Sept. 20, 1960 E. KLUGE 2,952,977

ROTARY HYDRAULIC COUPLINGS

Filed Dec. 17, 1956 4 Sheets-Sheet 1

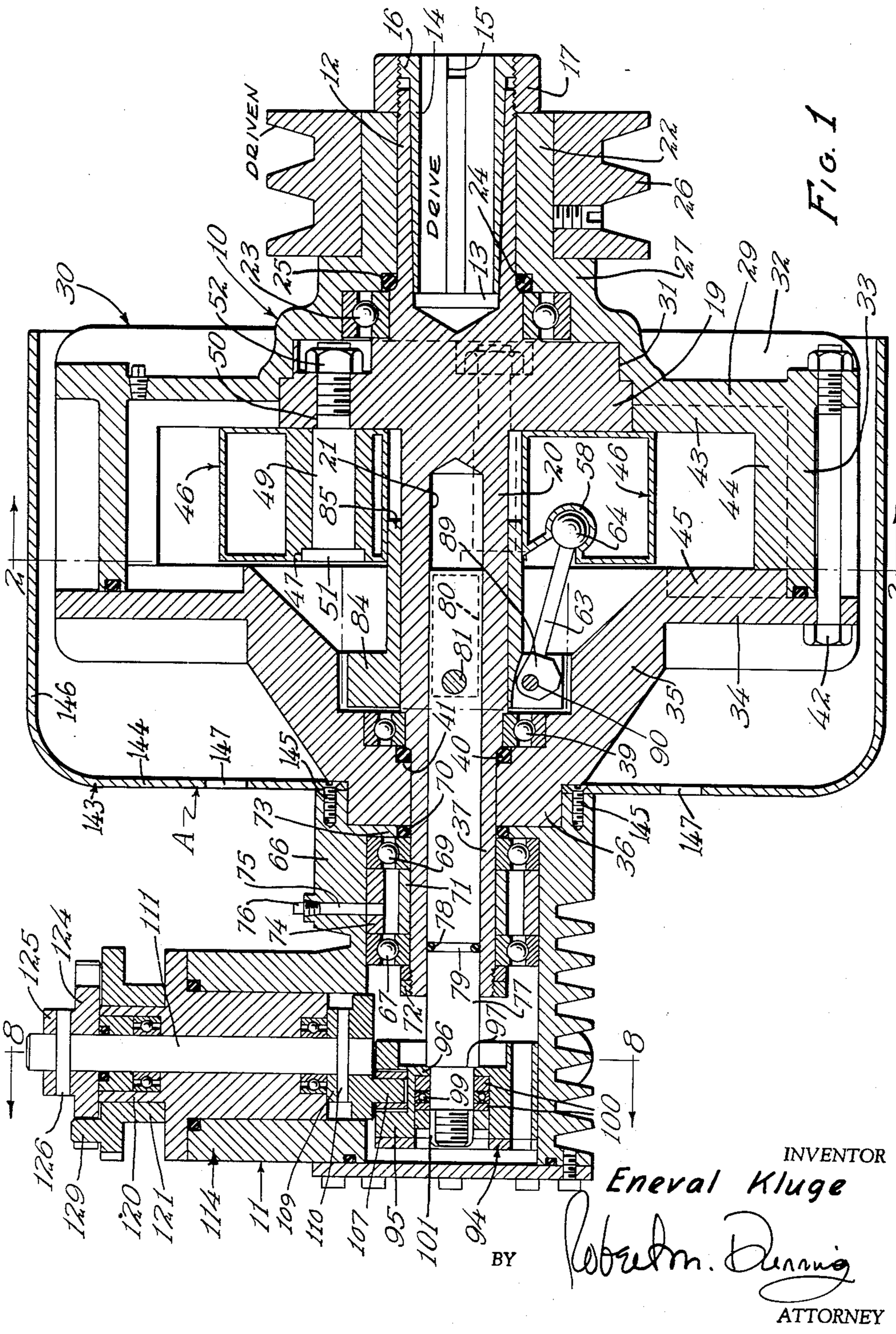

FIG. 1

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Sept. 20, 1960 E. KLUGE 2,952,977

ROTARY HYDRAULIC COUPLINGS

Filed Dec. 17, 1956 4 Sheets-Sheet 2

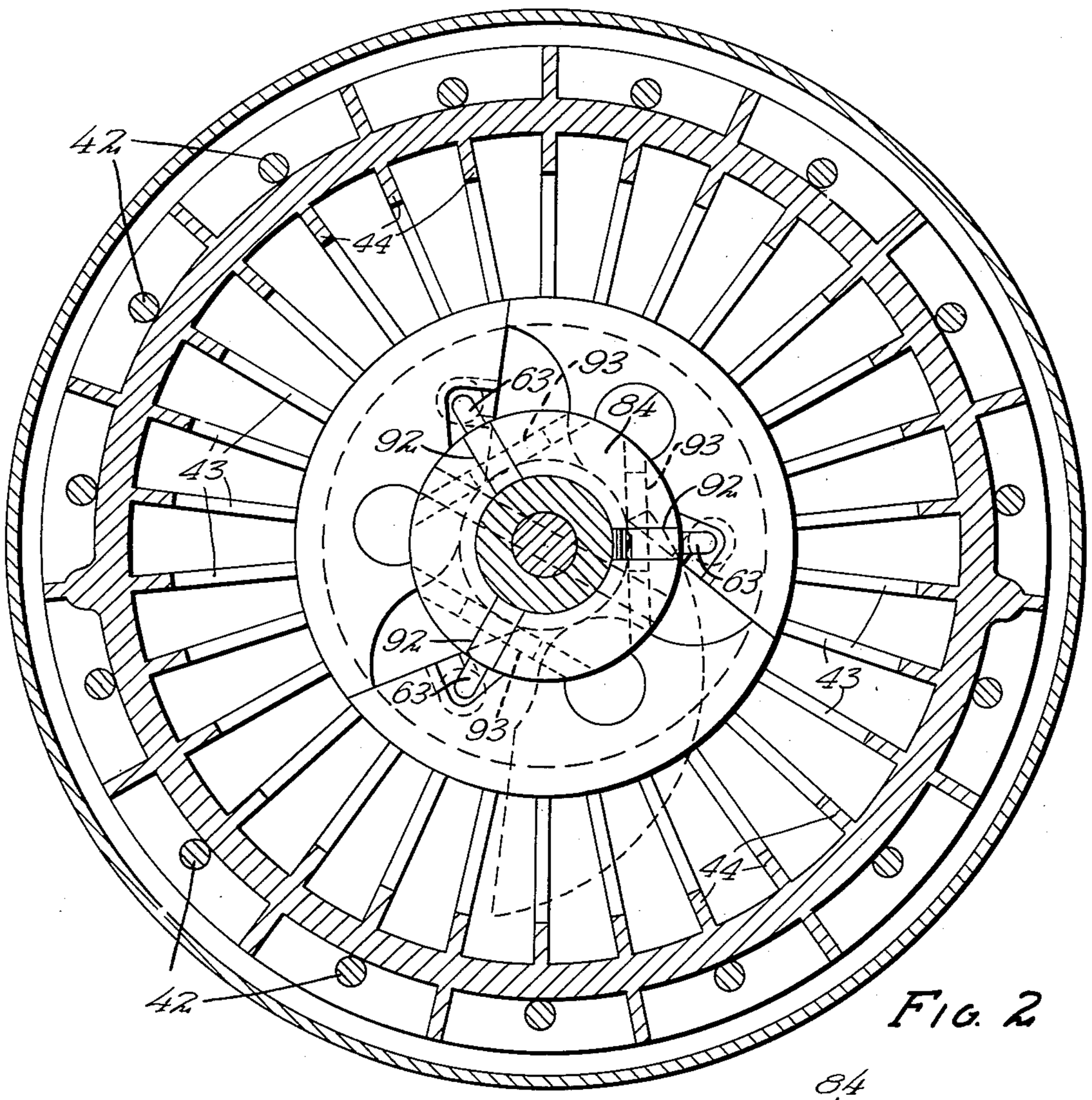

FIG. 2

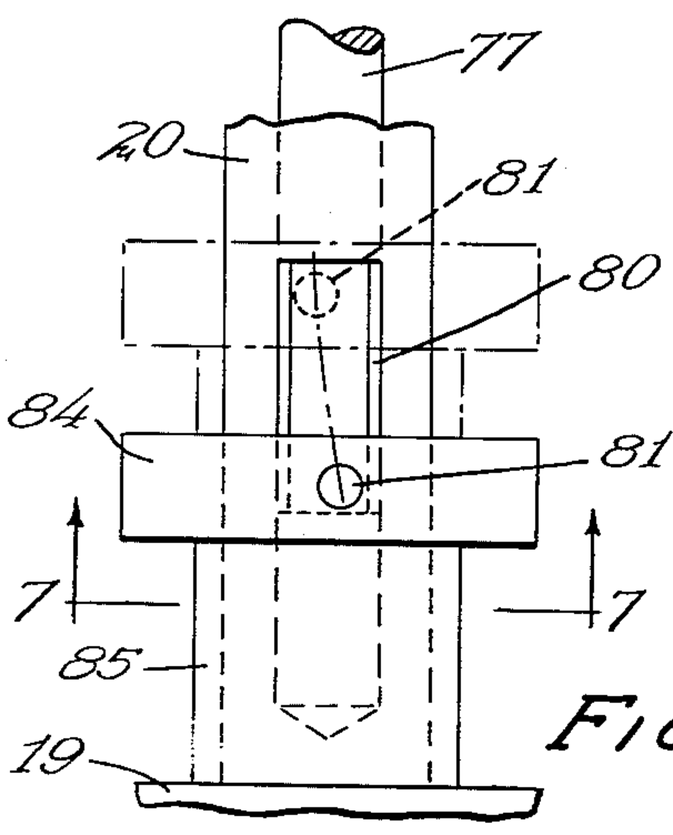

FIG. 6

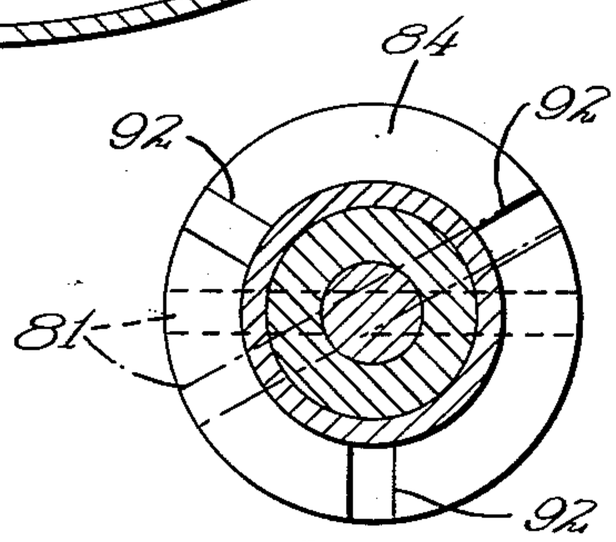

FIG. 7

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ROTARY HYDRAULIC COUPLINGS

Filed Dec. 17, 1956 4 Sheets-Sheet 3

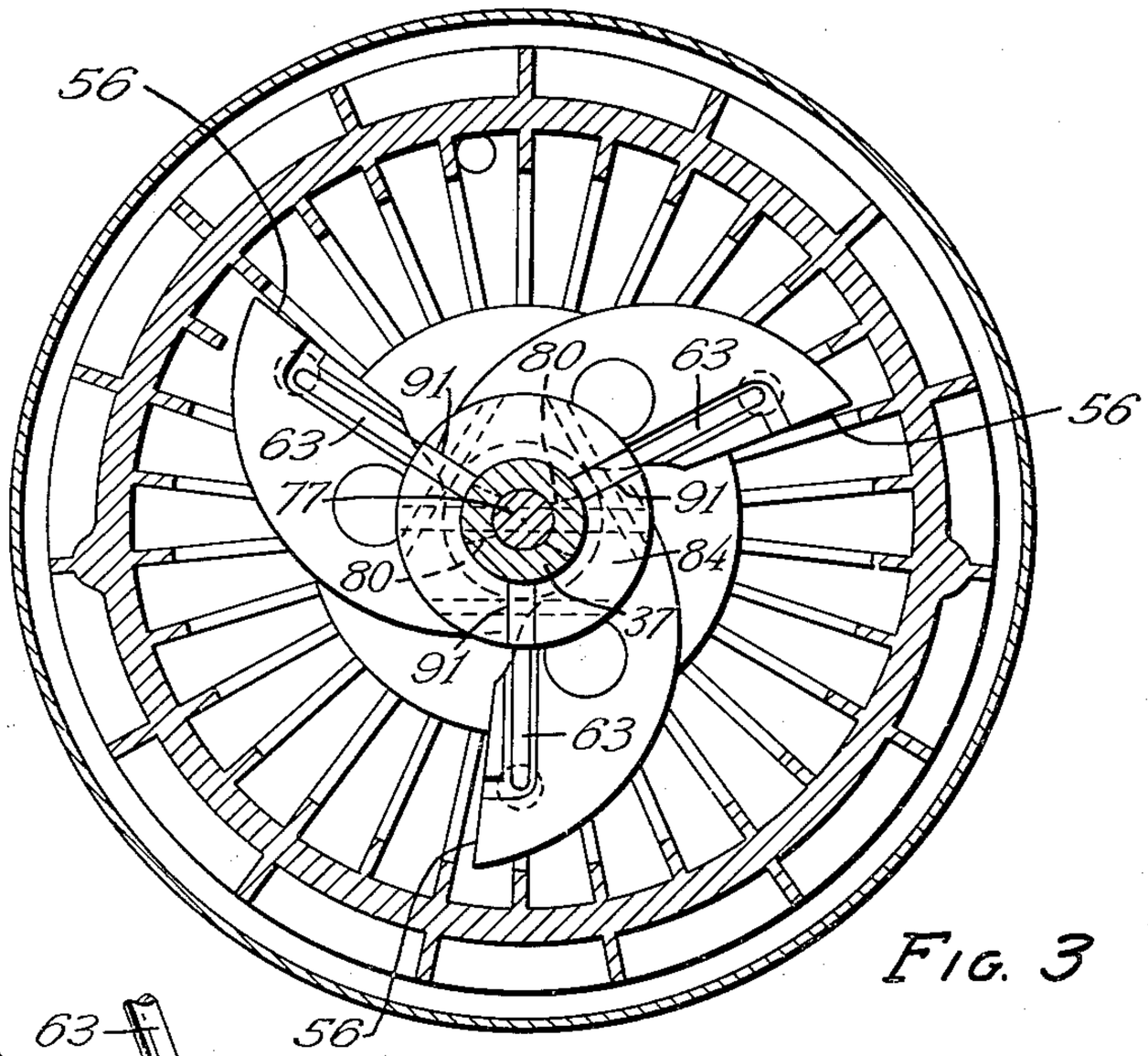

FIG. 3

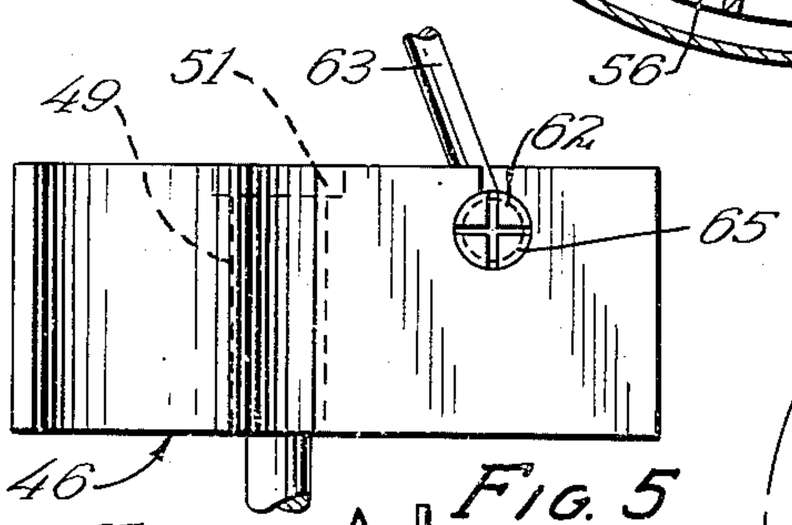

FIG. 5

FIG. 4

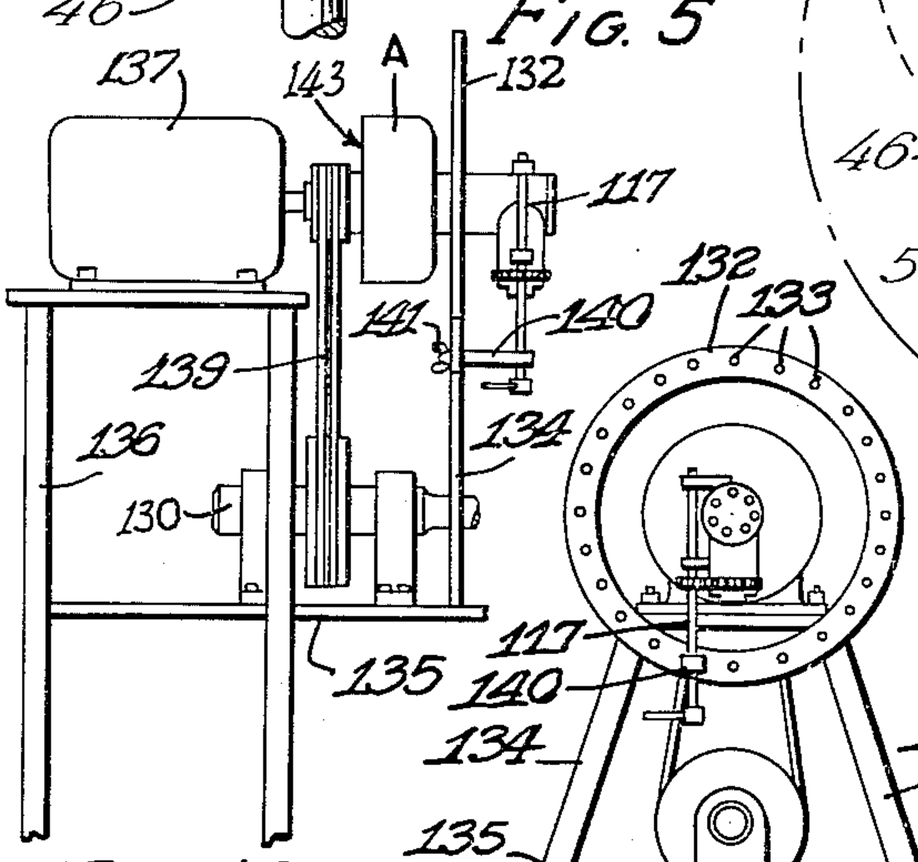

FIG. 13

FIG. 14

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ROTARY HYDRAULIC COUPLINGS

Filed Dec. 17, 1956 4 Sheets-Sheet 4

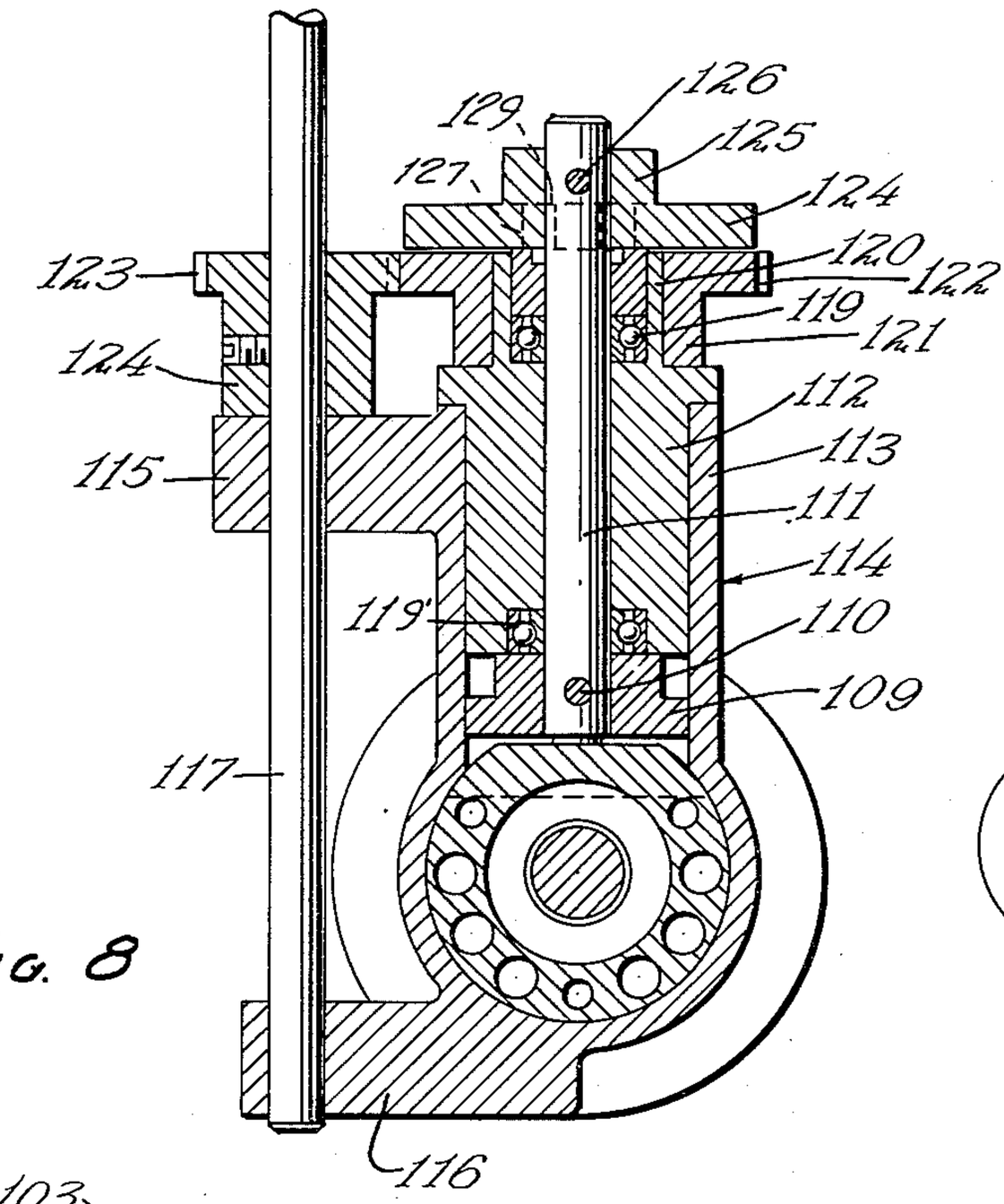

Fig. 8

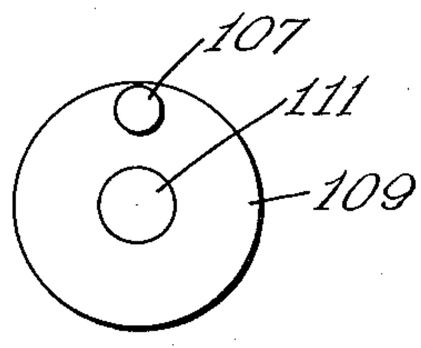

Fig. 9

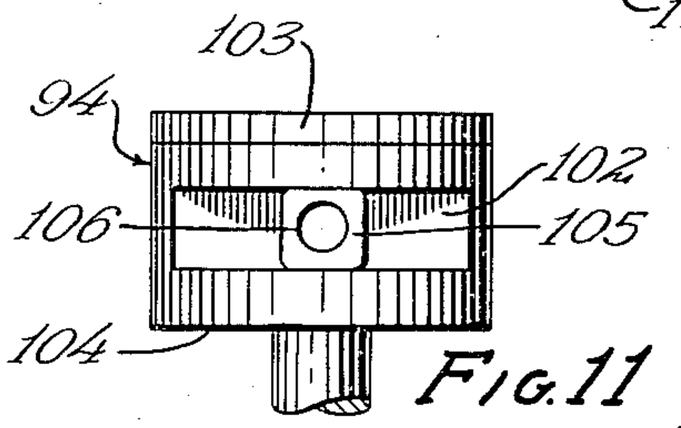

Fig. 11

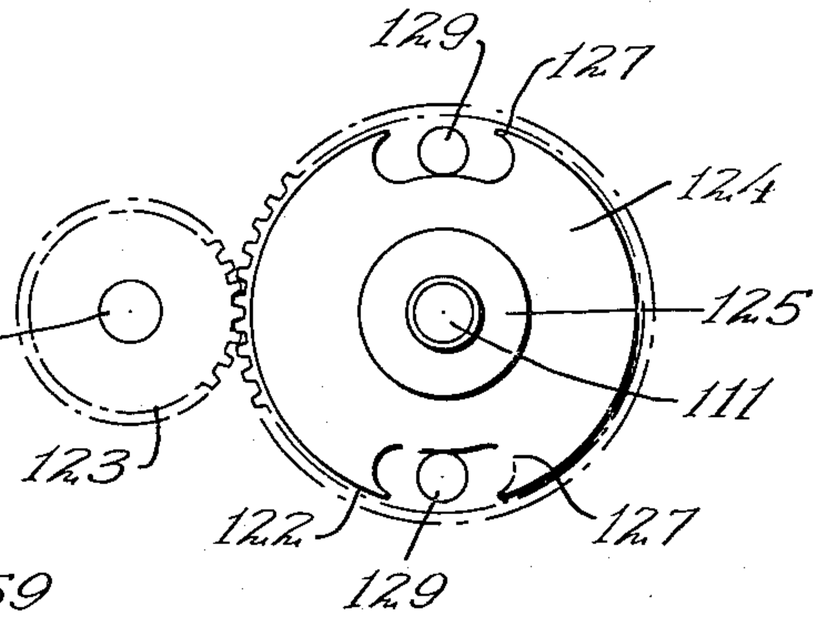

Fig. 10

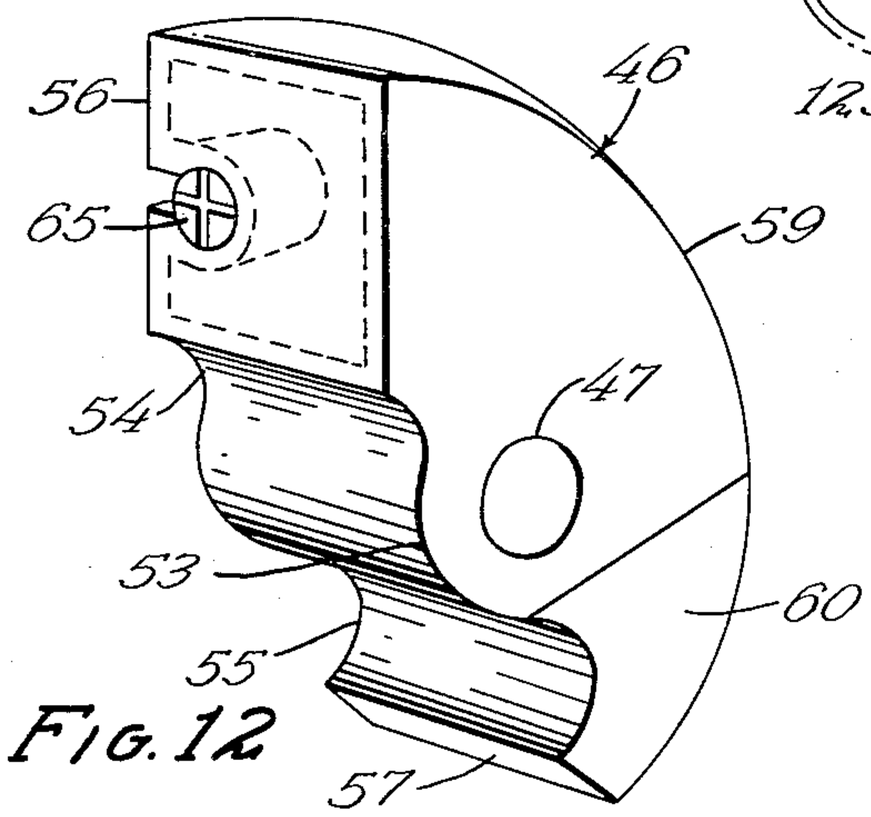

Fig. 12

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ROTARY HYDRAULIC COUPLINGS

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Filed Dec. 17, 1956, Ser. No. 628,768

13 Claims. (Cl. 60—54)

This invention relates to an improvement in rotary hydraulic couplings and deals particularly with a variable speed coupling which tends to maintain a constant adjusted speed.

An object of the present invention resides in the provision of a rotary hydraulic coupling which includes a drive member to which is secured a rotatable hub. A series of vanes are pivotally supported intermediate their ends to this hub. These vanes are so constructed and arranged that in completely retracted position they provide a cylindrical surface. In their other extreme position, the vanes extend outwardly in a generally radial direction from the center of the hub.

The hub and its vanes are rotatably supported in a chamber having internally extending fins. This casing or housing is rotatably supported and is connected to the driven member. When the chamber is filled with hydraulic fluid and the vanes are fully retracted, they provide a cylindrical structure which may rotate within the fluid with little tendency to rotate the housing. As the vanes are pivoted to swing outwardly from the hub, they provide an ever increasing force tending to move the housing with the hub.

A feature of the present invention resides in the provision of a coupling of the type described including vanes which are pivotally supported on axes which are generally parallel to the axis of rotation of the supporting hub. The inner end of each vane is heavily weighted. Thus, during the rotation of the hub, centrifugal force tends to swing the vanes toward closed or retracted position. In the event the force against the vanes increases, the centrifugal force acting upon the weighted ends of the vanes is overbalanced, tending to cause the vanes to project a greater distance from the hub.

A further feature of the present invention resides in the provision of a rotary coupling of the type described, including a manually operable means for adjusting the position of the vanes within the housing. This manually operable means includes a lost motion mechanism which permits some adjustment of the vanes independently of the manually operable control mechanism. As a result, if the load of the driven member increases, and the speed of rotation of the drive member is decreased to an extent where the centrifugal force upon the vanes decreases to a predetermined extent, the vanes may automatically project outwardly to a greater extent, thus providing a greater tendency to rotate the housing in unison with the hub. In a similar manner if the speed of rotation tends to increase, it also increases the force tending to retract the vanes.

A feature of the present invention resides in the provision of a hydraulic coupling which includes a series of pivotally supported vanes mounted upon a hub and in which the vanes are so shaped to provide a seal between the inner portion of the hub and the vanes at all times. The surface of the vanes is at all times in substantial surface contact with the hub regardless of the pivotal position thereof.

A further feature of the present invention resides in the provision of a novel means for projecting and retracting the vanes. An arm is connected to each vane and to an axially slidable support. By moving the axially slidable support in an axial direction, the arms act to swing the free ends of the vanes from one extreme position to the other. Means are also provided for compensating for changes in angularity between the points of connection of the arms with the vanes and the slidable support.

These and other objects and novel features of the present invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of the specification:

Figure 1 is a longitudinal sectional view through the rotary hydraulic coupling and the control therefore.

Figure 2 is taken on the irregular section line 2—2 of Figure 1.

Figure 3 is a view similar to Figure 2 on a somewhat reduced scale showing the vanes in a different rotative position.

Figure 4 is a diagrammatic view of the hub and the vanes, the view showing the vanes in contracted position in full lines and in projected position in dotted outline.

Figure 5 is a view of one of the vanes removed from the remaining structure, the view indicating the manner in which the vane operating rods are connected to the vanes.

Figure 6 is an elevation view of a detail portion of the apparatus removed from the remaining structure.

Figure 7 is a sectional view on the line 7—7 of Figure 6.

Figure 8 is a sectional view through a portion of the control mechanism, the position of the section being indicated by the line 8—8 of Figure 1.

Figure 9 is a detail portion of the control mechanism removed from the remainder of the construction.

Figure 10 is an end view of the control mechanism.

Figure 11 is another detail portion of the control mechanism.

Figure 12 is a perspective view of one of the vanes detached from the remainder of the construction.

Figure 13 is a side elevational view of the coupling mounted for a typical use.

Figure 14 is an end elevation view of the arrangement shown in Figure 13.

The rotary hydraulic coupling is indicated in general by the letter A. The coupling includes two main sections, one of which comprises the hydraulic coupling body and which is indicated in general by the numeral 10. The other main part or section of the apparatus includes the control apparatus and this is indicated in general by the numeral 11.

The coupling body

The coupling body 10 includes a drive shaft 12 having a slightly tapered socket 13 in its extremity. A sleeve 14 having a keyway 15 therein is provided with a tapered outer surface engaged in the socket 13 and includes an enlarged diameter externally threaded end portion 16. The outer end of the shaft 12 is also externally threaded with a left hand thread and a sleeve or collar 17 is threaded onto the sleeve portion 16 and the shaft 12 to hold these parts together. The sleeve is right hand threaded and left hand threaded, so that rotation of the sleeve is one direction draws the sleeve farther into the socket. As the keyway 15 forms a split in this sleeve, the sleeve may be wedged against a drive shaft inserted into the sleeve, to center this inserted shaft in the shaft 12.

A disc like body portion 19 is attached to the shaft 12, this disc actually forming a part of the hub. The hub body 20 extends axially from the disc portion 19, the hub 20 actually forming an extension of the shaft

12. The hub or shaft portion 20 is internally socketed as indicated at 21, the socket 21 extending axially into the shaft portion 20 from the opposite end thereof from the socket 13.

A hub 22 encircles the drive shaft 12. An anti-friction bearing 23 is interposed between the drive shaft 12 and the hub 22 to permit relative rotation between these parts. A sealing ring 24 is also provided in an annular groove 25 in the hub 22 to form a seal between the hub 22 and the drive shaft 12. A pulley 26 or other similar means is mounted upon the hub 22 to rotate in unison therewith. This pulley 26 forms the power take-off means of the coupling. Obviously, a gear, sprocket or other take-off means can be substituted for the pulley 26.

The hub 22 is connected by a laterally offset portion 27 to a disc-like plate 29 which forms one side of the fluid housing, the housing being indicated in general by the numeral 30. The offset portion 27 is preferably stepped as indicated at 31 to fit with a running fit about the disc portion 19 on the drive shaft 12. Cooling ribs such as 32 are preferably provided on the outer surface of the disc member 29, these cooling ribs preferably extending radially outwardly from the offset portion 27.

The disc-like portion 29 supports an integral hollow cylindrical sleeve 33 which extends in concentric relation to the hub or shaft portion 20 forming a part of the drive shaft 12 and encircling this hub 20. The fluid chamber is completed by a disc-like closure plate 34 which is connected to a generally conical portion 35 which terminates in a hub 36 encircling the extended end 37 of the hub or shaft portion 20. An anti-friction bearing 39 encircles the shaft portion 37 to provide a means of permitting relative rotation between the shaft and the fluid chamber. A seal 40 is also provided in the groove 41 in the inner surface of the hub 36 to prevent the leakage of fluid from the fluid chamber.

The closure plate 34 is connected to the disc-like closure 29 by means of bolts 42 or other suitable means. These bolts 42 are arranged in angularly spaced relation about the periphery of the fluid chamber as is indicated in Figure 2 of the drawings.

Angularly spaced fins 43 are provided on the inner surface of the disc-like closure member 29 and extend in a generally radial direction. Fins 44 are also provided on the inner surface of the sleeve 33, the fins 44 forming an extension of the fins 43. Fins 45 are also provided on the inner surface of the closure plate 34, the fins 45 being arranged to extend in a generally radial direction. These fins are designed to act somewhat in the capacity of the blades of a turbine and cause the fluid chamber to rotate with the hub 20 in the operation of the coupling in a manner which will be later described in detail.

A series of angularly spaced vanes indicated in general by the numeral 46 are pivotally connected to the disc 19 to encircle the hub 20. These vanes are shaped as is best illustrated in Figure 12 of the drawings. The vanes 46 include a pivot opening 47 designed to accommodate pivot bolts 49 which extend through angularly spaced apertures 50 in the disc 19. The pivot bolts 49 extend in a direction parallel to the axis of the shaft portion 20 and include a head 51 which engages the vanes to hold the same in place. The bolts 49 are held in place by suitable nuts 52 which are located in recesses in the disc 19.

The vanes 46 are provided with arcuate portions 53 having the axis of the pivot aperture 47 as their center of arcuation. Oppositely curved surfaces 54 and 55 are provided on opposite sides of the curved portion 53, these oppositely curved portions being of substantially the same radius of curvature as the hub 20. With reference to Figure 4 of the drawings, it will be seen that when the vanes 46 are in fully retracted position, the curved surface 54 engages against the hub 20 to limit rotation. When the vanes are in fully projected position, the curved surfaces 55 of the vanes engage against the surface of the hub 20. Thus, these surfaces 54 and 55 limit the pivotal movement of the vanes about their respective pivots 49.

As indicated in Figure 12 of the drawings, one end 56 of each vane 46 is flat and from Figures 3 and 4 of the drawings it will be noted that the flat ends 56 extend on substantially radial planes through the axis of the shaft when in fully projected position. As is also evident from Figure 4 of the drawings, the flat ends 56 of the blades 46 engage in surface contact with the opposite end 57 of an adjoining blade when the vanes are in fully retracted position. The outer surface 59 of each vane between the ends 56 and 57 thereof lies on a cylindrical surface concentric with the hub 20 when the vanes are in fully retracted position. Stated otherwise, the vanes 46 are designed to engage in end to end relation when the vanes are retracted to provide a cylindrical continuous outer surface in this position of the vanes.

As is indicated in Figure 12 of the drawings, the body of each vane 46 is hollow on one side of the pivot aperture 47 so that this end of each vane is extremely light in weight. The portion 60 of each vane adjoining the end 57 thereof is formed of a material substantially heavier than the remainder of the vane. In other words, if the vanes 46 are made of a lightweight material such as magnesium or the like the other end 60 of each vane may be formed by a relatively heavy metal such as lead or the like.

As is indicated in Figure 1 of the drawings, semi-spherical sockets 58 are cast into the hollow interior of each vane. As is indicated in Figure 5 of the drawings, an internally threaded cylindrical passage 62 leads into the socket 58. An operating arm 63 having a ball head 64 is engaged in each socket 58 and a threaded plug 65 is threaded into the passage 62 to engage against the ball 64 and to hold the ball in place in the socket. Preferably the inner end of the plug 62 is concave to fit the curvature of the ball 64 to provide the operating arm 63 with a suitable socket so that it can change angularity relative to the connected vane.

The control mechanism

The control mechanism 11 includes a sleeve 66 which encircles the drive shaft portion 37. Anti-friction bearings 67 and 69 are provided within the sleeve 66 and encircling the shaft portion 37 to provide relative rotation between these parts. A seal 70 is preferably provided outwardly of the hub 36. A spacing sleeve 71 is provided between the bearings 67 and 69. A nut 72 is provided on the externally threaded end of the shaft portion 37 to hold the bearings 67 and 69 in proper relation to the shaft portion 37. The outer race of the bearings 69 engages against an internally projecting flange 73 integral with the sleeve 66 and a spacing sleeve 74 is provided between the outer races of the bearings 67 and 69. A radially extending lubrication passage 75 closed by a plug 76 or other suitable means provides a way of lubricating the bearings when it is desired.

A shaft 77 is slideably supported in the socket 21 extending into the shaft portion 37 and the hub 20. An annular groove 79 in the shaft 77 supports a seal 78 between the shaft 77 and the shaft portion 37. The portion of the shaft portion 37 adjoining the hub 20 is provided with a generally rectangular aperture 80 therein, this aperture being elongated in a direction parallel to the axis of the shaft 77. A transverse rod 81 extends through the shaft 77 and through the elongated aperture 80 in the shaft portion 37, the ends of the rod 81 extending into the enlarged diameter flange 84 upon a sleeve 85 which encircles a portion of the shaft portion 37 and the hub 20. As a result of this arrangement, the flange 84 on the sleeve 85 may slide longitudinally of the hub 20

and may rotate to some extent relative to the hub 20 for a purpose which will be later described. The limits of this relative rotation is defined by the longitudinal edges of the apertures 80 on opposite sides of the shaft portion 37.

As shown in Figure 1 of the drawings, the connecting or operating arms 63 are provided with enlarged ends 89 having pivot apertures 90 extending therethrough. These enlraged ends 89 are provided with parallel sides which engage between the flat sides of the radial grooves 92 arranged in angularly spaced relation in the flange 84. Pivots 93 (Figure 2) pivotally support the arms 63 and connect these arms for movement with the flange 84 and slideable sleeve 85. A piston 94 is slideably supported within the sleeve 66 and includes a ring shaped body 95 having an inwardly extending flange 96 which engages against a shoulder 97 on the shaft portion 77. A bearing 99 is interposed between the flange 96 and spacing washers 100, these washers being held in place by a nut 101. Thus the piston may rotate relative to the shaft 77 but moves longitudinally in unison therewith.

As is best illustrated in Figure 11 of the drawings, the piston 94 is provided with a groove 102 which extends along a chord of the cylindrical outer surface of the piston, the groove having its side edges parallel with the ends 103 and 104 of the piston. A slide 105 is provided in the groove 102, the slide 105 having a cylindrical pivot opening 106 therein extending normal to the base of the groove 102. This aperture 106 is designed to accommodate an eccentric pin 107 mounted on the cam 109 which is shown in Figure 8 as being pinned at 110 to a shaft 111. Rotation of the cam 109 thus acts to reciprocate the piston 94 axially, the slide 105 moving in the groove 102.

As is indicated in Figure 8 of the drawings, the shaft 111 extends through the plug 112 mounted in a tubular portion 113 of the casting 114 forming the enclosure for the control mechanism. As is indicated in Figure 1 of the drawings, the casting 114 includes two right angularly extending tubular portions 66 and 113 the axes of which intersect. The casting also includes a pair of lugs or brackets 115 and 116 through which the operating shaft 117 extends for support.

The shaft 111 is supported by bearings 119 and 119'. The end portion of the plug 112 includes a reduced diameter sleeve element 120 which serves as a bearing for the hub 121 of a gear 122. The shaft 117 is parallel to the shaft 111 and a gear 123 has its hub 124 mounted upon the shaft 117 for rotation in unison therewith. Rotation of the operating shaft 117 thus acts through the gear 123 to rotate the meshing gear 122.

As is indicated in Figure 10 of the drawings, taken in conjunction with Figure 8, a disc 124 has its hub 125 keyed to the shaft 11 as indicated at 126. The disc 124 is provided with a pair of diametrically opposed notches 127. Pins 129 are mounted in the gear 122 and project into the notches 127. As the notches are substantially wider than the diameter of the pins 129, the disc 124 may rotate angularly for some distance relative to the gear 122. This provides a lost motion arrangement which assists in the operation of the construction as will be described.

Operation of the coupling

The coupling is mounted in a suitable position. A power shaft is inserted within the sleeve 14 and the sleeve wedged between this power shaft and the drive shaft 12. The pulley 26 is attached to a driven member which is to be driven at a variable speed.

By rotation of the control operating shaft 117, rotation may be transmitted through the gears 123 and 122 to the parallel shaft 111 through the disc 124. Rotation of the gear 122 brings the pin or pins 129 to one end of the slot 127 and further rotative movement of the gear in the same direction will act through the disc to rotate the shaft 111 and the eccentric disc 109 attached thereto.

Rotation of the eccentric disc 109 acts through the pin 107 and its bearing 105 to move the piston 94 longitudinally of the cylinder in which it is positioned. Longitudinal movement of the piston 94 moves the driven shaft 77 longitudinally within the axial socket of the hub 20 and its driven shaft extension 37.

Movement of the rod or shaft 77 in one direction acts to move the sleeve 85 which is connected by the arms 63 to the various vanes 46. Thus, movement of the member 77 in one direction acts to swing the vanes 46 toward retracted position so that the outline of the vanes forms a cylindrical surface. Accordingly, when the shaft or rod 77 is in its outermost position, the vanes are fully retracted and rotation of the hub 20 and the vanes will cause insufficient movement of the fluid within the fluid chamber to move the housing 30 in unison with the vanes.

Rotation of the control rod 117 in the opposite direction acts through the lost motion mechanism described to move the sleeve 85 inwardly. This motion acts through the rod 63 to urge the hollow ends of the vanes outwardly. As the vanes move outwardly, they create a force against the liquid within the housing 30 tending to rotate this body of liquid with the vanes. The moving liquid acts against the internal ribs in the casing 30 to rotate the housing or casing. If the vanes are but slightly projected, the housing will rotate at a relatively low speed. As the ends of the vanes are projected a greater amount, the tendency for the liquid in the casing to rotate the casing increases, until when the vanes are virtually fully projected, the casing will rotate at almost the same speed as the drive shaft.

From the foregoing description it will be seen that a variable speed drive is provided which can rotate the driven member at a desired speed, and this speed may be regulated by operation of the control mechanism. If the load upon the driven member remains substantially constant, the lost motion mechanism which has been described has little effect upon the operation.

It will be seen that as the vanes rotate, the force of liquid against the operating or outer ends of these vanes tends to swing the vanes toward fully projected position. At the same time, centrifugal force acting upon the weighted opposite or inner ends of the vanes tends to swing the vanes toward a closed or retracted position.

In the event the driven member is operating at a predetermined desired rate of speed and a heavy load is suddenly applied to the driven member, this load tends to hold the driven member and casing from rotation. The reduction in speed of the outer casing imposes a greater force upon the outer or projecting ends of the vanes. When this force is sufficient, the vanes are permitted to move outwardly by the lost motion mechanism previously described. In other words this pressure acts upon the connecting rods 63 to move the shaft or rod 77 inwardly, this motion acting through the eccentric to rotate the shaft 111 through the angular distance necessary to move the pin 129 from one end of the slot 127 to the opposite end thereof. By increasing the extent of projection of the vanes, these vanes will exert a greater force against the liquid in the housing 30 until the housing again rotates at the desired speed. When the pulley attains the proper speed, the force upon the vanes decreases and the centrifugal force on the weighted ends of the vanes tends to retract these vanes. In other words, when the driven member is adjusted to rotate at a desired speed, the vanes are not rigidly held at a predetermined degree of projection from their hub and there is at all times a balance between the centrifugal force acting on one end of each vane and the fluid pressure acting upon the other end thereof. When the load upon the driven member lessens, the effect of centrfiugal force overbalances the force acting upon the vanes, acting to retract the vanes within the limits of the lost motion mechanism. As a

result, during operation, the pin **129** of the lost motion mechanism merely floats between its two extreme positions moving in one direction when the load on the driven member increases and moving in the opposite direction when the load on the driven member decreases.

In accomplishing the result described, a careful balance between the weighted ends of the vanes and the hollow outer or projecting ends of the vanes is necessary.

However, in actual practice it has been found that when a load is applied to the driven member, the lost motion mechanism will quickly correct any variation in speed of the driven member by projecting the vanes to a greater extent. As the load eases off, the lost motion mechanism acts to retract the blades to some extent due to the counterbalancing effect of the weighted ends of the vanes thereby providing a variable speed mechanism which functions effectively for its intended purposes.

Manner of mounting

The manner of mounting the clutch may be varied within substantial limits. In Figures 13 and 14 is a typical mounting arrangement is shown. A ring **132** having holes **133** in angularly spaced relation therethrough is supported by arms **134** to a fixed platform **135** forming a part of the frame **136**. The coupling A is driven by a motor **137** on the frame **136**. The coupling is connected by belts **139** to a counter shaft **130**, to drive this shaft.

The control shaft **117** extends through an arm **140** having an internally threaded axial socket to accommodate a thumb screw **141**. This thumb screw may hold the shaft **117** in any angular position, so that the adjustment may vary through 360 degrees. In this way the operating handle may be positioned to suit the convenience of the operator.

The clutch is enclosed within an outer shell **143** including a disc **144** secured to the sleeve **66** by bolts **145**, and also including a cylindrical sleeve **146** connected at one end to said disc and encircling the housing. The disc **144** is provided with angularly spaced apertures **147** therethrough spaced from the periphery thereof. The other end of the sleeve **146** is open. Rotation of the housing within the shell acts to draw air through the apertures **147** and force air through the open end of the shell sleeve **146**.

Due to the fact that the sleeve **66** is rotatable relative to the driven shaft and the driven housing, some means must be provided for holding the sleeve **66** from rotation. By providing the ring **132** adjacent the control shaft **117**, and connecting the arm **140** encircling the control shaft to the ring, the shaft **117** may be secured to extend in any direction. The entire control, including the sleeve **66** and shell **143** may be pivoted about the axes of the drive shaft and housing when these elements are not in operation.

In accordance with the patent statutes, I have described the principles of construction and operation of my improvement in rotary hydraulic couplings, and while I have endeavored to set forth the best embodiment thereof, I desire to have it understood that changes may be made within the scope of the following claims without departing from the spirit of my invention.

I claim:

1. A rotary hydraulic coupling including a drive shaft, a housing encircling a portion of said drive shaft and being relatively rotatable with respect thereto, a series of vanes within said housing, pivot means pivotally connecting said vanes to said shaft for rotation in unison therewith, the axes of said pivots extending substantially parallel to the axis of said drive shaft, said pivots extending through said vanes intermediate the ends thereof, said vanes having outer projectable ends and inner weighted ends, said weighted ends being substantially heavier than said outer projectable ends, said housing having internal fins and including hydraulic fluid which may be forced against said fins by said vanes, the centrifugal force acting upon the weighted ends of said vanes tending to counter balance the force of hydraulic fluid against the projectable ends of the vanes, means for simultaneously pivoting said vanes toward projected or retracted position, and lost motion means in said vane pivoting means, said lost motion means permitting some variation in the projection of said vanes at a predetermined position of a portion of said vane pivoting means whereby an increase in the load resisting rotation of said housing tends to project said vanes and a reduction in load resisting rotation of said housing tends to retract said vanes.

2. The construction described in claim 1 and in which said vanes are angularly spaced about said drive shaft and are shaped to provide a cylindrical outer surface in fully retracted position.

3. A variable speed device including a rotatable drive member, a coaxial relatively rotatable driven member, one of said members including an outer rotatable housing having spaced sides and a connecting peripheral sleeve connecting said sides, the other of said members including a hub extending within said housing, vanes supported on said hub to extend outwardly therefrom within said housing, means pivotally supporting said vanes, means connecting said vanes for pivoting the same in unison, a control connected to said connecting means to actuate the same, said control being pivotal relative to said drive member and said driven member about the axis thereof when said drive member and driven member are stationary, an outer shell spaced from and encircling said housing and connected to said control and pivotal in unison therewith, said shell including a disc having angularly spaced apertures therethrough spaced from the periphery thereof and, said shell also including a cylindrical sleeve connected at one end to said disc and encircling said housing, said sleeve having an open end opposite the end thereof connected to said disc, whereby rotation of said housing within said shell will act to draw air through said apertures and force air through said open end of said shell sleeve.

4. The structure of claim 3 and in which said means connecting said vanes is movable in a direction axially of said drive and driven members.

5. A rotary hydraulic coupling including a drive shaft, a rotary housing encircling said drive shaft, internal ribs on the interior of said housing, a series of vanes pivotally connected to said drive shaft on axes substantially parallel to the axis of said drive shaft, said vanes being pivoted intermediate their ends and having inner ends substantially sealed relative to said drive shaft, said vanes, in one extreme position, forming a rotor having a substantially continuous cylindrical outer surface, an arm pivotally connected to each vane for controlling the pivotal position thereof, an axially movable control member to which each said arm is connected for movement, means externally of said housing connected to said axially movable member for moving the same, the inner ends of said vanes being weighted, while the outer vane ends are relatively light, whereby the action of centrifugal force tends to urge the vanes toward retracted position.

6. A rotary hydraulic coupling including a drive shaft, a rotary housing encircling said drive shaft, internal ribs on the interior of said housing, a series of vanes pivotally connected to said drive shaft on axes substantially parallel to the axis of said drive shaft, said vanes being pivoted intermediate their ends and having inner ends substantially sealed relative to said drive shaft, said vanes, in one extreme position, forming a rotor having a substantially continuous cylindrical outer surface, an arm pivotally connected to each vane for controlling the pivotal position thereof, an axially movable control member to which each said arm is connected for movement, means externally of said housing connected to said axially movable member for moving the same, the inner ends of said vanes being weighted, while the outer vane ends

are relatively light, so that the action of centrifugal force tends to urge the vanes toward retracted position, and including a lost motion mechanism between said arms and said means externally of said housing.

7. A rotary hydraulic coupling including a drive shaft having a cylindrical outer surface, a fluid containing rotary housing encircling said drive shaft, internal ribs on the interior of said housing, a series of vanes pivotally connected to said drive shaft on axes substantially parallel to the axis of said drive shaft, said vanes being pivoted intermediate their ends and having inner ends including arcuate portions substantially sealed relative to the cylindrical outer surface of said drive shaft regardless of the pivotal position thereof, said vanes each having an arcuate side, the center of arcuation of said sides being at a common point when said vanes are in one extreme position to provide a continuous substantially cylindrical outer surface, a flat portion of the inner end of each vane abutting against a flat portion of the outer end of the next adjacent vane in said one extreme position, said vanes having substantially flat ends extending in substantially radial planes through the shaft axis in their other extreme positions and means connecting said vanes for operation in unison.

8. The structure of claim 7 and in which said vanes are so shaped and supported that reaction of fluid against the vanes caused by rotation of the vanes tends to pivot the vanes toward the other extreme position, and in which the inner ends of said vanes are weighted, whereby centrifugal force tends to urge said vanes toward said one extreme position.

9. A rotary hydraulic coupling including a drive shaft, a fluid containing housing encircling said drive shaft, internal ribs on the interior of said housing, a series of vanes, means pivotally connecting said vanes to said drive shaft on angularly spaced axes about, and parallel to said drive shaft, said vanes being pivotal between two extreme positions, said vanes being substantially sealed relative to said shaft in all positions, means for pivoting said vanes in unison, said vanes having one substantially flat end projecting on a substantially radial plane through the shaft axis outwardly from said shaft in one extreme position, the ends of said vanes abutting in the other extreme position thereof, said vanes having an arcuate outer surface forming a substantially continuous cylindrical surface in said other extreme position of said vanes, said other ends engaging said shaft in said one extreme position to limit pivotal movement thereof.

10. The structure of claim 9 and in which each said vane includes an inner arcuate surface in tangential relation to said shaft and forming the seal between each vane and said shaft.

11. A rotary hydraulic coupling including a drive shaft, a housing encircling a portion of said drive shaft and being relatively rotatable with respect thereto, a series of vanes within said housing, pivot means pivotally connecting said vanes to said shaft for rotation in unison therewith, the axes of said pivots extending substantially parallel to the axis of said drive shaft, said pivots extending through said vanes intermediate the ends thereof, said vanes having outer projectable ends and inner weighted ends, said weighted ends being substantially heavier than said outer projectable ends, said housing having internal fins and including hydraulic fluid which may be forced against said fins by said vanes, the centrifugal force acting upon the weighted ends of said vanes tending to counter balance the force of hydraulic fluid against the projectable ends of the vanes, means for simultaneously pivoting said vanes toward projected or retracted position, whereby an increase in the load resisting rotation of said housing tends to project said vanes and a reduction in load resisting rotation of said housing tends to retract said vanes.

12. The structure of claim 11 and in which the inner weighted ends are substantially sealed relative to said drive shaft.

13. The structure of claim 11 and in which said outer projectable ends on said vanes are provided with surfaces on planes substantially through the axis of the drive shaft in projected position.

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