Aug. 16, 1960 H. W. MOSER ET AL 2,949,313

EXPANDING CHUCK MECHANISM

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5 Sheets-Sheet 1

FIG. 3

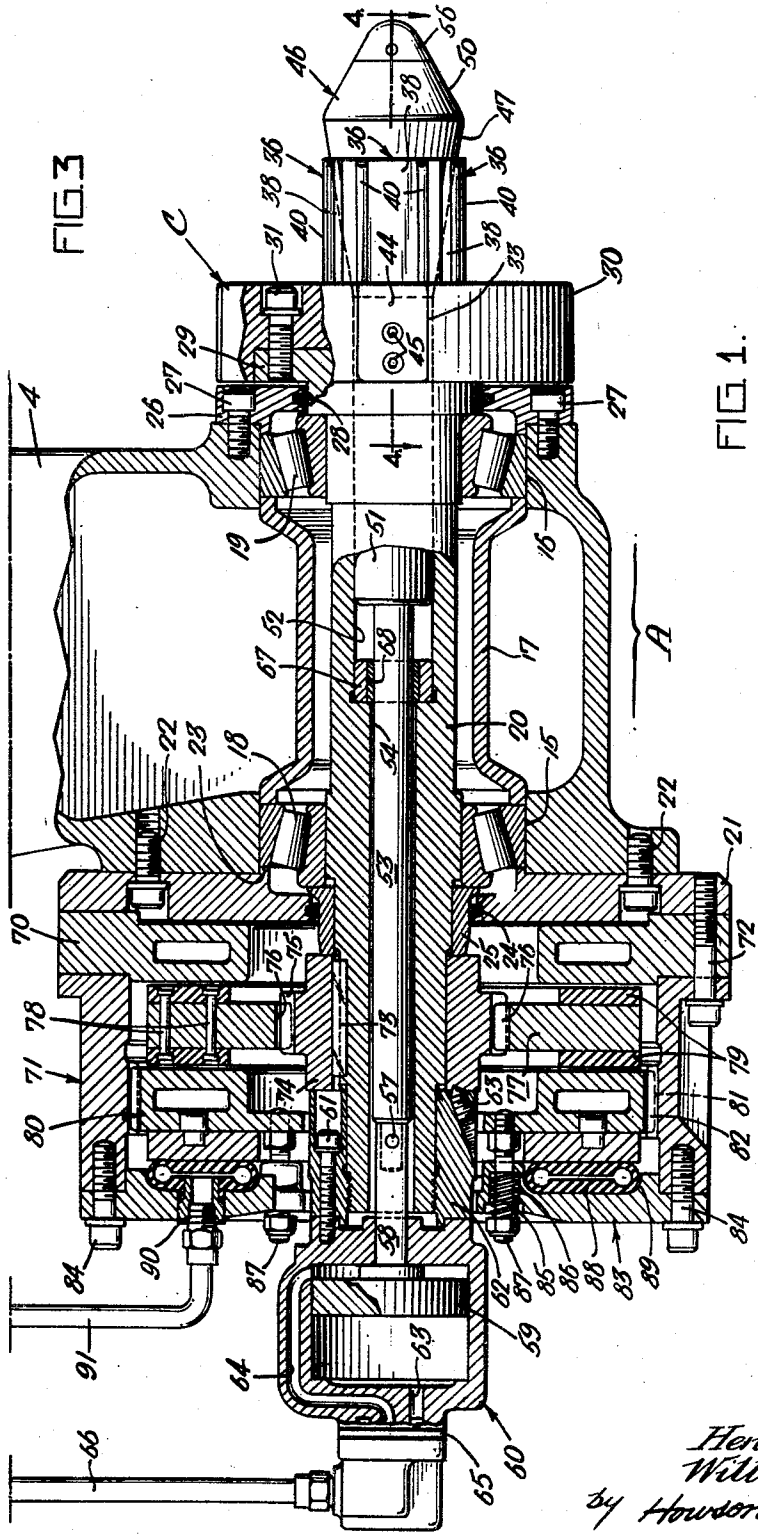


FIG. 1.

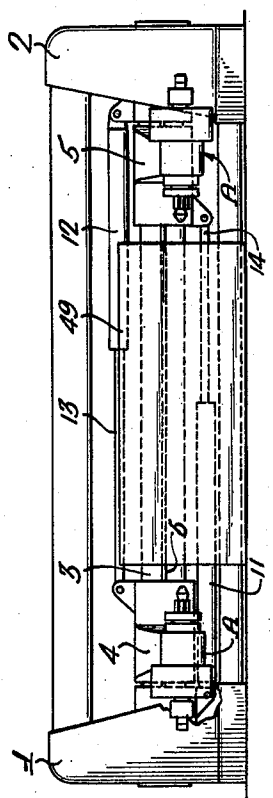
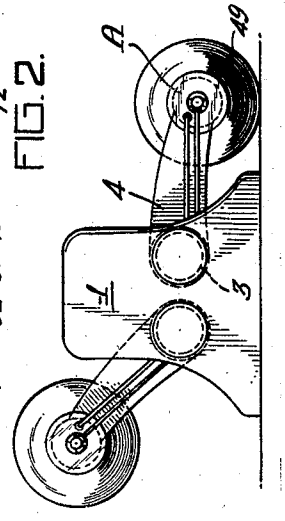


FIG. 2.



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EXPANDING CHUCK MECHANISM

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FIG. 4.

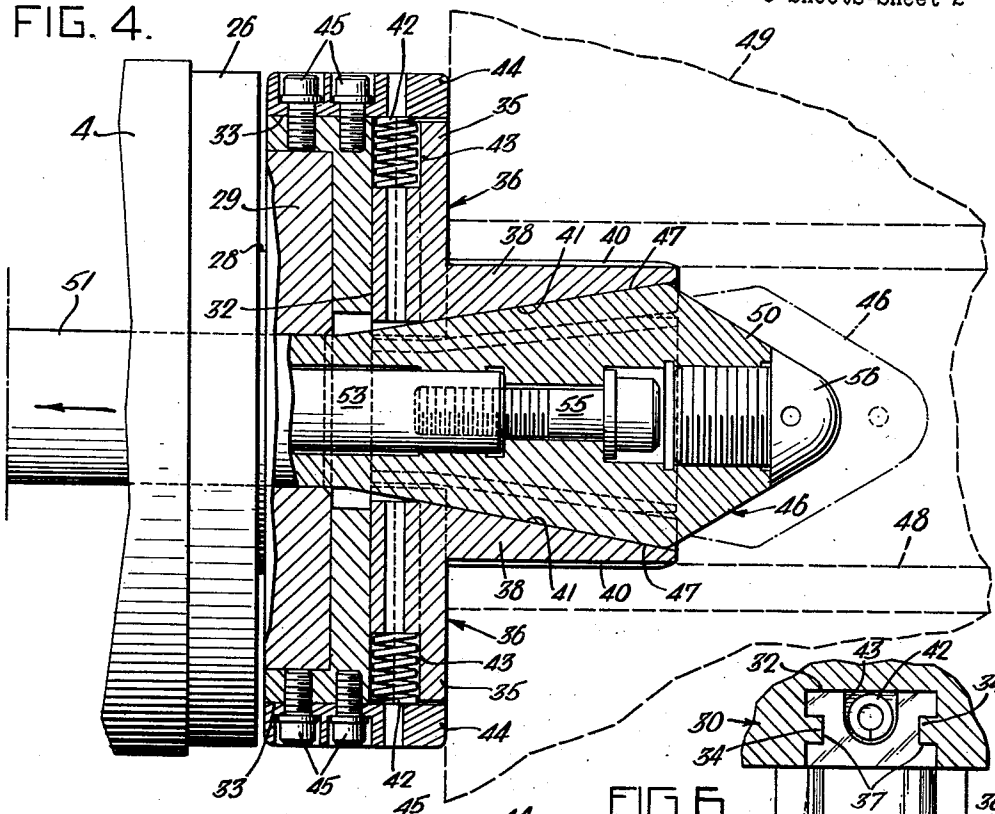


FIG. 5.

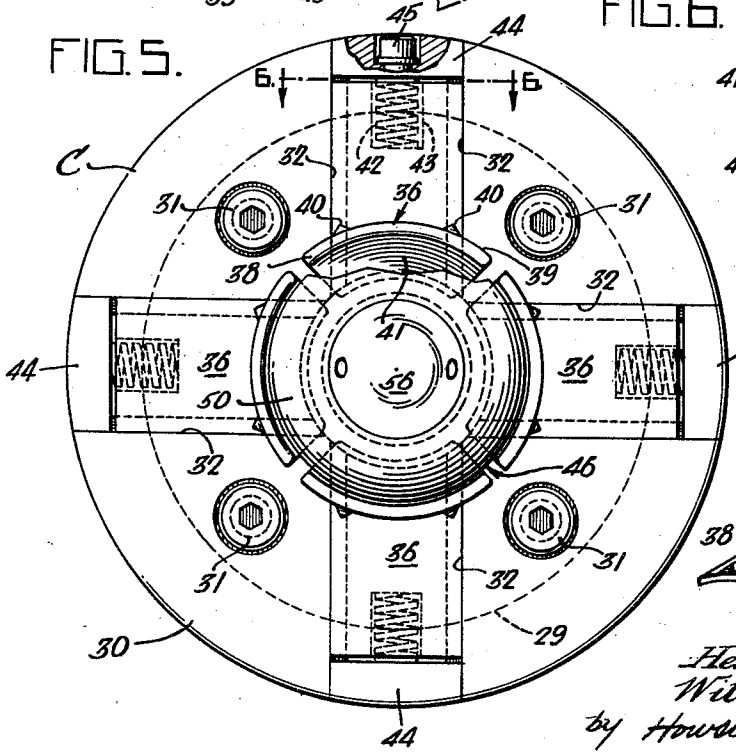


FIG. 6.

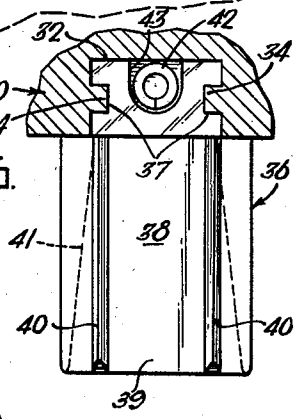
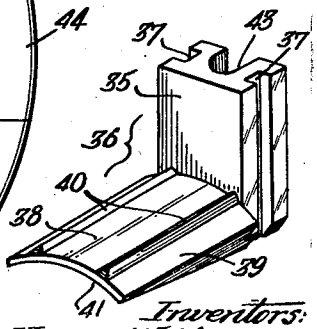


FIG. 7.



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EXPANDING CHUCK MECHANISM

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FIG. 8.

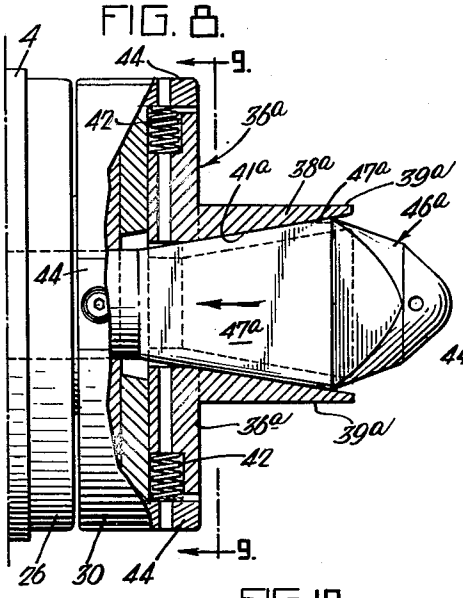


FIG. 9.

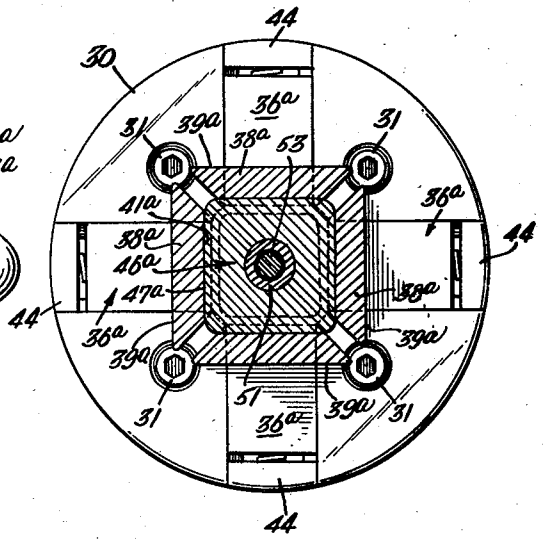


FIG. 10.

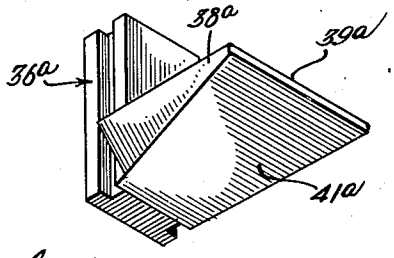


FIG. 13.

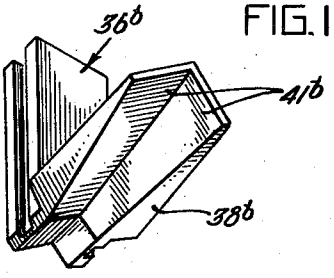


FIG. 11.

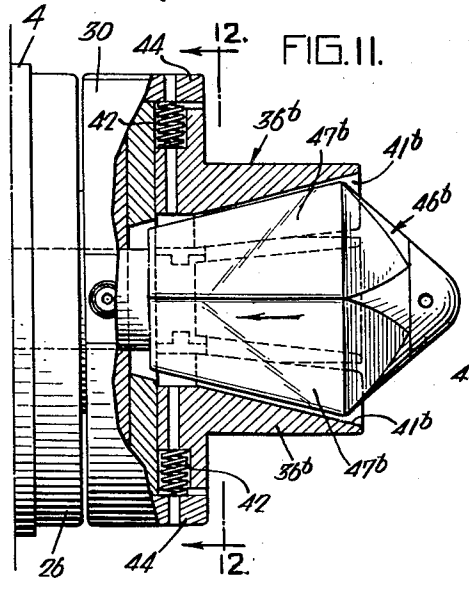
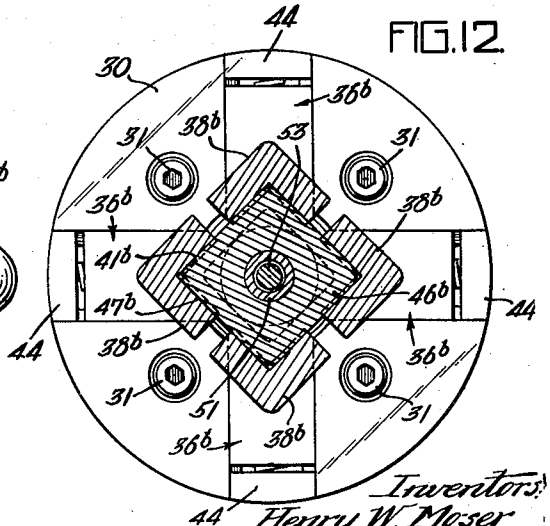


FIG. 12.



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Aug. 16, 1960 H. W. MOSER ET AL 2,949,313

EXPANDING CHUCK MECHANISM

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FIG. 14.

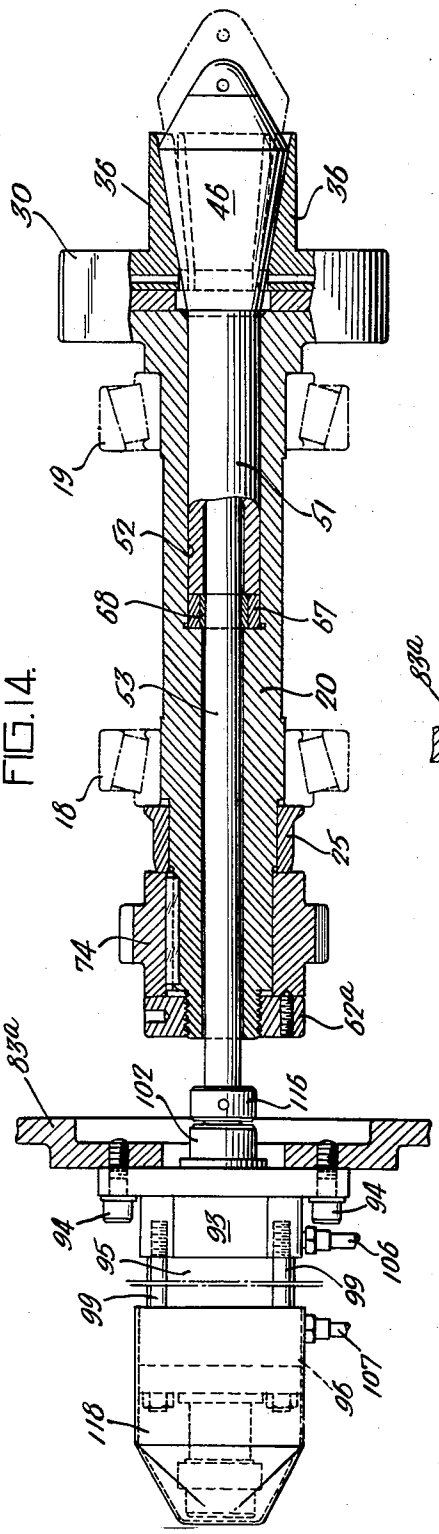
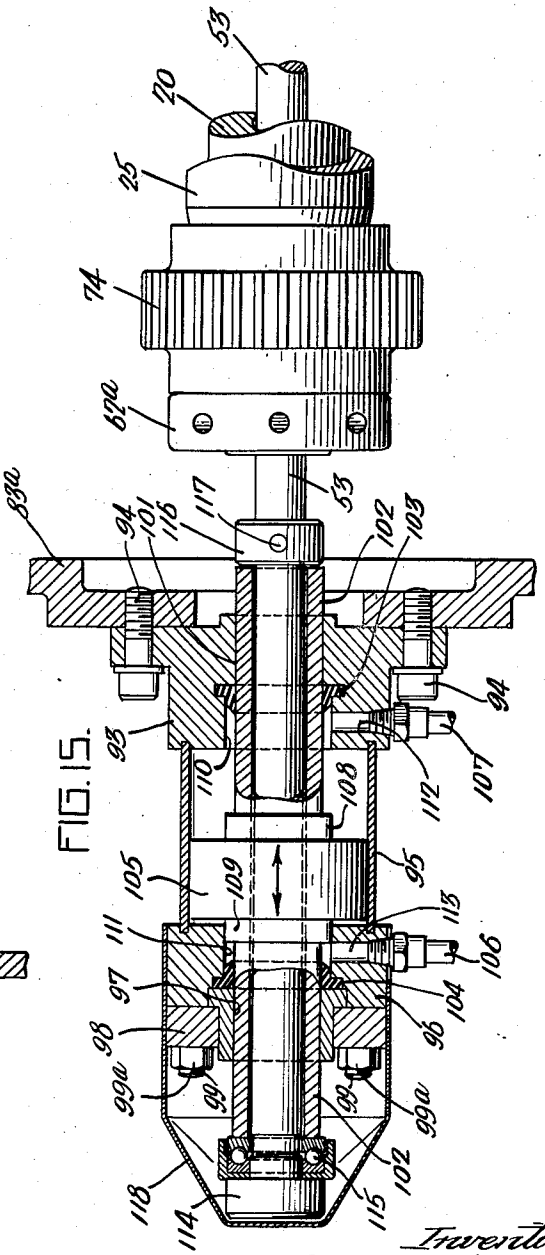


FIG. 15.



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EXPANDING CHUCK MECHANISM

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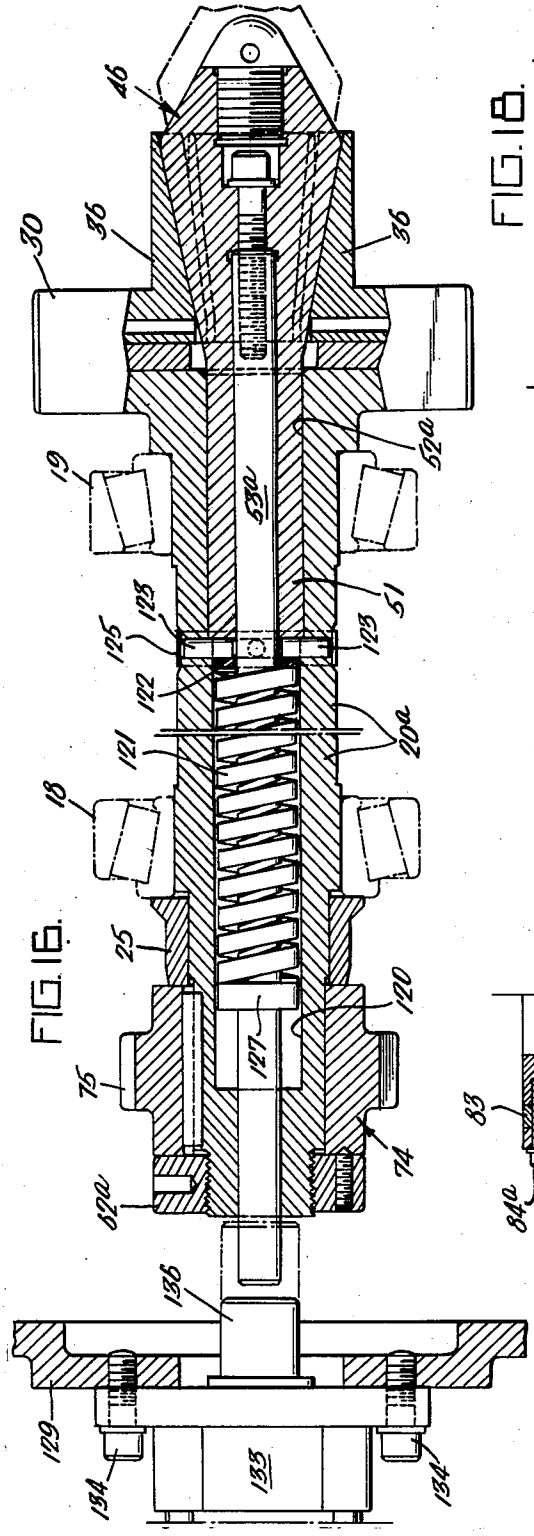

FIG. 16.

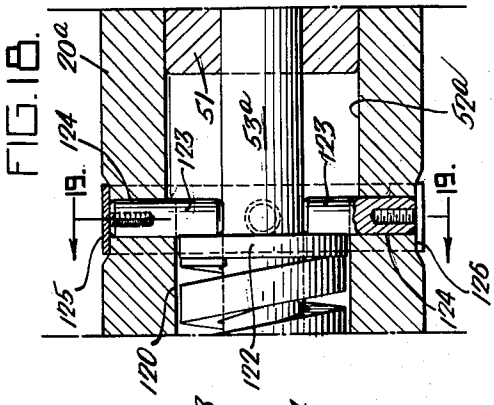

FIG. 18.

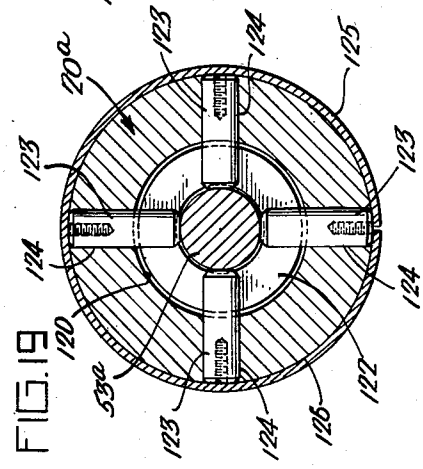

FIG. 19.

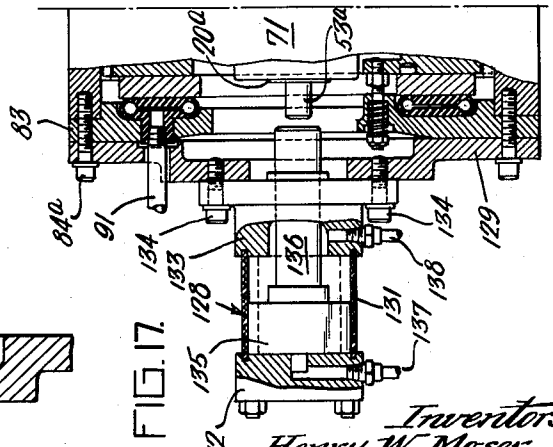

FIG. 17.

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United States Patent Office 2,949,313 Patented Aug. 16, 1960

2,949,313

EXPANDING CHUCK MECHANISM

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Filed Dec. 29, 1958, Ser. No. 783,261

9 Claims. (Cl. 279—2)

This invention relates to new and useful improvements in expanding chucks, and more particularly to improvements in expanding chucks for the spindles of shaftless mill stands of the type provided for supporting a heavy roll of sheet material such as paper so that it can be unwound for further processing.

Prior to the present invention it has been the customary practice to provide on the ends of the spindle or mill roll stands a metal cone which is forced into the opposite end openings of the core of the roll which may be a tube of paperboard or other suitable material or may be defined by the inner layers of material of the roll itself from which a rewind mandrel has been removed. Customarily, the large end of such a metal cone has a diameter greater than the inside diameter of the roll core and the cone surface is provided with longitudinally extending projections for interengagement with the inner surface of the roll core to prevent relative rotation of the roll with respect to the chuck.

These cones have several disadvantages. For example, they distort and mutilate the tubular cores and substantially limit the number of times that the cores can be used and in the case of rolls which do not have a separate tubular core member, the cones cut and mutilate the inner layers of the roll material which define the core of the roll. Also, it has been found in practice that these metal cones do not always function properly to center the roll on the spindle thereby causing excess eccentric loading on the spindles and making it difficult to maintain uniform tension in the material as it is unwound from the roll. Another disadvantage is that since these metal cones do not present a cylindrical surface to fit entirely within the roll core it is necessary that the cones be forced far into the core of the roll in order to insure sufficient gripping surface therewith and even then the cones do not provide a continuous pressure against the inside surface of the core which may become enlarged during unwinding of the roll and produce irregular or jumpy tension in the material as it is unwound.

Previous attempts have been made to provide expanding chucks for the spindles of shaftless mill roll stands with the aim of eliminating the use of such metal cones and their attendant disadvantages. However, these attempts have not been satisfactory primarily because exposed mechanical parts used to expand and collapse the chuck became fouled by pieces of material of the roll core to the extent that the chucks did not operate properly. Also, in some instances, partial disassembly of the chuck occurred due to centrifugal force generated at or near the end of the roll unwinding operation thus presenting a hazard to the safety of the personnel operating the machine.

With the foregoing in mind, the present invention provides an improved expanding chuck of the type described in which all operating mechanisms are concealed so that malfunctions due to fouling of the operating parts by paper or other materials is substantially eliminated.

The invention also provides an expanding chuck having jaws which accurately center the roll and reduce eccentric loading to a minimum thus reducing the load on the machine and permitting uniform tension to be maintained in the material during unwinding thereof. Moreover, an expanding chuck is provided in which the extent of opening or expansion of the chuck is positively limited to a predetermined diameter so that the possibility of the chuck parts being disconnected and thrown off by centrifugal force is eliminated. Furthermore, the invention provides an expanding chuck having portions which present a substantially continuous horizontal surface for engagement by the roll core, thus providing increased gripping surface between the chuck and core and thereby minimizing the possibility of slippage between the parts during the unwinding operation as well as reducing the possibility of distortion and mutilation of the core or inside layers of the material of the roll.

These and other features of the invention and the details of construction and operation of several illustrative embodiments thereof are hereinafter more fully set forth, described and claimed with reference to the accompany drawing, in which:

Fig. 1 is a front elevational view of a mill roll stand having roll suporting spindles made according to the present invention;

Fig. 2 is an end elevational view of the mill roll stand shown in Fig. 1;

Fig. 3 is an enlarged sectional view taken vertically through the lefthand expanding chuck spindle assembly shown in Fig. 1;

Fig. 4 is an enlarged sectional view taken on line 4—4, Fig. 3;

Fig. 5 is an end elevational view from the right of the disclosure in Fig. 4;

Fig. 6 is a fragmentary view, partially in section, taken on line 6—6, Fig. 5;

Fig. 7 is a detached perspective view of one of the members of the expanding chuck;

Fig. 8 is a fragmentary view, partially in section, similar to Fig. 4, showing a modified construction and arrangement of the expanding chuck;

Fig. 9 is a view, partially in section, taken on line 9—9, Fig. 8;

Fig. 10 is a detached perspective view of one of the members of the modified expanding chuck construction shown in Figs. 8 and 9;

Fig. 11 is a fragmentary view, partially in section, similar to Fig. 4, showing another modified construction and arrangement of the expanding chuck;

Fig. 12 is a view, partially in section, taken on line 12—12, Fig. 11;

Fig. 13 is a detached perspective view of one of the members of the modified expanding chuck construction shown in Figs. 11 and 12;

Fig. 14 is a detached view, partially in section, of the roll supporting spindle and expanding chuck of the present invention showing a modification of the mechanism for operating the expanding chuck;

Fig. 15 is an enlarged fragmentary view, partially in section, showing the chuck operating mechanism of Fig. 14;

Fig. 16 is a fragmentary view, partially in section, showing a modification of the roll supporting spindle and expanding chuck in conjunction with another modification of the mechanism for operating the expanding chuck;

Fig. 17 is an enlarged fragmentary view, partially in section, showing the chuck operating mechanism of Fig. 16;

Fig. 18 is an enlarged fragmentary sectional view of

a portion of the modified roll supporting spindle construction of Fig. 16; and

Fig. 19 is a sectional view on line 19—19 of Fig. 18.

Referring now to the drawings, and more particularly to Figs. 1 to 7, inclusive, thereof, one embodiment of a supporting spindle and expanding chuck made in accordance with the present invention is shown as applied to a mill roll stand of the type, for example, shown and described in the application of Henry W. Moser, Serial No. 635,808, filed February 6, 1958. Referring briefly to Figs. 1 and 2, such a stand comprises a pair of end frames 1 and 2 in which is journaled a rock shaft 3 that mounts a pair of arms 4 and 5 attached to the shaft by a key 6 so that said arms are free to slide axially on the shaft. The arms 4 and 5 are moved axially on the shaft 3 by cylinders 11 and 12 each containing a piston slidable therein and connected to piston rods 13 and 14, respectively, which in turn are connected to the arms 4 and 5. By this arrangement, fluid pressure applied to the rod sides of the pistons in the cylinders 11 and 12 causes said rods to draw the arms 4 and 5 together axially on the shaft 3, and fluid pressure applied to the opposite ends of the pistons operates to separate the arms.

Each of the arms 4 and 5 carries in its outer end a roll supporting spindle and chuck assembly which is generally designated by the letter "A" in Fig. 1 of the drawings, and since the spindle and chuck assemblies in both arms 4 and 5 are the same, only one of them need be described in detail.

Referring now more particularly to Figs. 3 to 7, inclusive, of the drawings, the arm 4 of the mill roll stand is of hollow construction and adjacent its outer end is provided with aligned openings 15 and 16 in the opposite side walls thereof. Fitted into these openings 15 and 16 is a sleeve 17 which serves as a spacer for the outer races of a pair of roller bearing assemblies 18 and 19, one of which is mounted in each of the openings 15 and 16, and has its inner race fitted or otherwise secured upon the surface of a spindle 20. The spindle 20 extends entirely through the openings in the outer end of the arm 4 and is rotationally mounted therein by the roller bearings 18 and 19.

Outward displacement of the bearing 18 from the arm opening 15 is prevented by means of an annular retainer plate 21 secured to the arm 4 by means of bolts 22 and having an annular flange 23 which engages against the outer race of the bearing 18. The inner periphery of the plate 21 carries a sealing ring 24 which engages the surface of a sleeve 25 that is fitted on the spindle 20 and has a radially extending flange which abuts the inner race of the bearing 18. In similar manner the bearing 19 is held against outward displacement from the arm opening 16 by means of a retaining ring 26 which may be secured to arm 4 by means of bolts 27. The internal periphery of the retaining ring 26 carries a seal 28 which is in engagement with the surface of an enlarged shoulder portion of the spindle 20 located inwardly adjacent a radially extending flange 29 provided at the right-hand end of the spindle 20.

A feature of the present invention resides in the novel construction and arrangement of the expanding chuck, generally designated C which is mounted on the flanged end of the spindle 20 for rotation therewith. With reference to the drawings, the expanding chuck C comprises an annular head member 30 which is secured by means of bolts 31 to the outer face of the flange 29 of the spindle 20 in coaxial relation with the latter. Provided in the endwise face of the annular head member 30 is a plurality of radially extending channels 32 which may be spaced, for example, 90° apart circumferentially of the head member, as shown in Fig. 5. The channels 32 extend from the inner periphery of the head member 30 to the outer periphery thereof and at their outer ends each channel 32 intersects with an axially extending recess 33 provided in the outer periphery of the head member 30. Each of the channels 32 is of generally rectangular cross-section shape and is provided on its opposite side walls with inwardly projecting ribs or runners 34.

Mounted for sliding movement in each of the channels 32 is the supporting portion 35 of a chuck member generally designated by the numeral 36. The portion 35 has a cross-sectional shape corresponding substantially to that of the channels 32 and is provided in its opposite side walls with vertically extending grooves 37 for slidably receiving therein the projecting ribs or runners 34 in the channels 32.

Projecting outwardly from the lower or inner end of the supporting portion 35 and axially of the spindle 20 is a core engaging portion 38. In the embodiment of the invention shown in Figs. 1–7 of the drawings, each chuck portion 38 is of arcuate cross-sectional shape and has its outer surface 39 extending parallel to the axis of the spindle 20 so as to form with the other portions 38 substantially a cylindrical supporting surface disposed coaxially of the spindle 20. As shown, the outer surface of each chuck portion 38 is provided with spaced longitudinally extending raised ribs or ridges 40. As shown more clearly in Fig. 4, the inner surface 41 of each of the chuck portions 38 slopes outwardly in divergent relation with respect to the axis of the spindle 20 and provides with the inner surfaces of the other portions 38 a divergent substantially conical inner surface which is disposed coaxially of the spindle 20.

Normally each of the chuck members 36 is biased or urged radially inwardly in its channel 32 to the closed position of the chuck by means of a coil spring 42 seated in a recess 43 provided in the outer end of the supporting portion 35 of each chuck member 36. Each spring 42 is retained in its recess 43 by means of a cap plate 44 secured by means of bolts 45 in the recesses 33 provided in the outer periphery of the chuck head member 30, as shown more clearly in Fig. 4 of the drawings. In addition to retaining the springs 42 in their recesses 43, the cap plates 44 serve also to provide a positive limit to radial outward movement of the chuck members 36 in their channels 32.

In accordance with the present invention, opening and closing of the chuck members 36 is accomplished by means of a conical cam member 46 having a conical surface 47 corresponding to and disposed in sliding engagement with the inner sloping surfaces 41 of the several chuck portions 38, the arrangement being such that movement of the conical cam member 46, back and forth, coaxially of the spindle 20 within the chuck portions 38 operates to cause the latter to be moved between their expanded and closed chuck positions. Referring particularly to Fig. 4, the conical cam member 46 is shown in its fully retracted position in which the several chuck members 36 are disposed in their outermost radial or expanded position with their outer cylindrical surface portions 39 and longitudinal ribs 40 engaged interiorly of the core 48 of a roll of paper or like material 49. The projected position of the conical member 46 is shown in broken lines in Fig. 4.

To facilitate the insertion of the chuck into the end of the tubular core 48 the conical cam member 46 is provided with a tapered or conical outer end or nose portion 50. At its inner end the conical cam surface portion 47 of the cam member 46 terminates in a cylindrical elongated sleeve portion 51 which is slidably received within an axially extending bore 52 in the spindle 20 to permit of axial sliding movement of the cam member 46 relative to the spindle 20.

Movement of the cam member 46 coaxially of the spindle 20 to cause expansion or closing of the chuck members 36 in the head member 30 is accomplished by means of a shaft 53 which is also mounted for sliding movement coaxially within the spindle bore 52 and also a

smaller bore 54 in the spindle 20. The forward end portion of the shaft 53 extends through the sleeve portion 51 of the cam member 46 and is secured to the latter by means of a screw 55, as shown in Fig. 4, the outer end or nose 50 of the member 46 being provided with a removable cap 56 for access to the screw 55 to disconnect and remove the cam member 46 from the shaft 53 for a purpose which will be described hereinafter.

At the opposite end from the cam member 46, referring to Fig. 3, the shaft 53 is connected at 57 to the rod 58 of a piston 59 which is in turn slidable within a cylinder 60. The cylinder 60 is secured by bolts 61 to a mounting sleeve 62 which is threaded on the adjacent end of the spindle 20 and locked with respect thereto by means of a set screw 63. Thus the cylinder 60, piston 59, rod 58 and mounting sleeve 62 rotate as a unit with the shaft 53, spindle 20 and expansible chuck assembly C.

As shown in Fig. 3, in the wall of the cylinder 60 and communicating with opposite sides of the piston 59 are ducts 63 and 64 which connect at their other ends through a roto-coupling 65 with a pipe 66 for supplying fluid under pressure to the cylinder. It will be apparent that when fluid under pressure is admitted from the pipe 66 through the coupling 65 and duct 63 to the left hand side of the piston 59, the latter will be actuated positively to the right thereby in turn actuating rod 58, shaft 53 and cam member 46 to the fully projected position of the latter in which the chuck segments 38 are in the collapsed or closed position. Positive actuation of the cam member 46 to closed chuck position by means of piston 59 is advantageous when inserting the cam nose 50 into the roll core 48 since frequently the core has been distorted or flattened and substantial force must be applied to force open the core material as the nose 50 is inserted therein.

On the other hand, when fluid under pressure is from duct 63 and admitted through the duct 64 to the opposite side of the piston 59, the latter will be actuated to the left, with respect to Fig. 3, thereby carrying with it rod 58, shaft 53 and the conical cam member 46 to move the latter inwardly of the chuck segments 38 a distance sufficient to cause the cam surface 47 to actuate the chuck elements 36 radially to a predetermined expanded position in which they will remain so long as fluid under pressure is supplied to the piston 59.

The stroke or length of movement of the cam member 46 relative to the spindle 20 and the chuck members 36 is limited by engagement of the end face of the cam sleeve portion 51 against a ring 67 positioned at the inner end of the bore 52 of the spindle 20. The ring 67 circumscribes the shaft 53 and a suitable bearing 68 is provided between the shaft 53 and the ring 67. It will be apparent that the stroke or length of movement of the cam member 46 and its actuating mechanism may be varied by substituting for the stop ring 67 other stop rings having greater axial length than the ring 67 shown in Fig. 3 of the drawings, and this may be accomplished simply by disconnecting the cam member 46 from the shaft 53 by means of screw 55 and removing the cam member 46 whereupon the stop ring 67 may be easily removed and replaced by a sleeve of different axial length.

Means is provided for applying a braking action on the rotating spindle 20 and chuck C to provide the desired back tension in the paper of the roll as it is being unwound and to prevent over-running of the roll during unwinding. Referring to Fig. 3, this brake comprises a rotationally and axially fixed annular brakeshoe member 70 which, together with a housing ring 71, is secured by meals of bolts 72 to the plate 21 in concentric relation to the axis of the spindle 20. Secured by means of a key 73 upon the spindle 20 intermediate the sleeves 25 and 62 is the hub portion of a gear form 74 having a circumferentially extending series of teeth 75. Interengaged with these teeth 75 for sliding movement in a direction axially of the spindle 20 is a series of complementary teeth 76 formed on the inner peripheral face of an annular brake disk 77. Fastened to opposite faces of the disk 77, for example by means of rivets 78, are annular brake disks 79 of suitable material.

Movable into and out of engagement with the brake disk 77 and operable to actuate the latter into engagement with the fixed brakeshoe 70 is an annular brakeshoe member 80 which is mounted for limited sliding movement axially of the spindle 20 by means of interengaging teeth 81 and 82 formed, respectively, on the outer periphery of the brakeshoe member 80 and the internal surface of the brake housing ring 71. Normally, the brake shoe member 80 is biased or urged to the left, with respect to Fig. 3 of the drawings, and disengaged from the brake disk 77, by means of springs 85 disposed in recesses 86 provided in an annular end plate 83 and acting on bolts 87 which are secured to the brake shoe member 80 and extended slidably through the end plate 83 and its recesses 86. The end plate 83 is secured to the brake housing ring 71 by means of bolts 84 to substantially enclose the brake mechanism.

Actuation of the movable brakeshoe member 80 to the right, with respect to Fig. 3, to engage the brake disk 77 and, in turn, the latter with the fixed brakeshoe 70, is accomplished by means of an inflatable ring 88 mounted in a correspondingly shaped recess 89 provided in the inner face of the end plate 83 in confronting relation to the movable shoe member 80. A port 90 having communication with the interior of the inflatable ring 88 is mounted in the end plate 83 and connected to said port is a pipe 91 through which fluid under pressure is supplied to the inflatable ring 88. From this it will be apparent that when fluid under pressure is admitted to the inflatable ring 88 the latter will be expanded thereby actuating the brakeshoe member 80 into engagement with the brake disk 77 and the latter into engagement with the fixed brakeshoe member 70 to exert a braking force against rotation of the spindle 20 and the expanding chuck C. The amount of the braking force exerted will depend, of course, upon the amount and pressure of the fluid admitted to the inflatable ring 88 and this is controlled to give the required braking action to provide the desired back tension in the material of the roll as it is being unwound and to prevent overrunning of the roll during unwinding.

The expanding chuck construction of the present invention is not limited to the use of chuck members 36 having elements 38 of arcuate cross-sectional configuration and chuck elements of different cross-sectional shape may be employed. For example, and referring to Figs. 8, 9 and 10 of the drawings, in the case of rolls having cores of square cross-sectional shape, chuck members 36*a* may be employed having chuck elements 38*a* of the cross-sectional shape illustrated wherein the outer core engaging surfaces 39*a* of the chuck elements 38*a* are flat and each lies in a plane parallel to the axis of rotation of the spindle 20, the arrangement being such that each of the chuck elements 38*a* constitutes, in effect, one side of a square which it forms in cooperation with the other associated chuck elements 38*a* in the relationship shown in Fig. 9. Referring to Fig. 10, the underside of each of the chuck elements 38*a* is provided with an inner surface 41*a* which extends angularly outward in divergent relation with respect to the spindle axis and provides with the inner surfaces 41*a* of the other elements 38*a* a divergent substantially truncated-pyramidal inner surface for cooperative engagement with the cam member 46*a*. In this instance, however, and for cooperation with the chuck surfaces 41*a*, the cam member 46*a* is provided with correspondingly truncated-pyramidal surfaces 47*a*, as shown in Figs. 8 and 9.

Alternatively, and referring to Figs. 11, 12 and 13 of the drawings, check members 36*b* may be employed

having chuck elements 38*b* of the angular cross-sectional shape illustrated. Here again, the arrangement is such that each of the chuck elements 38*b* constitutes, in effect, one corner portion of a square which it forms in cooperation with the other associated chuck elements 38*b* in the relationship shown in Fig. 12. Referring to Fig. 13, as in the other forms of chuck elements, the underside of each of the chuck elements 38*b* is provided with angular inner surfaces 41*b* which extend angularly outward in divergent relation with respect to the spindle axis and provides with the inner surfaces 41*b* of the other elements 38*b* a divergent substantially truncated-pyramidal inner surface for cooperative engagement with a correspondingly truncated-pyramidal surface 47*b* of the cam member 46*b*.

In any event, regardless of whether chuck elements of the form of Figs. 5–7, or Figs. 8–10, or Figs. 11–13, are employed, each of them is characterized by the fact that it provides a continuous axially extending surface of predetermined extent for supporting engagement with the inner surface of the roll core thereby minimizing the possibility of slippage between the parts during the unwinding operation as well as reducing the possibility of distortion and mutilation of the core or inside layers of the material of the roll.

In lieu of the cam member actuating mechanism employed in the embodiment of the invention shown in Figs. 3–7 of the drawings, it may be desirable, in some instances, to provide for positive piston actuation of the cam member 46 in both directions. One embodiment of such an arrangement is shown in Figs. 14 and 15 of the drawings wherein the sleeve 62, shown in Fig. 3, is removed and replaced by a retaining ring 62*a* and a double acting piston assembly is bolted to the brake end plate 83*a*, the plate 83*a* being the counterpart of the plate 83 of the embodiment of Figs. 3–7 of the drawings.

As shown, this double acting piston assembly comprises an annular head member 93 which is secured endwise to the plate 83*a* in coaxial relation to the spindle 20 and shaft 53 by means of bolts 94. Secured at one end in the member 93 is one end of a cylinder wall 95 which has its other end secured in a second annular head member 96 and this member 96 has mounted therein a bushing 97 which is retained in place by a ring 98, the entire assembly being secured together by means of rods 99 having nuts 99*a* threaded thereon. The bore 101 through the member 93 and the bore of the bushing 97 have the same diameter and are disposed coaxially of each other and with respect to the spindle 20 and shaft 53 which is connected to the cam member 46.

Mounted for axial sliding movement in the bore 101 of the end plate 93 and the bore of the bushing 97 is a sleeve 102 which extends coaxially through the cylinder 95. Suitable seals 103 and 104 are provided, respectively, between the surface of shaft 102 and the members 93 and 96. Formed integrally with or secured on the sleeve 102 and slidable within the cylinder 95 is a piston 105. The piston 105 is actuated to the right, with respect to Fig. 15 of the drawings, by supplying fluid under pressure thereto through a pipe 106 and is similarly actuated in the reverse direction by supplying fluid to the opposite side thereof through a pipe 107. In this connection, it will be observed that the piston 105 is provided at its opposite sides with piston portions 108 and 109, respectively, of reduced diameter which are slidably received in the bores 110 and 111 of the members 96 and 93 and function to cushion the thrust of piston 105 as it approaches the opposite ends of its stroke. The pipes 106 and 107 are connected to the bores 110 and 111 through suitable ports 112 and 113, respectively, provided in the members 93 and 96.

As shown in Fig. 15, the shaft 53 extends entirely through the piston sleeve 102 and is provided at its left hand or free end with an enlarged head portion 114. Mounted on the shaft 53 inwardly adjacent the head portion 114 is a thrust bearing 115 against which abuts the adjacent end of the bearing sleeve 102. Also mounted on the shaft 53, adjacent the opposite end of the bearing sleeve 102, is a stop ring or collar 116 which is secured against displacement axially along the shaft 53 by means of a pin 117. The member 96 and associated parts including ring 98, shaft head 114, thrust bearing 115 and the adjacent end of the piston sleeve 102 are all enclosed within a suitable housing member 118.

From the foregoing description of the arrangement shown in Figs. 14 and 15 of the drawings, it will be apparent that when fluid under pressure is supplied through the pipe 107 to the lefthand side of the piston 105, the latter will be actuated to the right carrying with it the sleeve 102, the righthand end of which engages the collar 116 to actuate shaft 53 and cam member 46 to the projected position of the latter, shown in broken lines in Fig. 14, in which position the chuck members 36 are permitted to be moved to their closed position by the springs 42. On the other hand, when fluid is supplied by the pipe 106 to the opposite side of the piston 105 the latter with its sleeve 102 will be actuated to the left to the position shown in Fig. 15 thus causing the opposite end of said sleeve 102 to engage against the thrust bearing 115 and actuate the shaft 53 to the left thereby moving the cam member 46 to the chuck expanding position shown in solid lines in Fig. 14. The supply of fluid under pressure through the pipe 106 is continuously maintained so long as it is desired to maintain the cam member 46 in the expanded chuck position. In all other respects the construction and operation of the spindle, chuck assembly and braking mechanism are the same as previously described with respect to the embodiment of the invention shown in Figs. 3–7 of the drawings.

Still another arrangement of mechanism for actuating the cam member 46 between expanded and closed chuck positions is shown in Figs. 16–19 of the drawings. In this particular arrangement the spindle 20*a* is provided with an axially extending bore 120 of slightly smaller diameter than the bore 52*a* which slidably receives the sleeve portion 51 of the cam member 46. Mounted within the bore 120 is a coil spring 121 which operates normally to bias and maintain the shaft 53*a* and cam member 46 in the expanded chuck position shown in Fig. 16. The spring 121 at the end thereof adjacent the cam member 46 operates against a thrust washer 122 which is retained against axial displacement along the shaft 53*a* by means of a plurality of pins 123 inserted through radial openings 124 in the spindle 20*a* and spaced 90° apart circumferentially thereof. The pins 123 are retained against displacement from the spindle 20*a* by means of a circular spring clip 125 which extends circumferentially thereof within a recess 126 and overlies the outer ends of said pins 123. The opposite end of the spring 121 abuts against a shoulder portion 127 which is machined on the shaft 53*a* and the position of the shoulder 127 longitudinally of the shaft and with respect to the thrust washer 122 is predetermined so that, in the position shown in Fig. 16, the spring 121 is pre-stressed.

In this embodiment of the invention the shaft 53*a* and cam member 46 are actuated to the projected position of the latter, shown in broken lines in Fig. 16, against the force of the spring 121, by means of a piston assembly designated generally by the numeral 128. The piston assembly 128 is mounted on an annular end plate 129 which is, in turn, bolted to the brake housing 71 by means of bolts 84*a*, as more clearly shown in Fig. 17 of the drawings. A cylinder wall 131 has its opposite ends secured in head members 132 and 133, respectively, the latter being secured to the end plate 129 by means of bolts 134. Slidably mounted within the cylinder wall 131 is a piston 135 having connected thereto a rod or ram 136 which extends slidably through the head member 133 and has its outer end freely disposed in confronting relation to the adjacent end of the shaft 53*a*.

To actuate the shaft **53***a* and cam member **46** against the spring **121** to the projected position, shown in broken lines in Fig. 16, fluid under pressure is admitted through a pipe **137** to the side of the piston **135** opposite the ram **136** thereby actuating the piston and ram to the right with respect to Fig. 17 and causing the free end of the ram **136** to engage the adjacent end of the shaft **53***a* and actuate the latter. When it is desired to move the cam member **46** to the solid line position shown in Fig. 16 in which the chuck members **36** are in their relatively expanded position, the supply of fluid to the piston **135** through pipe **137** is discontinued and fluid under pressure is supplied by a pipe **138** to the ram side of the piston **135** to return it and the ram **136** to the position shown in Fig. 17, thus allowing the spring **121** to actuate the shaft **53***a* and cam **46** to the chuck expanded position shown in solid lines in Fig. 16.

From the foregoing it will be apparent that the present invention provides a novel construction and arrangement of expanding chuck which substantially eliminates the aforementioned disadvantages and objectionable features of prior devices used for similar purposes.

While certain embodiments of the present invention have been illustrated and described herein, it is not intended to limit the invention to such disclosures and it is contemplated that changes and modifications may be incorporated and embodied therein within the scope of the following claims.

We claim:

1. A supporting spindle for a roll of material having a core opening extending axially therethrough, comprising a tubular spindle having an axial counterbore extending inwardly from one end thereof, means mounting said spindle for rotation with a roll of material during unwinding thereof, a chuck fixedly mounted at said one end of the spindle coaxially thereof, a plurality of chuck members mounted in said chuck at equally spaced intervals circumferentially thereof for radial sliding movement between inner closed and outer expanded positions, means normally urging the chuck members radially inward to closed chuck position, a shaft slidably mounted coaxially within the spindle, a cam member having a sleeve portion slidable axially within the spindle counterbore and connected to said shaft for movement therewith axially of the spindle and chuck in cooperative engagement with the radially slidable members thereof to actuate said members radially outward to their expanded position upon movement of said cam member in one direction and upon movement thereof in the opposite direction to cause said members to be urged radially inward to their closed position, means to actuate the shaft and cam member in respectively opposite directions relative to the spindle and chuck between one limit position in which the chuck members are expanded and another limit position in which the chuck members are closed, and means in said spindle bore cooperable with the sleeve portion of the cam member to predeterminedly limit the stroke of the latter.

2. A supporting spindle construction as claimed in claim 1 wherein the cam member is provided at its free end with a convergent substantially conical nose portion operable to facilitate insertion of the chuck into the core opening of the roll.

3. A supporting spindle for a roll of material having a core opening extending axially therethrough, comprising a chuck for engagement within the core opening of a roll, a plurality of chuck members mounted in said chuck at equally spaced intervals circumferentially thereof for radial sliding movement between inner closed and outer expanded positions, springs normally urging each chuck member radially inward to closed chuck position, a cam member movable axially of the chuck in cooperative engagement with the radially slidable members thereof to actuate said members radially outward to their expanded position upon movement of said cam member in one direction and upon movement thereof in the opposite direction to cause said members to be urged radially inward to their closed position, and means to actuate the cam member in respectively opposite directions relative to the chuck between one limit position in which the chuck members are expanded and another limit position in which the chuck members are closed, said means comprising a spring operable normally to urge said cam member to the limit position in which the chuck members are expanded and a fluid pressure operated piston operable to actuate the cam member to the other limit position in which the chuck members are closed.

4. A supporting spindle as claimed in claim 3 wherein the spring is pre-stressed in its extended limit position.

5. A supporting spindle as claimed in claim 1 wherein the chuck members are each provided with projecting core engaging portions of arcuate cross-sectional shape and intercooperate to provide a substantially cylindrical supporting surface for engagement with the roll core.

6. A supporting spindle as claimed in claim 1 wherein the chuck members are each provided with projecting core engaging portions of generally rectangular cross-sectional shape and intercooperate to provide a substantially square supporting surface for engagement with the roll core.

7. A supporting spindle as claimed in claim 1 wherein the chuck members are each provided with projecting core engaging portions of angular cross-sectional shape and intercooperate to provide a substantially square supporting surface for engagement with the roll core.

8. A supporting spindle construction as claimed in claim 1 wherein the cam member at its free end has a removable cap and is counterbored to receive coaxially therein a screw for detachably connecting the cam member to said shaft.

9. A supporting spindle construction as claimed in claim 1 wherein the chuck members each have a core engaging portion extending parallel to the spindle axis defining in cooperation with the other core engaging portions a surface area of substantial axial and circumferential extent for engagement interiorly of the roll core, and the cam member has a maximum diameter substantially as great as the diameter of said surface area of the core engaging portions of the chuck members in the closed position of the latter.

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