Nov. 26, 1963 K. ROCHLA 3,112,085

MACHINE FOR WINDING CONTINUOUS SHEET MATERIAL

Filed Feb. 15, 1961 7 Sheets-Sheet 1

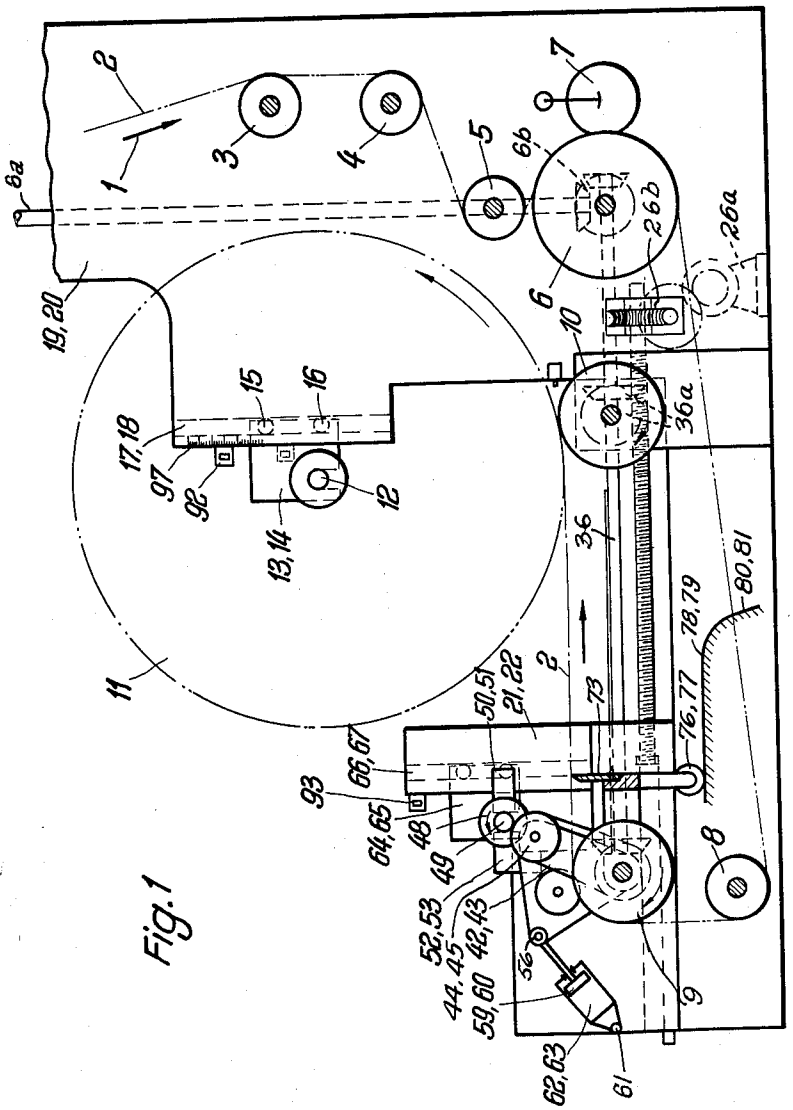


Fig. 1

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MACHINE FOR WINDING CONTINUOUS SHEET MATERIAL

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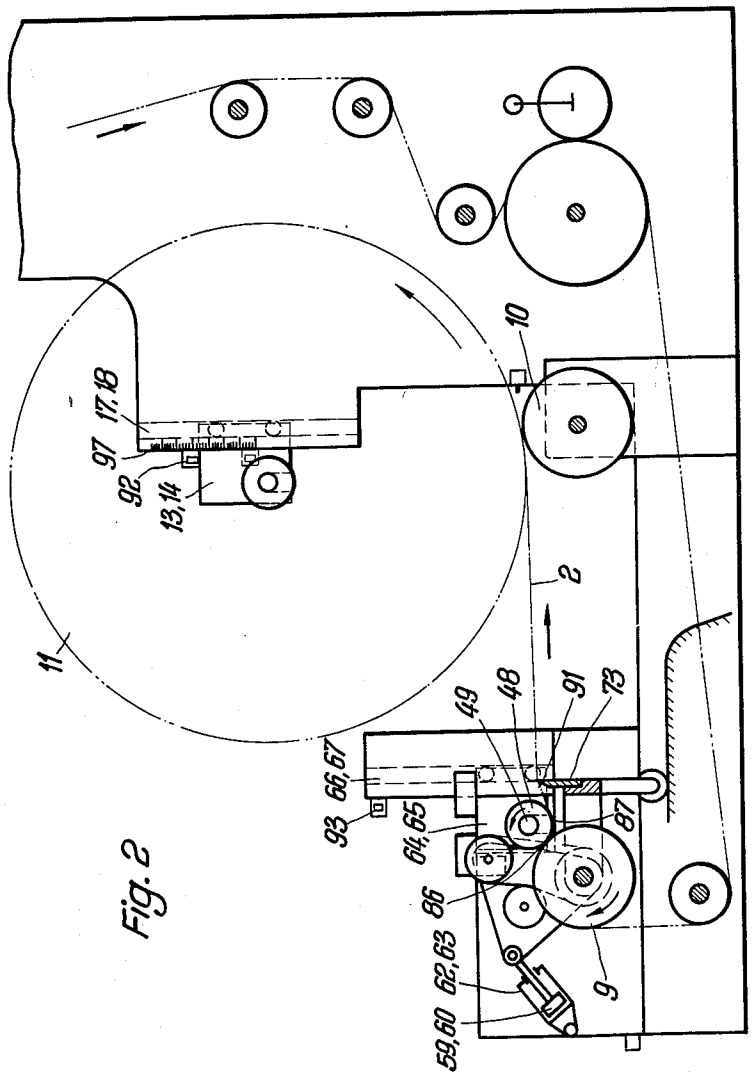


Fig. 2

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MACHINE FOR WINDING CONTINUOUS SHEET MATERIAL

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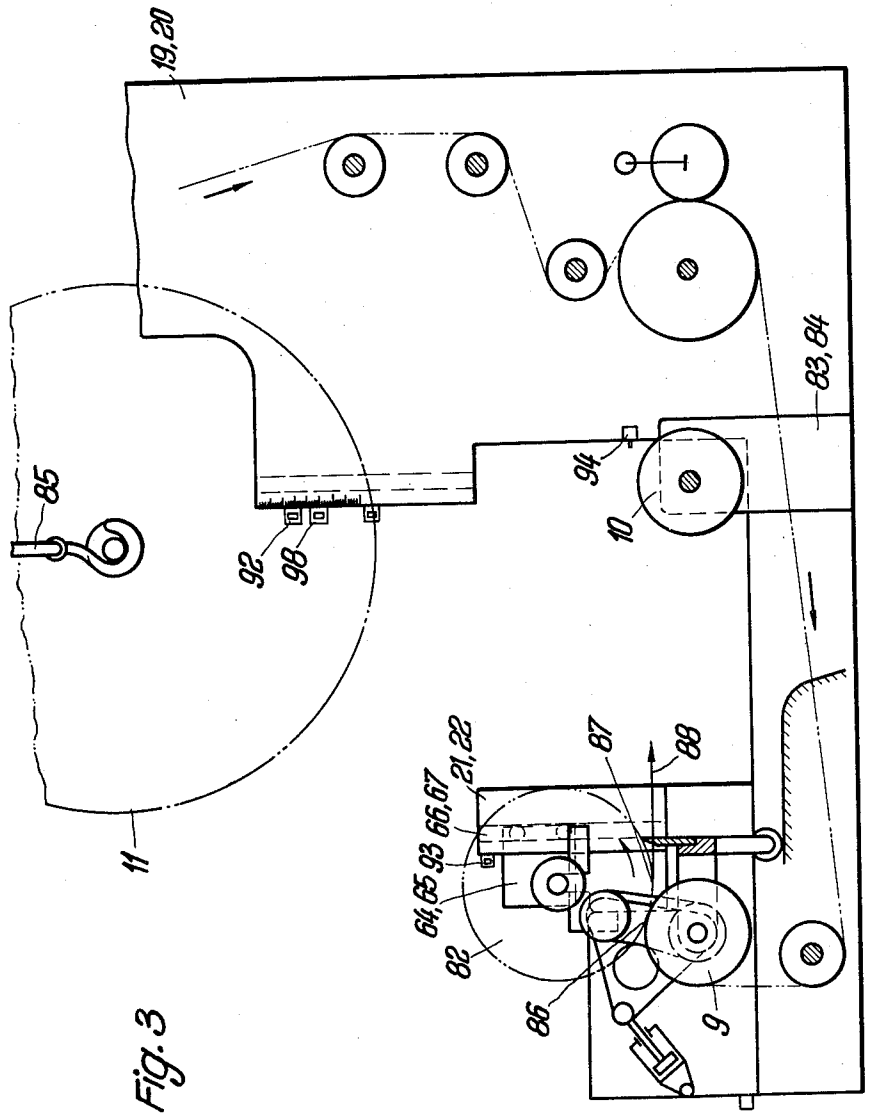


Fig. 3

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Fig. 4

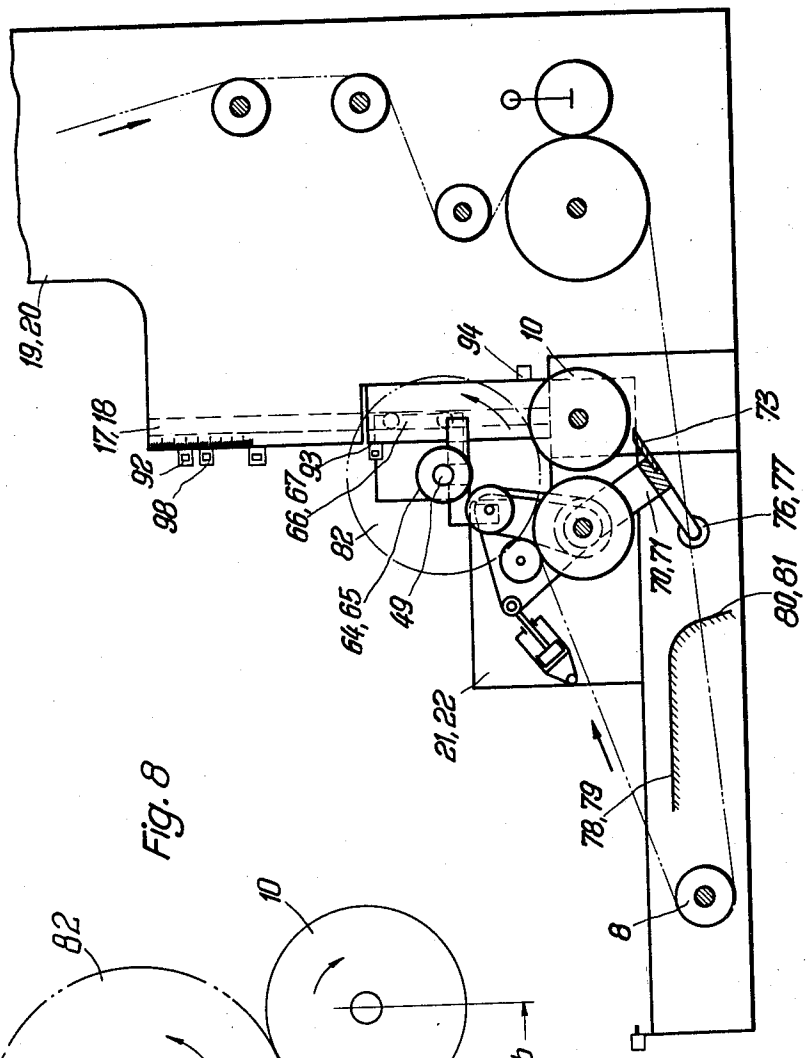
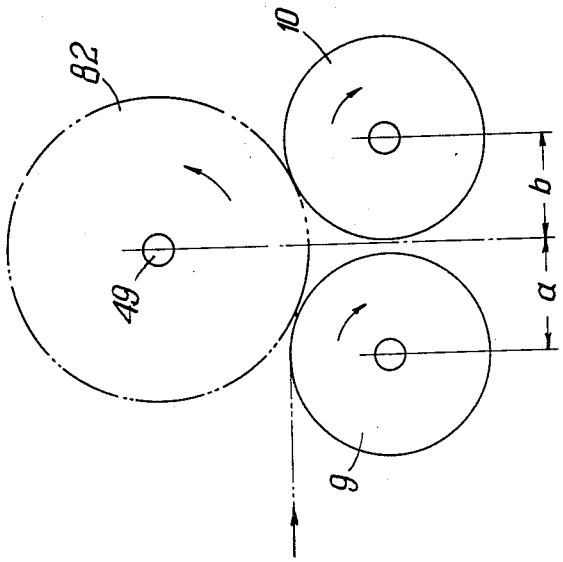


Fig. 8



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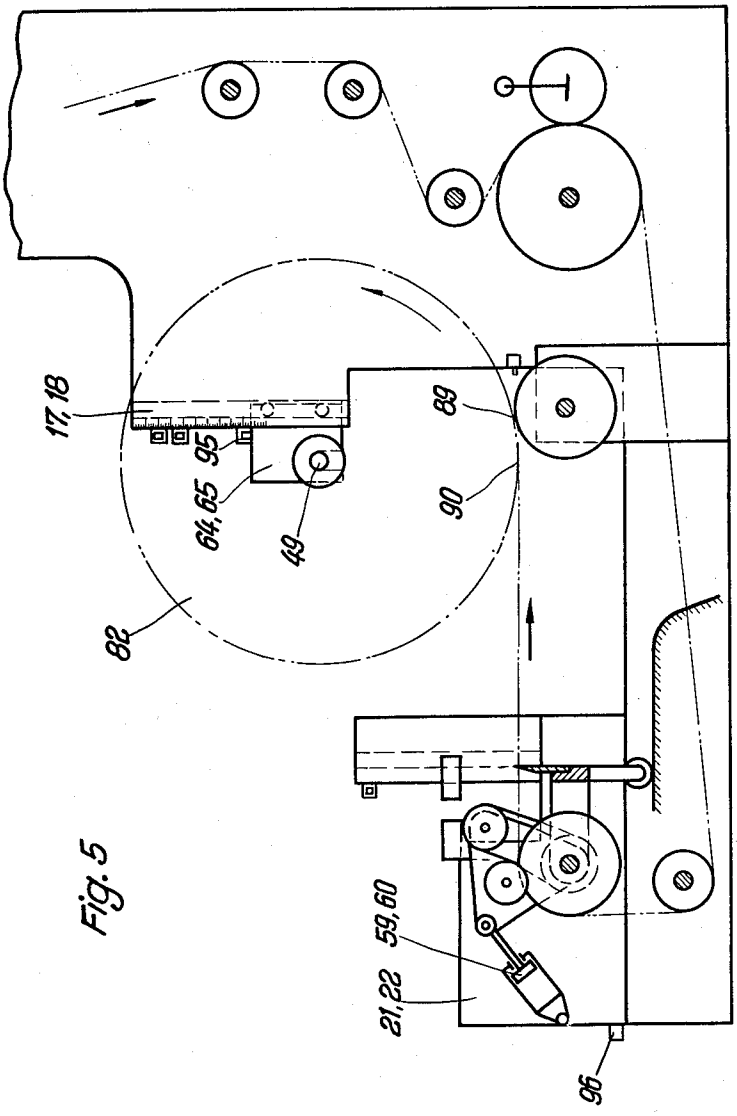


Fig. 5

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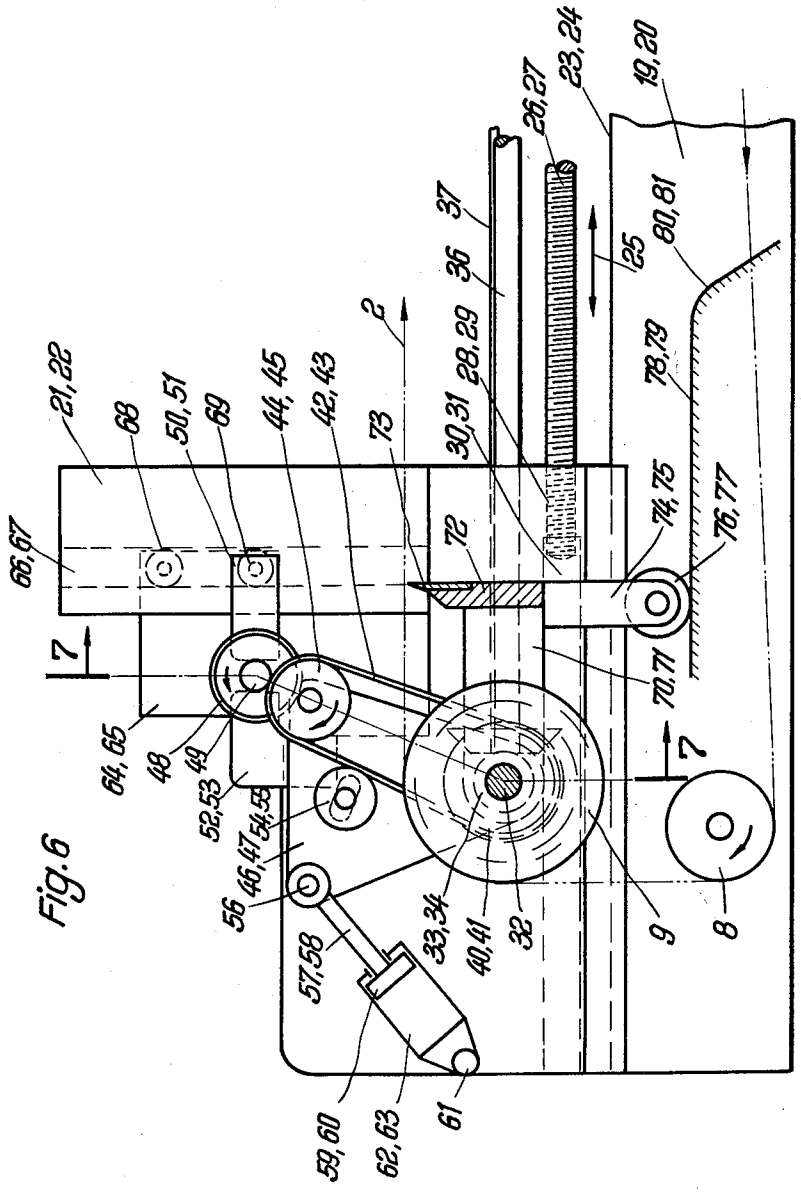


Fig. 6

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MACHINE FOR WINDING CONTINUOUS SHEET MATERIAL

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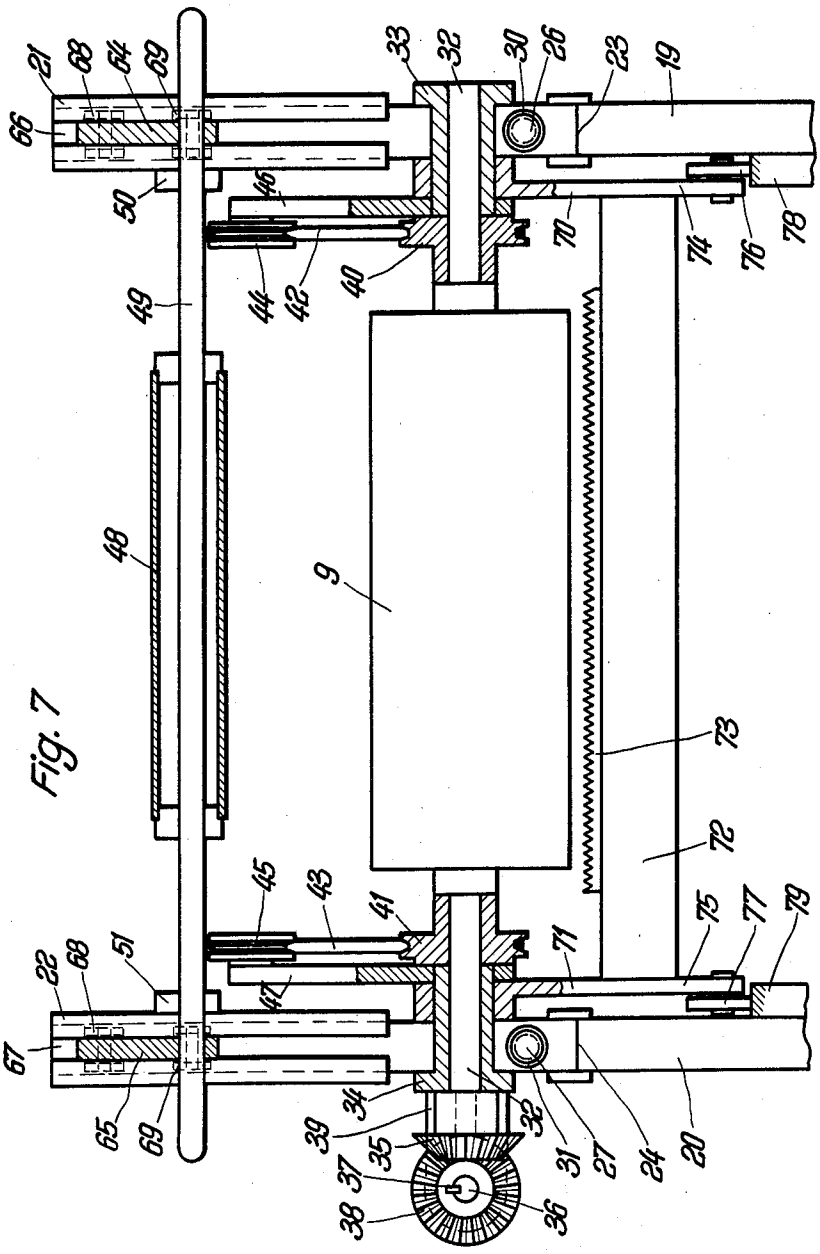


Fig. 7

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United States Patent Office 3,112,085 Patented Nov. 26, 1963

3,112,085

MACHINE FOR WINDING CONTINUOUS SHEET MATERIAL

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Claims priority, application Germany Feb. 18, 1960
6 Claims. (Cl. 242—56)

This invention relates to a machine for winding into rolls continuous sheet material, such as paper or the like, leaving a processing machine, particularly a printing machine.

For winding a continuous sheet material such as paper as it emerges from a processing machine, such as a printing machine, it was hitherto necessary to stop the machine to remove the completed roll and to substitute therefore a fresh core or shell for winding the next roll. These stoppages cause loss of valuable production time and at the same time involve considerable waste of material whilst the processing machine is started again.

The object of my invention is to avoid the said and other disadvantages of machines of the said type and particularly to provide a machine permitting the substitution of a fresh core or shell for a completed full sheet roll without interrupting the operation of the processing machine.

The machine according to my invention comprises a first or auxiliary supporting and propelling drum for initiating the formation of a sheet roll on a fresh core or shell and a second or principal supporting and propelling drum for completing the started sheet roll, the axes of the drums being parallel; the second drum rests in stationary bearings while the first drum is displaceable in preferably horizontal direction perpendicular to its axis towards the second drum to transfer the initiated roll to said second drum for completion to the desired size whilst the first drum is returned to its starting position to initiate a repeated winding operation on a fresh core or shell.

The machine, according to the present invention, comprises a first or auxiliary supporting and propelling drum for initiating the formation of a roll on a fresh core or shell, said first drum being displaceable in preferably horizontal direction perpendicular to its axis, towards a second or principal and propelling drum resting in stationary bearings to which second drum, the roll having built up to a predetermined size on said first drum is transferred whereupon said second drum drives the transferred unfurnished roll by peripheral contact until it has reached its full size, whilst the first drum returns to its starting position in readiness to initiate a fresh winding operation.

Other features will be explained as the following detailed description proceeds, in which reference will be made to the accompanying drawings which illustrate an embodiment of my new apparatus. In the drawings

FIGS. 1 to 5 are schematic side elevations of an embodiment of the new machine and illustrate five succeeding operational phases, the side of the frame facing the viewer being omitted.

FIG. 6 is a side elevation on a larger scale of that part of the machine containing the displaceable first or auxiliary supporting and propelling drum, the side of the frame facing the viewer likewise being omitted;

FIG. 7 is a section taken on the line 7—7 in FIG. 6, the cutter blade being shown in lowered position, and

FIG. 8 is a schematic side view of the supporting and propelling drums during the transfer of the roll from the first drum to the other.

The continuous sheet material 2 such as paper, emerging from the processing, say a printing, machine travels in the direction of arrow 1 (FIG. 1), for instance, over

guide rollers 3, 4, 5 to feed rollers 6 and 7, roller 6 being directly driven by the processing machine by shaft 6a and bevel gear 6b. The peripheral speed of roller 6 is preferably arranged to be adjustable to maintain the tension of the continuous sheet travelling through the machine independently of the winding process. Such adjustment may be in known manner by independent tension feeler meas operating through suitable amplifiers.

From feed roller 6, which has a relatively large diameter for feeding the sheet without slippage despite the pull of the winding means, the sheet next travels over a deflecting roller 8 and then to a first or auxiliary supporting propelling drum 9. The sheet is then taken to a second supporting and propelling drum 10 which applies it to the roll 11 of sheet material being wound around the winding core or shell 12 held in bearing blocks 13 and 14. Rollers 15 and 16 on each side of these blocks ride in vertical guideways 17 and 18 provided in the two stationary side frames 19 and 20 of the machine. As the roll 11 builds up in size, the two bearing blocks 13 and 14 ascend the guideways in a manner that is well understood.

FIGS. 6 and 7 show in enlarged scale that part of the apparatus which contains the said first supporting and propelling drum 9. This drum 9 is mounted between pedestals 21 and 22 which are slidably movable transversely to the axis of drum 9 by lead screws 26, 27 along guideways 23 and 24 in the side frames 19 and 20. The lead screws are rotatably mounted in the frames 19 and 20 as shown in FIG. 1 and are concurrently driven by motor 26a over worm gear 26b. They are female threads 28 and 29 cut into bores 30, 31, respectively, in each of the movable pedestals 21 and 22 so that the same may be slidably displaced in guideways 23, 24 by rotation of the lead screws which are secured against axial displacement.

The ends of the shaft 32 carrying the drum 9 rest rotatably in flanged bearings 33 and 34 mounted in the two pedestals 21 and 22. One end of shaft 32 projects from one of the flanged bearings 34 and carries a driving bevel gear 35. For imparting rotation to the bevel gear 35 a longitudinal shaft 36 with an axial key 37 extends from the processing machine and slidably carries a bevel gear 38 which is rotatably held by a bracket 39 affixed to pedestal 22 to remain in mesh with bevel gear 35. Key 37 and a cooperating slot in bevel gear 38 ensure that the rotation of shaft 36 will be transmitted to supporting roller 9 irrespectively of the position of the two pedestals 21 and 22.

On each side of the drum 9 its shaft 32 carries a keyed on V-belt pulley 40 and 41. V-belts 42 and 43 embrace said pulleys 40 and 41 and also V-belt pulleys 44 and 45 rotatably mounted on a triangular lever 46 and 47 or a similar working member pivoted on the flanged bearings 33 and 34. The groove in the V-belt pulleys 44, 45 is somewhat shallower than the V-section of the belts so that the latter project beyond the circumference of pulleys 44 and 45. The winding shaft 49 supporting the freshly inserted winding core or shell 48 bears on the projecting outer faces of the V-belts 42 and 43 as they revolve together with drum 9. The winding shaft 49 which is thus driven by the V-belts is held between cheeks or other positioning members 50, 51 and 52, 53. Each of the levers 46 and 47 is also each provided with a rotatable and adjustable tensioning roller 54 and 55 for tightening the V-belts 42 and 43 and is articulatedly connected for instance at a point 56 (FIG. 6) with a piston rod 57 and 58 attached to pistons 59 and 60 which are each slidably reciprocatable for instance by compressed air between two end positions in a cylinder 62 and 63 pivotably mounted for instance at point 61 on each of the two pedestals 21 and 22. In FIGS. 1, 5 and 6, the pistons are shown in one end position, and in FIGS. 2, 3 and 4 in the

other end position. In this latter position they retract the levers 46, 47 and the pulleys 44 and 45 move away from underneath the winding shaft 49 permitting the same to drop (FIG. 2). However, the winding shaft 49 is held in bearing blocks 64 and 65 which have been previously placed into position and which guided by rollers 68 and 69 now likewise slide downwardly in guideways 66 and 67 arranged in a manner identical with that provided for the two bearing blocks 13 and 14.

Likewise pivotably mounted on the flanged bearings 33 and 34 are levers 70 and 71 which carry a cross beam 72. Secured to this cross beam 72 is a serrated knife 73 which at the beginning of the winding process projects into close proximity of the sheet of paper 2 or the like from underneath thereof. Each lever 70 and 71 is extended to form an arm 74 and 75 for a rotatably mounted roller 76 and 77. These rollers 76 and 77 are each adapted to travel on a guideway 78 and 79 secured to the inside of the machine frames 19 and 20 and having a cammed portion 80 and 81 which descends in the direction towards the second or principal drum 10.

During the working phase illustrated in FIG. 1 the members of the apparatus associated with the first drum 9 will be in the positions above described and illustrated in FIG. 6; in this phase a winding shaft 49 with a fresh winding core 48 has been placed between the positioning members 50 to 53 and will rest on the travelling V-belts 43 and 42; the shaft 49 is then weighted by the superimposed bearing blocks 64 and 65 which connect the shaft and the core 48 with the guideways 66 and 67 in the two movable pedestals 21 and 22. The serrated blade 73 is located immediately below the sheet 2 as it travels from the first drum 9 to the second drum 10 from where it winds to form the sheet 11.

As soon as roll 11 has built up to the desired size illustrated in FIG. 2, a compressed air valve, not specially shown, is operated either by hand or by a limit switch 92 activated by the ascending bearing blocks 13, 14 when the same reach a level corresponding with the desired radius of the roll. Said valve causes the pistons 59, 60 to move into their lower end positions in cylinders 62 and 63, as shown in FIG. 2. The winding shaft 49 which until then has been maintained in rotation by contact with the V-belts travelling on pulleys 44, 45 thereby free from support and said shaft, together with the bearing blocks 64 and 65 which slide down in guideways 66 and 67, will drop onto the drum 9 at the same time deflecting the travelling sheet 2 over the edge of the serrated knife 73 to be cut thereby. The revolving winding core 48 which has previously been coated with an adhesive picks up the cut end 91 of sheet 2 on the left side of the knife 73 and winds it around itself, thus starting to form a fresh roll 82 under the action of drum 9.

Whilst the fresh roll (82) begins to grow in size (FIG. 3) and the bearing blocks 64 and 65 begin to rise in their guideways 66 and 67, the available time can be utilised to hoist the completed roll 11 off its supporting drum 10 and to remove it from the machine. The drum 10 which is mounted between fixed bearings 83 and 84 (FIG. 3) secured to the inside of the two machine frames 19 and 20, is likewise driven by the longitudinal shaft 36 (FIGS. 1, 6 and 7) from the machine, by means of a pair of beveled gears 36*a*. One of the two beveled gears is coupled with its shaft by a preferably electromagnetically operable clutch to disconnect the drive when the roll 11 has reached the desired diameter; said clutch is operated by the above described limit switch 92 which also controls the compressed air valve for the actuation of the two pistons 62 and 63. The supporting drum 10 as well as the completed roll 11 of sheet material therefore cease to rotate. When the bearing blocks 13 and 14 (FIG. 2) have been removed by lifting them out of their respective guideways 17 and 18 the completed roll 11 can be lifted out of the machine, for instance by hoisting gear 85 as illustrated in FIG. 3.

Before the fresh roll 82 of sheet material has reached a size which would lift the bearing blocks 64 and 65 completely out of the upper ends of guideways 66 and 67, the two pedestals 21 and 22, together with the revolving drum 9 and the revolving roll 82 of sheet material are moved into the position shown in FIG. 4 by rotation of the two lead screws 26 and 27 (FIGS. 6 and 7). The motor 26*a* for driving the lead screws 26 and 27 (FIGS. 6 and 7) may be started by hand, but preferably this may again be done by means of a limit switch 93 actuated by one of the two bearing blocks 64 and 65 when they have risen to a given level in their respective guideways 66 and 67. A second limit switch 94 actuated by the pedestals 21 and 22 when they have reached the position shown in FIG. 4 stops the further rotation of the two lead screws 26 and 27. During the displacement of the pedestals 21 and 22 the two rollers 76 and 77 ride down the descending cammed portion 80 and 81 of guideways 78 and 79 and thus permit the levers 70 and 71 to lower the serrated knife 73 below the level of the drum 10 (FIG. 4), said lowering motion being assisted, as a precautionary measure, by a spring not specially shown in the drawings. When the pedestals 21 and 22 are restored to their starting positions the knife 73 is conversely automatically raised into operative position (FIG. 5).

In the end position of the two pedestals 21, 22 after having moved towards the drum 10, as shown in FIG. 4, said position being preferably determined by a stop, the guideways 66 and 67 in the pedestals 21 and 22 are in accurate vertical alignment with the corresponding guideways 17 and 18 in the side frames 19 and 20 of the machine. In the course of their further ascent, due to the continuing build up of the roll 82, the bearing blocks 64 and 65 will therefore slide out of the guideways 66 and 67 and enter the guideways 17 and 18, the guide rollers 68, 69 compensating for minor misalignment and assuring a smooth transition between the two sets of guideways. When the pedestals 21 and 22 reach the end position shown in FIG. 4 they will have carried the sheet roll 82 into contact with the drum 10 and off drum 9, as schematically illustrated in FIG. 8. This is due to the fact that the horizontal distance *a* of the centre line of drum 9 from the centre line of the winding core shaft 49 exceeds the corresponding distance *b* of the centre line of drum 10 from the centre line of the winding core shaft. These distances *a* and *b* are established by design. As the pedestals 21 and 22 approach drum 10 the sheet roll 82 is pushed slightly up the periphery of drum 10 and this causes said sheet roll 82 to be lifted just clear of drum 9. This action ensures that, apart from the brief instant of transfer from one drum to the other, the roll 82 will be driven by only one of said drums, thus warranting a permanently uniform tightness of the formed roll.

When the bearing blocks 64 and 65 have ascended into the positions illustratively shown in FIG. 5, that is to say when they have completely entered the two guideways 17 and 18, the lead screws 26 and 27 (FIGS. 6 and 7) are again actuated to restore the pedestals 21 and 22 to their starting positions. The action of the lead screws may be started either by hand or by a further limit switch 95 stimulated by the bearing blocks 64 and 65 when they reach the said position. After having been restored to their initial positions, as illustrated in FIG. 5, which may likewise be determined by a fixed stop, the two pedestals 21 and 22 actuate yet another limit switch 96 for stopping the lead screws 26 and 27. Conveniently the transmission for operating the lead screws 26 and 27 may contain a slip clutch which is adjusted to slip until the drive has run out after the pedestals have been intercepted. Upon reaching the said end position shown in FIG. 5 a second

contact in the said limit switch 96 reverses the previously mentioned air pressure valve, permitting compressed air to push the two pistons 59 and 60 back into the positions shown in FIGS. 1 and 5. The described cycle of operations can then be repeated.

For adjusting the hardness of the wound roll the common drive means of the drums 9 and 10 contain an adjustable friction clutch not specially shown, and the speed of rotation applied to the friction clutch is so adjusted that when the friction clutch is in non-slip engagement the peripheral speed imparted to the drums will sufficiently exceed that of feed roller 6 (FIG. 1). The greater peripheral speed of the drums maintains the travelling sheet under a corresponding amount of tension between rollers 6, 8, 9 and 10, and hence causes a tight roll to be formed. By relaxing the friction clutch the overrunning speed of the drums can be adjusted to the dimensions of the travelling sheet and to the nature of the material to produce a roll which is as tightly wound as may be desired.

The friction clutch could, of course, be replaced by an infinitely variable gearing.

If, as previously stated, feed roller 6 is driven at an adjustable peripheral speed to maintain constant tension of the travelling sheet in the processing machine, then the speed of rotation of the drums including that of the preceding friction clutch or variable gearing is derived from the adjustable speed of the feed roller 6, so that any change in the peripheral speed of the feed roller will be reflected in a corresponding change in the speed of the drums, in such manner that the adjusted speed differential between the drums and the feed roller and hence the winding tension will be maintained if the peripheral speed of the feed roller 6 changes.

The linear speed of the V-belts 42 and 43 (FIGS. 6 and 7) for accelerating the fresh winding core shaft is determined by the selection of the size of the driving V-belt pulley 40 and 41 and ararnged to impart to the winding core 48 a peripheral speed slightly in excess of the speed of travel of the continuous sheet, thus ensuring that upon making contact with the sheet the peripheral speed of the core will not be less than the linear speed of the sheet.

The lead screws 26 and 27 (FIGS. 6 and 7) are driven sufficiently slowly to displace the pedestals 21 and 22 towards supporting drum 10 and back again in such a way that the resultant slight change in the length of the sheet between deflecting roller 8 (FIGS. 1 and 4) and the point where the sheet passes over to the formed roll has no significant effect on its tightness.

In automatic operation, that is to say when the several operations are controlled by the afore-mentioned limit switches 92 to 96, facilities for the precise adjustment of the size of the roll at which these operations take place, are desirable. To this end limit switch 92 which controls the air valve for the initiation of the cutting operation is arranged to be adjustable on guideways 17 and 18 by reference to a special scale 97 calibrated in terms of roll diameters.

The diameter of the drums 9 and 10 should be as large as possible to provide maximum contact area with the forming roll of sheet material.

When winding continuous sheets of synthetic thermoplastic materials, the serrated knife may be replaced by an electrically heated rod or suspended wire, the heating current being switched on by a limit switch 98 (FIG. 3) actuated by the bearing blocks 13 and 14 shortly before the limit switch 92 which initiates the actual severing action is actuated. The heating current may preferably be switched off by time delay relay means.

If a heated rod or wire is thus used, a modified form of construction employs the above described limit switch 92 for switching on the heating current and at the same time for energizing two time delay relays of which one operates at the end of the necessary heating-up time to actuate the air valve for the withdrawal of the V-belts 42, 43 from their supporting position relative to the winding shaft 49, whereas the other relay later switches off the heating current when the cutting operation has been performed. This arrangement saves the second limit switch 98 otherwise located closely below limit switch 92.

The earlier statement that the friction clutch may be replaced by an infinitely variable gearing in the transmission for driving the drums requires some qualification. A friction clutch will transmit a constant torque independently of the driving speed, whereas an infinitely variable gearing will generate a constant speed irrespectively of the torque which is transmitted. Since the winding process primarily calls for the maintenance of constant tension it is in fact desirable that the torque should be constant. A friction clutch is therefore more suitable for the purpose in view than an infinitely variable gearing, because a friction clutch automatically adapts itself to fluctuations in the tension of the incoming sheet by varying the winding speed. This advantage of a friction clutch is of special significance when the two pedestals 21 and 22 are advanced, because the resultant change in tension is then compensated by an increase or decrease in the winding speed due to the action of the friction clutch in maintaining a constant torque.

While specific embodiments of my invention have been shown and described in detail to illustrate the application of the principles of my invention, it will be well understood that the same may be otherwise embodied without departing from such principles and without avoiding the scope of my appended claims.

What I claim as my invention is:

1. A machine for winding sheet material emerging from a processing machine into rolls,

(*a*) a machine frame;

(*b*) at least a first and a second winding shaft, each adapted to receive sheet material to be wound thereupon into a roll;

(*c*) first and second bearing means each rotatably and exchangeably supporting one of said shafts;

(*d*) a first drum adapted to support and to propel a roll initially forming on a first winding shaft;

(*e*) a second drum rotatably mounted in said frame in parallelism to said first drum and adapted to support and to propel to completion a roll precedingly initiated on a second winding shaft;

(*f*) driving means concurrently rotating the said two drums in the same direction with equal peripheral speed;

(*g*) a support rotatably holding the first drum in sheet feeding relation to the second drum, said support reciprocably resting on said frame to displace said first drum horizontally from a starting spaced position to a neighboring transfer position relative to the second drum;

(*h*) actuating means to effect said reciprocable movement of said support;

(*i*) first guide means in said support for said first bearing means extending in substantially vertical direction and permitting said first bearing means with a first winding shaft to slide from an upper suspended idling position into a lower position to bring said shaft in rolling contact with sheet material passing the first drum and thus to initiate the formation of a roll thereupon;

(*j*) controlled retaining means to hold said first shaft in said upper idling position while the second drum propels to completion a roll on a second winding shaft and to release said first shaft into said lower position after completion of the roll on said second shaft;

(*k*) second guide means in the machine frame for said second bearing means extending in substantially vertical direction above the second drum to permit a

second winding shaft to slide upwardly while a roll forms thereupon;

(*l*) the first guiding means located to move below the second guiding means into registering position when the first drum with a roll initiated on the first winding shaft is in said transfer position thereby permitting the first bearing means, after the second bearing means with winding shaft and a completed roll have been removed from the machine frame, to enter said second guiding means and to hold the roll initiated on the first winding shaft in rolling contact with the second drum until such roll is completed; and

(*m*) cutting means arranged between said two drums and adapted to transversely cut the sheet material traveling from the first to the second drum when the released first winding shaft comes into rolling contact with sheet material passing said first drum thereby initiating the formation of a roll upon said shaft while the second winding shaft with a completed roll is being removed from the machine frame.

2. A machine according to claim 1 wherein the said retaining means comprise a retractably mounted and rotatably driven roller supporting and rotating said first winding shaft in its upper idling position and means to retract and release said roller from said winding shaft when the roll propelled by the second drum is completed.

3. A machine according to claim 1 wherein the said retaining means comprise a lever pivotably mounted about the axis of the first drum; a driving belt pulley rotatably connected with the first drum; a driven belt pulley mounted near the outer end of said lever; a belt operatively connecting said pulleys; said belt while passing

over the driven pulley supporting and rotating said first winding shaft in its upper idling position; and means to retract said lever and thus to release said first winding shaft to descend into rolling contact with the first drum.

4. A machine according to claim 3 wherein the belt is a V-belt and at least the driven pulley is provided with a groove for the belt leaving its outer surface projecting from said groove.

5. A machine according to claim 1 comprising lever means pivotably mounted on the shaft of the first drum and supporting said cutting means, a roller on the free end of said lever means and a stationary cam means retaining the cutting means in operative position when the support is in its starting position, the roller dropping off of the cam means whereby the cutting means moves away from the traveling sheet material after the performed cutting operation.

6. A machine according to claim 1 wherein in the transfer position of the first drum the horizontal distance between the rotational axis of the first drum from the vertical plane passing through the rotational axis of the second winding shaft or shell is greater than the distance of the rotational axis of the second drum from said plane.

References Cited in the file of this patent

UNITED STATES PATENTS

542,034	Simpson	July 2, 1895
1,122,834	Wood	Dec. 29, 1914
1,844,081	Valentine et al.	Feb. 9, 1932
2,030,684	Coleman	Feb. 11, 1936
2,676,764	Aulen	Apr. 27, 1954