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N. H. NYE ET AL
WIRE REELING MECHANISM

2,407,899

Filed May 30, 1944

2 Sheets-Sheet 1

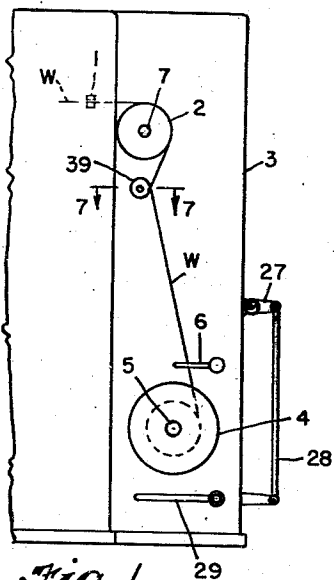


Fig. 1

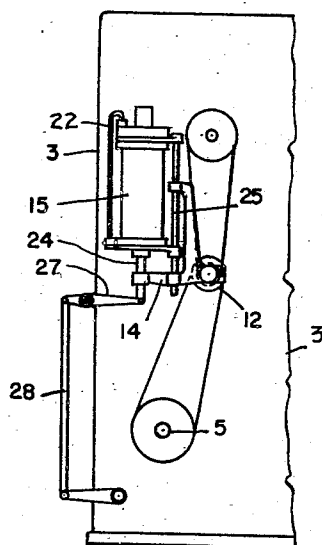


Fig. 2

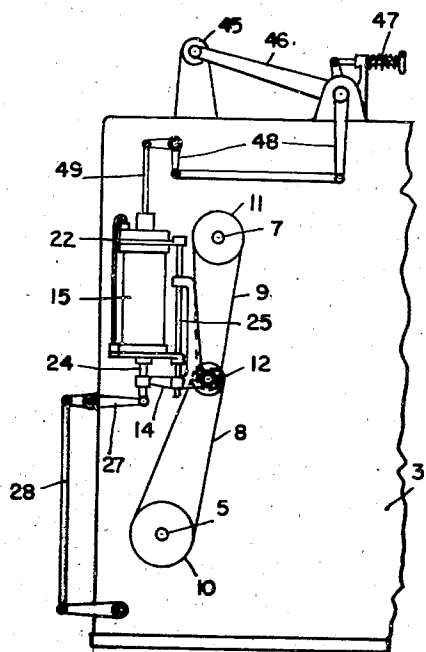


Fig. 4

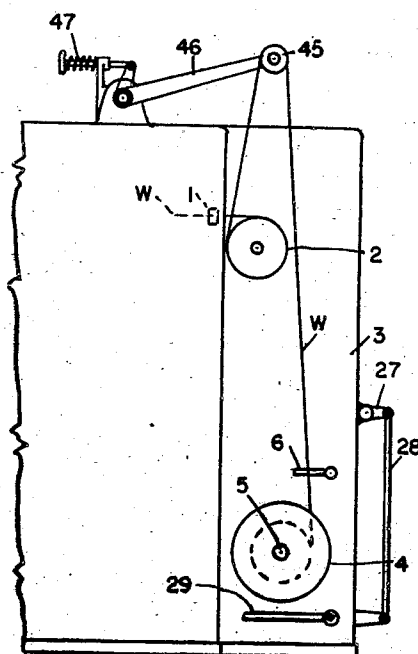


Fig. 3

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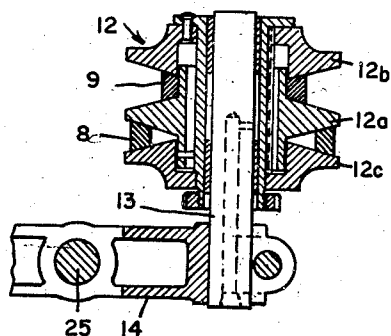
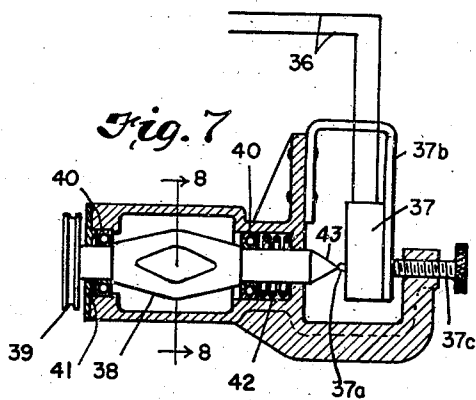
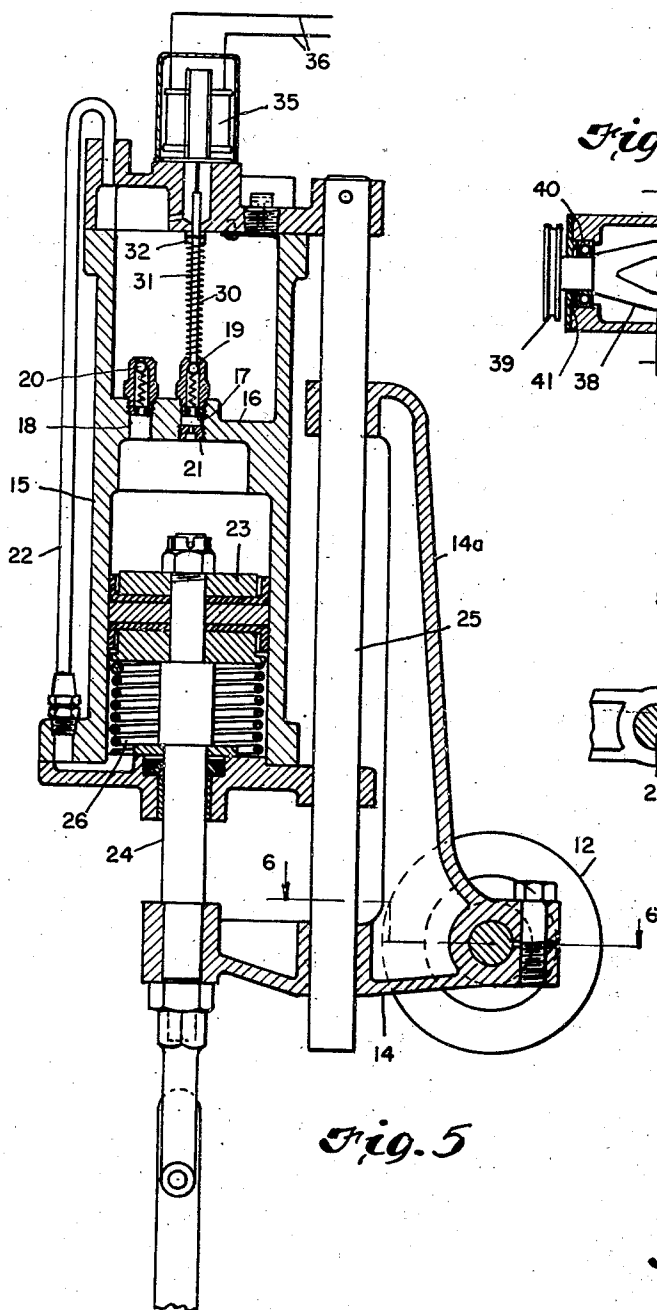
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UNITED STATES PATENT OFFICE

2,407,899

WIRE REELING MECHANISM

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Application May 30, 1944, Serial No. 537,998

3 Claims. (Cl. 242-45)

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The present invention, relating as indicated to wire reeling mechanism, has more particular regard to mechanism for winding or reeling fine wire or other like delicate stranded material in which automatic variation of the winding speed, as such material is built up on the reel or spool, requires to be smoothly effected and without subjecting the material to undue stress likely to cause breaking thereof.

An improved form of reeling apparatus for accomplishing the foregoing result is disclosed in Patent No. 2,243,480, issued under date of May 27, 1941 to N. H. Nye, one of the present inventors, and E. J. McIlvried, wherein a member, positively actuated during the winding operation, is utilized to actuate a variable speed drive connected with the winding member or spool.

One principal object of the present invention is to provide speed changing means whereby such winding member or spool is driven which will not only be extremely sensitive but which may be operated directly by differences in the speed of travel or tension of the strand, without imposing any undue strain thereon. Another object is to provide a mechanism of the class in question which will be extremely simple and not likely to get out of order.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a front elevation of the terminal portion of a wire drawing machine or stand of the type employed in drawing fine diameter wire, such mechanism including the reel or spool on which the finished product is wound;

Fig. 2 is a rear elevation of the same portion of such machine;

Fig. 3 is a view corresponding to Fig. 1 but showing a modification in construction;

Fig. 4 is a view corresponding to Fig. 2, showing the same modification as is illustrated in Fig. 3;

Fig. 5 is a central vertical section of a portion of the speed changing mechanism whereby the speed of the winding spool or reel is varied;

Fig. 6 is a transverse section of another por-

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tion of such mechanism, the plane of the section being indicated by the line 6-6 in Fig. 5;

Fig. 7 is a sectional view of control device associated with such speed change means in the first form of my improved mechanism, that illustrated in Figs. 1 and 2, the plane of such section being indicated by the line 7-7 Fig. 1; and

Fig. 8 is a transverse section of such last-mentioned device, the plane of the view thereof being indicated by the line 8-8, Fig. 7.

It is noted that the parts of the speed change mechanism illustrated in Figs. 5 and 6 are common to both the form of reeling mechanism shown in Figs. 1 and 2 and that shown in Figs. 3 and 4; while the device illustrated in Figs. 7 and 8 is utilized only in such first-mentioned form.

Referring to such first form, illustrated in Figs. 1 and 2, as previously stated only the terminal portion of the wire drawing machine is shown including the final die 1 through which the wire W passes on its way to the final drawing drum or block 2. Such die and drum are mounted on a suitable vertical plate-like frame or stand 3 which also carries such additional number of dies and drawing drums (not shown) as may be required to effect the desired reduction of the strand being drawn.

Also suitably mounted on such frame or stand, preferably directly below drum 2, is a reel or spool 4 whereon the finished wire is wound. The latter is removably mounted in conventional manner on a spindle 5 so that when one is filled another may be substituted therefor. There is also diagrammatically shown associated with such spool or reel 4 the usual travelling guide device 6 for guiding or laying the strand as it is being wound. As successive layers of the material are wound on the spool or reel the effective diameter of the latter of course is increased and it accordingly becomes necessary gradually to reduce the speed of rotation of shaft 5 since otherwise the portion of the strand between drum 2 and such spool or reel would be subjected to undue strain which would finally break it.

As shown, spindle 5 which carries the spool or reel 4 is conveniently driven from the spindle 7, which carries winding drum 2, by means of V-belts 8 and 9 which at their outer ends pass around pulleys 10 and 11 on such shafts respectively and at their inner overlapping ends pass around a change speed pulley 12 of the special construction shown in Fig. 6. The latter is in effect a double pulley with an intermediate section 12a which is axially shiftable with respect to the end sections 12b and 12c so as to leave a cor-

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respondingly wider or narrower space for engagement of the overlapping ends of belts 8 and 9 with the pulley. The latter as a whole is mounted for rotative as well as endwise shiftable movement on a pin 13 carried by an arm 14 which is reciprocable in the same general direction in which the belts 8 and 9 are extended, i. e. vertically in the construction illustrated (see Figs. 2 and 4).

The type of change speed pulley in question forms no part of the present invention, being well known, and it will suffice to state that as arm 14 is lowered the upper end of belt 8 and the overlapping lower end of belt 9 will be forced into the positions which they are respectively shown as occupying in Fig. 6, in which position spindle 5 will be driven at its maximum speed. On the other hand, as said arm 14 is raised, the relative positions of such overlapping belt ends in pulley 12 will change until such positions are reversed, in which condition spindle 5 will be driven at its minimum speed.

Such shifting movement of arm 14, and consequent change in the rate of speed at which spindle 5 is driven, is related to the condition of the wire W between drawing drum 2 and the spool or reel 4 mounted on said spindle 5 by one or the other of the means presently to be described. Both such means are affected by the rate of speed at which such stretch of wire travels, one being thus affected directly through a governing device and the other indirectly through a tensioning device which takes up any slack in such stretch of wire.

In the case of both such means the same operating mechanism (shown in detail in Fig. 5), is employed to shift arm 14 in the manner and for the purpose previously stated. The main element of such mechanism is a hydraulic cylinder 15, mounted on the rear face of frame 3 adjacent one side and just above the change speed pulley 12. Said cylinder is divided into two approximately equal portions by a transverse partition 16, communication between the two portions being controlled by a centrally located port 17 and one or more lateral ports 18 in which are seated spring pressed ball valves 19 and 20 respectively. These valves are so disposed as normally to permit a liquid, e. g. oil, with which the cylinder is approximately filled, to pass freely through the wall 16 from the upper portion to the lower portion of the cylinder but to prevent such flow in a reverse direction. There is also replaceably seated in port 17 below valve 19 an apertured plug 21, the aperture in such plug being selected to permit flow of liquid from the lower portion of the cylinder to the upper portion at a predetermined rate when valve 19 is unseated.

The upper portion of the cylinder is also connected with the lower portion by a duct 22 which provides in effect a by-pass permitting any fluid which may leak past the piston 23 to be returned from beneath such piston to the upper portion of the cylinder. Said piston is reciprocally mounted in the lower portion of the cylinder, the stem 24 thereof extending through the lower wall of the latter to receive the arm or bracket 14 that carries the speed change pulley 12, as previously described. This arm, including an extension 14a, is further slidably mounted on a guide rod 25 suitably supported from cylinder 15 in parallel relation to such piston stem 24.

A heavy compression spring 26, interposed between piston 23 and the lower end of cylinder 15, tends to urge such piston upwardly, i. e. toward the wall 16, but such movement will only be pos-

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sible of course upon ball valve 19 being unseated, by the means to be described. Downward movement of the piston to compress said spring 26 may be accomplished through any suitable means, manual or otherwise, a lever 27 connected with the lower end of the piston stem 24 and, through the medium of a link 28, with a treadle 29 being shown for this purpose in the general views Figs. 1 to 4 inclusive of the mechanism.

Located in the upper portion of the cylinder and disposed in alignment with ball valve 19 is a rod 30, the lower end of which rests on said valve while the upper end extends through the upper end of the cylinder. A compression spring 31, which surrounds said rod and bears against an abutment 32 thereon, serves to counterbalance its weight and yet permit its downward movement upon application of light pressure on its upper end. In the first form of control device which, as previously mentioned, is designed to be affected by the speed of travel of the stretch of wire W between drawing drum 2 and reel 4, a solenoid 35 is mounted on the end of cylinder 15 adjacent such upper end of rod 30, such solenoid being arranged so that upon energization the rod will be forced downwardly a sufficient distance to unseat valve 19. Energization of the solenoid is effected through a relay circuit 36 whenever a micro-switch 37 (see Fig. 7) is closed by the action of a governor 38 driven by means of a pulley 39 around which the stretch of wire W in question is looped as shown in Fig. 1. This governor 38 is of special construction, consisting simply of a short bar section turned at its ends to provide suitable journals for rotative mounting in bearings 40, said bar being split longitudinally immediately of such ends and the respective portions spread outwardly a sufficient distance so as to be affected by the centrifugal force generated upon rapid rotation of the governor. Such rotation at a sufficiently high rate of speed will cause a slight increase in the amount of such spread and correspondingly shorten the overall length of the governor with the result that the end 43 thereof which normally contacts element 37a of switch 37 will be withdrawn a sufficient amount to permit the switch to snap and close the relay circuit 36.

It will be noted that bearing 40 adjacent the outer end of the governor to which pulley 39 is attached is seated against an abutment 41 while a spring 42 is interposed between the other bearing and the adjacent wall of the housing in which the governor is mounted. The governor is thus held in fixed endwise position with respect to said abutment 41, but its inner end 43, that which is designed to operate the micro-switch 37, is free to partake of the slight axial movement required to actuate said switch when the overall length of the governor is shortened by the centrifugal spreading of the split body thereof. Switch 37 is mounted as usual on one end of a U-shaped resilient arm 37b, the position of which may be adjusted by means of a knurled screw 37c so as to vary the setting of contact member 37a in relation to the adjacent end of the governor.

In the alternative construction illustrated in Figs. 3 and 4, instead of employing a governor with relay circuit and solenoid, as described, to actuate valve 19 in cylinder 15, a tension pulley 45 is provided around which the stretch of wire W intermediate drum 2 and reel 4 is passed. Such a pulley is familiarly used to take up any slack in the wire being drawn, both at the point

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in question and between successive drawing drums, and the mounting therefor, it will be understood, is merely typical of various mountings which may be employed. As shown, said pulley is carried by lever 46 with which is associated an adjustable compression spring 47 whereby any desired degree of tension may be imposed on such stretch of wire as it passes around pulley 45. Connected with lever 46 through a system of links and levers 48 is a rod 49 which is disposed in alignment with valve rod 30 and adapted to contact with the upper end thereof. The arrangement is such that as the stretch of wire W which passes around pulley or sheave 45 is shortened, said rod 49 will be caused to press downwardly upon rod 30 and thus unseat valve 19 in exactly the same manner as the latter is unseated when solenoid 35 is energized by operation of governor 38 at a predetermined speed.

The operation of my improved wire reeling mechanism, as a whole, will now be set forth. When a fresh spool or reel 4 is mounted on spindle 5 at the beginning of a winding or reeling operation, the piston 23 in cylinder 15 will be drawn downwardly to its lowermost position, approximately as shown in Fig. 5. The spring 26 will thus be compressed and the liquid below the piston in the cylinder will be forced through by-pass 22 into the upper portion of the latter, i. e. above the wall or partition 16. At the same time such liquid will be drawn from such upper portion of the cylinder through the valves 19 and 20 (more particularly the latter) to fill the space in the lower portion of the cylinder between such wall or partition and piston 23. Since said valves normally prevent reverse flow of liquid, the piston will be permitted to move upwardly only as valve 19 is from time to time unseated. In such lowermost position of the piston the change speed pulley 12 will drive the spindle 5 and thus the reel 4 at maximum speed. However, as successive layers of wire are wound on the latter so that its effective diameter is increased, a point will be reached where in one case through the increased speed at which the wire is drawn around pulley or sheave 39, the governor 38 will be actuated to unseat valve 19, or in the other case the pulley or sheave 45 will be drawn downwardly to similarly actuate said valve through linkage 48 and rod 49.

In either case liquid in the lower portion of the cylinder 15 will be allowed to pass into the upper portion thereof with resultant upward movement of piston 23 and corresponding actuation of change speed pulley 12 to reduce the rate of speed at which spindle 5 is driven.

From the foregoing it will be seen that the change in speed of rotation of the winding spool or reel is effected gradually, i. e. by increments so small as to be barely perceptible. Particularly where the solenoid with relay circuit actuated by a micromatic switch is utilized, an extremely sensitive effect is obtainable. Accordingly, with my improved mechanism even the

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finest wire or equivalent stranded material may be wound up with a minimum risk of breakage.

It is noted that claims to the above described governor have required to be divided out and accordingly are presented in our separate application filed December 1, 1944, Serial No. 566,156.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

We therefore particularly point out and distinctly claim as our invention:

1. In mechanism for winding stranded material, a rotatable winding spool, a variable speed drive therefor, and means for adjusting said drive, said means including a fluid-containing cylinder, a piston reciprocable in said cylinder and operatively connected with said drive, means other than said fluid associated with said piston and tending to move same to reduce the speed of said drive, a check valve normally preventing escape of fluid from said cylinder in front of said piston whereby such movement of the latter is restrained, means engaging the material as it passes to said spool and adapted to be actuated thereby to unseat said check valve, and a by-pass permitting flow of fluid from the rear to the front of said piston.

2. In mechanism for winding stranded material, a rotatable winding spool, a variable speed drive therefor, and means for adjusting said drive, said means including a fluid-containing cylinder, a piston reciprocable in said cylinder and operatively connected with said drive, a spring associated with said piston and tending to move same to reduce the speed of said drive, a check valve normally preventing escape of fluid from said cylinder in front of said piston whereby such movement of the latter is restrained, means engaging the material as it passes to said spool and adapted to be actuated thereby to unseat said check valve, and a by-pass permitting flow of fluid from the rear to the front of said piston.

3. In mechanism for winding stranded material, a rotatable winding spool, a variable speed drive therefor, and means for adjusting said drive, said means including a fluid-containing cylinder, a piston reciprocable in said cylinder and operatively connected with said drive, a compression spring associated with said piston and tending to move same to reduce the speed of said drive, a check valve normally preventing escape of fluid from said cylinder in front of said piston whereby such movement of the latter is restrained, an electric circuit including a solenoid adapted upon being energized to unseat said valve, a one-piece, longitudinally split rotatable member connected to be driven by the material as it passes to said spool, and a micromatic switch in said circuit arranged to be actuated by change in length of said member due to centrifugal force.

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