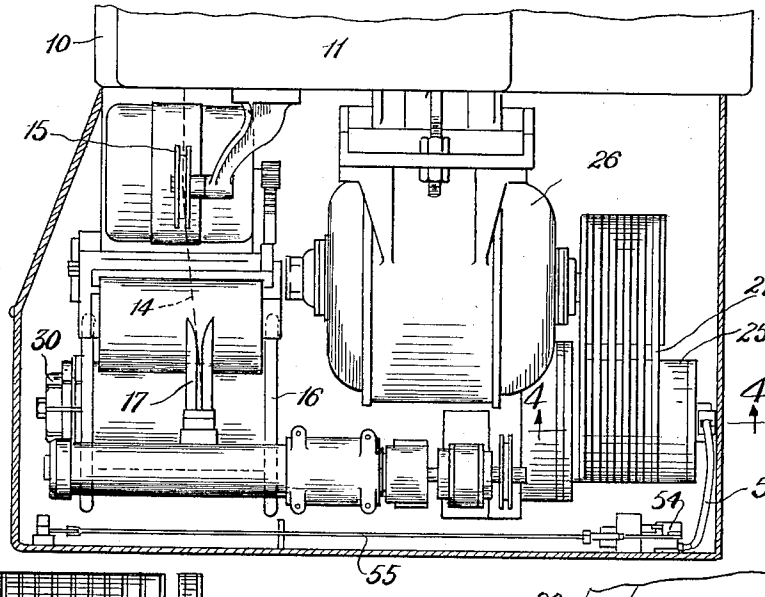
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SERVO-MOTOR

Original Filed July 26, 1930 2 Sheets-Sheet 1

FIG. 1



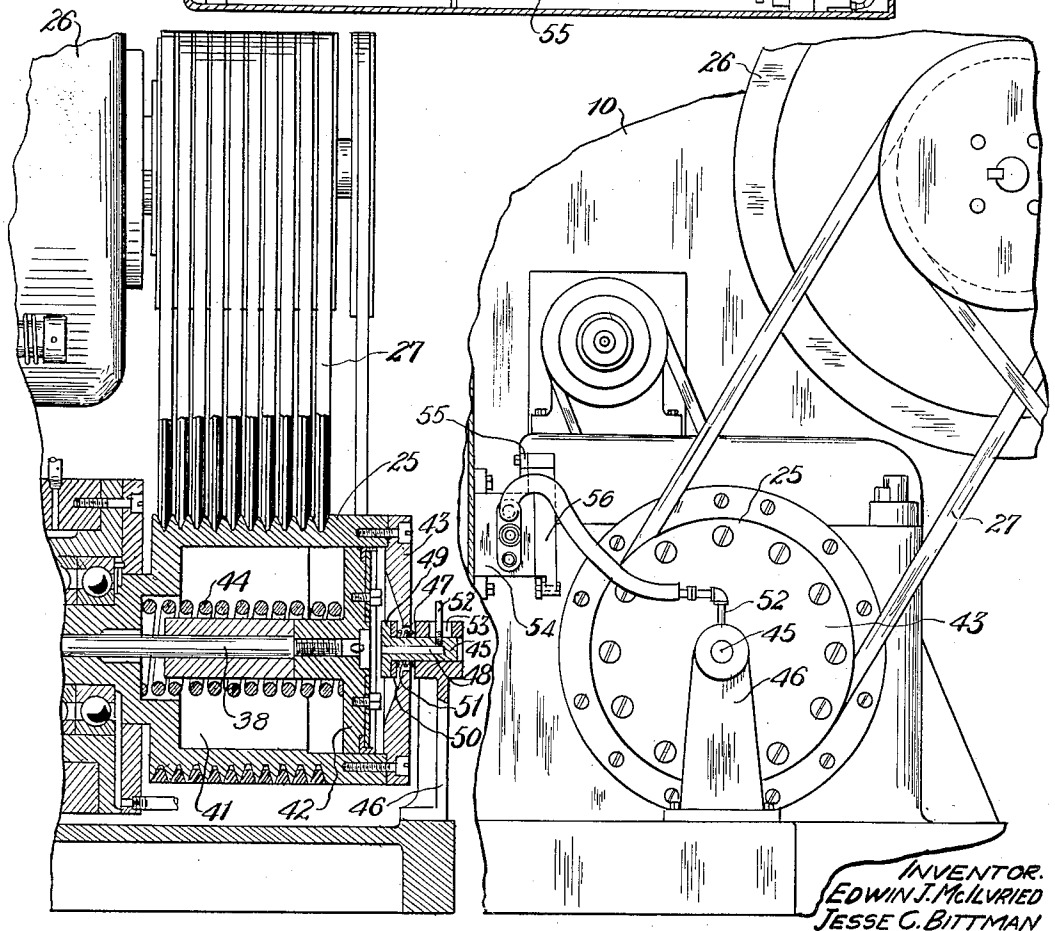


FIG. 4

FIG. 3

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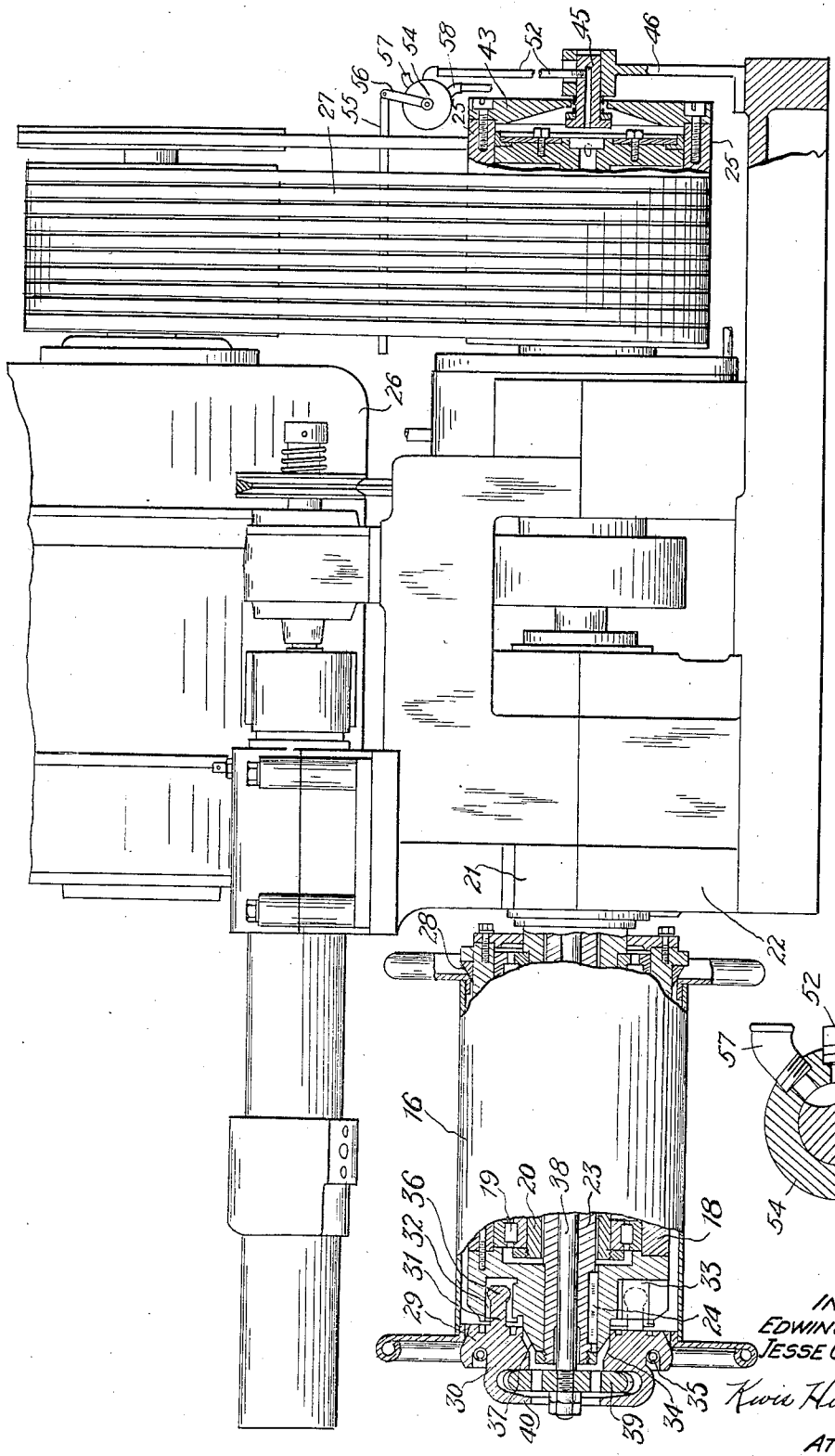


FIG. 2

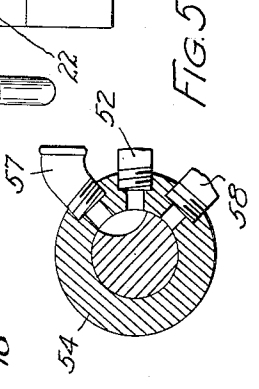


FIG. 5

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SERVO-MOTOR

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Original application July 26, 1930, Serial No. 470,890. Divided and this application September 19, 1931. Serial No. 563,738

4 Claims. (Cl. 121—38)

This invention relates generally to spooling apparatus for use in winding or taking up material which is delivered in strand or strip form from apparatus, such as wire drawing machinery, or the like, and more particularly, in this invention relates to a novel form of servo-motor, which, in this instance, is used to actuate retaining means for the spool.

This application is filed as a division of our original co-pending application, Serial Number 470,890, filed July 26, 1930, and the strand winding means herein disclosed but not claimed, is claimed in said original copending application.

As its principal object our invention aims to provide an improved form of servo-motor embodying novel means for supplying motive fluid to a cylinder.

Another object of our invention is to provide an improved servo-motor of the rotating cylinder type wherein novel means is employed for automatically establishing a fluid supply connection with the cylinder and automatically disconnecting the fluid supply from the cylinder to permit the free rotation of the latter.

Our invention may be further briefly summarized as consisting in certain novel combinations and arrangements of parts hereinafter described and particularly set out in the appended claims.

In the accompanying sheets of drawings illustrating one embodiment of our invention,

Figure 1 is a top plan view showing winding apparatus, associated with a wire drawing machine, and embodying the servo-motor of our invention.

Fig. 2 is an elevational view showing the winding apparatus with parts broken away.

Fig. 3 is a partial elevational view of the apparatus, and

Fig. 4 is a sectional view taken through the cylinder of the servo-motor substantially on line 4—4 of Fig. 1.

Fig. 5 is a section through the servo-motor valve.

In disclosing the servo-motor of our invention, we have shown, and referred to the same as being used in connection with the winding apparatus of a wire drawing machine, but it should be understood, however, that the utility of our invention is by no means limited to the one practical embodiment disclosed in this application.

The wire drawing machine or the like with which our servo-motor may be used, is indicated generally by the reference character 10, and comprises a casing 11 which houses suitable strand working apparatus. The wire or strip of material 14 which issues from the machine 10, will for convenience be termed a "strand", and as indicated in Fig. 1, passes over the sheave 15 arranged near the casing 11, to the reel or spool 16 upon which it is wound. During the winding operation the strand of material is guided by the fingers 17 which move back and forth in timed relation with the speed of rotation of the spool, in a well known manner.

The spool upon which the material is to be wound is removably mounted upon, and is driven by the carrier or arbor 18. By means of the anti-friction bearings 19 this carrier is rotatably mounted upon the substantially horizontally extending hollow spindle 20, which is clamped between the frame members 21 and 22. A hollow drive shaft 23 extends through the opening of the hollow spindle, and at one end thereof this shaft is drivingly connected to the carrier 18, as by means of the key 24. The opposite end of the drive shaft is provided with an enlargement forming a pulley 25 which is driven from the electric motor 26 by means of the belt 27.

For removably mounting the spool 16 upon the rotatable carrier 18, we provide the latter with cooperating abutment means comprising an annular shoulder or abutment 28 adjacent the inner end of the carrier which is engaged by one end of the spool, and a relatively movable abutment or clamp 29 adjacent the outer end of the carrier which is adapted to be moved into and out of engagement with the opposite end of the spool. As indicated in Fig. 2, these abutments are formed with annular tapered faces which are oppositely inclined. These tapered faces wedgingly engage the ends of the spools mounted on the carrier to thereby provide a driving connection, and also enable the spools to readily center themselves upon the carrier regardless of slight variations which may occur in the dimensions of the spools.

The abutment or clamp 29 is constructed so that it can be expanded radially and also moved axially of the carrier into driving and centering engagement with the spool, and can be contracted for passage through the spool barrel, and to this end is made up of a plurality of circumferentially arranged segments 30. Each of these segments is provided with a pair of spaced blocks or extensions 31 which project into an annular recess 32 of the carrier 18, the spaces between the pair of extensions of each segment forming radially extending keyways in which the keys 33 engage. These keys are fitted into slots pro-

vided in the outer end of the carrier so as to extend radially across the annular recess 32 and thus form a driving means for connecting the segments for rotation with the carrier. The segments are so shaped that when they are assembled in circumferential arrangement, as illustrated, to make up the abutment 29, portions of their outer surfaces align to form the annular tapered surface 34 which is adapted to be brought into engagement with the outer end of the spool. Correspondingly arranged grooves in the segments form an annular recess in which is arranged an endless tension spring 35 formed of coiled wire. This spring normally urges the segments radially inwardly and tends to hold them in a contracted condition with the outer diameter of the abutment member reduced to a dimension which is less than the inner diameter of the barrel portion of the spool so that the spool may be readily mounted and dismounted by moving it over the abutment.

It will be noted that at their inner ends the blocks or extensions 31 of the segments are provided with enlargements 36 having rounded surface portions. The rounded enlargements on the extensions serve as loose pivots about which the segments swing during their radial movement. In addition to the swinging movement permitted the tongues, they are also slidable on the driving keys 33 so that the segments are movable axially of the carrier, as well as radially.

For wedging the segments radially outwardly into tapering and driving engagement with the spool, we provide a tapered annular surface 37 at the outer end of the carrier which is engaged by the segments when they are moved axially of the carrier by means of the actuating shaft 38 extending through the hollow drive shaft 23. The actuating shaft is operably connected to the segments by means of the disc 39 which is secured to the outer end of this shaft, and which is operably connected to the segments by loosely engaging in an annular recess formed by the lips 40 of the segments. It will be seen from this arrangement that when the actuating shaft 38 is moved inwardly, that is, toward the right of the apparatus as viewed in Fig. 2, the segments 30 are moved in the same direction. During the early part of their inward movement the segments engage the tapered annular surface 37 of the carrier, and are wedged radially outwardly by this surface to an expanded condition in which the maximum diameter of the tapered surface 34 is greater than the inner diameter of the spool barrel. Further inward movement of the shaft 38 moves the expanded abutment into driving and centering engagement with the outer end of the spool. When the actuating shaft is moved outwardly to disengage the abutment or clamp 29 from the spool, the outward movement of the segments of the latter member, relative to the tapered surface of the carrier, allows the segments to be compressed together or retracted radially inwardly by the endless spring 35.

To impart motion to the actuating shaft 38, we construct the enlargement at the inner end of the drive shaft 23 in the form of a fluid pressure cylinder 41 having a piston 42, reciprocably mounted therein. The piston is secured to the end of the actuating shaft 38 so that when fluid pressure is introduced between the cylinder cover 43 and the piston, the movement of the latter actuates the shaft in a direction to disengage the abutment or clamp 29 from the spool. A coil spring 44 arranged within the cylinder 41, engages the piston 42 and normally urges the actuating shaft 38 inwardly in the direction which moves the segments of the abutment 29 into engagement with the spool.

During the normal operation of our winding apparatus the segments of the abutment 29 are held in engagement with the spool by the action of the spring 44 against the piston 42, but when the machine has been stopped and the spool is to be removed, fluid pressure is supplied to the cylinder to move the piston against the action of the spring and thereby disengage the clamp or abutment 29 from the spool. Since fluid pressure is not maintained in the cylinder while the latter is rotating, the use of a packed joint for supplying the actuating fluid to the cylinder would be undesirable because of the rapid wear to which the parts of such a joint would be subjected. We have therefore devised a fluid supply connection which permits the cylinder to rotate freely during normal operation of the apparatus, and which will automatically seal itself when actuating fluid is supplied to the cylinder. As shown in Fig. 4 of the drawings, this connection involves the use of a plunger 45 which is slidably mounted in the stationary supporting bracket 46, and which is arranged to extend into the rotatable cylinder through an opening 47 provided centrally of the cylinder cover 43. The plunger has a fluid supply passage 48 therethrough, and at its inner end is provided with a flange portion 49 of larger diameter than the cover opening through which the plunger extends. A ring of suitable sealing material 50 is secured to the flange portion, and when fluid pressure is introduced into the cylinder through the passage of the plunger, this fluid pressure acting against the inner end of the plunger moves the latter axially against the action of the spring 51 to press the sealing ring against the inner surface of the cover so as to provide a seal around the opening through which the plunger extends. Fluid pressure, such as compressed air, is delivered to the supply passage of the plunger by a suitable pipe, or other conducting means 52, which extends into the plunger and slides in the slot 53 of the bracket 46 thereby holding the plunger against rotation with the cylinder. The flow of fluid to and from the cylinder through the conducting means 52 may be controlled by suitable valve means, such as the two-way valve 54, shown in Fig. 2, which may be located near the cylinder 41 and actuated by the rod 55 and the valve lever 56. Compressed air is supplied to the valve 54, from a suitable source by the pipe 57, and the air which returns to the valve from the cylinder through the pipe 52, is discharged to atmosphere through the exhaust fitting 58.

It will be noted that the cylinder cover opening through which the plunger 45 extends, while being of smaller diameter than the flange portion 49, is of a larger diameter than the body portion of the plunger so that when the fluid pressure in the cylinder has been exhausted through the three-way valve, and the flange portion has been moved away from the cylinder cover by the action of the coil spring 51, the cylinder will be free to rotate independently of the fluid supply means and will not subject the latter to wear. It will be understood, or course, that although some of the fluid initially supplied to the cylinder, will escape through the opening 47, the parts are so proportioned that the amount of fluid which can escape will not be sufficient to prevent fluid pressure from quickly building up

in the cylinder and pressing the flange portion 49 against the cylinder cover. From the arrangement as just described it will be seen that the opening 47 through the cover of the cylinder forms a conduit which constitutes a restricted or auxiliary exhaust normally establishing communication between the atmosphere and the interior of the cylinder.

We have already stated that air pressure is not maintained in the cylinder 41 during the operation of the spooling apparatus, or in other words, while the cylinder is rotating, but is supplied to the cylinder only after the latter has been brought to a stop and the abutment 29 is to be moved outwardly to the position where it does not engage the spool. If the motor 26 were to be operated with air pressure in the cylinder, damage to the fluid supply connection to the cylinder might result, and since the abutment 29 would not be in clamping engagement with the spool, injury to workmen, or damage to the apparatus might result from the spool sliding off the carrier, or by the segments 30 being thrown out by centrifugal force. Thus it will be readily understood that we have provided novel fluid supply means for a servo-motor, such that a fluid-tight connection is automatically established between the cylinder and the motive fluid supply line or source when the servo-motor is to be operated, and thereafter the fluid supply line is automatically disconnected from the cylinder to permit the latter to rotate freely, and without injury to the fluid supply means.

While we have described the apparatus of our invention in a detailed manner, it should be understood, however, that we do not intend to limit ourselves to the precise details of construction shown and described, but regard our invention as including such changes and modifications as do not involve a departure from the spirit of the invention and the scope of the appended claims.

Having thus described our invention what we claim is:

1. In apparatus of the character described the combination of a rotatable cylinder, a piston in said cylinder, and means for supplying and exhausting pressure fluid to and from said cylinder comprising a non-rotatable member extending through an opening in the wall thereof and having a fluid passage communicating with the interior of the cylinder, valve means for controlling the passage of said member, portions of said member being spaced from the sides of said opening to provide an auxiliary exhaust passage through said opening and around said member, said member having an enlarged portion adapted to be sealingly pressed against said wall by fluid pressure within the cylinder, and spring means normally urging said enlarged portion away from said wall.

2. In apparatus of the character described the combination of a rotatable hollow shaft, a fluid pressure cylinder rotatable with said shaft, an operating member extending through said hollow shaft, a piston in said cylinder for moving said operating member, means for introducing and exhausting pressure fluid into and from said cylinder comprising a member extending through an opening in the wall thereof and having a fluid passage communicating with the interior of the cylinder, the last mentioned member being provided with an enlarged portion disposed in the cylinder for movement toward and away from said wall and adapted to be sealingly pressed against said wall around said opening by fluid pressure admitted to said cylinder through said passage, said member having portions thereof spaced from the sides of said opening to provide a combined clearance and auxiliary exhaust passage, and valve means for controlling the fluid passage of said member.

3. In a servo-motor the combination of a rotatable cylinder, a piston in said cylinder, said cylinder having an opening through the wall thereof substantially on the axis of rotation of the cylinder, means for supplying and exhausting pressure fluid to and from said cylinder for actuating said piston including a fluid conducting member extending through said opening and valve means controlling the passage of said member, said member having portions thereof in spaced relation to the sides of said opening to provide a combined clearance and restricted exhaust passage, and sealing means carried by said conducting member and disposed in said cylinder for movement into sealing engagement with said wall to close said restricted passage.

4. In a servo-motor the combination of a rotatable cylinder, a piston in said cylinder, said cylinder having an opening through the wall thereof substantially on the axis of rotation of the cylinder, means for supplying and exhausting pressure fluid to and from said cylinder for actuating said piston including a fluid conducting member extending through said opening, said member having portions thereof in spaced relation to the edges of the opening to provide a combined clearance and restricted exhaust passage, said conducting member being axially shiftable in said opening and being provided with an enlarged sealing portion adapted to be pressed against said wall around said opening by fluid pressure supplied to said cylinder through the conducting member, and valve means controlling the passage of said member.

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