July 29, 1930. W. HAHN 1,771,711

SPLIT GUIDE BLADE FOR CENTRIFUGAL PUMPS

Filed Jan. 17, 1929 2 Sheets-Sheet 1

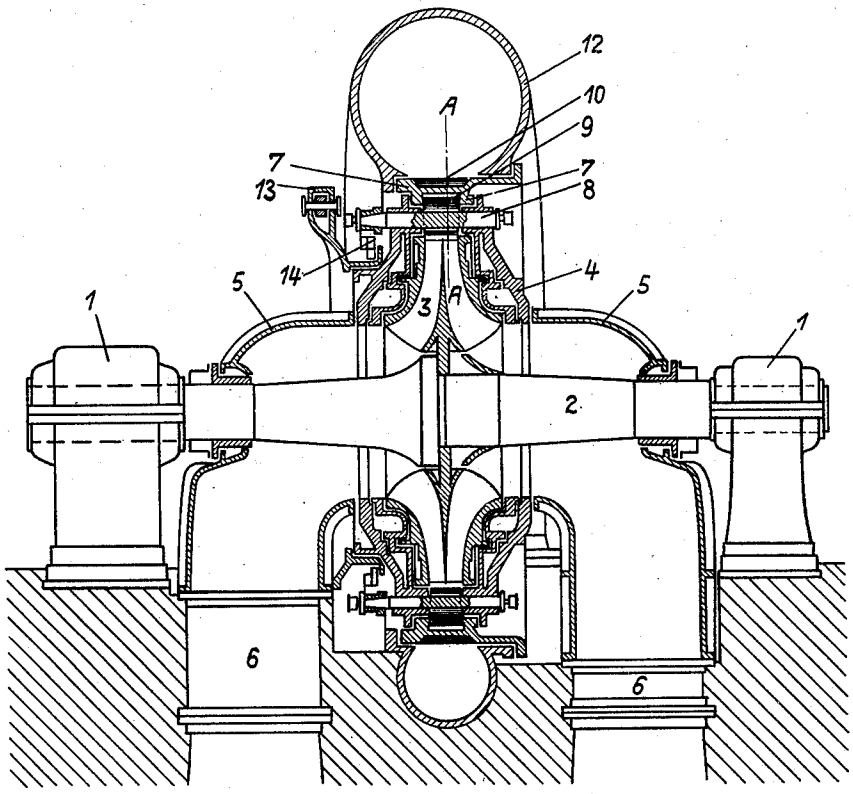


Fig. 1

Wilhelm Hahn
by C. F. Wiepel
his Attorney.

July 29, 1930. W. HAHN 1,771,711

SPLIT GUIDE BLADE FOR CENTRIFUGAL PUMPS

Filed Jan. 17, 1929 2 Sheets-Sheet 2

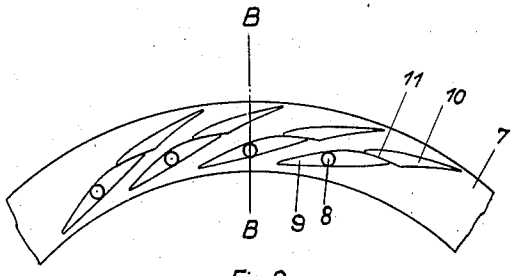


Fig. 2

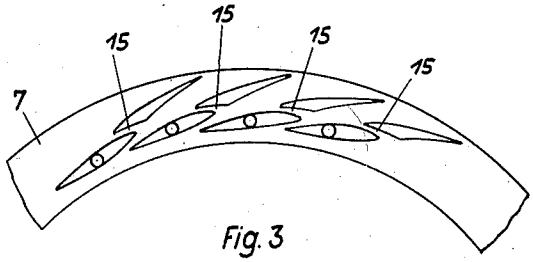


Fig. 3

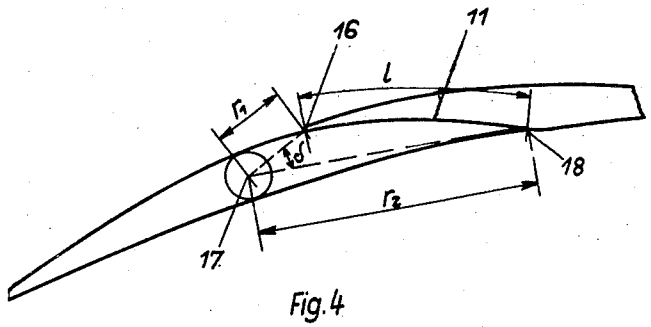


Fig. 4

Wilhelm Hahn
by A. P. Greppel
his Attorney

Patented July 29, 1930

1,771,711

UNITED STATES PATENT OFFICE

WILHELM HAHN, OF HEIDENHEIM-ON-THE-BRENZ, GERMANY, ASSIGNOR TO J. M. VOITH, OF HEIDENHEIM-ON-THE-BRENZ, GERMANY, A CORPORATION OF GERMANY

SPLIT GUIDE BLADE FOR CENTRIFUGAL PUMPS

Application filed January 17, 1929, Serial No. 333,050, and in Germany January 19, 1928.

The invention refers to split guide blades for centrifugal pumps consisting of a fixed and a movable part.

Guide blades are known on which the movable part of the guide blade situated next to the runner wheel is so arranged that the pivot is at the end opposite to the runner and immediately before the fixed part of the blade (seen in the direction of flow). This design has the disadvantage that by the blade being suspended at one side of the pivot large powers have to be transmitted so that often breakages occur, and further such blades tend to vibrate and to chatter, thus prejudicing the smooth running and by the favoured moving away of the stream from the blade also the efficiency of the pump.

The object of the invention is a split guide blade consisting of a movable part and a fixed part on which the part turned to the runner wheel is supported by a journal arranged about in the middle of its length and at its opposite end so bevelled that with quite opened position the turnable part is pressed by the water pressure to the fixed part forming with this a body of a constantly limited cross section so that a chattering of the blade is impossible. By the fact that the movable blade is supported in its middle the forces acting upon it are more or less balanced.

In making blade adjustments the guide vane gear for governing the movable part of the blade is turned in the closing direction, thus reducing the clearance at the entrance of the blade; at the same time the bevelled end moves away from the fixed part producing between the two parts of the guide blade a gradually extending channel. With a correct bevelling this channel adapts itself to the flow so that in the guide vane gear a system is formed of channels constantly extending in the direction of flow, in which the velocity of discharge from the impeller is favourably changed into pressure.

Figures 1, 2, 3 and 4 show an example of the invention. Fig. 1 represents a longitudinal section through a centrifugal pump with double inlet with which the guide vane gear shows the form according to the invention, Figs. 2 and 3 represent a partial section according to the line A—A of Fig. 1, the guide vanes being shown in Fig. 2 fully opened and in Fig. 3 in partly closed position. Fig. 4 shows the movable part of the guide vane and its connection to the stationary part in a larger reproduction. Bearings (1) support shaft (2), on which is arranged double runner (3). It is enclosed by housing (4) supporting on both sides draft elbows (5), to which are connected draft tubes (6). The guard rings for guide wheel cover (7) forming the continuation of housing (4) outwards are pierced by shanks (8), around which the movable parts (9) of the guide vanes may be turned. They are supported at their outer ends by the fixed guide vane parts (10), along the bevelled ends (11). Outside of the guide vane rim the pump housing passes over into the spiral casing (12). Shifting ring (13) acting upon guide vane shanks (8) by means of levers (14) serves to adjust the guide vanes. In the partly closed position of the guide vanes, as it is represented by Fig. 3, channels (15) are visible between the movable parts (9) and the fixed parts (10).

In order to obtain the effect set forth the bevelling at the movable part must be made according to Fig. 4. It can be made straight or curved, but in any way it must adjust itself with sufficient rounding off at the point 16 to the other profile of the movable part. The position of bevelling to the fulcrum is determined by the stipulation that the diffuser angle ϵ, which is formed by the walls of the channel arising by turning the guide vanes, is not larger than about 14°, because otherwise in this channel the flow moves away from the walls. The angle of the channel depends how far the movable guide vane parts for governing must be turned in the closing direction. This is different from one time to the other. The above mentioned stipulation, that the angle of the channel shall not exceed the amount of about 14° therefore requires for any largest torsional angle of the guide vane a certain position of beveling to the fulcrum. If (r_1) and (r_2) signify the radii from the blade fulcrum 17 up to the beginning 16 and the end 18 respectively of

the channel, (δ) the angle formed by the two radii and (l) the length of the channel 16—18, then between torsional angle (φ) and diffuser angle (ϵ) results the following relation:

$$tg.\ \epsilon = \frac{\varphi(r_2 - r_1).\ \cos\delta}{l}.$$

The value of ϵ to be calculated from it for the highest value of should not be greater than about 14°.

Claims:

1. In guide blades for centrifugal pumps, stationary and movable blade sections arranged in circumferentially spaced pairs around the runner wheel of the pump, the blade sections in each pair having coacting opposed ends, and the movable blade section being constantly urged by the pressure of water flowing between the spaced pairs of blade sections into abutting contact with the end of the fixed blade section to provide a water passage between said spaced pairs of blade sections of definite predetermined area, and the movable blade sections adapted to be moved relative to the fixed blade sections to provide water diverting channels between the opposed ends of the fixed and movable blade sections extending in the direction of flow of the water through said passages.

2. In guide blades for centrifugal pumps, pairs of blade sections arranged around the runner wheel of the pump in circumferentially spaced relation, the blade section in each pair contiguous to the runner wheel being pivoted intermediate of its ends and having one of its ends bevelled for abutting contact against a bevelled end of the outer relatively fixed blade section by the pressure of water flowing between the spaced pairs of blade sections to thereby provide flow directing passages of definite area, and said pivoted blade sections adapted to be moved relative to the fixed blade sections to constrict the inner discharge ends of said passages and provide water diverting channels between the opposed ends of the fixed and movable blade sections extending in the direction of flow.

In testimony whereof I affix my signature.

DR. WILHELM HAHN.