April 20, 1937. N. C. HAND 2,077,883

HYDRAULIC TURBINE

Filed Nov. 23, 1936 2 Sheets-Sheet 1

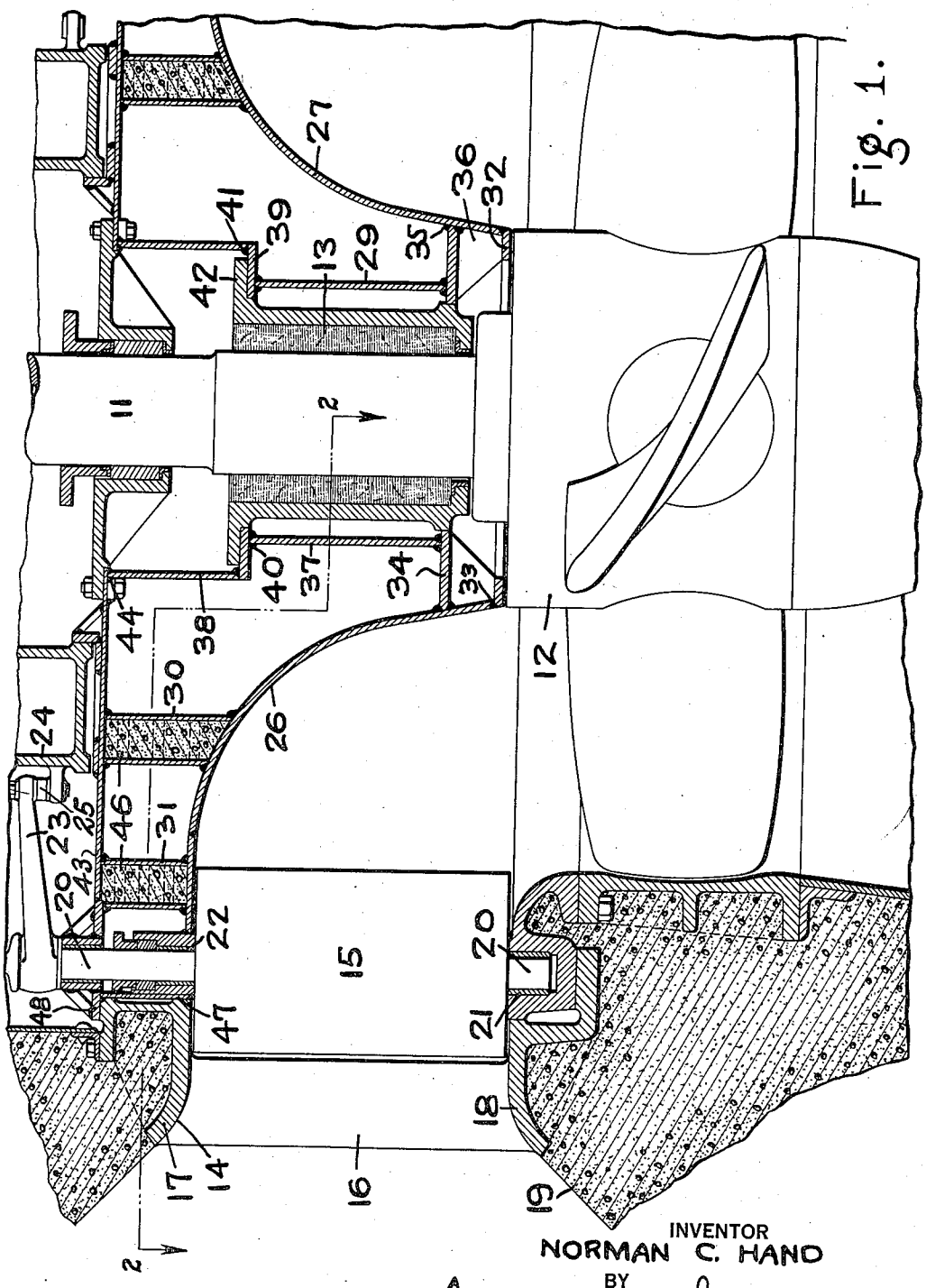


Fig. 1.

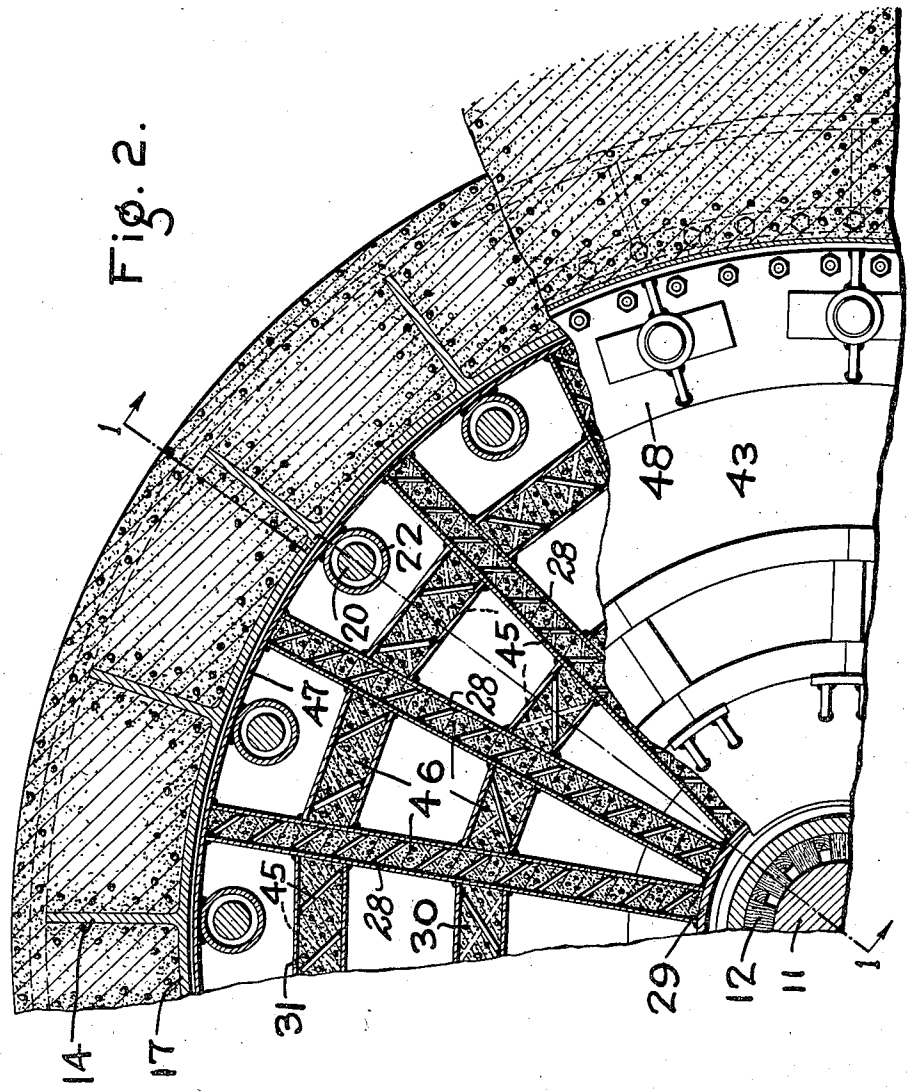
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Fig. 2.



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HYDRAULIC TURBINE

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2 Claims. (Cl. 253—117)

This invention relates to hydraulic turbines and particularly to a novel form of top or crown plate therefor.

An object of the present invention is to dispense with the usual cast or heavy metal top or crown plate structure and replace the said usual cast or heavy metal top or crown plate structure by plate steel structural elements assembled in such a manner as to serve the purpose of a turbine frame or casing with the same efficiency, strength and durability as the more expensive, heavier metal structures and at the same time reduce the cost of manufacture and installation and also lighten the weight of the frame or top plate to such an extent as to materially reduce the cost of transportation.

Another object of the invention is to provide an improved top or crown plate structure which is built up or fabricated in such a manner that its components or parts will uniformly contribute to the formation of a strong and more durable top plate with less labor, and one which is considerably stronger and more durable in its organization.

With the foregoing and other objects and advantages in view, the invention consists in the construction and arrangement of the several parts which will be more fully hereinafter described and claimed.

In the accompanying drawings:—

Figure 1 is a vertical section of a portion of a turbine embodying the features of the invention, taken on the line 1—1 of Fig. 2; and

Fig. 2 is a horizontal section taken on the line 2—2 of Fig. 1.

The general arrangement of the turbine is similar to that usually adopted and comprises a shaft 11 having a runner 12 secured to the lower end thereof, the shaft being mounted in a suitable bearing 13.

The runner 12 is mounted in a suitable structure comprising a speed ring 14, in which are mounted an annular series of wicket gates 15 and guide vanes 16.

The wicket gates 15 are adapted to be rotated simultaneously into different angular positions to control the flow of water into the turbine, and the guide vanes 16 are so disposed relatively to the wicket gates as to intercept the water flowing into the turbine and direct the same toward the openings between the wicket gates.

The speed ring 14 is composed of an upper flange 17 and a lower flange 18, which flanges are rigidly held in spaced relation relatively to each other by the guide vanes 16.

The turbine is adapted to be mounted in an open flume with the lower flange 18 of the speed ring 14 set in a concrete setting 19.

A shaft or stem 20 extends through each wicket gate 15. The lower end of the shaft 20 is mounted in a bearing 21 formed in the flange 18, and the upper end of said shaft projects upwardly through a bearing or bushing 22.

The upper end of each shaft 20 carries a gate operating arm 23 which is fixed to said shaft. The arms 23 are connected to a gate adjusting ring 24 as indicated at 25, Fig. 1. The gate adjusting ring is adapted to be operated in a well known manner so as to simultaneously rotate the wicket gates.

The upper portion of the turbine is closed by an annular top or crown plate 26 which is disposed within the speed ring 14.

According to the present invention the top or crown plate 26 is adapted to be constructed of pieces of sheet metal, such as plate steel, bent to the desired shape and united into a single unitary structure by fusion of metal as by welding.

The top or crown plate 26 is formed with an outer sheet metal wall 27 which extends from the upper flange 17 of the speed ring 14 inwardly and downwardly to the hub of the runner 12. The contour of the wall 27 is such as to provide means for directing the water which passes through the speed ring 14 toward the blade of the runner. The sheet metal wall 27 can readily be bent to the desired conical shape shown in Fig. 1 with the aid of dies, and if so desired several pieces of the sheet metal or plate steel can be employed in forming the wall 27 and these pieces of sheet metal can be welded together along their abutting edges so that the wall will be a single homogeneous structure.

For the purpose of reinforcing the outer wall 27, a plurality of radially disposed webs 28 and substantially cylindrical or circular webs 29, 30 and 31 are provided. These radial and cylindrical webs are constructed in the manner to be hereinafter more fully described.

The lower portion of the top or crown plate 26 is formed with an inwardly extending flange 32. The flange 32 is preferably formed from sheet metal which is connected to the lower edge of the outer wall 27 of the top or crown plate 26 by welding indicated at 33. The flange 32 overlies the top of the hub of the runner 12 and the shaft 11 extends upwardly through the opening formed centrally in said flange.

At a suitable distance above the flange 32 there is another horizontally disposed sheet metal ring

34 which is connected to the inner suruface of the wall 27 by welding, as indicated at 35, Fig. 1.

The two flanges 32 and 34 are reinforced by means of vertical webs 36.

The cylindrical web 29 heretofore referred to surrounds the main bearing 13 and said web is so formed as to provide a support for the bearing 13, as shown in Fig. 1.

In constructing the inner cylindrical web 29 two circular or tubular pieces of sheet metal are employed, a lower tube 37 and an upper tube 38. Connecting the two tubes 37 and 38 is a horizontally disposed sheet metal ring 39. The lower tube 37 is smaller in diameter than the upper tube 38 and said lower tube is connected along its upper edge to the inner portion of the ring 39 by welding indicated at 40, while the lower edge of the upper tube 38 is connected to the periphery of the ring 39 by welding indicated at 41. The bearing 13 has an outwardly extending flange 42 which is mounted on the flange provided by the ring 39, whereby said bearing is supported in the top or crown plate. The lower portion of the bearing 13 fits snugly within the flange provided by the ring 34, as shown in Fig. 1.

Spaced a suitable distance above the outer wall 27 of the top or crown plate 26 is a horizontally disposed top wall 43, formed from a suitable sheet of plate steel.

The inner end of the top wall 43 is connected to the upper edge of the tube 38 by welding as indicated at 44, Fig. 1.

The radial webs 28 and the cylindrical webs 30 and 31 extend between the outer wall 27 and the top wall 43, providing a skeleton structure for reinforcing said walls.

The radial webs 28 and the cylindrical webs 29 and 30 are each similarly formed, in that said webs have vertically disposed plate steel side walls which are spaced apart a suitable distance and reinforced by suitable diagonally disposed cross members 45 connecting each pair of side walls constituting each web, as shown in Fig. 2. The parts used in forming these webs are welded together so as to provide a rigid homogeneous structure and the spaces between the side walls of said webs are filled with concrete 46, cement, or other non-metallic filler. The concrete 46 may be readily admitted to the interior of the webs 29, 30 and 31 through the open top ends thereof before the top wall 43 is mounted on the structure.

As shown in Fig. 2 the bearings or bushings 22 for the wicket gate shafts 20 may be secured to an outer vertical circular wall 47 connecting the periphery of the outer wall 27 of the top or crown plate 26 and an upper flange plate 48 which latter rests upon the upper flange 17 of the speed ring 14. In this way the top or crown plate 26 is supported from the speed ring.

It will be noted that with a top or crown plate thus constructed the outer wall 27 is rigidly held against pressure by the struts provided by the webs 28, 29, 30 and 31. While the use of plate steel for forming the several parts of the device provides a structure which is considerably lighter in weight than the heavy cast metal structures heretofore manufactured, since the hollow reinforcing webs 28, 29 and 30 are filled with concrete, sufficient weight will be provided at the points subject to greatest pressure of the water for preventing collapse or bending of the top plate. The entire structure is relatively inexpensive and enables the use of material having relatively higher wear resisting qualities for the surfaces which are exposed to direct contact with the water.

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

Having thus described my invention, what I claim is:—

1. A crown plate for turbines comprising a relatively thin sheet metal conical outer wall, a horizontal sheet metal top wall, and a plurality of radial and circular struts interposed between said outer and top walls, each of said struts being composed of a pair of spaced parallel vertical sheet metal plates and diagonally disposed reinforcing members within said struts and weld connected to the parallel sheet metal side plates thereof, said side walls of the struts being weld connected to the outer wall and top of the crown plate.

2. A crown plate for turbines comprising a relatively thin sheet metal conical outer wall, a horizontal sheet metal top wall, and a plurality of radial and circular struts interposed between said outer and top walls, each of said struts being composed of a pair of spaced parallel vertical sheet metal plates and diagonally disposed reinforcing members within said struts and weld connected to the parallel sheet metal side plates thereof, said side walls of the struts being weld connected to the outer wall and top of the crown plate, and a filling of concrete within each of said struts.

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