

July 25, 1933.

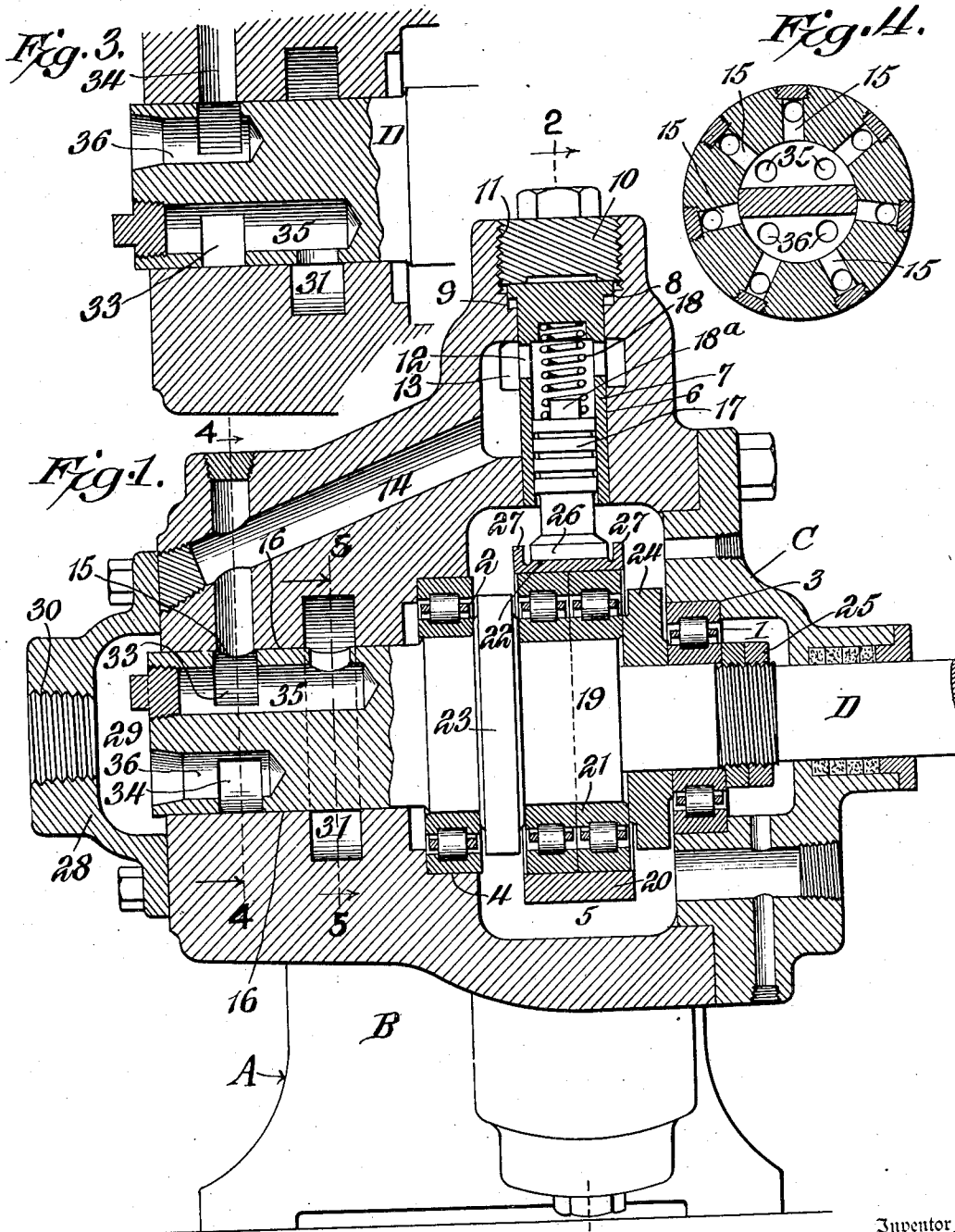
W. ERNST

1,920,123

RADIAL PUMP

Filed June 27, 1929

2 Sheets-Sheet 1



2⁷ *Walter Ernst,*
Baldwin & Knight

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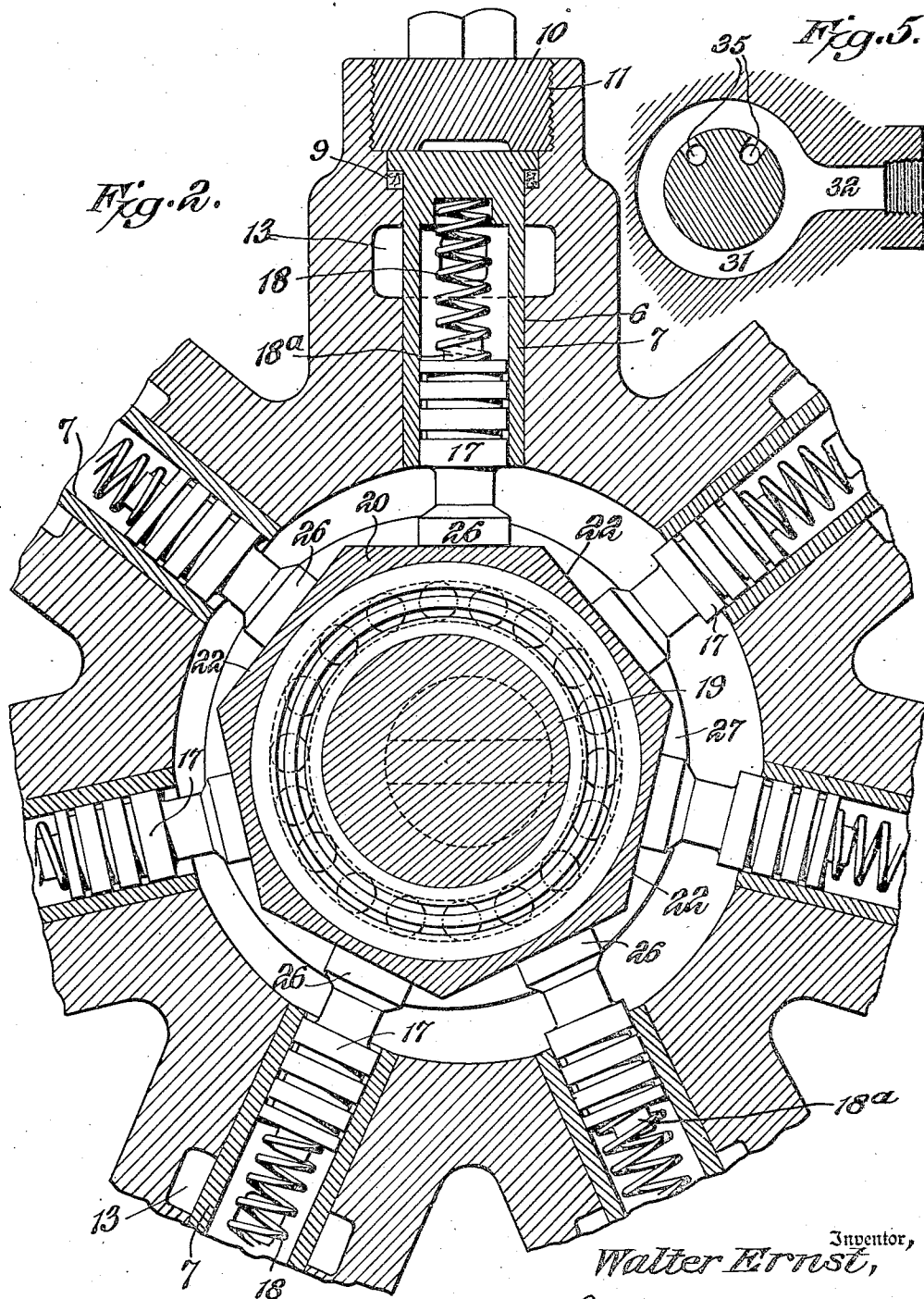
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UNITED STATES PATENT OFFICE

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RADIAL PUMP

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My invention relates to pumps, and more particularly to radial pumps of the kind including a plurality of cylinders disposed radially about a shaft and each having mounted therein a piston adapted to be reciprocated to and fro in the associated cylinder by an eccentric fixed to the shaft.

An object of the invention is to provide a pump of the character described which is capable of being operated at high speeds and which consists of a minimum number of moving parts and which it is economical to manufacture and to operate.

Other objects of the invention will be apparent from a reading of the following description, the appended claims, and the several views illustrated in the drawings, in which:

Figure 1 is a vertical longitudinal sectional view of a pump embodying my invention;

Figure 2 is a fragmentary sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a fragmentary vertical longitudinal sectional view of one end of a pump casing and shaft;

Figure 4 is a sectional view drawn on a reduced scale and taken on the line 4—4 of Figure 1; and

Figure 5 is a sectional view drawn on a reduced scale and taken on the line 5—5 of Figure 1.

In the drawings, there is shown a pump embodying my invention and including a combined pump and valve casing A comprising a main casting B and an end cover plate or casting C bolted thereto. A shaft D is journaled in the casing and is supported by roller bearings 1 and 2 respectively positioned in counter bores 3 and 4 formed in the casing on opposite sides of a central opening 5 located therein.

The casting B is formed with a plurality of bores 6 in each of which is mounted a cylinder 7. The bores and the correlated cylinders are disposed radially about the shaft D in a common plane and are circumferentially spaced at equal distances from each other. Preferably an odd number of cylinders is employed, the particular num-

ber being varied in accordance with the pumping characteristics desired, and the pump herein disclosed is shown and described as including seven cylinders. Each of the cylinders is provided at its outer end with a flange 8 which fits in a counter bore 9 in the casting B, and for clamping the cylinders within the respective bores 6 there is provided a plurality of plugs 10 screwed into threaded openings 11 in the casing and bearing upon the outer ends of the respective cylinders.

The cylinders 6 are open at their inner ends to communicate with the opening 5 in the casing and are closed at their outer ends. Each cylinder is provided adjacent its outer end with cylinder openings 12 which communicate with the inner end 13 of a duct 14 extending longitudinally through the casting B, and communicating at its outer end 15 with a bore 16 through which the shaft extends. The outer ends 15 of the ducts 14 are all disposed in a common plane and communicate with the bore 16 at points circumferentially spaced at equal distances from one another.

A plurality of pistons 17 is mounted for reciprocatory movements in the respective cylinders; and for urging the pistons towards the shaft I provide each cylinder with a coiled spring 18 interposed between the closed end of the cylinder and the associated piston, an axial projection 18a on the outer end of the piston serving to maintain the spring in axial alinement with the piston.

For reciprocating the pistons I provide the shaft with an eccentric 19 and connections between the eccentric and the pistons including a polygonal block 20 mounted on the eccentric for rotary movements relative thereto, and a roller bearing 21 interposed between the block and the eccentric for minimizing friction. The block 20 is formed with a plurality of straight connected sides 22 equal in number to the number of pistons, these sides being perpendicular to the longitudinal axes of the respective cylinders and having operative connection with the pistons mounted therein. Counter-balance weights 23 and 24 are fixed to the shaft on

opposite sides of the eccentric 19 for eliminating the vibrational stresses which would otherwise be set up in the shaft when the eccentric is revolved. The shaft is threaded to receive nuts 25 for clamping the roller bearing assembly against the counter weight 24 to thus maintain the shaft and the bearings in assembled relation.

Each of the pistons at its inner end is provided with an extension or head 26 forming a part of the piston and being arranged to contact the associated perpendicular side of the block and to have sliding surface contact therewith. For maintaining the block against axial displacement with respect to the eccentric, the block is provided with a pair of spaced peripheral flanges 27—27 integral with the block and located on opposite sides of the piston heads. It will be observed that when the shaft is rotated the eccentric will move about the axis of the shaft and will at the same time rotate within the block 20, and that the block will move bodily in a circular path about the axis of the shaft and will thereby impart reciprocal movements to the several pistons.

In order that the reciprocations of the pistons will constitute suction and discharge strokes for pumping the fluid acted upon, it is necessary that the ducts 14 be valved so that, when a particular piston is moving away from the associated opening 12, the associated duct 14 will communicate with an intake opening; and that the duct communicating with any particular cylinder in which the associated piston is being moved toward the opening 12 will communicate with a discharge opening. To this end the casing is provided with an end cap 28 conjointly forming with the casting B an end chamber 29, which chamber is adapted to communicate exteriorly of the casing with an intake pipe or the like by means of an intake opening 30 in the cap 28. To provide means for exit of the fluid being pumped, the casting B is formed with an annular chamber 31 extending around and communicating with the bore 16 and adapted to communicate exteriorly of the casing with a discharge pipe or the like by means of a discharge port 32.

Adjacent the end chamber 29 and between said chamber and the annular chamber 31 the shaft is provided with a pair of opposite and transversely extending grooves 33 and 34 which both lie in the same plane as the plane in which the inner ends 15 of the ducts 14 lie, being thereby adapted to register with the inner ends of the ducts when the shaft is rotated. The groove 33 is arranged to be in constant communication with the annular chamber 31 by means of discharge passages 35—35 formed in the shaft, and the groove 34 is arranged to be in constant communication with the end chamber 29 by means of inlet passages 36—36 also formed in the

shaft. The grooves are each of a size to simultaneously communicate with more than one of the ducts and the bottoms of the grooves are parallel to each other and are parallel to a line connecting the center of the eccentric with the center of the shaft so that, when the shaft is rotated in a clockwise direction as viewed in the drawings, the groove 33 will register with the inner ends of those of the ducts 14 which communicate with cylinders in which the associated pistons are moving towards the associated cylinder openings 12, whereas the groove 34 will register with those of the ducts 14 which communicate with cylinders in which the associated pistons are moving away from the associated cylinder openings 12. Thus, when the parts are in the relative positions shown in Figures 1, 2, 4, and 5, and the shaft is being rotated in a clockwise direction, those of the pistons which are located above the center of the shaft will be moved outwardly towards the respective openings 12, the fluid in said cylinders being thereby forced out through said openings, the ducts 14, the groove 33, the discharge passage 35 in the shaft, the annular chamber 31, and the discharge port 32. Those of the pistons which are located below the center of the shaft will be moved inwardly away from the respective openings 12 and will draw fluid into the cylinders through the intake opening 30, the end chamber 29, the intake passage 36 in the shaft, the groove 34, the ducts 14, and the openings 12. When the shaft is in the position shown in Figure 3 and is being rotated in a clockwise direction, the cylinders above the shaft will be receiving fluid and those below the shaft will be discharging fluid in the manner described. It will therefore be seen that the grooves 33 and 34 will in turn register successively with the inner ends of the ducts 14, and, since the grooves 33 and 34 are adapted to register simultaneously with more than one of the ducts, the pump will deliver a smooth, uninterrupted discharge.

A pump constructed in accordance with my invention is extremely simple in construction and is therefore economical to manufacture and to operate. No intricate valve mechanism is required, since the main pump casing constitutes a valve casing as well, and cooperates with easily and cheaply formed passages in the shaft for controlling the flow of fluid to and from the cylinders in proper timing with the movements of the pistons. Because of the small number of moving parts included, the pump may be operated at high speeds without undue frictional losses.

I claim:

1. The combination with a support; of a shaft journaled for rotary movements with respect thereto; an odd number of cylinders

fixedly mounted with respect to the support and disposed radially about said shaft, each of said cylinders being provided with an opening; an eccentric on said shaft, a polygonal block mounted on said eccentric for rotary movements with respect thereto, said block having a number of sides equal to the number of said cylinders, the sides of said block being perpendicular to the longitudinal axes of the respective cylinders; a plurality of pistons respectively mounted in said cylinders for reciprocation independently of each other; extensions fixedly connected to the inner ends of the pistons and having sliding surface contact with the sides of the block; means for maintaining said extensions in contact with the sides of the block; and a valve for controlling the flow of fluid through said cylinder openings into and out of said cylinders.

2. The combination with a support; of a shaft journaled for rotary movements with respect thereto; an odd number of cylinders fixedly mounted with respect to the support and disposed radially about said shaft, each of said cylinders being provided with an opening; an eccentric on said shaft, a polygonal block mounted on said eccentric for rotary movements with respect thereto, said block having a number of sides equal to the number of said cylinders, the sides of said block being perpendicular to the longitudinal axes of the respective cylinders; a plurality of pistons respectively mounted in said cylinders for reciprocation independently of each other; a head fixed to each of said pistons and having sliding surface contact with the sides of said block; means for maintaining said heads in contact with the sides of the block; and a pair of spaced circumferential flanges on said block, said flanges being disposed on opposite sides of said piston heads for cooperation with the latter to maintain the block against axial displacement relative to said eccentric; and a valve for controlling the flow of fluid through said cylinder openings into and out of said cylinders.

3. The combination with a support; of a shaft journaled for rotary movements with respect thereto; an odd number of cylinders fixedly mounted with respect to the support and disposed radially about said shaft, each of said cylinders being provided with an opening; an eccentric on said shaft, a polygonal block having an opening and mounted in surrounding spaced relation to said eccentric, an anti-friction bearing disposed

within the space between the eccentric and the block, said block having a number of sides equal to the number of said cylinders, the sides of said block being perpendicular to the longitudinal axes of the respective cylinders; a plurality of pistons respectively mounted in said cylinders for reciprocation independently of each other and having their inner ends slidably engaging the respective perpendicular surfaces of said block; and a valve for controlling the flow of fluid through said cylinder openings into and out of said cylinders.

4. In combination; a rotatable shaft; an eccentric thereon; a plurality of radially disposed valved cylinders arranged around said shaft; a polygonal block mounted on said eccentric and having a number of sides equal to the number of said cylinders, the sides of said block being perpendicular to the axis of the respective cylinders; pistons mounted in said cylinders for reciprocation independently of each other and having sliding contact with the respective sides of said block; and means for maintaining said pistons in contact with said block.

5. In combination; a rotatable shaft; an eccentric thereon; a plurality of radially disposed valved cylinders arranged around said shaft; a polygonal block mounted in surrounding relation to said eccentric and having a number of sides equal to the number of said cylinders; a roller bearing assembly interposed between said block and eccentric; pistons mounted in said cylinders for reciprocation independently of each other and having sliding contact with the respective sides of said block; and means for maintaining said pistons in contact with said block.

6. In combination; a rotatable shaft; an eccentric thereon; a plurality of radially disposed valved cylinders arranged around said shaft; a polygonal block mounted on said eccentric and having a number of sides equal to the number of said cylinders, the sides of said block being perpendicular to the axis of the respective cylinders; pistons mounted in said cylinders for reciprocation independently of each other and having sliding contact with the respective sides of said block; means for maintaining said pistons in contact with said block; and a pair of spaced circumferential flanges on said block, said flanges being disposed on opposite sides of the pistons for cooperation with the latter to maintain the block against axial displacement relative to said eccentric.

WALTER ERNST.