July 20, 1943. A. J. STEPANOFF 2,324,650

CONTROLLING DEVICE FOR PUMPS

Filed April 15, 1941 2 Sheets-Sheet 1

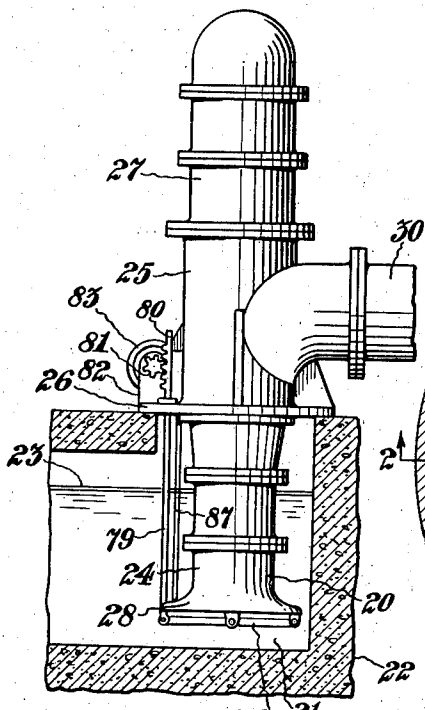


FIG.-1.

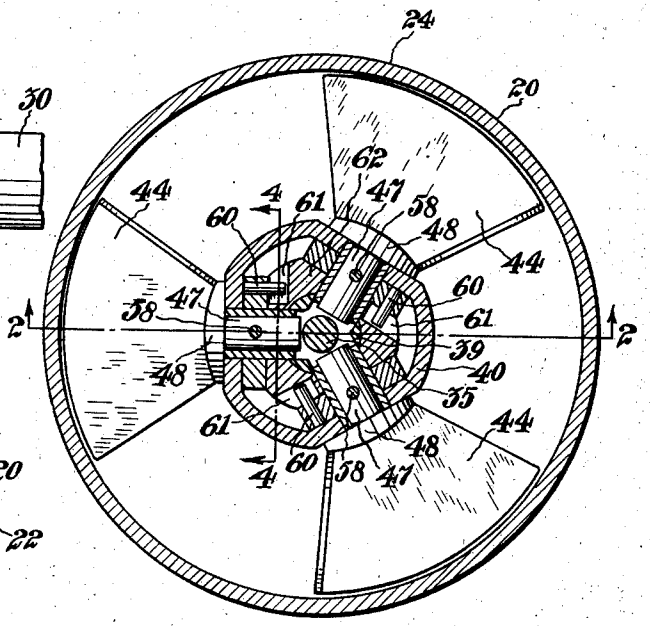


FIG.-3.

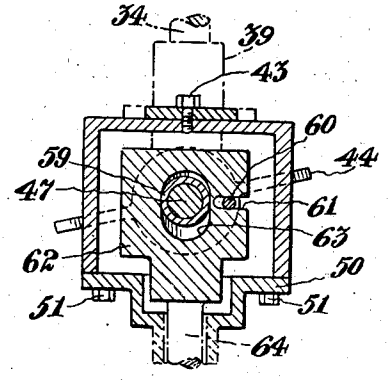


FIG.-4.

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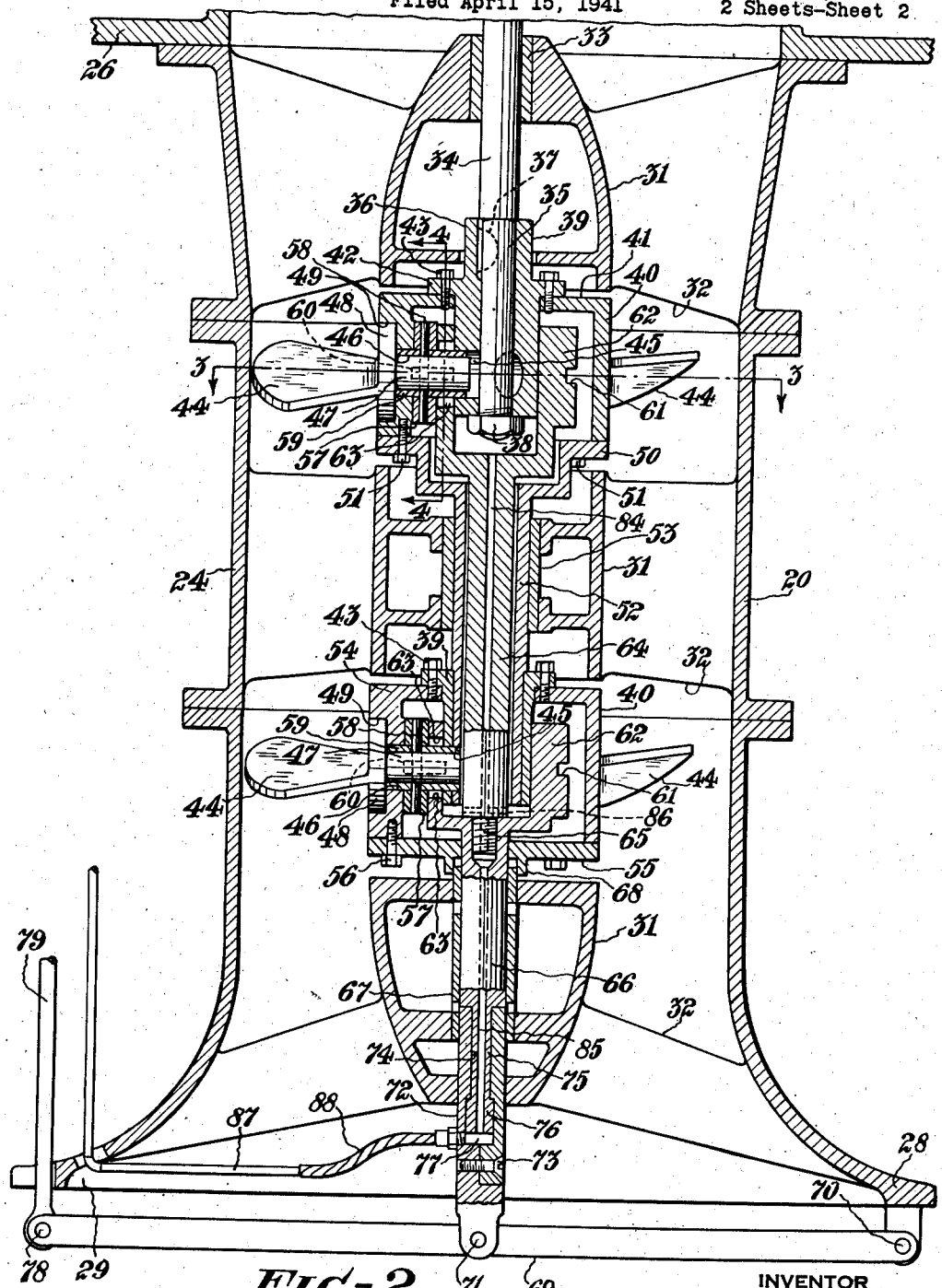


FIG-2.

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UNITED STATES PATENT OFFICE

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CONTROLLING DEVICE FOR PUMPS

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2 Claims. (Cl. 103—93)

This invention relates to pumps, and more particularly to a controlling device for pumps of the centrifugal type.

One object of the invention is to selectively vary the impelling effect of the pump in accordance with immediate requirements or conditions of operation.

A more specific object is to avoid overloading the motor driving the pump when operating the pump at reduced capacity.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawings accompanying this specification and in which similar reference numerals refer to similar parts,

Figure 1 is an elevation of a centrifugal pump equipped with a controlling device constructed in accordance with the practice of the invention and a foundation shown in section to support the pump,

Figure 2 is an elevation, partly in section, showing an enlarged view of the pump,

Figure 3 is a transverse view taken through Figure 2 on the line 3—3, and

Figure 4 is an elevation, in section, taken through Figure 3 on the line 4—4.

Referring more particularly to the drawings and at first to Figure 1, the pump designated, in general, by 20 is shown extending into a pit 21 defined by a foundation 22 for removing liquid 23.

The casing 24 of the pump is formed in sections, a number of which lie within the pit 21, and one section, designated 25, lies above the pit 21 and is provided with a suitable flange 26 to seat upon the foundation 22. The casing section 25, moreover, serves as a seat for a motor 27, only the casing of which is shown.

The pump is of the vertical type and the lowermost end 28 of the casing 24 is flared outwardly to define an inlet opening 29 for the passage of liquid from the pit 21 into the casing 24. The pump is also provided with a suitable outlet conduit 30 shown as leading from the casing section 25.

Arranged within the casing 24 and in coaxial relationship therewith is a series of support members 31, three in the present instance, for the rotary elements of the pump and said support members are connected to the casing 24 by ribs 32. The support members are of generally cylindrical shape and as a preferred arrangement, the upper and lower support members are tapered, respectively, toward the corresponding ends of the pump.

In the upper support member 31 is a bearing 33 for a shaft 34 that may be secured in suitable manner to the shaft (not shown) of the motor 27. The shaft 34 terminates between the upper and intermediate support members 31. Its lower end portion 35 is of reduced diameter and extends into a hub 36 locked to the shaft 34 by a key 37 and held against endwise movement by a nut 38 on the lower end of the shaft 34.

The hub 36 consists of two parts of which one is in the form of a sleeve 39 in direct engagement with the shaft 34. The other part is in the form of a box 40 of cylindrical shape having an introverted flange 41 at one end that seats against a flange 42 on the periphery of the sleeve 39 and is secured thereto by bolts 43. The hub 36 supports the vanes 44 of the pump. The sleeve 39 and the box 40 are, respectively, provided with radially extending apertures 45 and 46 to accommodate trunnions 47 on the vanes 44, and between each trunnion 47 and associated vane 44 is a collar 48 that lies in a recess 49 in the peripheral surface of the box 40.

The lowermost end of the box 40 is covered by a plate 50 secured to the box by bolts 51, and on said plate is a depending hollow stem 52 that forms a continuation of the pump shaft. The stem 52 is journalled in a bearing 53 in the intermediate support member 31 and carries, at its lower end, a hub 54 similar in all essential respects to the hub carried by the shaft 34 to accommodate a second group of vanes 44 constituting, in the present instance, a first impelling stage. The lower end of the box 40 of the hub 54 is also suitably sealed by a cover plate 55 held in position by bolts 56.

The trunnions 47 are rotatable in the apertures 45 and 46 to change the angular relationship of the vanes with respect to the path of flow of the fluid being pumped in order to vary the impelling effect of the vanes. This rotational movement of the vanes is effected by suitable devices; preferably actuated manually and operating in such wise that all the vanes of the several impelling stages will be rotated about their axes in unison.

The connections between the vanes and the device or devices serving to rotate them are also preferably of such nature as to cause all of the vanes to be rotated in equal degree, irrespective of the number of impelling stages. In furtherance of these ends, each trunnion 47 is provided with a collar 57 that lies within the box 40 and is secured to the trunnion by a pin 58 that also se-

cures in position a sleeve 59 encasing the trunnion.

Each collar 57 carries a crank pin 60 having an end extending into a slot 61 in a hollow block 62 slidable upon the sleeve 39. The blocks 62 are rotatable with the pump shaft and such movement is imparted to them by the sleeves 59 which extend through apertures 63 in the blocks 62. The apertures 63 are of oblong shape to permit of endwise movement of the blocks with respect to the shaft but are only of sufficiently greater width than the diameters of the sleeves 59 to enable the blocks 62 to move freely without binding upon said sleeves.

The blocks 62 are connected together by a rod 64 on the uppermost block 62 extending through the hollow stem 52 and having a screw portion 65 at its lower end for threaded engagement with the block 62 in the hub 54. The latter block 62 also has a depending rod portion, designated 66, that is journalled in a bearing 67 inserted in the lowermost support member 31. The upper end of the bearing 67 projects above the support member 31 and is encircled by a flange 68 on the plate 55 to prevent the free flow of liquid to the cooperating surfaces of the rod 66 and the bearing 67.

The means employed for shifting the blocks 62 to rotate the vanes 44 include a lever 69 lying across the lower end of the pump casing 24 and having an end pivotally connected thereto by a pin 70. In the intermediate portion of the lever 69 and in the axial plane of the pump is a pin 71 seated in the end of a rod 72 which lies in the adjacent support member 31 and the bearing 67.

The rod 72 is split longitudinally and the parts thus formed are secured together by a screw 73. Within the rod 72 is a bore 74 for the accommodation of a stem 75 on the lower end of the rod 66. The stem 75 is preferably integral with the rod 66 and has an enlargement 76 at its lower end that lies in an enlarged portion 77 of the bore 74 for locking the rod 72 against endwise movement on the rod 66. The stem 75 is freely rotatable within the rod 72 which is held against such movement by the pin 71 and the lever 69.

In order to impart rocking movement to the lever 69 the free end of said lever is pivotally connected, as by a pin 78, to a rod 79 extending upwardly along the exterior of the casing 24. On the upper end of the rod 79 is a rack 80 that meshes with a pinion 81, supported by a bearing 82, and being provided with a hand wheel 83 for rotating it. A suitable locking device (not shown) may be provided to cooperate with the rod 79, or with the rotary unit comprising the pinion 81 and the hand wheel, to prevent unauthorized movement of the train of elements used for rotating the vanes 44.

In order that the cooperating surfaces of the stationary and movable parts of the controlling device may at all times be provided with a plentiful supply of oil the rods 64 and 66 are provided, respectively, with passages 84 and 85. The passage 84 supplies oil to the cooperating surfaces of the upper block 62 and the sleeve 39 and through the natural clearance between these elements to the associated sleeves 59 and their bearing surfaces. Suitable branch passages 86 also supply oil from the passage 84 to the cooperating surfaces of the lower block 62 and sleeve 39 and to the surfaces of the adjacent sleeves 59 and collars 57.

The oil used for this purpose is introduced into the lower end of the enlarged portion 77 of the bore 74 by a conduit 87 having a flexible portion 88 connected to the rod 72 to communicate with the enlarged portion 77 of the bore 74. The conduit 87 extends upwardly along the exterior of the casing 24 to a conveniently accessible point above the flange 26 and may be connected to an oil reservoir and, if desired, to an oil metering device, neither of which are shown.

The operation of the device is as follows: Whenever it is desired to change the pitch of the vanes the free end of the lever 69 is raised or lowered by rotating the pinion 81, to cause the blocks 62 to move upwardly or downwardly, depending upon whether it be intended to increase or decrease the pumping effect of the vanes. This movement of the blocks 62 will be transmitted through the crank pins 60 to the collars 57 and thus to the vanes for rotating them to a desired position.

In practice, the present invention has been found to be a highly desirable device for preventing the overloading of the motor driving the pump as, for example, when starting the pump against a closed discharge system. By rendering the vanes of the pump adjustable, in the manner herein described, they may be positioned to exert little or no pumping force during the initial effort of the motor, and after a suitable motor speed has been attained the vanes may be again rocked to the position best suited to produce the required discharge output.

I claim:

1. A controlling device for a rotary pump, comprising a casing having inlet and outlet openings, a rotary shaft in the casing, a hollow extension on the shaft to form a continuation of the shaft, a plurality of hubs spaced along the length of the hollow extension each having a group of vanes connected rotatably thereto, means for securing one hub to the shaft, bearings within the casing for the shaft and the hollow extension, means reciprocable in the hollow extension and the hubs for rotating the vanes to vary their impelling effect, means extending through the free end of the extension for actuating the second mentioned means, and a bearing in the casing to guide the last mentioned means.

2. A controlling device for a rotary pump, comprising a casing having inlet and outlet openings, a rotary shaft in the casing, a hub on the shaft having a group of vanes connected rotatably thereto, a hollow extension on the hub to form a continuation of the shaft, a hub on the hollow extension having a group of vanes connected rotatably thereto, bearings for the shaft and the hollow extension, means reciprocable in the hubs and the hollow extension to rotate the groups of vanes for varying their impelling effect, and means on the casing for actuating the first-mentioned means.

ALEXEY J. STEPANOFF.