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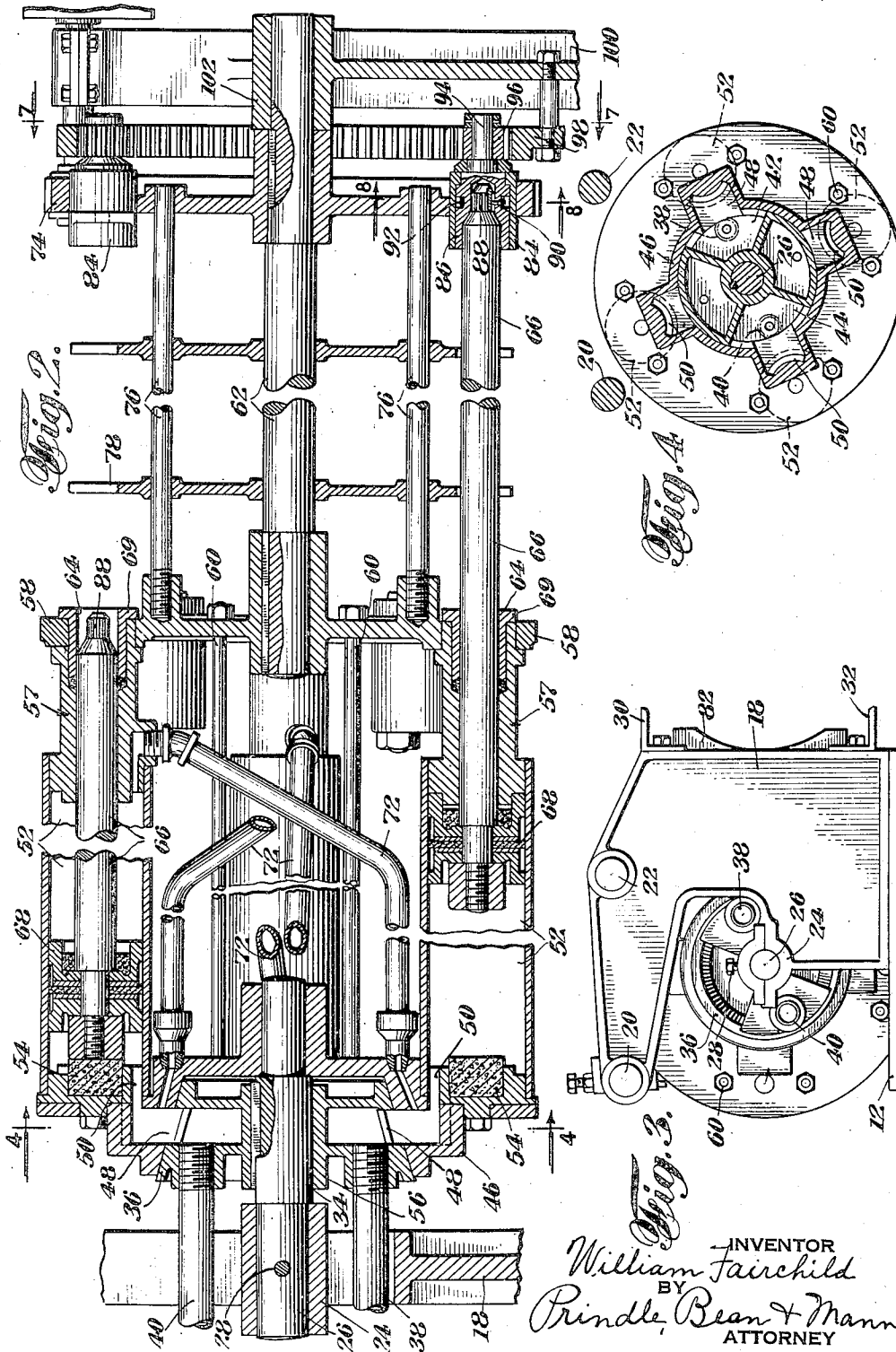
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1,934,660

TUBE CUTTING MACHINE

Filed March 1, 1932

3 Sheets-Sheet 2



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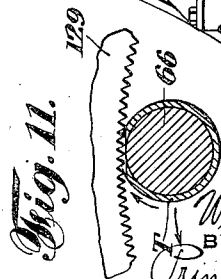
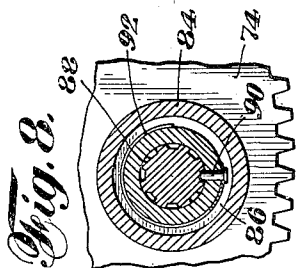
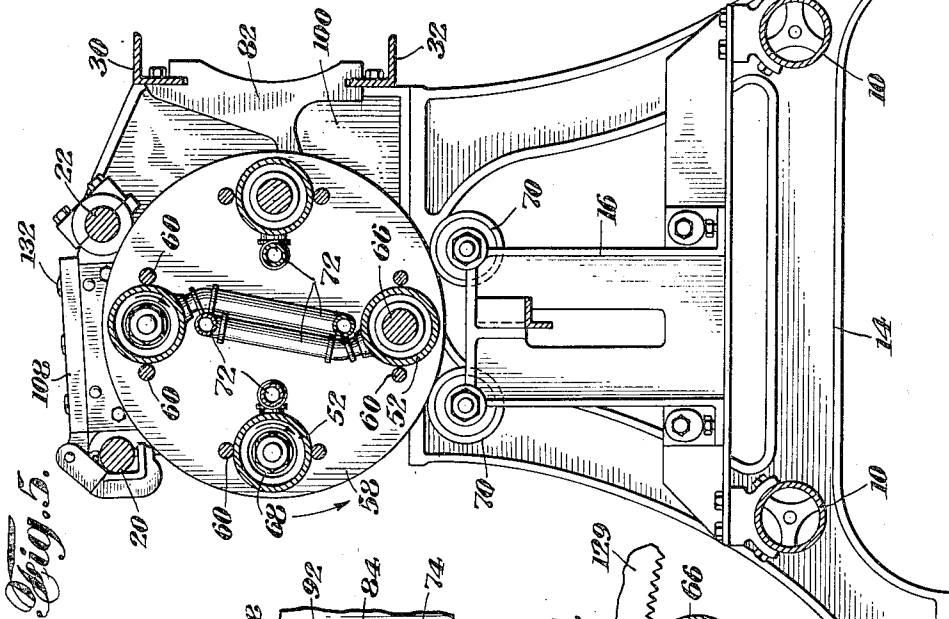
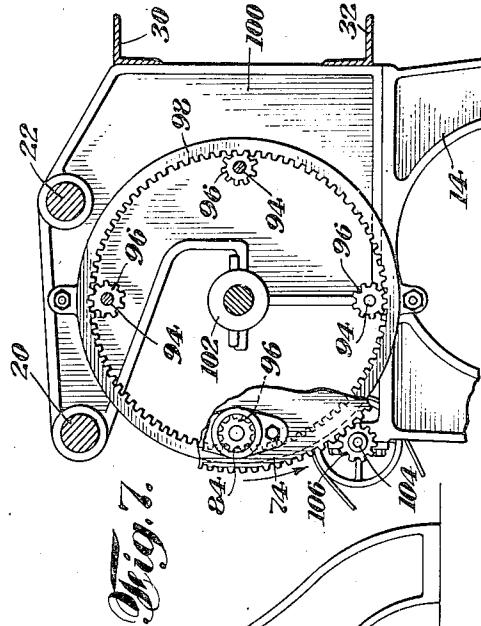
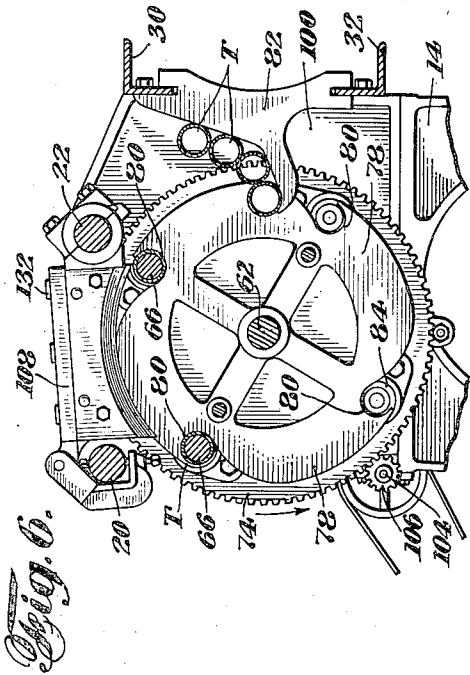
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1,934,660

TUBE CUTTING MACHINE

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7 Claims. (Cl. 164-69)

This invention relates to a machine for cutting cardboard or paper cylinders into shorter lengths. The cylinders are ordinarily made by winding paper or cardboard spirally while gluing the paper in place. Frequently such cylinders have to be used in short lengths with accurate dimensions, as for example where the tubes are used as a base or support for a roll of toilet paper. If tubes are cut for this purpose by a saw or ordinary cutter, a burr is usually left on the inside which makes it difficult to mount the cut tubes on the mandrel of a winding machine.

According to the present invention, I supply a rotor which revolves about a horizontal axis which is provided with arms or brackets on to which the long tubes can be dropped. As the rotor revolves, mandrels are automatically successively driven forward into the tubes supported by the brackets and then the mandrels are themselves positively rotated about their center as an axis while the tube is moved along in contact with a cutting knife. After the tube has passed the cutting position, the mandrels are successively retired, dropping the cut sections of tubing from the machine.

This invention can readily be understood from the illustrative example shown in the accompanying drawings in which Fig. 1 is a side view of the machine with some parts broken away; Fig. 2 is an enlarged horizontal section shortened so as to show all of the working parts on a large scale; Fig. 3 is a section on line 3-3 of Fig. 1; Fig. 4 is a section on line 4-4 of Fig. 2; Fig. 5 is a section on line 5-5 of Fig. 1; Fig. 6 is a section on line 6-6 of Fig. 1; Fig. 7 is a section on line 7-7 of Fig. 2; Fig. 8 is a section on line 8-8 of Fig. 2; Fig. 9 is a detailed view of the cutting mechanism; Fig. 10 is a section on line 10-10 of Fig. 9, and Fig. 11 is a sectional view showing means which may be used for preventing a tube from slipping while on its mandrel.

The machine here illustrated comprises base frame members 10 connected to two end members 12 and 14 and to a central support member 16. End member 12 carries a bracket 18 the shape of which is shown in Fig. 3. This bracket supports the two rods 20 and 22 and also supports the bearing 24 in which is positioned the stub shaft 26. Rotation of this shaft relative to its bearing is only for the purpose of adjustment and a set screw 28 is provided so that the shaft may be locked in any desired position. Angle bars 30 and 32 supplement bars 20 and 22 as connections between bracket 18 and a bracket carried by sup-

port 14 at the other end of the machine which will be described later.

Stub shaft 26 has an enlarged portion 34 which bears against the end of bearing 24 to take up any thrust. Keyed to this enlarged portion of stub shaft is a valve member 36 here shown in the form of a truncated cone. This cone is used for alternately transmitting suction or pressure to control the movement of the mandrels in and out of the paper tubes, and therefore has connected to it an air pressure line 38 and a vacuum line 40.

As shown in Fig. 4, the air pressure line 38 connected to the cone 36 leads into a segmental chamber 42 opening toward the periphery of the cone, and in like manner the vacuum line 40 opens into segmental chamber 44 which likewise opens towards the periphery of the cone. By loosening the set screw 28 the stub shaft 26 can be rotated so as accurately to adjust the position of the segmental chambers 42 and 44.

The main rotor is made up of two halves, of which the part nearest the end support 12 comprises the cylinders carrying the mandrels as plungers, while the other half carries the support arms for the tubes to be cut. The cylinder half of the rotor has an end member 46 chambered to receive the cone shaped valve 36, (see Figs. 2 and 4). Leading from the surface with which the periphery of cone 36 contacts are four radial passages 48 each connected with a longitudinal duct 50. Each of the four ducts 50 opens into the interior of a cylinder 52. It is to be noted, as shown in Fig. 2, that the ducts 50 do not open into the extreme ends of the cylinders, but each cylinder has at its rear end a mass of resilient material 54 beyond which the duct 50 opens. At its center, end member 46 has a bearing 56 which is supported on and rotates around one end of stub shaft 26.

Near the middle of the machine each cylinder 52 is closed by a member 57 which is mounted in a central ring member 58, which in turn is tied to member 46 by rods 60, and at its center, is keyed onto a driving shaft 62. Each member 57 has a circular opening 64 which is concentric with one of the cylinders 52. Adapted to slide in each of the four openings 64 is a mandrel 66 carrying at its inner end a piston head 68. If desired, each opening 64 may be enlarged to receive a bearing 69. As shown in Fig. 5, central support member 16 carries two rollers 70 which support member 57 so that it is free to rotate with shaft 62.

From the description thus far given it will

be seen that when the rotor turns about stub shaft 26 through force transmitted by shaft 62, the radial passages 48 will be brought successively across the ends of chambers 42 and 44, with neutral zones between, so that the mandrels 66 will be successively driven out of the cylinders by air pressure from the pressure line 38 and sucked back into the cylinders by the vacuum from the vacuum line 40. Air may be permitted to enter and leave the cylinders 52 by openings formed adjacent members 57. These openings may simply extend into the outside air but I prefer to interconnect opposite cylinders, as by lines 72, which doubly connect one cylinder 52 with the opposite (not the adjacent) cylinder 52. It is to be noted that these lines 72 interconnect the two cylinders at opposite ends. Thus when one mandrel 66 is being retracted by vacuum, super-atmospheric pressure will be transmitted into this cylinder beyond the piston 68 through the opposite cylinder 52 and one of the interconnecting pipes 72. At the same time, the air in front of the piston 68 which is moving outward will be exhausted through the opposite cylinder and the vacuum line 40. This interconnection assists in the operation of the plunger and has the added advantage that by introducing positive pressure around the mandrels while they are being retracted, there is no danger of dust being drawn in to the cylinders, but any dust collecting around the mandrels will be blown out by air which leaks around the mandrels through the openings 64.

Adjacent the end support 14, the rotor has an end member 74 which, like member 58, is keyed on shaft 62. This end member is connected with member 58 not only by shaft 62 but also by tie rods 76. Carried by the rods 76 and rotating with the shaft 62 are a series of ring members 78, each provided with four evenly spaced hook shaped recesses 80. These support brackets are of course all in line. At the front of the machine, carried by the angle bars 30 and 32, are a series of feed members 82 shaped as shown in Fig. 6. The tubes to be cut, designated by the letter T, roll down the face of the support member into one of the recesses 80 of ring members 78, picks up the first tube from the feed member. It will be noted that the recesses 80 are so shaped that they can pick up only one tube at a time and that ordinarily the outer circumference of ring members 78 positively check the feeding of the tubes from the feed member. Instead of recesses the members 78 may be provided with hooked projections to pick up the tubes, but clogging of the feed may result.

The rotor end 74 carries four bearing cylinders 84 the centers of which are aligned with the centers of the mandrel openings 64 in the member 58. Adapted to rotate in each of the bearing cylinders 84 is a mandrel socket 86. As shown in Figs. 2 and 8, each mandrel 66 has its free end reduced in size and serrated as indicated at 88. Each socket 86 is shaped to receive the free end of a mandrel and is provided with a pin 90 (see Fig. 8) controlled by a spring 92 to engage with the serrations of the mandrel so that when the mandrel is driven into the socket, it will be caused to rotate with the socket.

Extending out of bearing cylinders 84 each socket 86 is provided with a cylindrical portion 94 carrying a star gear 96. These star gears 96 engage with a fixed ring gear 98 (see Fig. 7) carried by the bracket 100 which in turn is mounted on the end support 14. Bracket 100 has a bear-

ing 102 for the shaft 62 and also carries the ends of rods 20 and 22 and angle bars 30 and 32. Shaft 62 may be driven in any desired way but is here shown as being driven through the shaft 104 carrying the gear 106, the teeth of which mesh with teeth formed in the periphery of end member 74.

Carried by rods 20 and 22 are a series of cutter supports 108. As here shown, the cutter supports 108 are mounted so that they can pivot around shaft 22 and slide longitudinally of this shaft, but can be locked against shaft 20 by tightening up stud screw 110 carried by a hinged bracket 112 which draws down the cutter support 108 until a stud screw 114 contacts with the bar 20. The exact elevation of each cutter support 108 can readily be adjusted by turning stud screw 114 either in or out.

The cutter supports 108 are each formed with a removable face-plate 116 bearing against a shoulder 120 of the support cutter, to which the face-plate is attached by bolts 122. Between the face plate 116 and the lower edge of the cutter support, floats a cutter holder 124 which has a removable face-plate 126 so that the cutter proper 128 can be anchored between the holder 124 and the face-plate 126. Bolts 130 pass through the face-plate 116 and into cutter support 108 and pass through enlarged holes in the cutter holder 124 so that this holder is permitted some movement relative to the cutter support. Hollow screws 132 pass down from the top of cutter support 108 each having a central spring 134 tensioning cutter holder 124 and cutter 128 away from the cutter support. By changing the tension of these springs through adjustment of screws 132, cutters 128 can be set to give an even pressure. Any desired number of cutter assemblies may be mounted on the shafts 20 and 22, for if at any time any of them are not needed, they can readily be pivoted around shaft 22 into an inoperative position.

If desired, in one or more instances a toothed member may be substituted for cutter blade 128 in the cutter assembly. This is illustrated in Fig. 11 where the toothed member is designated by the numeral 129. The use of such toothed members will assist in causing the paper tubes to rotate with the mandrels, for it will be noted, as shown in Fig. 2, that the circumference of the mandrels is approximately in line with the working circumference of the star wheels 96, so that the peripheries of the mandrels will rotate at a speed approximately equal to the speed at which the mandrels move past the knife and so that therefore toothed members 129 will bite into the rolls and function in the same way as the ring gear 98 but will operate directly on the rolls instead of through the mandrels.

In operating the machine, the cutting assemblies are positioned to cut the rolls into the desired lengths. Set screw 28 is loosened and the valve cone 36 is adjusted so that air will enter one of the cylinders 52 just after the corresponding bracket supports have picked up a tube from feed members 82. Tubes are then fed in against feed members 82 and the rotor is started in operation. One of these rolls will be picked up by the bracket supports 80 and immediately after it has been picked up, air under pressure will be admitted into the corresponding cylinder 52 forcing forward the mandrel 66 through the center of the tube which has been picked up. When this mandrel is seated in socket 86 the mandrel and the surrounding tube will rotate around the axis of the mandrel. As the rotor continues

its movement, the revolving mandrel and tube will be brought against the cutters 128 and roll along the face of these cutters so that a rolling cut is given to the tubes without any tearing action. The cutters are adjusted so that they will exert some pressure against the mandrels and therefore the mandrels should be made with hardened surfaces or encased in hardened steel. As the mandrel carrying the tube which has been cut leaves the cutters 128, its corresponding radial passage 48 will pass over vacuum chamber 44 causing air to be sucked out of the cylinder so that the mandrel will be withdrawn, permitting the cut sections of tube to drop to the floor or into any convenient receptacle provided for them. In describing the operation there has simply been described the operation of one mandrel, but it is to be understood that the others are following in succession so that the tubes will be picked up continuously, cut, and the cut sections delivered.

It is to be understood that the mechanism described is intended only as an illustrative example of one form of machine embodying my invention and that the same may be modified in many particulars without departing from the spirit of my invention.

What I claim is:

1. In a device for the purpose described, the combination of a rotor, a supporting means on such rotor to receive a hollow tube, a mandrel, means for driving the mandrel forward through a tube carried on the said supporting means while the rotor is in motion, cutting means positioned to contact with a tube into which a mandrel has been driven, and means for rotating the mandrel in the rotor while the tube around it is in contact with such cutting means.

2. A structure as specified in claim 1, which further includes means for withdrawing the mandrel from the cut tube.

3. A structure as specified in claim 1 which includes a plurality of sets of tube supports and a separately movable mandrel for each set.

4. A structure as specified in claim 1 in which the means for driving the mandrel forward includes a cylinder in which the mandrel moves and means for supplying air under pressure to such cylinder.

5. A structure as specified in claim 1, in which the means for driving the mandrel forward includes a cylinder in which the mandrel moves, and means for supplying air under pressure to such cylinder, and which further includes means whereby air may be exhausted from such cylinder to withdraw the mandrel.

6. A structure as specified in claim 1 which includes a plurality of sets of tube supports, a separately movable mandrel for each set and in which the means for driving the mandrels forward separately includes a cylinder for each mandrel, and means for supplying air under pressure successively to such cylinders while the rotor is in operation, and which further includes means whereby air may be exhausted from behind the mandrels in the cylinders to retract the same, and means whereby when a mandrel is being driven forward air may be withdrawn from its cylinder in advance of the mandrel, and whereby when the mandrel is being withdrawn air under pressure may be forced into the cylinder in front of the mandrel to assist in causing the mandrel to move backward.

7. A structure as specified in claim 1, in which the cutting means include a fixed knife and which further includes means to cause the mandrel to rotate in the rotor at a peripheral speed approximately equal to the speed at which the mandrel is caused to move past a given point on the knife.

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