Feb. 17, 1953 E. L. HUFF 2,628,486

MECHANICAL REEL

Filed March 27, 1947 3 Sheets-Sheet 1

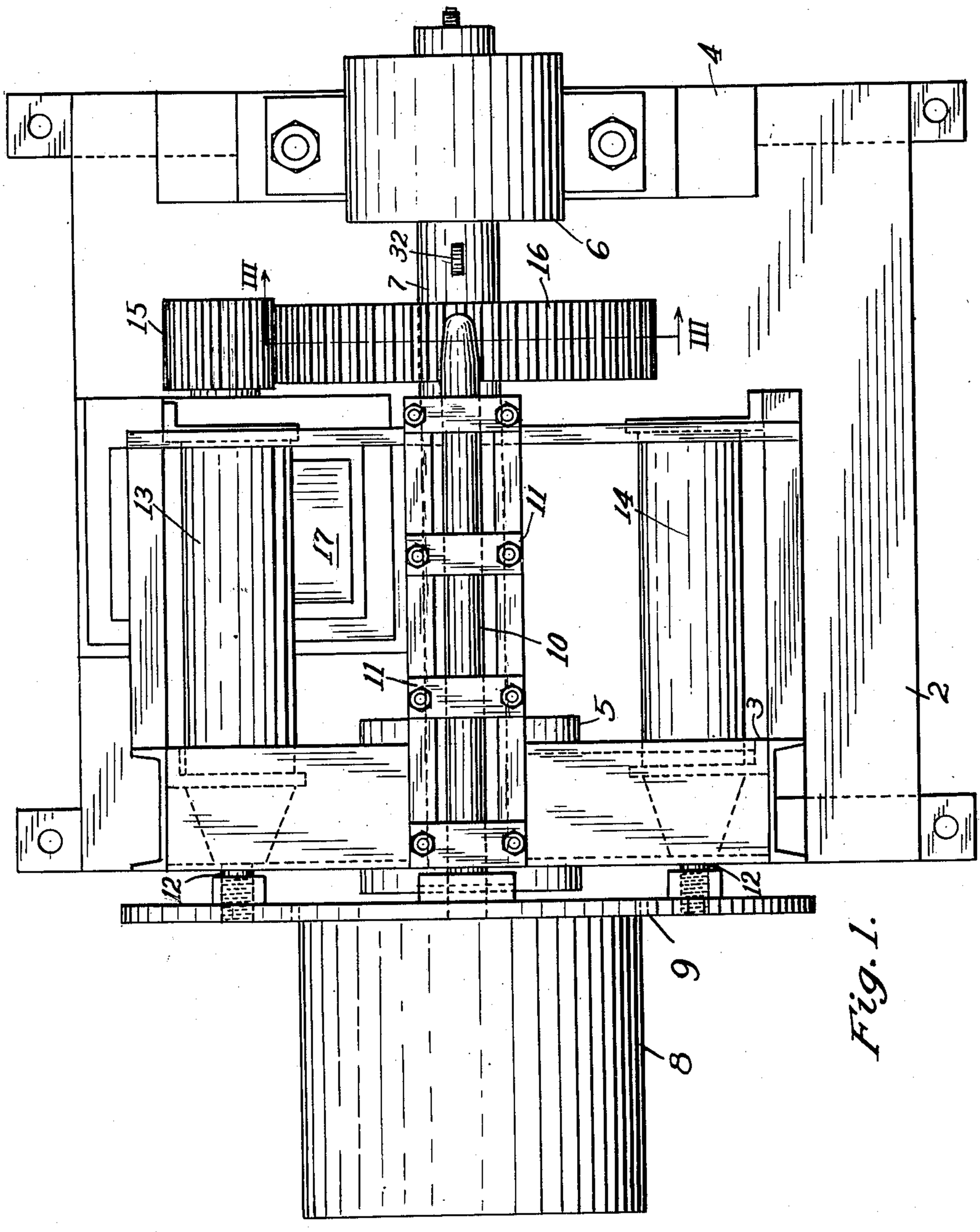

Fig. 1.

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3 Sheets-Sheet 2

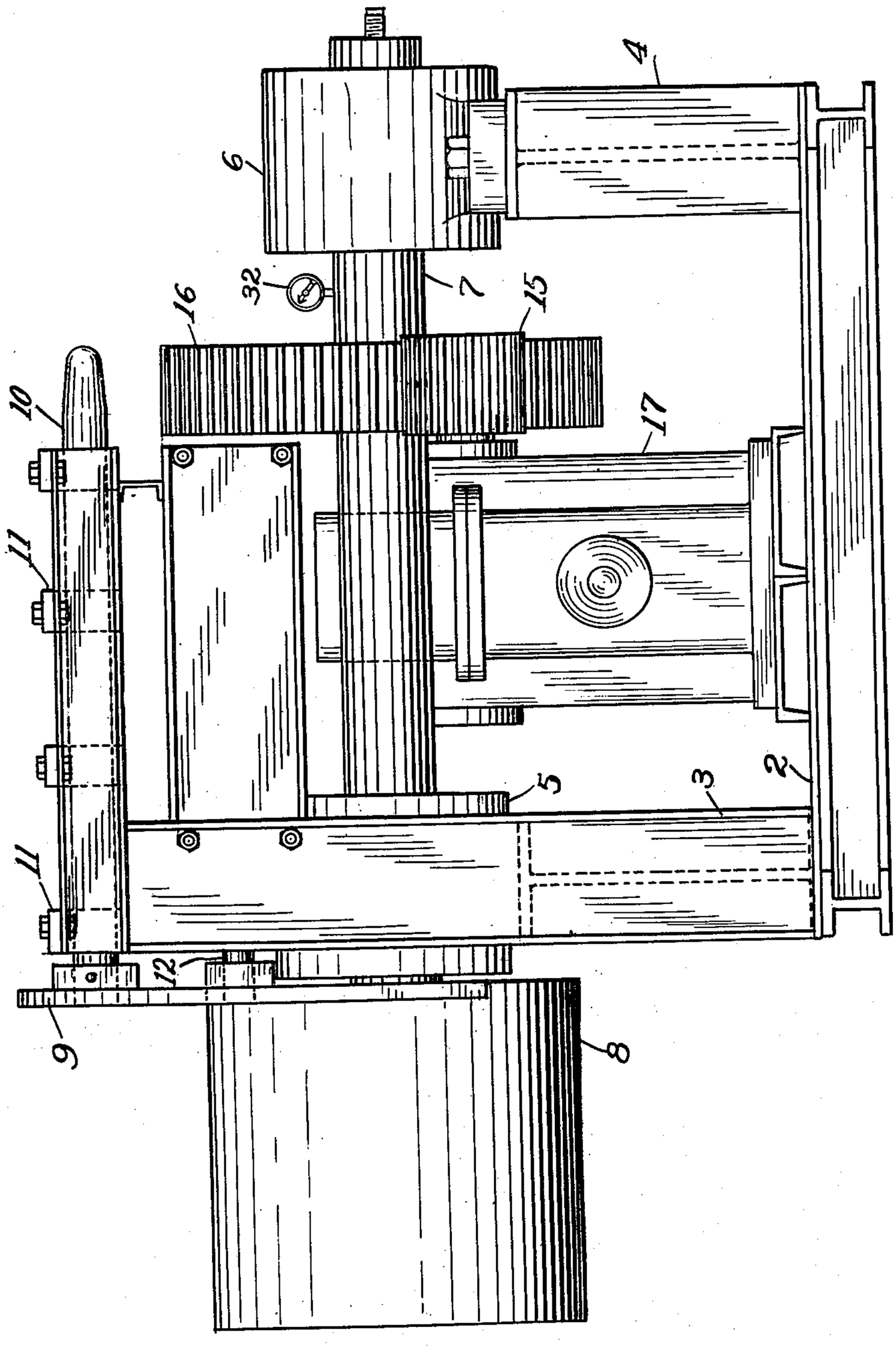

Fig. 2.

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MECHANICAL REEL

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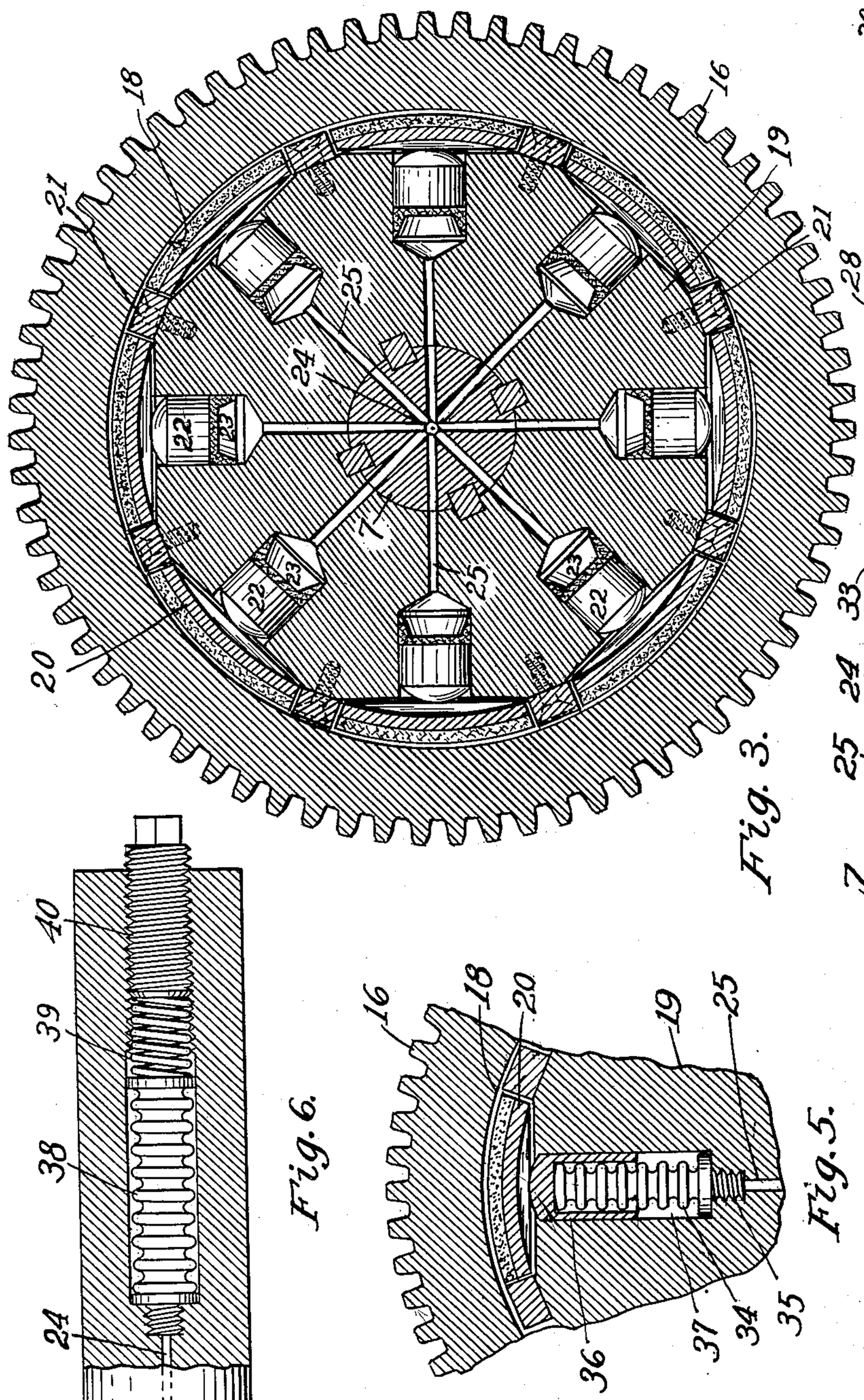


Fig. 3.

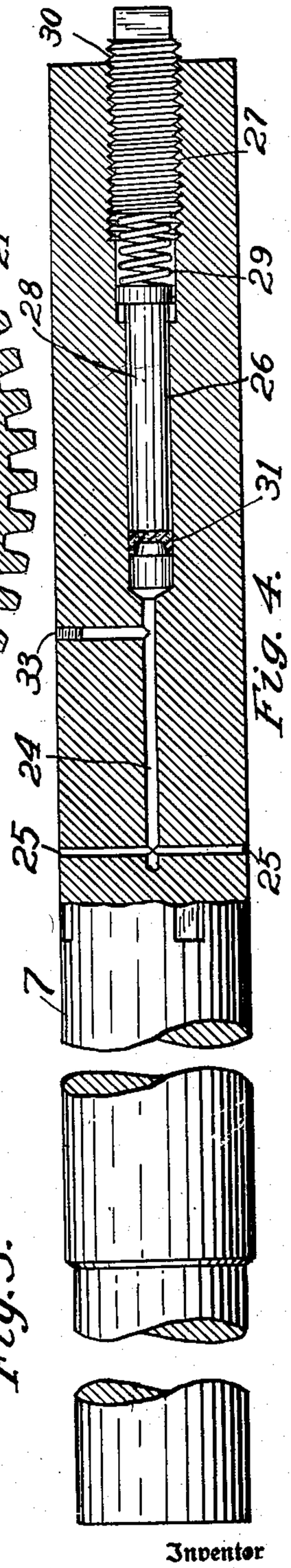
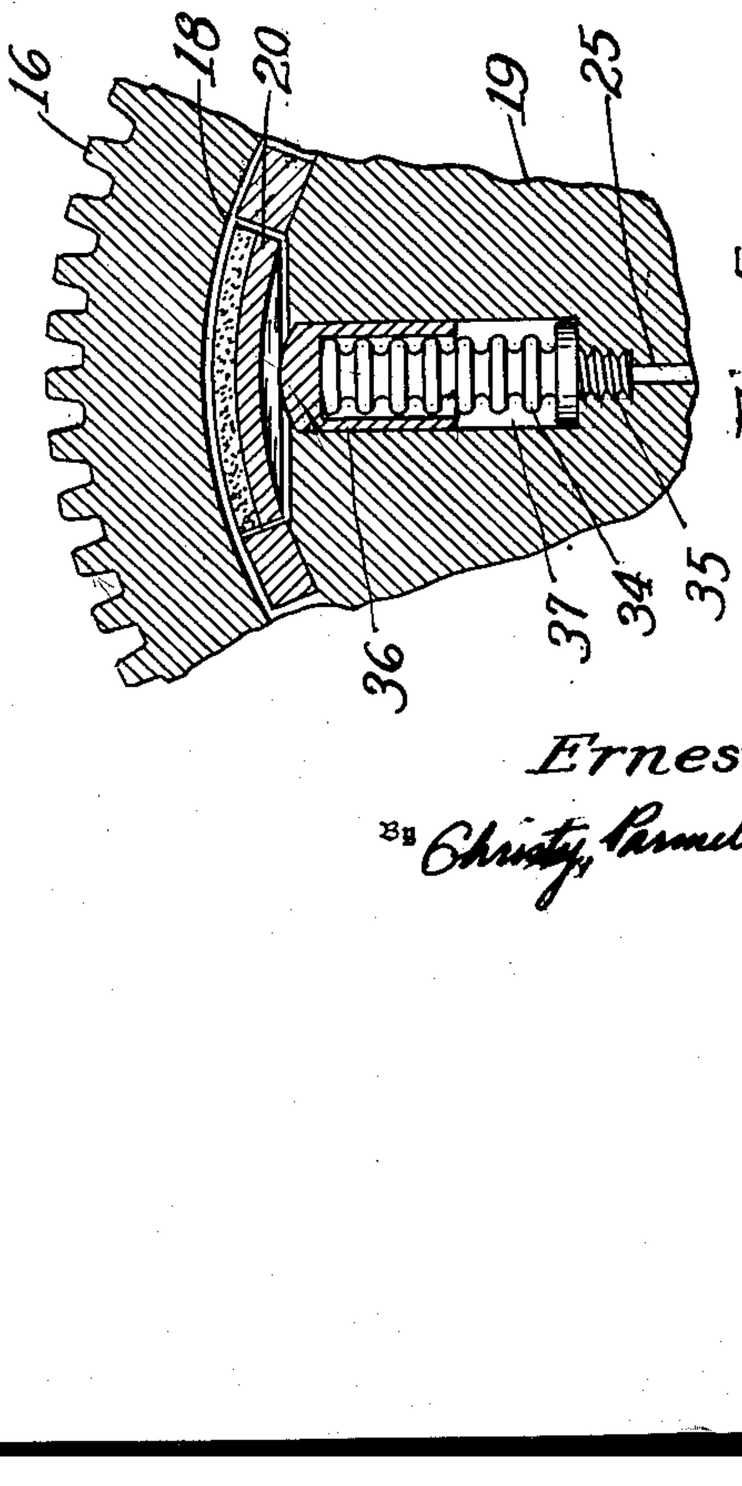


Fig. 4.

Fig. 6.



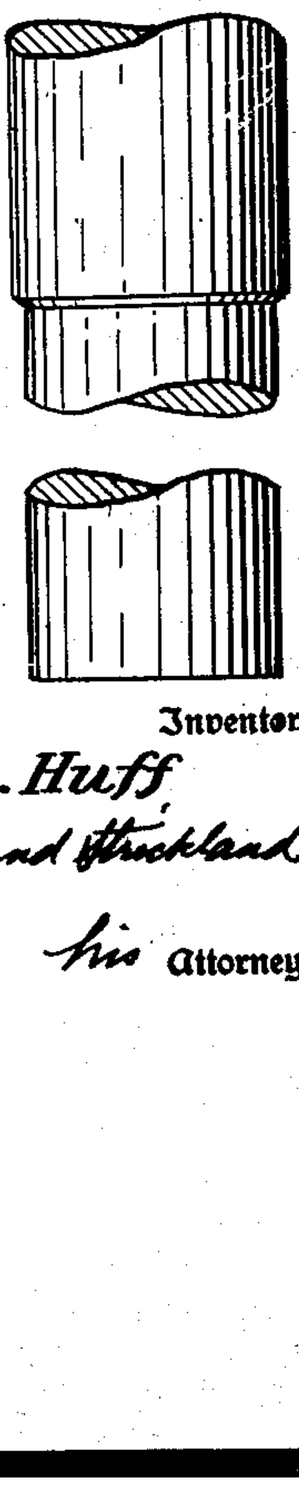


Fig. 5.

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UNITED STATES PATENT OFFICE

2,628,486

MECHANICAL REEL

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Application March 27, 1947, Serial No. 737,557

3 Claims. (Cl. 64—30)

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My invention relates to reeling machines, that is, machines for winding into coils such material as steel strip, continuous sheet steel, rod, wire, and other continuous products.

Reeling machines are used at the delivery ends of continuous mills, rolling mills, finishing mills, extruding and drawing machines, and at the delivery ends of apparatus for annealing, pickling, and otherwise treating such products. A reeling machine of the type to which my invention relates, comprises a reel member which is driven mechanically to coil the product, and to maintain tension upon the product during the coiling operation. A friction clutch is provided in the mechanical transmission between the reel and the motor or other source of rotation for the reel. The reel is driven at a speed which maintains the product under tension, and the tension is established and maintained by the frictional engagement between the clutch elements. That is to say, the reel-driving mechanism is operated at a slightly higher speed than the speed required for the reel to receive and coil the product delivered to it at a controlled rate, with the consequence that there is a continuous slipping of the clutch and a continuous tension imposed upon the product. By regulating the magnitude of the friction effective between the clutch elements, the desired rotative stress or torque may be applied to the reel, and this torque is effective to maintain tension upon the product delivered to the reel at a constant or controlled rate. It will also be understood that the friction clutch, by slipping, provides for an automatic compensation for the gradual increase in the diameter of the coil formed upon the reel as the reeling operation progresses, whereby the peripheral speed of the outer turn of the coil (which speed would otherwise increase in ratio to the increase in the diameter of the coil) remains constant, that is, remains equal to the linear speed at which the product is delivered to the reel. The slipping clutch also provides a safeguard in the event that the mill, or other apparatus delivering the product, should fail in operation, with the effect that the advance of the product is suddenly arrested. Upon the occurrence of such a failure, the slipping of the clutch permits the reel to cease rotation entirely, even though the reeling machine otherwise continues in uninterrupted operation. No damage to the apparatus and no danger to the operating personnel are encountered.

It is desirable that the tension upon the material being coiled shall be maintained constant.

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However, due to the slipping of the clutch, there is a more or less constant wear of the clutch elements, and this wear tends to diminish the pressure effective between the engaged clutch surfaces, with a corresponding decline in the torque acting through the reel to maintain tension upon the product being coiled. In the usual reeling machine the clutch comprises an annular surface on one of the driving members in the line of transmission between the motor and the reel, and upon such annular surface a plurality of friction shoes, carried by a driven member of the transmission, is held in pressure engagement by means of hydraulic plungers. As the wear of the clutch elements progresses in service the plungers advance under hydraulic pressure and tend to maintain the essential engagement between the said clutch elements, but the movement of the plungers results in a drop in the pressure of the liquid acting upon them, with the effect that the torque is not held to desired constant value.

Heretofore, the practice has been to increase from time to time the pressure of the liquid acting on the hydraulic plungers, in an effort to make compensation for the wear of the clutch elements, but this practice manifestly affords only an approximation of the desired constant torque. In the intervals between adjustments of the hydraulic pressure, there is a gradual falling off of pressure due to wear, and a corresponding drop in the torque acting on the reel.

Realizing the problem presented in the foregoing remarks, it will be understood that my invention consists in the provision of means for effecting theadjustment or regulation of the hydraulic clutch pressure while the machine is in operation, together with instrumentalities for maintaining the pressure substantially constant between periodic adjustments.

A machine embodying the improvements of my present invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a view of the machine in top plan;

Fig. 2 is a view of the machine in side elevation;

Fig. 3 is an enlarged sectional view of the clutch of the machine as seen on the plane III—III of Fig. 1;

Fig. 4 is a fragmentary view of the drive shaft of the machine, on which the clutch and reel are mounted; this view shows the shaft partly in side elevation and partly in axial section;

Fig. 5 is a fragmentary view, illustrating a modification in the structure of the clutch; and

Fig. 6 is a view comparable with Fig. 4, showing a modification in the means for adjusting and

maintaining the hydraulic pressure that acts on the clutch elements.

Referring to Figs. 1 and 2 the reeling machine, herein shown for illustration of the invention, comprises a frame having a base 2, and standards 3 and 4 supporting bearings 5 and 6 for a drive shaft 7 upon which a reel 8 is rigidly mounted. The reel 8 here takes the form of a cylindrical drum upon which strip steel is adapted to be coiled. Means for removing a completed coil are provided, consisting of a semi-circular yoke 9 that embraces the upper half of the drum. The yoke 9 is supported upon a central shaft 10 slideable in bearings 11, and the plungers 12 of two pneumatic or hydraulic cylinders 13 and 14 are arranged powerfully to move the yoke over the face of the reel, and to dislodge a coil of strip steel (not shown) which has been wound thereon. The drive for the shaft 7 comprises a pinion 15 meshing with a gear 16 on the shaft 7, the pinion 15 being driven through a gear-box 17 by an electric motor or other source of rotation. In the line of transmission between the drive 17 and the reel 8, a friction clutch is provided, and in this case the clutch is interposed between the gear 16 and the shaft 7. The shaft 7 is the driven member and the gear 16 is the driving member between which the clutch functions.

More particularly, the gear is freely rotatable on the shaft, but, within the gear, clutch members operate frictionally to engage the gear to the shaft. Referring to Fig. 3 it will be seen that gear 16 includes a recess having an annular surface 18; within the recess in the gear a clutch head 19 is received, and this clutch head is rigidly keyed to the shaft 7; on the rim of the head 19 a plurality of clutch elements 20 is provided. The clutch elements 20 are nested between keepers 21 secured to the periphery of the head 19 and thus the clutch elements are secured against relative rotary movement with respect to the head 19, or to the shaft 7 on which the head is keyed. The clutch elements 20 are movable radially outward of the shaft and head under a thrust imposed upon them severally by plungers 22 backed by suitable cup-washers or gaskets in cylinders 23. The cylinder of each of these plunger units stands in open communication with a system of passages filled with such a liquid as machine oil under pressure, and under the pressure of such liquid the plungers are urged radially outward, forcing and holding the clutch elements or shoes 20 in pressure contact with the annular clutch surface 18.

The system of passages alluded to comprises an axial passage 24 in the shaft 7 (Fig. 4), from which radial passages 25 extend, one to each of the unit cylinders 23. Opening through the right-hand end of the shaft 7 is a bore forming a cylinder 26 and a threaded bore portion 27. The passage 24 opens into this cylinder. A plunger 28 is arranged in the cylinder, and in the bore portion 27 a spring 29 is compressed against the right-hand end of the plunger by an adjusting screw 30. The left-hand end of the plunger 28 is equipped with a cup-washer 31, and the plunger so organized bears under the pressure of spring 29 upon the liquid contained in the system of passages, it being noted that the cylinder 26 to the left of the plunger 28, as well as the passages 24 and 25 are filled with the clutch-operating liquid. The cylinder 26 is in reality a master cylinder, containing a supply of oil that is fed into the passages 24 and 25 as the

clutch elements wear in service, and as the plungers 22 gradually move outwardly to maintain the clutch elements in frictional contact with the annular clutch surface 18. The frictional engagement of the elements 20 with the surface 18 transmits rotative stress from the driven gear 16 to the head 19 and thence to the shaft 7 on which the reel is fixed. The gear 16 is driven at a rate which tends to rotate the reel 8 with a peripheral speed exceeding the linear speed at which the strip steel is delivered to the reel, with the result that the strip is placed and held under tension, preventing the reel from rotating as fast as the gear 16 would otherwise rotate it, a slipping of the gear 16 relatively to the clutch elements that bear upon it permitting the gear to rotate at a higher R. P. M. than the reel, while maintaining the torque for driving the reel.

The torque which is thus transmitted through the clutch to the reel is proportional to the magnitude of the pressure under which the clutch elements 20 are held against the clutch surface 18, and this pressure may be determined by the degree of compression of the spring 29 that maintains the clutch liquid under a continuously applied static pressure. The compression of the spring is regulated or set by the adjustment of the screw 30, which is accessible at the end of the shaft 7 where it may be adjusted while the shaft is in rotation. A gage 32, for visually indicating the pressure of the liquid established by such adjustment of the screw 30, is mounted on the side of the shaft and a passage 33 (Fig. 4) connects the gage to the liquid confined in the system of passages described. Thus, the spring may be compressed to that indicated static pressure which, continuously applied, will provide the desired torque in the driven reel, which in turn will provide the desired tension in the strip steel being coiled.

As in service the clutch elements wear, the screw may be tightened from time to time, as the need therefor is indicated by the reading of gage 32, and in the intervals between such adjustments the spring 29 advances the plunger 28 to the left (Fig. 4), making up for the liquid which flows into the unit cylinders 23 as wear progresses, and maintaining a substantially constant pressure on the liquid. Accordingly, the tension on the material being coiled is held at substantially constant value. The gage 32 may be read and the screw 30 turned while the shaft 7 is in rotation, wherefore it is unnecessary that the coiling machine adjustments be made while the machine is at rest.

Fig. 5 illustrates that a tubular metal bellows or Sylphon 34 may be used in place of the hydraulic plungers 22 to urge and maintain the clutch elements 20 in desired frictional contact with the clutch surface 18 of the gear 16. Each Sylphon is secured at its inner end by a hollow threaded nipple 35 in a threaded socket in the head 19, and at its outer end is equipped with a cap 36 that slides in a bore 37 in the head as the Sylphon expands and transmits the hydraulic pressure to the associate clutch element. The passages 25 of the hydraulic or liquid pressure system communicate with the interiors of the Sylphons severally, whereby the Sylphons under the effect of the internal hydraulic pressure axially expand and maintain the desired contact of the clutch elements with the surface 18.

The function performed by the master cylinder and plunger 26, 28 of the structure first de-

scribed may be obtained by the arrangement of a master Sylphon 38 connected to the passage 24 as shown in Fig. 6. A spring 39 compressed by the adjusting screw 40 serves to maintain the liquid in the system under the desired pressure. The Sylphons of Figs. 5 and 6 have an advantage over the cylinders and plungers of the construction first described, in that the liquid is confined within the hollow Sylphon bodies and passages 24 and 25 wherein there are no sliding surfaces of contact (as the surfaces of sliding contact of a plunger with a cylinder) between which leakage of the liquid under pressure might develop during long periods of service.

Within the terms of the appended claims various other modifications are held in contemplation within the spirit of the invention defined.

I claim:

1. In the combination of a drive transmission for a reel having an annular surface, said transmission having a rotary member provided with a rotary shaft, a plurality of clutch elements mounted for rotation in unison with said shaft and arranged to bear upon said surface, liquid-operated units mounted for rotation with said clutch elements and cooperating with said elements for forcing them into pressure contact with said surface, a system of intercommunicating passages in said shaft leading to said units, and a quantity of liquid confined in said system of passages; the invention herein described comprising stressed resilient means mounted in said rotary shaft for exerting a constantly applied static pressure on the confined liquid in said system, and a device for adjusting the stress of said means to regulate said continuously applied static pressure and the torque of said transmission, said device being rotatable with the shaft and accessible externally thereof for effecting said adjustment while the shaft is in rotation.

2. In the combination of a constant-slip drive transmission for a reel, said transmission having a rotary member provided with an annular clutch surface, a rotary shaft, a plurality of clutch elements mounted for rotation in unison with said shaft and arranged to bear upon said clutch surface, a cylinder and plunger unit for each clutch element, a charge of liquid under pressure in each unit cylinder acting on the plunger therein for forcing the associate clutch element into pressure contact with said clutch surface, a master cylinder, a system of passages extending through said shaft from said master cylinder to the unit cylinders severally, a piston in said master cylinder, and a quantity of liquid confined in said system of passages and master

cylinder communicating with the liquid in said unit cylinders; the invention herein described comprising stressed resilient means urging said piston against the liquid in the master cylinder for maintaining a constantly applied, fixed pressure on said liquid to effect through the instrumentality of said cylinder and plunger units a constant frictional engagement of said clutch elements with said clutch surface, and a device for regulating the stress of said resilient means to adjust the fixed pressure on said liquid and the constant frictional constant-slip engagement of the clutch elements with said surface and for regulating the limit of the transmitted torque.

3. In the combination of a mechanical reel having a constant-slip reel-driving transmission including a driven portion clutched to a rotating driving portion, and an annular clutch surface on said driving portion, a plurality of clutch elements on said driven portion, liquid-operated units carried by the driving portion for forcing said clutch elements against said clutch surface, a system of intercommunicating passages leading to said units, and a quantity of liquid confined in said system of passages; the invention herein described comprising stressed resilient means mounted in said driven portion in communication with the liquid in said system of passages, said means being arranged to exert a continuously applied, fixed pressure on said liquid to effect through the instrumentality of said units the frictional engagement of said clutch elements with said clutch surface, and a device for regulating the stress of said resilient means to adjust the fixed pressure on said liquid and the constant slip frictional engagement of the clutch elements with said clutch surface and for regulating the limit of the transmitted torque.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
535,264	Smith	Mar. 5, 1895
823,765	Conklin	June 19, 1906
935,442	Wilson	Sept. 28, 1909
1,823,626	Peskar	Sept. 15, 1931
1,879,633	Olsen et al.	Sept. 27, 1932
2,159,137	Doty	May 23, 1937
2,292,146	Meunier	Aug. 4, 1942
2,393,010	Arnold et al.	Jan. 15, 1946
2,398,392	Page	Apr. 16, 1946
2,398,330	Rueb	Aug. 9, 1946