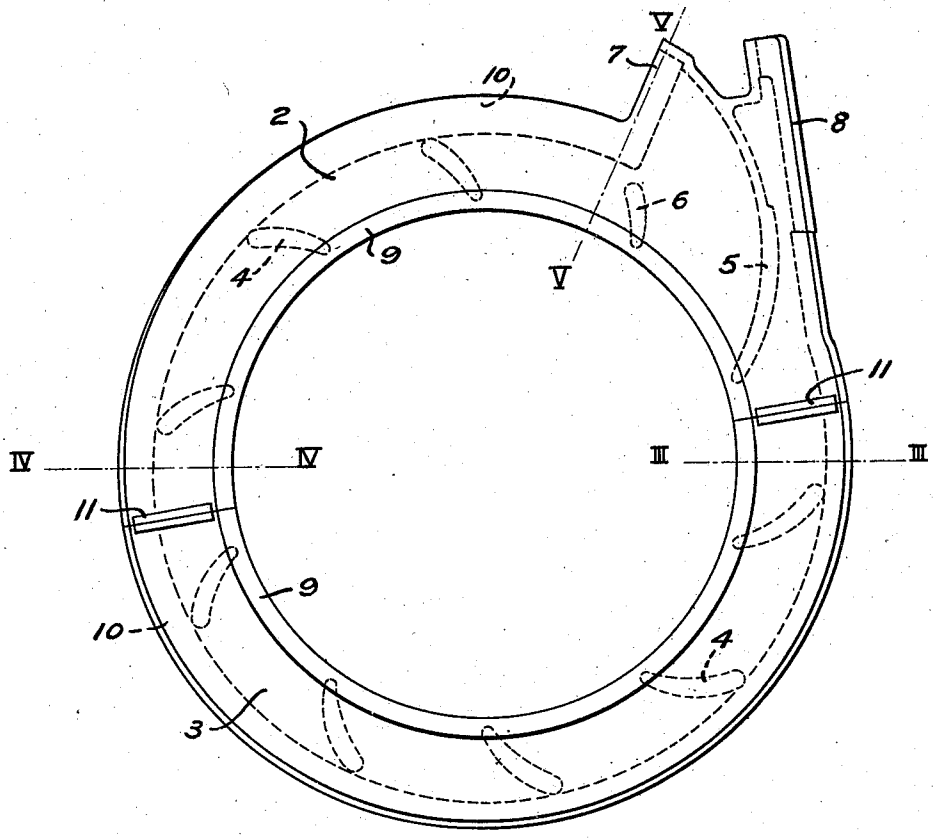


Fig. 1

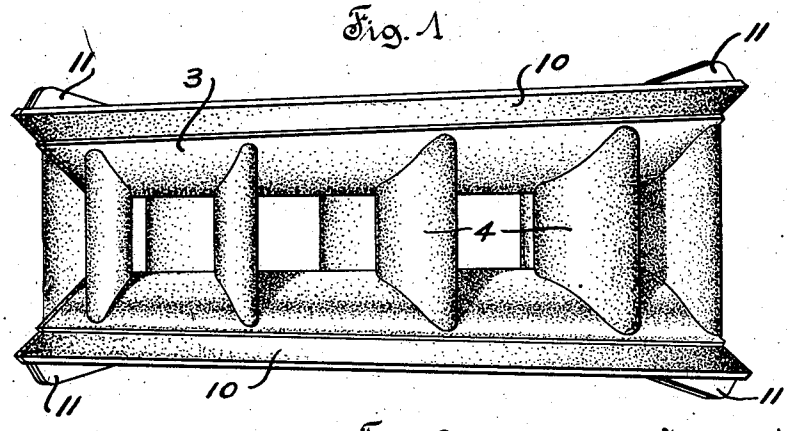


Fig. 2

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HYDRAULIC MACHINE

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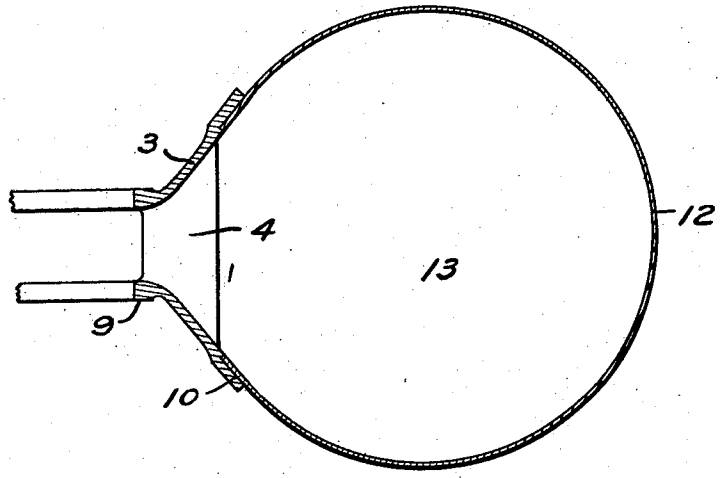


Fig. 3

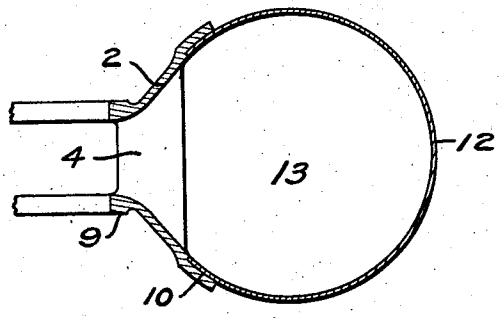


Fig. 4

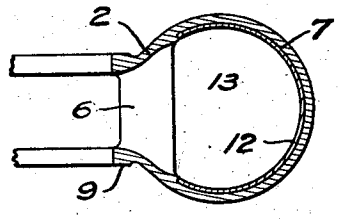


Fig. 5

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Patented June 3, 1930 1,762,121

UNITED STATES PATENT OFFICE

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HYDRAULIC MACHINE

Application filed February 29, 1928. Serial No. 257,806.

This invention relates in general to improvements in hydraulic machines, and relates more specifically to improvements in the construction of fluid guiding casings and speed rings for hydraulic turbines or the like.

An object of the invention is to provide improved fluid conducting structure for hydraulic machines, which will effectively guide the fluid with least disturbance, and which may be readily manufactured and assembled. Another object of the invention is to provide an improved speed ring structure for hydraulic turbines which will facilitate attachment of a spiral casing thereto, and which will effectively guide the fluid with a whirl toward the turbine rotor. A further object of the invention is to provide a combined speed ring and casing structure for hydraulic turbines wherein shock and eddies are positively eliminated, and which may be constructed with minimum difficulty. A further object of the invention is to provide an inlet structure for reaction type hydraulic turbines, wherein uniform delivery of fluid to all portions of the turbine rotor is insured. These and other objects and advantages attained by the present invention will appear from the following description.

A clear conception of an embodiment of the invention and of the manner of constructing and of operating devices in accordance with the improvement, may be had by referring to the drawings accompanying and forming a part of this specification in which like reference characters designate the same or similar parts in the various views.

Fig. 1 is an end elevation of a cast metal speed ring for hydraulic machines, embodying the improvement.

Fig. 2 is a side elevation of the speed ring shown in Fig. 1.

Fig. 3 is a transverse section through a sheet metal spiral casing and the cooperating speed ring, the section being taken along the line III—III of Fig. 1.

Fig. 4 is another section through the sheet metal spiral casing and speed ring, the section being taken along the line IV—IV of Fig. 1.

Fig. 5 is still another section through the sheet metal spiral casing and speed ring, the section being taken along the line V—V of Fig. 1.

The spiral casing and speed ring specifically illustrated in the drawings is especially applicable to hydraulic turbines of the reaction type wherein the fluid admitted to the rotor advances progressively through a spiral casing, a speed ring, an annular series of adjustable guide vanes, and the turbine rotor. The annular series of adjustable guide vanes and the rotor have been omitted from the disclosure because their construction is old and well known to those skilled in the art, and only the spiral inlet casing and the speed ring forming the subject of the present invention, have been illustrated.

The improved speed ring comprises a plurality of sections 2, 3 each consisting of laterally spaced inwardly converging side walls interconnected by means of a series of fixed guide vanes 4 which are directed tangentially with respect to the interior of the ring. The side walls and vanes of each section of the speed ring are cast integral, and the speed ring sections cooperate to provide an annular inwardly directed delivery opening surrounding the axis of the ring and adapted to receive the water from the spiral casing past the guide vanes 4 and to deliver the same past the usual adjustable guide vanes to the rotor. The guide vanes 4 are of progressively decreasing transverse cross-section advancing about the speed ring. The inner edges 9 of the speed ring sections are formed for attachment of other turbine parts thereto, the flow controlling adjustable guide vanes usually provided to direct the

water to the runner being ordinarily attached to the speed ring at the surfaces 9. The outer edges of the speed ring walls are provided with surfaces 10 which gradually approach each other in the direction of advancement of the water about the speed ring, these surfaces 10, however, being of substantially uniform width throughout their lengths. The speed ring sections 2, 3 are also provided with laterally projecting integral ears or lugs 11 whereby the sections may be firmly united. The section 2 of the speed ring is additionally provided with an integral inlet portion 8 adapted for direct attachment to the pipe line which conducts water to the turbine, and is further provided with an integral wall 5, and with a smaller vane 6 formed integral with the side walls of the section 2 and providing a final discharge portion for the spiral.

The supply casing which forms a spiral conduit 13 is composed of series of interconnected sheet metal sections 12 having substantially circular transverse cross-sectional area decreasing progressively about the axis of the speed ring in the direction of advancement of the fluid. The sheet metal sections 12 have their inner edges spaced apart to provide a discharge opening communicating with the speed ring as shown in Figs. 3, 4 and 5, and these inner edges of the casing sections are rigidly attached to the speed ring walls at the surfaces 10 by welding, riveting or otherwise. The edges of the sheet metal sections 12 by virtue of the location of the attaching surfaces 10, gradually approach each other advancing about the spiral, thereby permitting maintenance of the circular cross-section throughout without great difficulty. The final delivery end of the spiral casing is attached directly to the portion 7 of the speed ring, this end of the spiral casing being likewise maintained substantially circular in transverse cross-section.

During normal use of the device, the water is admitted to the spiral conduit 13 at the largest end thereof and proceeds about the axis of the speed ring in an obvious and well known manner. During this progress about the speed ring, portions of the water are constantly delivered inwardly past the stationary vanes 4 and through the delivery opening of the speed ring, to the turbine rotor. By virtue of the gradually decreasing cross-sectional area of the conduit 13, and also by virtue of the gradually decreasing cross-sectional area of the guide vanes 4, the distribution of the fluid and the delivery thereof about the axis of the speed ring, is maintained substantially uniform throughout.

By forming the speed ring with gradually approaching surfaces 10 the transverse cross-section of the spiral casing 12 may readily be maintained substantially circular throughout, thereby facilitating construction of the sheet metal casing. The formation of the attaching surfaces 10 at the inner portions of the speed ring walls also facilitates attachment of the sheet metal casing sections to the speed ring and provides a smooth conduit for conducting the water from the conduit 13 through the speed ring. The attaching surfaces 10 need not be accurately machined prior to attachment of the sheet metal thereto, and these surfaces by virtue of their location on the inner sides of the speed ring walls, also assist in resisting bulging of the casing due to internal pressure. The gradual reduction in cross-sectional area of the speed ring vanes 4 also insures uniform and smooth distribution of the flow. By forming the final discharge portion of the spiral casing and the inlet portion thereof integral with the speed ring, manufacture of the casing is also facilitated and a rigid final structure results. The attaching surfaces 10 are warped, in addition to approaching each other, thereby permitting convenient attachment of the ends of the sheet metal sections 12 having circular cross-section, thereto, the warping being of such a nature that the surfaces are tangent to the adjoining sheet metal casing sections at all points along the spiral. The speed ring may obviously be constructed of any number of sections in order to facilitate transportation of large units, and in the case of small units, the speed ring may be formed of a single piece.

It should be understood that it is not desired to limit the invention to the exact details of construction and operation herein shown and described for various modifications within the scope of the claims may occur to persons skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. In a hydraulic machine, a speed ring comprising side walls having fluid guiding surfaces of gradually diminishing width forming an annular delivery opening directed toward the axis of the ring, and a spiral casing surrounding said ring and having inner edge portions connected to said walls adjoining said surfaces, said edge portions being disposed progressively nearer to said opening advancing in the direction of flow of the fluid through said casing.

2. In a hydraulic machine, a speed ring comprising side walls having fluid guiding surfaces of gradually diminishing width forming an annular delivery opening of uniform width directed toward the axis of the ring, and a spiral inlet casing surrounding said ring and having edge portions secured to said walls, said edge portions at the inlet portion of said casing being disposed farther from said opening than at successive points along said casing proceeding in the direction of flow of fluid therethrough.

3. In a hydraulic machine, a speed ring comprising inwardly converging side walls

having fluid guiding surfaces of gradually diminishing width forming an annular inwardly directed delivery opening of uniform width, and a spiral inlet casing of substantially circular transverse cross-section throughout having oppositely disposed edge portions secured to the outer edges of said ring, said edge portions progressively approaching each other as they advance about the spiral.

4. In a hydraulic machine, a sectional speed ring comprising sections each consisting of inwardly converging side walls having fluid guiding surfaces of gradually diminishing width and a plurality of guide vanes rigidly uniting said surfaces, said sections cooperating to form an annular delivery opening directed toward the interior of said ring, and a spiral inlet casing surrounding said ring and comprising interconnected sections having oppositely disposed edge portions secured to the outer edges of said walls adjoining said surfaces, said edge portions gradually approaching each other as they advance about said spiral.

5. In a hydraulic machine, a speed ring comprising a plurality of sections each consisting of inwardly converging side walls having fluid guiding surfaces of gradually diminishing width and at least one vane formed integral with said walls at said surfaces, said sections cooperating to form an annular inwardly directed delivery opening, and a sectional spiral inlet casing surrounding said ring, the sections of said casing having substantially circular transverse cross-section and being provided with edge portions disposed on opposite sides of said delivery opening, the edge portions of said casing sections near the inlet of said casing being disposed farther apart than at other portions of said casing advancing about the spiral.

6. In a hydraulic machine, a sheet metal spiral inlet casing disposed about an axis, and a speed ring secured to the inner edges of said casing and forming an annular delivery opening directed toward said axis, said speed ring comprising inwardly converging side walls and a series of vanes of progressively decreasing cross-sectional area advancing around the spiral.

7. In a hydraulic machine, a spiral inlet casing extending around an axis and comprising sheet metal sections of substantially circular transverse cross-section, said casing having opposite edge portions spaced apart to provide an opening directed toward said axis, and a speed ring comprising side walls secured to said edges and vanes integrally uniting said side walls, said vanes being directed inwardly toward said axis and being of progressively decreasing cross-sectional area advancing around the spiral.

8. In a hydraulic machine, a spiral inlet casing extending about an axis, and a speed ring disposed within and secured to said casing, said speed ring comprising side walls and vanes rigidly uniting said walls, and an integral portion of said ring forming integral inlet and discharge portions of said casing, said casing having substantially circular transverse cross-sectional area at the points of attachment thereof to said speed ring adjoining said inlet and discharge portions.

In testimony whereof, the signature of the inventor is affixed hereto.

EMIL GROSS.