June 6, 1967 D. E. GERSTEIN ETAL 3,323,399

APPARATUS FOR SLITTING ROLLS OF MATERIAL

Filed March 17, 1965 3 Sheets-Sheet 1

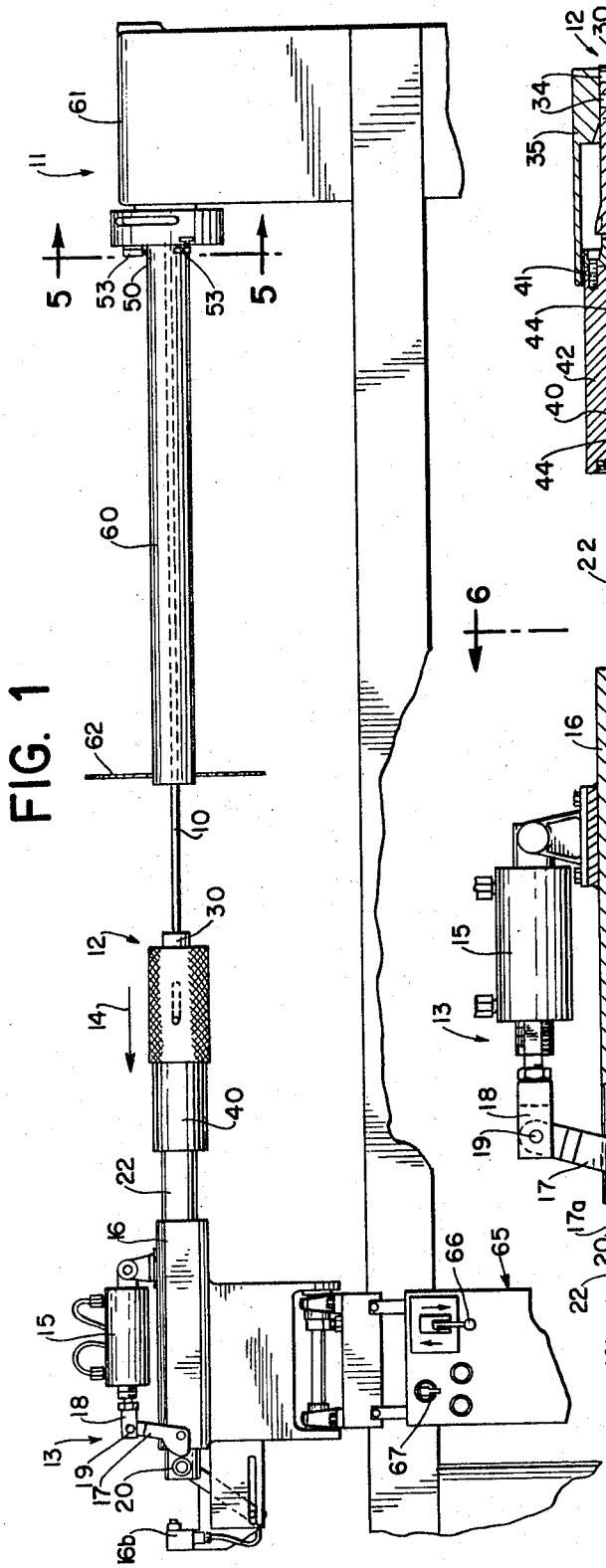


FIG. 1

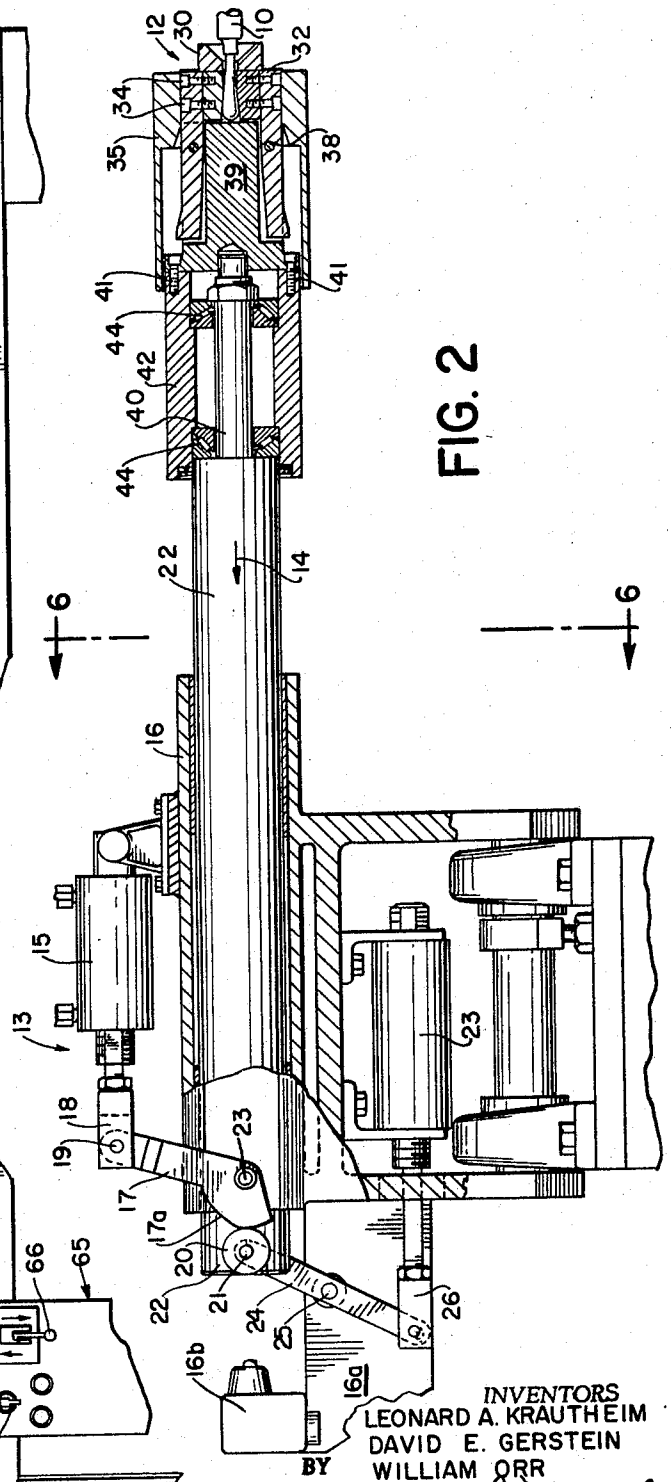


FIG. 2

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APPARATUS FOR SLITTING ROLLS OF MATERIAL

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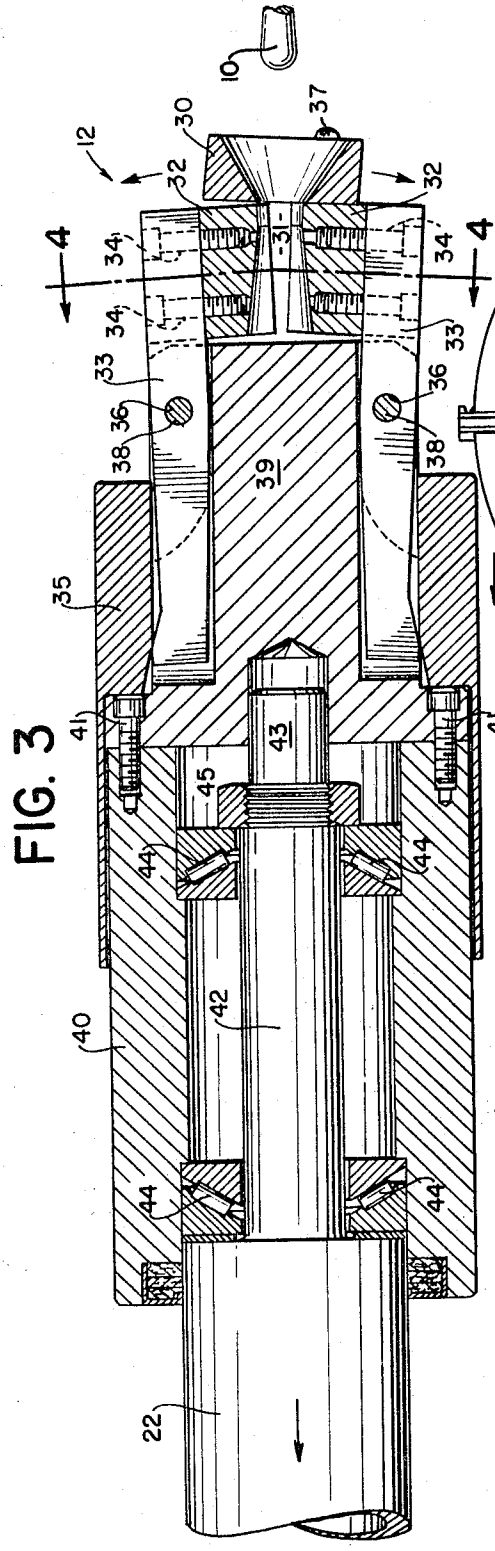


FIG. 3

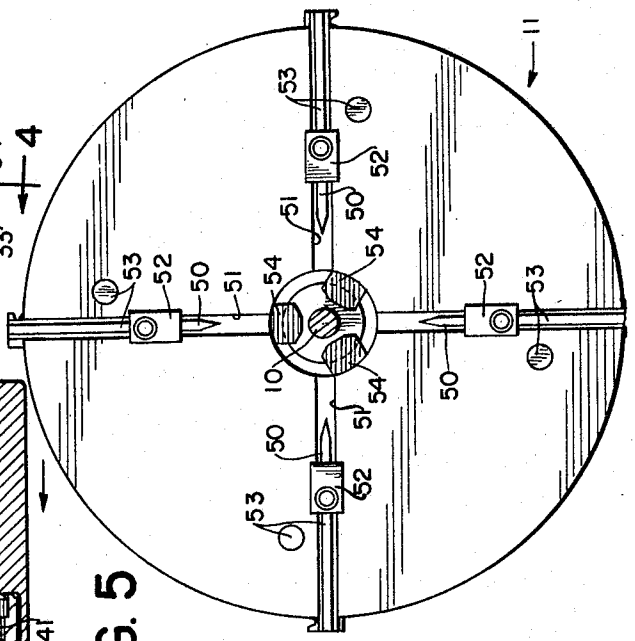


FIG. 5

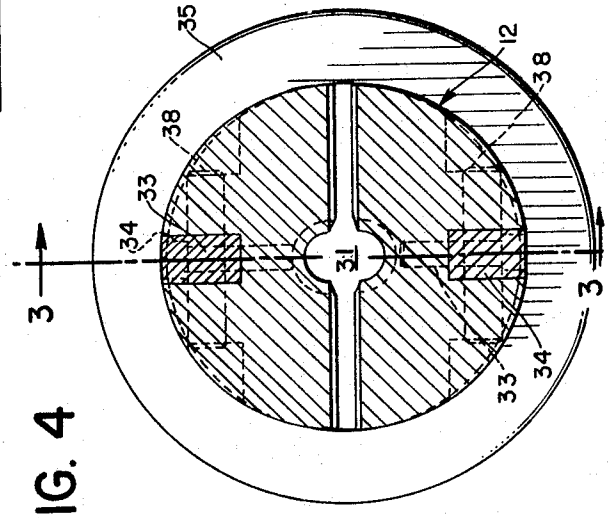


FIG. 4

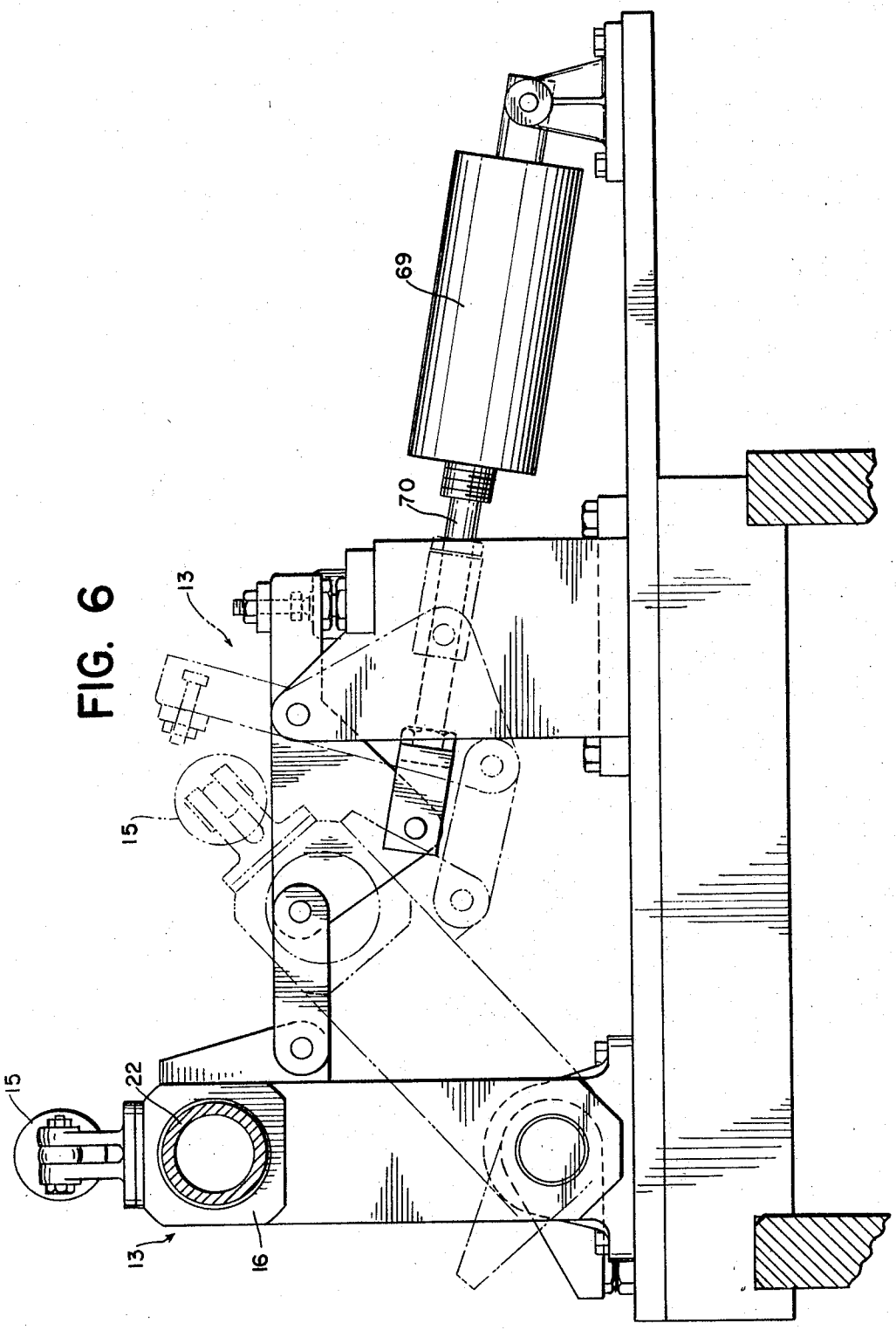
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APPARATUS FOR SLITTING ROLLS OF MATERIAL

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FIG. 6



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3,323,399

APPARATUS FOR SLITTING ROLLS OF MATERIAL

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12 Claims. (Cl. 82—101)

The present invention relates to machines for slitting wide webs or sheets of material such as paper and the like and more specifically to machines which slit or part-off narrow spools of paper from a wide roll of such material. Although the invention will be described in connection with the cutting of rolls of paper, it will be obvious that the invention has broader application and may be employed in the cutting of other materials such as rolls of fabric.

One part of such a machine is the paper roll carrying member commonly known as a mandrel. The mandrel is caused to rotate and with the paper roll secured to it imparts rotary movement to the paper roll. The rotating paper roll is exposed to a cutting tool having a direction of cutting transverse to the longitudinal axis of the mandrel and the paper roll. The mandrel itself, the means by which the mandrel is mounted and the means by which the paper roll is secured to the mandrel may all take various forms and configurations. In one of the more common arrangements, the mandrel is so mounted as to be driven at one end with the opposite end cradled in a yoke and free to rotate. The paper roll is secured to the mandrel through a driving head which rotates with the mandrel and which carries prongs which are inserted into the paper roll and its central core. In another arrangement, the mandrel is so constructed as to be radially expendable. Upon expansion of this mandrel, the central core is firmly grasped without a marring of the paper. A great number of other arrangements, besides the two just described are possible or are already in use.

Many of the techniques for mounting the mandrel involve the application of compressive forces to the ends of the mandrel. It has been found that the application of compressive forces is apt to cause two undesirable effects. One is that the mandrel vibrates and the other is that the mandrel becomes bowed. It should be pointed out that the mandrel is apt to vibrate even without the application of compressive forces; for example, where the mandrel is merely cradled at one end in a yoke. It is apparent that both vibration and bowing of the mandrel may result in difficulty in cutting the paper roll along with the resulting cuts being of various and improper sizes.

Heretofore, in order to inhibit such vibration, supporting rollers have been used engaging the outer perimeter of the paper roll being cut. Such supporting rollers, however, smudge and smear materials such as carbon-less duplicating material.

It is an object of the present invention to provide a new and improved apparatus for slitting rolls of paper into multiple narrow spools.

It is another object of the present invention to provide a new and improved mandrel mounting arrangement for a machine which slits rolls of paper into multiple narrow spools.

A further object of the present invention is to provide a mandrel mounting arrangement which is simple in construction, easy to maintain, and not subject to the shortcomings mentioned above.

There are provided in a machine for slitting rolls into multiple narrow spools in accordance with the present invention a roll carrying member and means for subjecting this roll carrying member to a condition of tension. Also included are means for securing a roll of material to the roll carrying member and means for driving the roll carrying member to effect a turning of the roll of material.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description, taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

Referring to the drawings:

FIG. 1 is a side elevation view of a paper roll cutting machine and a mandrel mounting arrangement according to the present invention;

FIG. 2 is an enlarged view, partly in cross-section, of the tailstock portion of the machine shown in FIG. 1;

FIG. 3 is an enlarged view of the mandrel gripping mechanism of the apparatus shown in FIG. 2 taken along line 3—3 of FIG. 4;

FIG. 4 is a cross-section view taken along line 4—4 of FIG. 3;

FIG. 5 is a view taken along line 5—5 of FIG. 1 with the paper roll removed; and

FIG. 6 is a view taken along the line 6—6 of FIG. 2 showing the tailstock portion of the machine in the position of engagement with the mandrel, and, in dotted lines, its position when disengaged from the mandrel.

Referring to FIG. 1, the invention includes a mandrel or paper roll carrying member **10**. Although shown as a single continuous solid shaft in the drawing, mandrel **10** may take any of the various other forms which are well known to those skilled in the art.

The invention also includes means for subjecting the mandrel **10** to a condition of tension. Such means may include a pair of chucks **11** and **12** disposed at opposite ends of the mandrel **10**, for grasping and supporting the mandrel.

To achieve the desired condition of tension in the mandrel **10**, an outward force is applied to at least one of the chucks **11** or **12** along the longitudinal axis of the mandrel. For the embodiment shown in FIG. 1, chuck **11**, at the headstock, is held in place and an outward force is applied, at the tailstock, by a drive **13** directly to the chuck **12** in the direction of the arrow **14**. It should be pointed out that the condition of tension may be created by applying oppositely directed forces at both the headstock and the tailstock to both of the chucks **11** and **12**, respectively.

FIG. 2 is an enlarged view, partly in cross-section, of the tailstock of the machine shown in FIG. 1. FIG. 2 illustrates the mandrel **10** being held by the chuck **12** with the mandrel in a condition of tension. Referring to FIG. 2, an air or hydraulic cylinder **15**, suitably mounted on the housing **16** of the tailstock, has a lever **17** pivotally connected to the piston rod **18** of the cylinder at a pivot point **19**. The lever **17** has a cam surface **17***a* which bears against a cam follower **20** rotatably mounted on a bearing shaft **21** extending through a support shaft **22**. Shaft **22** is slidingly fitted within the housing **16**. The lever **17** pivots about a pivot point **23** on the housing **16**. In operation, as the cylinder piston rod **18** moves to the right, lever **17** rotates in a clockwise direction about pivot point **23** and pushes against the cam follower **20** so that the shaft **22** is moved to the left, thereby applying a condition of tension to the mandrel **10**. As the cylinder piston rod **18** moves to the left, the condition of tension is released since now lever **17** rotates counter-clockwise and the shaft **22** is permitted to move to the right until the condition of tension is released.

A second cylinder **23**, also suitably mounted on the housing **16**, is provided to impart relatively large movements to the shaft **22** necessary during the striking or un-

striking of the mandrel 10. A lever 24, pivotally mounted on a pivot point 25 on a frame extension 16*a* which is rigidly connected to the housing 16, has one end which pivots about pivot point 21 and another end pivotally connected to the piston rod 26 of the second cylinder 23. As the piston rod 26 moves to the left, lever 24 pivots clockwise and the shaft 22 is moved to the right. As the piston rod 26 moves to the right, the lever 24 pivots counterclockwise and the shaft 22 is moved to the left.

In actual operation, the cylinder 23 is actuated so as to move the shaft 22 to the right to permit striking the mandrel 10 in the chuck 12. After the requisite adjustments have been made on the chuck 12, the cylinder 23 is actuated so as to draw shaft 22 to the left. At this point, cylinder 15 is actuated, and, in the manner previously described, moves the shaft 22 further to the left, thus applying tension to the mandrel.

It is preferable to provide a second lever, similar to lever 17 and a second cam follower, similar to the cam follower 20 on the opposite side of the machine housing 16. These additional elements would be mounted in the same way as the corresponding elements on the front side of the machine and serve the same purposes.

As shown in FIG. 1, a control unit 65 which is provided with an OFF-ON switch lever 66, is secured to the machine. A switch 67 actuates the cylinder 23 to move the shaft 22 to the right as above described.

FIG. 3 is an enlarged view of the chuck 12 and its associated components taken along line 3—3 of FIG. 4, while FIG. 4 is a cross-section view taken along line 4—4 of FIG. 3. Referring to FIGS. 3 and 4, the chuck 12 is seen to be in its opened condition ready to receive the knob end 10*a* of the mandrel 10. The knob end 10*a* is guided through a conical opening in a guide member 30 into a cavity or opening 31. A set of jaws 32, 32 secured to a set of jaw supports 33, 33 by means of a plurality of screws 34 close upon the knob end 10*a* and firmly grasp the knob end as a sleeve 35 is moved toward the right. The sleeve 35 and the jaw supports 33, 33 are so shaped that when the sleeve is moved to the left, the jaw supports pivot about pivot points 36, 36 in the direction of the arrows shown adjacent the chuck to release the knob 10*a* and when the sleeve is moved to the right, the jaw supports pivot in a direction opposite to the direction of the arrows to grasp the knob. The guide 30 is secured to one of the jaws, the lower one for the embodiment being described, by means of screw 37. Pivot points 36, 36 correspond to the axes of bearing shafts 38, 38 upon which the jaw supports 33, 33 are mounted. Bearing shafts 38, 38 also pass through corresponding bores in a rigid support member 39. Support member 39 is secured to a cylindrical member 40 by means of screws 41, 41. The support shaft 22, running through the housing 16 shown in FIGS. 1 and 2, has a narrowed section 42 and a partially threaded guide section 43 which fits into a guide recess within the support member 39.

To achieve the disconnect required between the non-rotating shaft 22 and the rotating cylindrical member 40 which actually carries the rotating chuck 12, a plurality of roller bearings 44 are provided. Instead of using only one roller bearing, two are provided so as to furnish axial stability along the narrowed section 42 of shaft 22. A nut 45 engages the threaded portion of the guide section 43 and is tightened to provide the proper bearing between the surfaces contacted by the roller bearings 44.

The apparatus shown in FIG. 3 serves as an effective means for supporting and grasping the mandrel 10 under a condition of tension and still effects the required disconnect between the non-rotating support shaft 22 and the rotating mandrel.

The invention further includes means for securing a roll of paper to the mandrel 10. Referring to FIGS. 1 and 5, such securing of the paper roll may be accomplished by means of a plurality of prongs 50 adapted to penetrate the end portion of a paper roll 60. The driving chuck 11 has

a plurality of radial T-slots 51 in which riders 52 are slidably mounted. The riders 52 carry the prongs 50. The riders 52 may be locked in driving or engaged position by convenient means such as rack and pinion assemblies 53, thereby insuring positive drive of the paper roll 20. In addition, there may also be provided axially extending prongs (not shown) which are adapted to engage the central core of the paper roll.

The jaws 54 carried by the driving head of chuck 11 may engage the extended head of the core of the paper roll when desired, whereby the paper roll will be engaged on the exterior by the prongs 50 and at the core by the jaws 54. At this end, the mandrel may be held by mechanism similar to the grasping mechanism of the chuck 12 shown in FIG. 3, or the mandrel may be threaded at this end and secured into a threaded aperture provided in the housing of the head stock 61 of this driving end.

The invention additionally includes means for driving the mandrel 10 to effect a turning of the paper roll 60. This drive in the form of rotary motion, is achieved by applying a rotary driving force to at least one of the chucks 11 or 12. For the embodiment shown in the drawing, the driving force is imparted to chuck 11 through a drive mechanism contained in a housing 61. This drive mechanism may be the same mechanism, with any necessary, suitable modifications, which is provided for the driving head 26 in U.S. Patent 3,083,601 assigned to the same assignee.

A cutting tool 62 shown without the suitable support and conveying mechanism is also shown in FIG. 1. This cutting tool moves transverse to the longitudinal axis of the mandrel 10 to effect the cutting of a spool and moves parallel to the longitudinal axis of the mandrel to a new position for the commencement of new cuts.

To unload the cut rolls of material and re-load a new roll, it is only necessary to disengage the tailstock from the mandrel. The depression of switch 68 in the control box 65 (see FIG. 1) causes the shaft 22 to retract. The shaft engages a microswitch 16*b* which activates an air cylinder 69 causing a rod 70 to pull the entire tailstock over to the position shown in dotted lines in FIG. 6. The mandrel is then exposed and easily accessible. The cut roll may be removed from the mandrel and a new roll placed thereon.

While there has been described what is at present considered to be the preferred embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and it is, therefore, aimed to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a machine for slitting rolls into multiple narrow spools:
   - a roll carrying member;
   - means for subjecting said roll carrying member to a condition of tension;
   - means for securing a roll of material to said roll carrying member;
   - and means for driving said roll carrying member to effect a turning of said roll of material.

2. In a machine for slitting rolls of paper into multiple narrow spools;
   - a paper roll carrying member;
   - means for applying a tensive force to said roll carrying member along its longitudinal axis;
   - means for securing a roll of paper to said roll carrying member;
   - and means for driving said roll carrying member to effect a turning of said roll of paper.

3. In a machine for slitting rolls of paper into multiple narrow spools:
   - a mandrel;

a chuck disposed at one end of said mandrel and rigidly grasping said mandrel;
means for applying an outward force to said chuck along the longitudinal axis of said mandrel thereby subjecting said mandrel to a condition of tension;
means for securing a roll of paper to said mandrel;
and means for driving said mandrel to effect a turning of said roll of paper.

4. In a machine for slitting rolls of paper into multiple narrow spools:
a mandrel;
means for applying a tensive force to said mandrel along its longitudinal axis;
means for securing a roll of paper to said mandrel;
and means for applying a rotating driving force to said mandrel to effect a turning of said roll of paper.

5. In a machine for slitting rolls of paper into multiple narrow spools:
a mandrel;
a chuck disposed at an end of said mandrel and rigidly grasping said mandrel;
means for applying a tensive force to said mandrel along its longitudinal axis;
means for securing a roll of paper to said mandrel;
and means for applying a rotating driving force to said mandrel to effect a turning of said roll of paper.

6. In a machine for splitting rolls of paper into multiple narrow spools:
a mandrel;
a pair of chucks disposed at opposite ends of said mandrel, at least one of which rigidly grasps said mandrel;
means for applying an outward force to said chuck along the longitudinal axis of said mandrel thereby subjecting said mandrel to a condition of tension;
means for securing a roll of paper to said mandrel;
and means for applying a rotating driving force to at least one of said chucks to effect a turning of said roll of paper.

7. In a machine for slitting rolls into multiple narrow spools:
a machine frame;
a roll carrying member;
a chuck coupled to said machine frame through roller bearings and disposed at one end of said roll carrying member for rigidly grasping said roll carrying member;
means for applying an outward force to said chuck along the longitudinal axis of said roll carrying member thereby subjecting said roll carrying member to a condition of tension;
means for securing a roll of material to said roll carrying member;
and means for driving said roll carrying member to effect a turning of said roll of material.

8. In a machine for slitting rolls of paper into multiple narrow spools:
a machine frame;
a mandrel;
a pair of chucks coupled to said machine frame through roller bearings and disposed at opposite ends of said mandrel, at least one of which rigidly grasps said mandrel;
means for applying an outward force to said chucks along the longitudinal axis of said mandrel thereby subjecting said mandrel to a condition of tension;
means for securing a roll of paper to said mandrel;

and means for applying a rotating driving force to at least one of said chucks to effect a turning of said roll of paper.

9. In a machine for slitting rolls of paper into multiple narrow spools:
a machine frame;
a mandrel;
first and second support shafts individually slidable within said machine frame in a direction along the longitudinal axis of said mandrel;
a first chuck coupled to said first support shaft through roller bearings and disposed at one end of said mandrel for rigidly grasping said end of said mandrel;
a second chuck coupled to said second support shaft through roller bearings and disposed at the opposite end of said mandrel for rigidly grasping said opposite end of said mandrel;
means for applying an outward force to at least one of said chucks through its associated support shaft along the longitudinal axis of said mandrel thereby subjecting said mandrel to a condition of tension;
means for securing a roll of paper to said mandrel;
and means for applying a rotating driving force to at least one of said chucks to effect a turning of said roll of paper.

10. The apparatus of claim 9 wherein the tensioning means include a fluid layer rigidly affixed to the machine frame and lever means pivotally mounted on the machine frame and connected between the fluid cylinder and one of the support shafts.

11. In a machine for slitting rolls of material into multiple spools:
a roll carrying member;
a chuck disposed at one end of said roll carrying member and rigidly grasping said roll carrying member;
means for applying an outward force to said chuck along the longitudinal axis of said roll carrying member thereby subjecting said roll carrying member to a condition of tension;
means for securing a roll of material to said roll carrying member;
means for driving said roll carrying member to effect a turning of said roll of material; and
means for disengaging said chuck from said roll carrying member to effect the removal of said roll of material.

12. In a machine for slitting rolls of material into multiple spools:
a roll carrying member;
a chuck disposed at one end of said roll carrying member and rigidly grasping said roll carrying member;
means for applying an outward force to said chuck along the longitudinal axis of said roll carrying member thereby subjecting said roll carrying member to a condition of tension;
means for securing a roll of material to said roll carrying member;
means for driving said roll carrying member to effect a turning of said roll of material; and
means for moving said chuck out of engagement with said roll carrying member to effect disengagement therefrom.

No references cited.

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