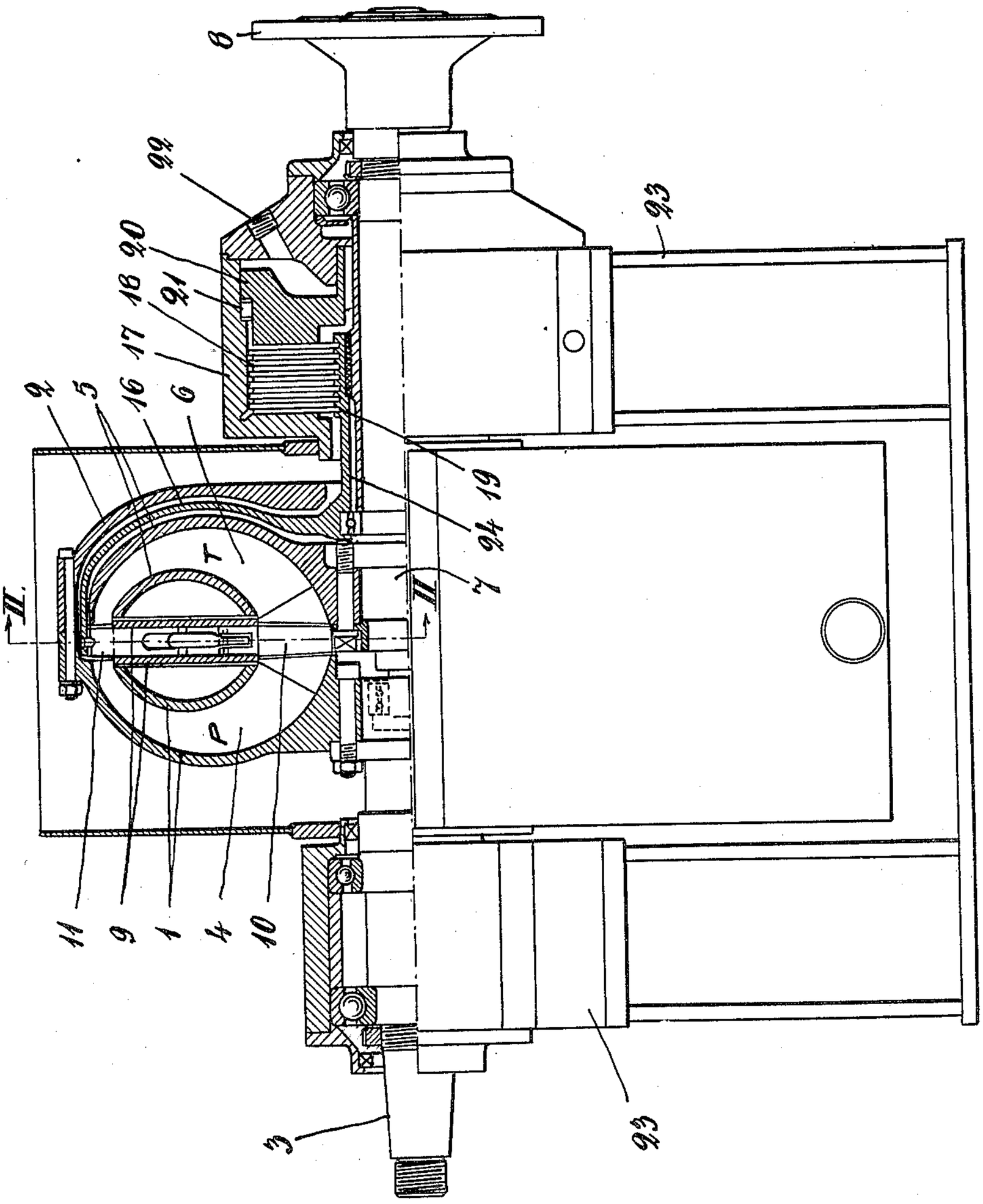
March 6, 1951 S. G. LUNDGREN ET AL 2,544,167

REVERSIBLE ROTARY HYDRAULIC COUPLING

Filed April 26, 1945 2 Sheets-Sheet 1

Fig. 1.



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Filed April 26, 1945 2 Sheets-Sheet 2

Fig. 2.

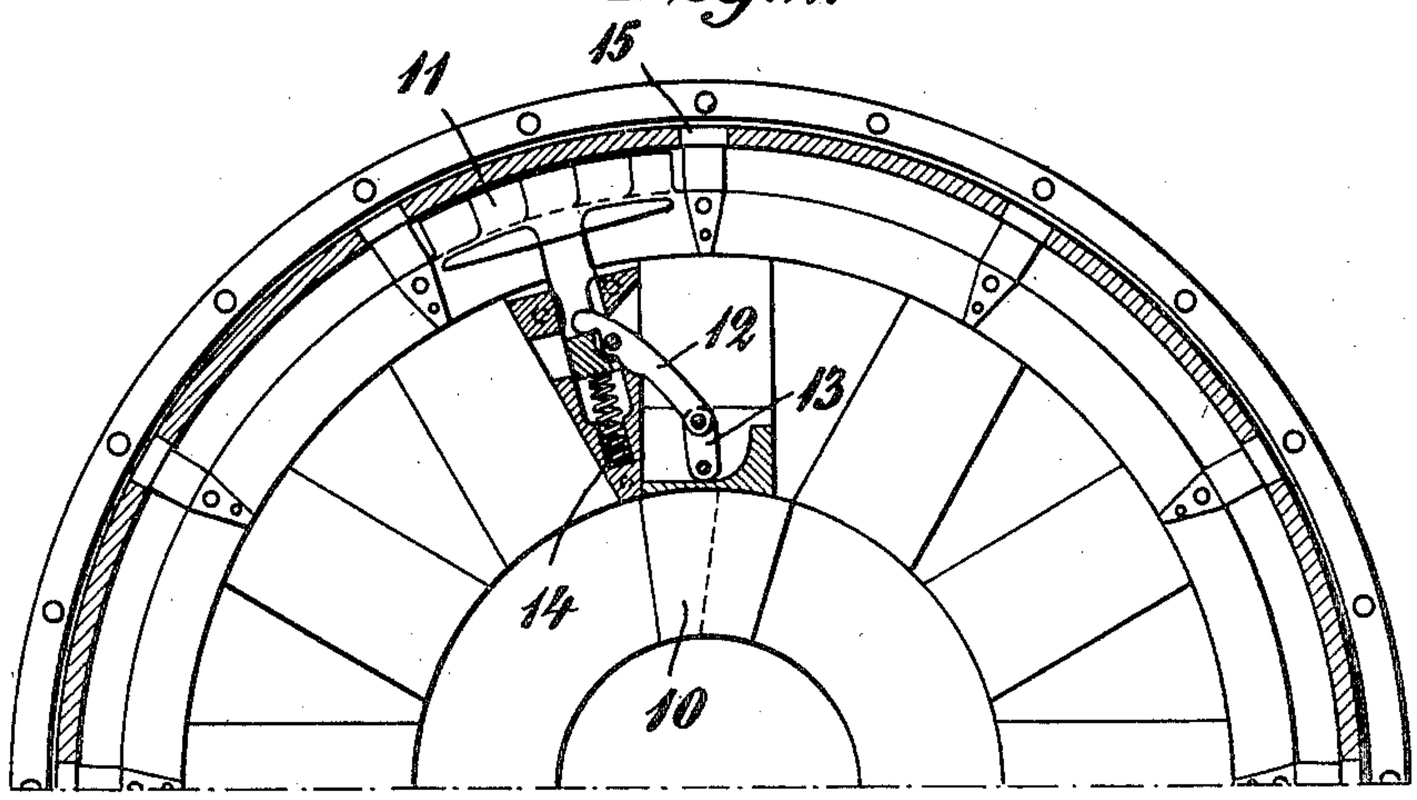
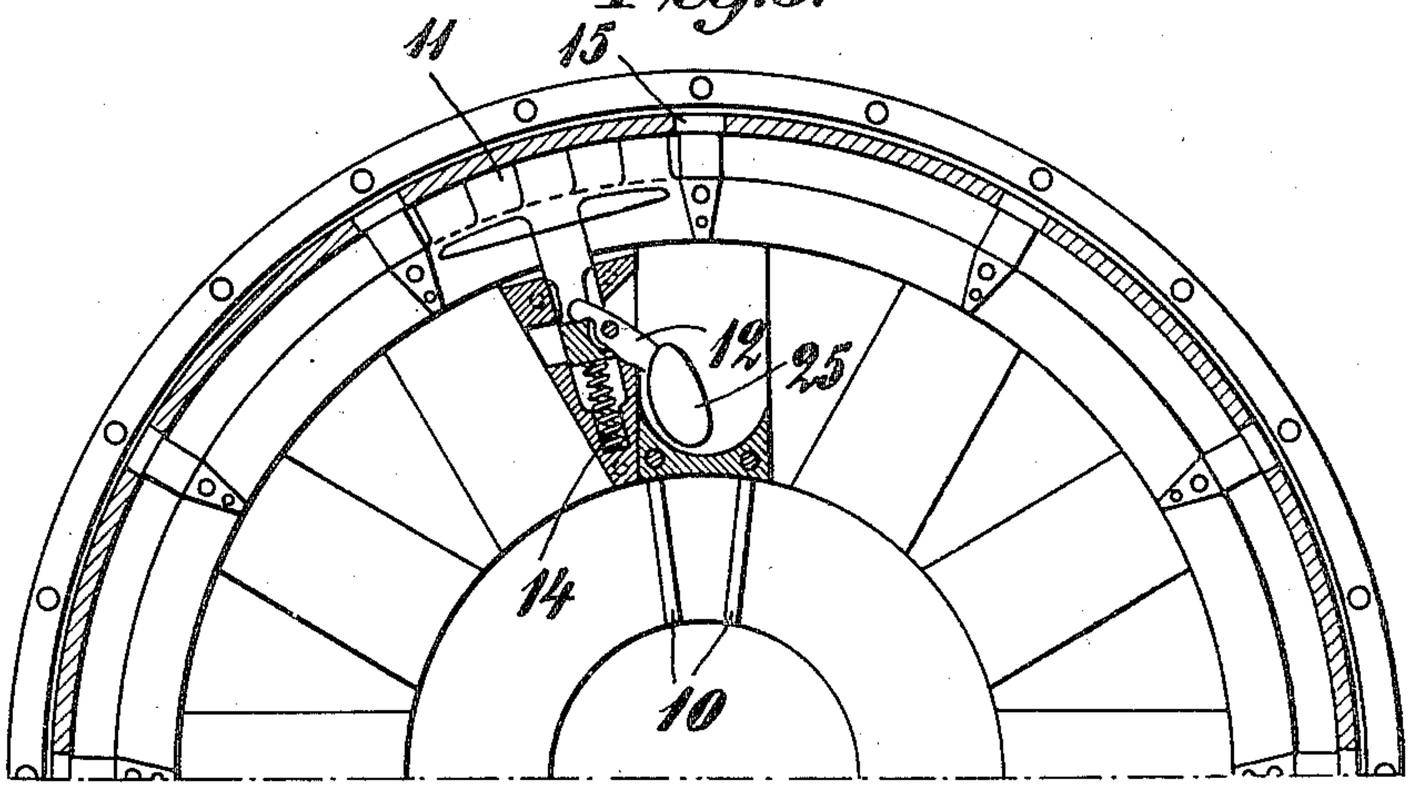


Fig. 3.



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REVERSIBLE ROTARY HYDRAULIC COUPLING

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In Sweden March 27, 1945

6 Claims. (Cl. 60—54)

1

This invention relates to hydraulic couplings of the closed circuit type and has particular reference to reversible couplings of this kind.

In the pending application for patent Serial No. 500,007 filed by Alf Lysholm, issued as Patent No. 2,474,586 on June 28, 1949, there is shown and described a reversible coupling of the general type under consideration in which the reversing function is accomplished by shifting reversing blades from a position in the circuit between the outlet side of the pump blades and the inlet side of the turbine blades to a position outside of the circuit. While in many respects satisfying reasonable demands on a reversible hydraulic coupling it has not proved to be fully effective when it has to fulfil greater demands particularly in case of backward drive.

Therefore, the general object of the present invention is to provide an improved form of reversible hydraulic coupling which is capable of providing capacity and efficiency characteristics in backward drive which will, for example, permit of a marine propeller or other driven element being operated under load in reverse at a speed that may be as high as of the order of 80 to 90% of forward speed.

In order to accomplish the above general object and other objects not specifically mentioned, in view, the invention contemplates the novel form and arrangement of parts hereinafter more particularly described in the ensuing portion of this specification wherein, taken in conjunction with the accompanying drawings, there is disclosed by way of example, but without limitation, one suitable form of apparatus for carrying the invention into effect.

In the drawings:

Fig. 1 is a more or less diagrammatic half section of a coupling embodying the principles of the invention;

Fig. 2 is a more or less diagrammatic sectional view on line II—II of Fig. 1 on an enlarged scale and

Fig. 3 is a view similar to Fig. 2 but illustrating another embodiment of the invention.

Referring to the drawings, a pump P, a turbine T and two rims of reversing guide blades 10 and 11 between them provide the hydraulic circuit.

The pump P is driven by a primary or power input shaft 3, and it consists substantially of two discs 1 and a rim of pump blades 4 between them.

The turbine T drives a secondary or output shaft 7 and consists substantially of two discs 5 and a rim of turbine blades 6 between them. The

2

confronting inner discs 1 and 5 of the pump and turbine members form the usual annular core member defining the inner wall of the hydraulic circuit. The shaft 7 has at its outer end a coupling flange 8 or other corresponding means for transmitting the output torque. The primary shaft 3 as well as the secondary shaft 7 are journalled in a stationary housing 23.

The reversing blades interposed between the pump and the turbine consist of an inner rim 10 and an outer rim 11, said rims being conveniently subdivided into sectors as shown in Fig. 2. At least the sectors of the outer rim are displaceable radially. The sectors of the rims of reversing blades are each secured to carriers 9 which by means of beams 15 or the like are connected to a carrier disc 16. The disc 16 is at its hub 24 journalled on the secondary shaft 7. The hub 24 is at its outer end connected to a brake, suitably in the form of a plate compressor brake.

The sectors of reversing blades forming the outer rim are connected by pairs to corresponding sectors of the inner rim, by means of lever arms 12, suitably pivoted on the reaction member, and links 13. Springs 14, or equivalent means, act on the connected parts to urge the reversing blades into the circuit.

In the illustrated embodiment the brake consists of a plate compressor brake comprising a stationary casing 17, a series of non-rotary plates 18 and a series of plates 19 connected to the hollow hub 24.

An air or oil operated plunger 20 is adapted to compress the plates of the brake, and springs 21 acting on the plunger serve to release the plates. A channel 22 serves as an inlet and outlet for the air or oil for controlling the plunger 20.

The coupling operates substantially as follows:

In the case of forward drive the channel 22 is open to the atmosphere and the plunger 20 is by the springs 21 held in its retracted position, i. e. the brake is disengaged. Thereby the disc 16 and the blade carriers 9 rotate at substantially the same speed as the pump, and under the influence of centrifugal force the inner blade sectors 10 are displaced outwardly. By suitable arrangement of the linkage 12, 13 and suitable proportionating of the masses the centrifugal forces affecting the outer sectors 11 of the reversing blades will be balanced so that said outer sectors are pulled inwardly into the blade carriers 9 by like movements of the inner blade sectors 10. Then the only obstruction in the circuit will consist of the beams 15.

The turbine and the secondary shaft 7 will

then rotate in the same direction as the pump and with a slip of about 3%. Then the input torque and the output torque are equal.

When reversing to backward drive air or oil is admitted through the channel 22, whereby the plunger 20 will compress the plates 18 and 19 so that the disc 16 and the blade carrier 9 are arrested and the centrifugal forces cease.

The springs 14 will then force the outer and the inner sectors of reversing blades into their respective circuits so that the rotary direction of the turbine and the secondary shaft 7 is reversed. The springs 14 may also be positioned in the chambers between the walls of the carrier 9 and the inner walls 1 and 5, respectively. The blade sectors 11 may also be guided in other manner than that illustrated. They may be mounted on links, for example.

In accordance with the invention the blading may also be so arranged that only the outer reversing blades are withdrawn from the circuit when in forward drive. Such arrangement is shown in Fig. 3 in which the inner blades 10 are arranged to remain permanently in the circuit and, for withdrawing the outer blades 11, counterweights 25 are attached to the levers 12 in place of the links 13 which connect the levers to the inner blades in the embodiment shown in Fig. 2. In the arrangement of Fig. 3 centrifugal force acting on the counterweights 25 operates to pull the sectors of reversing blades 11 inwardly out of the circuit. In this latter embodiment the inner blades 10 are preferably substantially straight.

We claim:

1. A reversible hydraulic coupling of the closed circuit type comprising a driving member having a row of pump blades, a driven member having a row of turbine blades, means for reversing the direction of rotation of said driven member comprising a first row of guide blades receiving fluid directly from the pump blades and discharging directly to the turbine blades and a second row of guide blades receiving fluid directly from the turbine blades and discharging directly to the inlet of the pump blades, said guide blades being rotatably mounted and having means operatively associated therewith for selectively holding said guide blades rotationally stationary or releasing them to rotate freely and means for withdrawing at least said first row of guide blades from the circuit when the guide blades are released to rotate.

2. A coupling as set forth in claim 1 in which an annular core member defines the inner wall of the circuit and said first guide blades are withdrawn from the circuit into the core member when they are released to rotate.

3. A coupling as set forth in claim 1 having an annular core member defining the inner wall of the circuit and means responsive to rotation of the guide blades when the guide blades are released for withdrawing said first guide blade means from the circuit into the core member.

4. A coupling as set forth in claim 1 including an annular core member defining the inner wall of the circuit, spring means acting to force said first guide blades radially outwardly from said core member into the circuit when the guide blades are held against rotation and means connected with said first guide blades and acted on by centrifugal force when the guide blades are released and rotate for overcoming said spring means and withdrawing said first guide blades radially inwardly into said core member.

5. A coupling as set forth in claim 1 in which an annular core member defines the inner wall of the circuit, said first row of guide blades is subdivided into a series of segments and said means for withdrawing the blades from the circuit is actuated by centrifugal force to move the blade segments into the core member when the guide blades are released and rotate.

6. A coupling as set forth in claim 1 in which an annular core member defines the inner wall of the circuit and means interconnecting said first and said second rows of guide blades and responsive to centrifugal force when the guide blades are released and rotate for withdrawing both rows of guide blades from the circuit into said core member.

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