United States Patent [19]

Walkington

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[54] **APPARATUS FOR FORMING AND HANDLING REELS OF PAPER OR LIKE MATERIAL**

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[52] **U.S. Cl.** **242/65**

[51] **Int. Cl.²** **B65H 17/08**

[58] **Field of Search** ..... 242/56 R, 65, 66, 68.4

[56] **References Cited**

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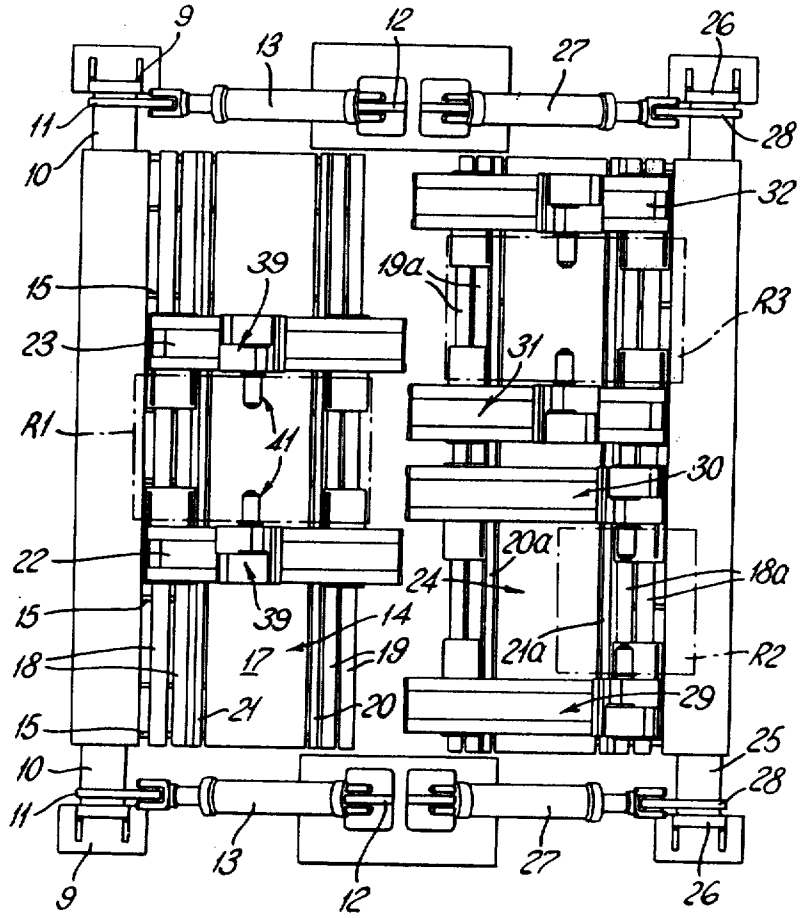
Attorney, Agent, or Firm—John C. Smith, Jr.

[57] **ABSTRACT**

Apparatus in which reels of paper are formed on a hollow core supported at its ends by freely rotatable chucks, the core being rotated by contact with a driven winding roller. Nip pressure between the reel being wound and the winding roller is maintained by air pressure acting through pneumatic cylinders and linkages, connecting the piston rod of each cylinder to one of the chucks. The chucks are movable along horizontal rails fixed to separate support means slidably mounted on a frame which is pivotally connected to a fixed part of the apparatus. When a reel is completed it is moved away from the winding roller to a rest position, and is then lowered to the ground by swinging the frame and thus the support means, about its pivot.

To ensure substantially constant nip pressure across the whole width of the reel a bracket is slidably mounted on the frame between a pair of support means, the bracket pivotally supporting a pair of arms which carry two rollers which are moved into engagement with the reel by pneumatic means, and moved away from the reel when the latter is of such a diameter that it is stiff enough to prevent bowing.

14 Claims, 7 Drawing Figures



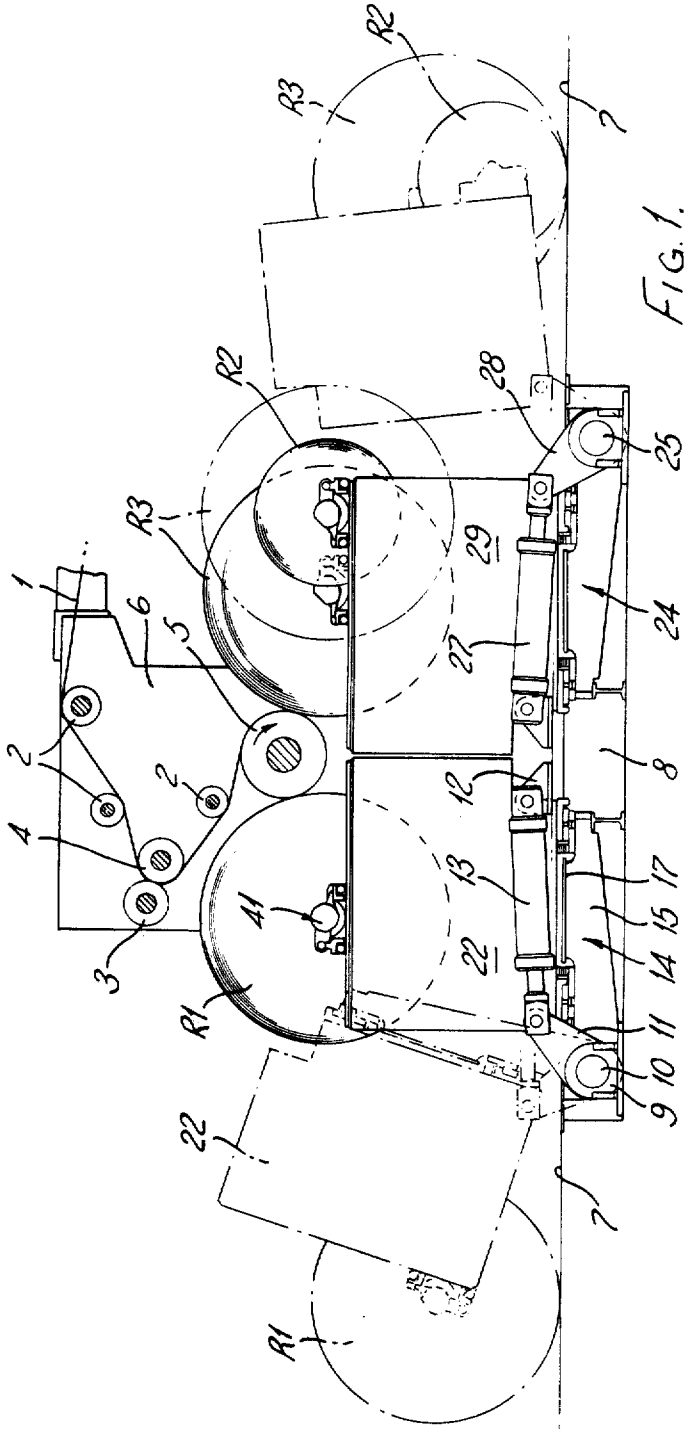

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FIG. 1.

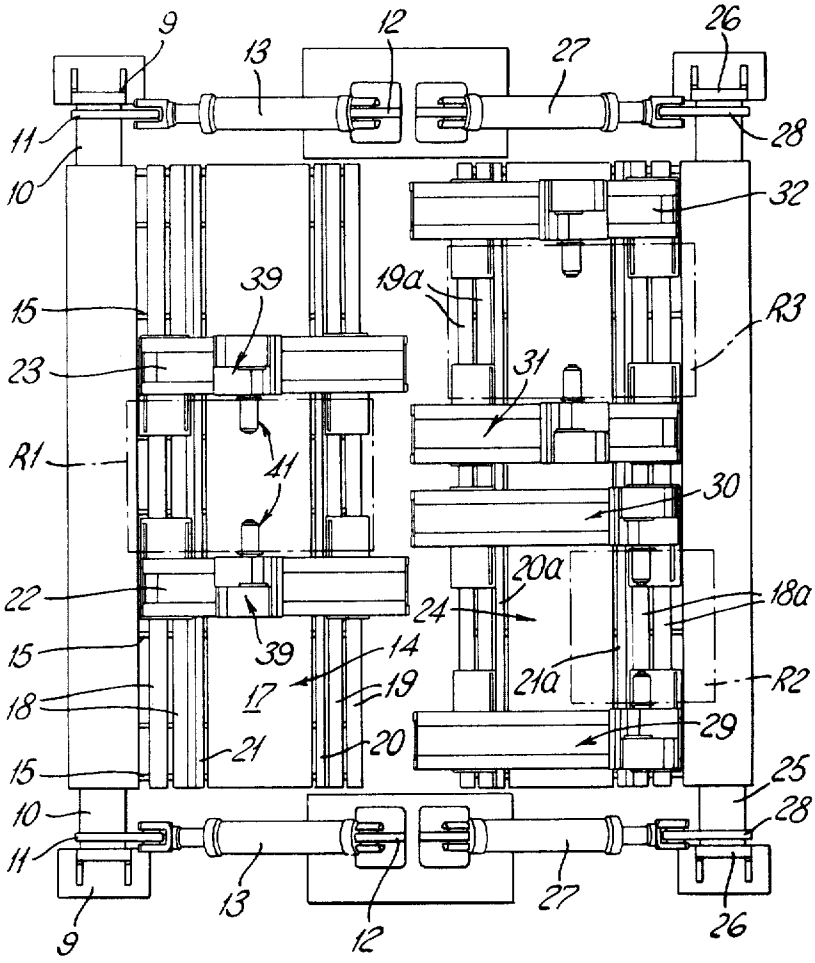
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FIG. 2.

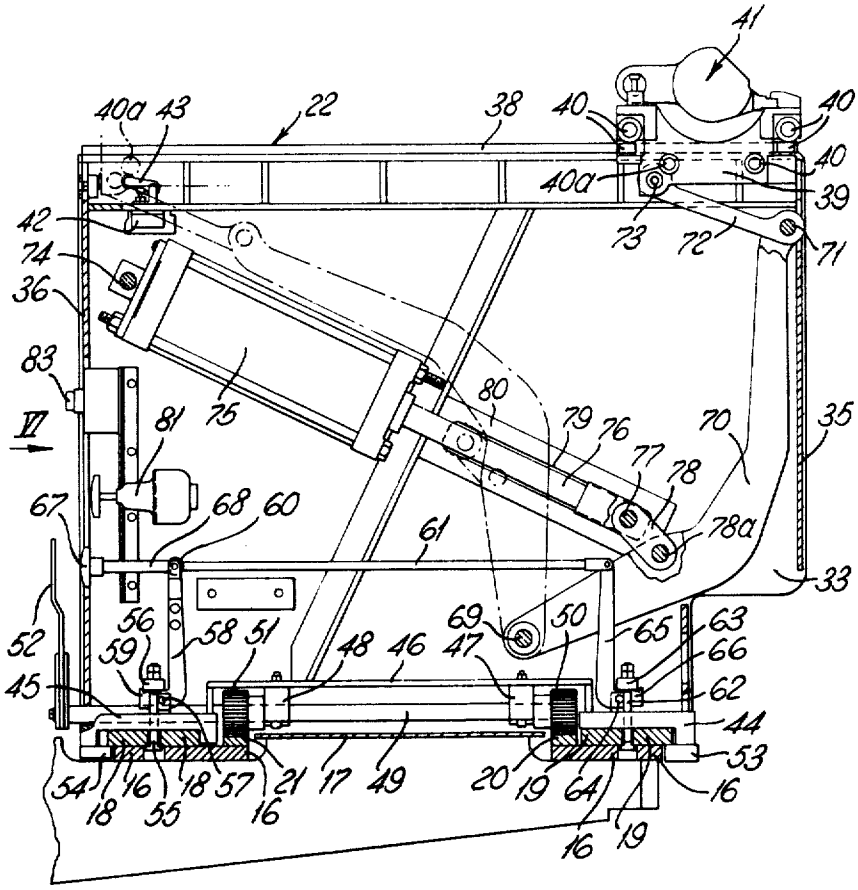
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Fig.3.

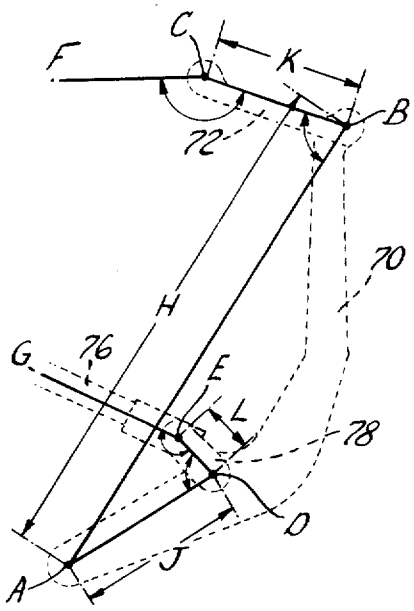

FIG. 4.

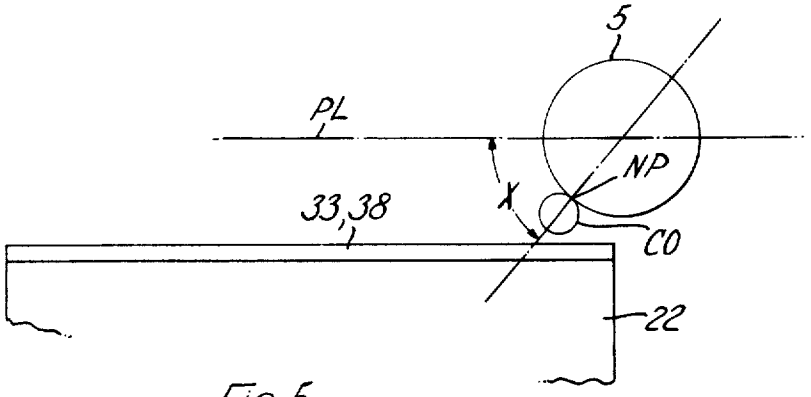

FIG. 5.

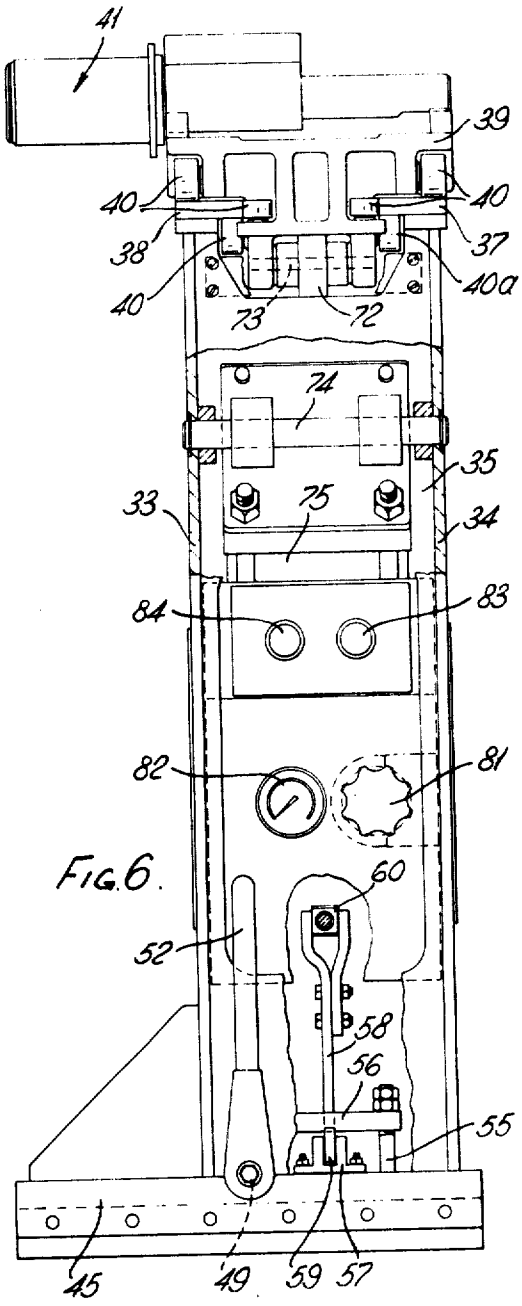
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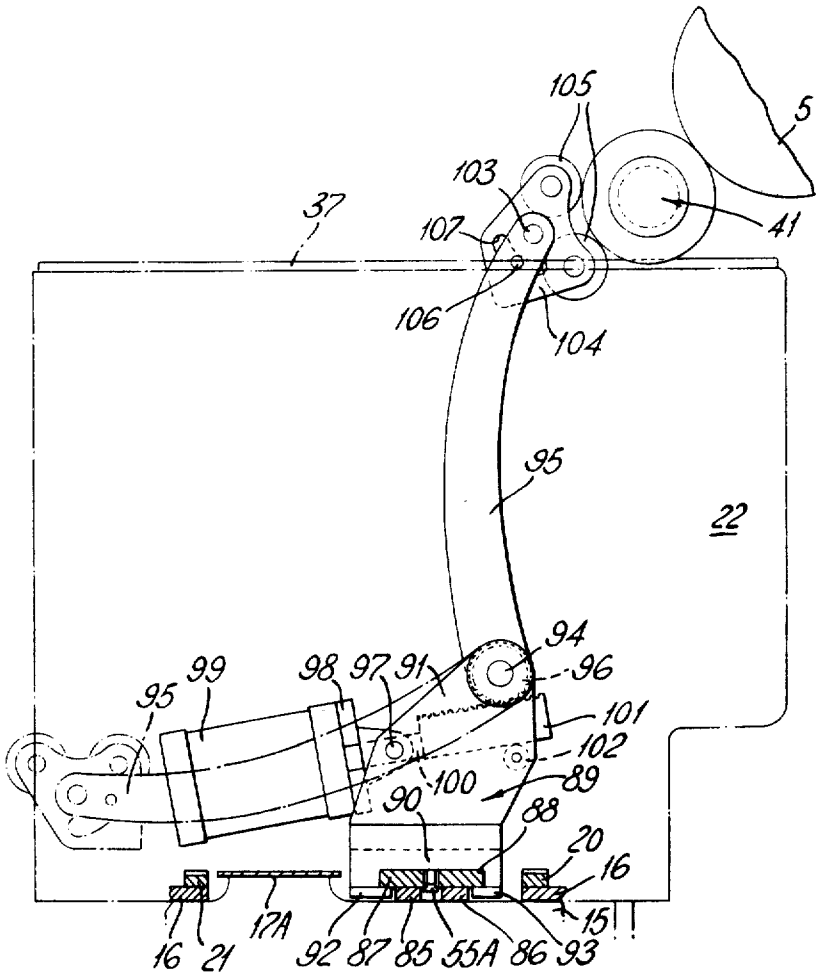
FIG. 6.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17A
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FIG. 7.

APPARATUS FOR FORMING AND HANDLING REELS OF PAPER OR LIKE MATERIAL

This invention concerns improvements in or relating to apparatus for forming and handling reels of paper or like material.

For convenience in the following description reference will only be made to apparatus embodying the invention when used in conjunction with a paper winder/ slitter, but it should be understood that the invention may equally be applied to the forming and handling of reels of paper delivered by other types of machines or reels of other materials.

Paper winders and slitters are conventionally arranged with the axes of their supply and take-up reels horizontal and the reel being formed is some distance above the floor on which the machine stands. When a completed reel is to be unloaded from the machine it is usual to provide some convenient form of mobile crane for lifting the reel away from the machine and lowering it onto the floor or onto a truck. Alternatively a lowering or tilting table is often provided, adjacent to but separate from the machine, and onto which the reel is transferred for lowering onto the floor or truck.

According to the present invention there is provided apparatus for handling reels of paper or like material comprising a pair of rotatable chuck means adapted to be inserted into opposite ends of a hollow core on which a reel is to be formed, a carrier for each of said chuck means, support means for each of said carriers, said support means being movably connected to a platform and each having a surface along which one of said carriers is arranged to be moved, a fixed mounting to which said platform is pivotally connected, the axis of said pivotal connection being parallel to the axis of said core when the latter is engaged by said chuck means, and operating means connected to said platform, wherein said carriers are arranged to move in one direction along said surface on said support means during formation of the reel and said operating means is operable after completion of the reel to cause said platform to move relative to said fixed mounting about said pivotal connection so as to move the completed reel to an unloading position.

Where two or more reels are to be formed side by side (i.e., in axial alignment) and the completed reels are of different diameters all the support means associated with the reels are connected to a common platform, the operating means being arranged to move the platform so that all the support means move in unison about said pivotal connection, so that the axes of the reels remain in alignment, but due to the different diameters of the reels, the peripheries of the individual reels reach the unloading position one after the other in one operating cycle of said operating means. Thus the periphery of the largest diameter reel reaches the unloading position first and whilst the other smaller diameter reels are being moved to the unloading position, on continued pivotal movement of said platform, further movement of the largest diameter reel about said pivotal connection is prevented but due to the continued movement of said platform the carrier means associated with the largest diameter reel moves relative to the surface on the associated support means in the opposite direction to said one direction. By the time said operating means reaches the end of its operating stroke all the reels will have completed their travel to said unloading position.

In a preferred form of apparatus means are provided for moving said carrier means in said one direction along said surface on said support means to a rest position prior to said operating means being actuated to cause said platform to move relative to said fixed mounting about said pivotal connection. Control means may be provided adjacent said surface at said rest position said control means being arranged so that actuation of said operating means is inhibited until said carrier means has reached the rest position (or, in apparatus wherein two or more reels are formed side by side, actuation of said operating means is inhibited until both or all the carrier means have reached the rest position).

Preferably said operating means is a pneumatic cylinder and said control means comprises a microswitch associated with each carrier, the microswitch or microswitches being connected to control energisation of a solenoid valve which in turn controls the flow of air to the pneumatic cylinder.

According to a further aspect of the invention there is provided apparatus for forming reels of paper or like material including at least one pair of chuck means on which a reel can be supported for rotation during its formation by insertion of said chuck means into opposite ends of a hollow core on which said reel is wound, comprising a driven rotatable winding roller, a carrier for each of said chuck means, support means for each of said carriers, said support means each having a horizontal surface along which the associated carrier is movable, and operating means arranged to keep the peripheral surface of the reel in contact with the peripheral surface of said winding roller as the reel is wound and said carriers move along said horizontal surface away from said winding roller, wherein said operating means includes first moving means and a constant ratio linkage connecting said moving means to said carriers.

The constant ratio linkage (i.e., a linkage having a constant mechanical advantage over its operating range) may take various forms but in a preferred form the linkage comprises in essence a pivotally mounted lever connected at different radii to the moving means and to the associated carrier.

Preferably a moving means and constant ratio linkage is provided in each of the support means. The moving means may comprise a pneumatic cylinder to which pressure air is supplied. During formation of the reel, the air pressure is regulated so that an appropriate nip pressure always exists between the winding roller and the reel being formed. With this arrangement the pressure of the air supplied to the cylinder provided in each of two support means between which a reel being formed is supported, may be regulated so that a different nip pressure exists between the winding roller and the reel, at opposite ends of the reel.

It may be desirable, especially in apparatus winding wide webs, not to rely solely upon forces applied through the chuck means to secure a desired nip pressure as (at least in the early stages of winding, when the material wound upon the core is insufficient to stiffen the latter to any significant extent) the partly wound reel may bow. Reel-forming apparatus embodying the invention may therefore include one or more rollers arranged to function as so-called riding rollers, i.e., to press against the reel being wound intermediate its

ends, and a preferred arrangement of this nature will be disclosed in the following description.

Some variation in nip pressure occurs due to the change in the relative position of the reel-engaging elements during winding. As will later be explained in more detail, it is advantageous that the apparatus layout is such that, at the commencement of forming the reel, the angle between the horizontal plane containing the axis of rotation of the winding roller and the radius of the winding roller through the point of contact of said winding roller with the core is between 20° and 60°, preferably between 30° and 50°.

A preferred form of apparatus according to the invention will now be described by way of example only with reference to the accompanying drawings in which:

FIG. 1 is a side view partly in section of the delivery end of a machine for forming reels of paper from a continuous web and unloading the completed reels from the machine;

FIG. 2 is a plan view of FIG. 1 with some parts omitted for clarity;

FIG. 3 is a detail of part of FIG. 1 with some parts shown in a different position, and drawn to a larger scale;

FIG. 4 is a diagram of the gometry of some of the parts shown in FIG. 3;

FIG. 5 is a diagram of the geometry of some of the parts shown in FIG. 1;

FIG. 6 is a view taken in the direction of the arrow VI—VI of FIG. 3, drawn to a larger scale with some parts broken away; and

FIG. 7 shows a modification to part of the apparatus of FIGS. 1 and 2.

A continuous web 1 of paper (FIG. 1) is fed over rollers 2 and slit into three narrower webs by means of two disc knives 3, only one of which is visible in the drawings, the knives 3 cutting against a cooperating roller 4. From the roller 4 the three webs are fed over a winding roller 5, which rotates in the direction of the arrow. The three webs of paper are each formed into a reel as will be described later, the centre web being formed into a reel R1 on the left-hand side (as viewed in FIG. 1) of the roller 5, and the two outer webs being formed into reels R2 and R3 on the right-hand side (as viewed in FIG. 1) of the roller 5. For the sake of clarity, the reels R1, R2, R3 are shown in FIG. 2 in chain-dot lines. The rollers 2, 4, 5 and the knives 3 are each carried on separate shafts which extend between side frames 6 only one of which is visible in FIG. 1.

Formed in the floor as shown at 7, on which the side frames 6 stand, is a shallow pit 8. Fixed to the bottom of the pit 8, and to the left (as viewed in FIG. 1) of the roller 5 is a pair of fixed mountings 9. A shaft 10 extends between and is journalled at its ends in the mountings 9. One end of each of a pair of short levers 11 is fixed to the shaft 10 adjacent to one of the mountings 9. To the right (as viewed in FIGS. 1 and 2) of the shafts 10, in line with the levers 11, and mounted on the floor are a pair of brackets 12. Connected between the other end of each of the levers 11 and the bracket 12 in line therewith is one of a pair of pneumatic cylinders 13, the brackets 12 each being connected to one of the cylinders 13 and the levers 11 being connected to the associated piston rod.

Also fixed to the shaft 10 is a platform, generally indicated at 14, which extends over almost the whole length of the shaft 10, as shown in FIG. 2. The platform 14 comprises a number of arms 15, which are spaced apart along and fixed to the shaft 10. Extending across all the arms 15 and fixed to the upper surfaces thereof are a number of narrow slats 16 (FIG. 3) and a wide plate 17. Mounted on top of the slats 16 are a number of further narrow slats 18, 19 (FIGS. 2 and 3 and a pair of toothed racks 20, 21. Carried on the platform 14 are two support means 22, 23 which are so mounted that they may be individually moved along the slats 18, 19 as will be described later. With this arrangement the support means 22, 23 may be swung about the axis of the shaft 10 by rotating the latter by means of the cylinders 13 and levers 11.

Apparatus similar to that just described with reference to numerals 7 to 21 is mounted in the pit 8 to the right (as viewed in FIG. 1) of the roller 5, so will not be described in detail again. A platform 24 is fixed to a shaft 25 which is rotated in mountings 26 by means of pneumatic cylinders 27 and short levers 28, the platform being provided with narrow slats 18*a*, 19*a* and toothed racks 20*a*, 21*a* corresponding respectively to the narrow slats 18, 19 and toothed racks 20, 21 on the platform 14. Carried on the platform 24 are four support means 29, 30, 31, 32 which are mounted on the platform 24 in a similar manner to that in which the support means 22, 23 are mounted on the platform 14.

The construction of the support means 22 will now be described with reference to FIGS. 3 and 6. The support means comprises two side plates 33, 34, a front plate 35, and a rear plate 36. Fixed to the top of the side plate 34 and extending between the front and rear plates 35, 36 respectively is a rail 37, a similar rail 38 being fixed to the side plate 33. A carrier, in the form of a carriage 39, is mounted on the support means 22 so that it may be moved along the rails 37, 38 as will be described later. For this purpose the carriage 39 is provided with a number of rollers 40 which are arranged, as shown in the drawings, so that the carriage is constrained to move in a path parallel to the surfaces of the rails 37, 38. Mounted for free rotation in the carriage 39 is a chuck 41, capable of being inserted, by axial movement thereof, into the end of a hollow cardboard core and then expanded so as to grip the interior surface of the core, and may be of any convenient form.

Positioned near to and below the left hand end (as viewed in FIG. 3) of the rail 37 is a microswitch 42 having an operating arm 43 which is engageable at certain times, as will be described later, by one of the rollers 40, the roller in question being marked 40*a* in FIG. 3.

The side plates 34, 35 are carried on a pair of base plates 44, 45 which are spaced apart as shown in FIG. 3, and extend beyond the side walls 34, 35 as shown in FIG. 6. Supported at opposite ends from the base plates 44, 45 is a bridge piece 46 which carries two bearings 47, 48. Journalled in the bearings 47, 48 is a shaft 49, to one end of which a pinion 50 is fixed adjacent the bearing 47. A further pinion 51 is fixed to the shaft 49 adjacent the bearing 48, the shaft extending through the pinion 51 and beyond the rear plate 36. A handle 52 is mounted on that end of the shaft 49 which extends beyond the plate 36 and is provided with a reversible ratchet of any known form so that the shaft 49 and thus also the pinions 50, 51 may be rotated in either direction.

The support means 22 is mounted on the platform 14 so that the under surfaces of the base plates 44, 45 engage the upper surfaces of the narrow slats 19, 18

respectively, and the pinions 50, 51 engage in the racks 20, 21 respectively. A block 53 (FIG. 3) is fixed to the base plate 44 so that it engages the under surface of the right hand (as viewed in FIG. 3) slat 19. A similar block 54 is fixed to the base plate 45 so that it engages the under surface of the left hand (as viewed in FIG. 3) slat 18. The arrangement is such that by operating the handle 52 the pinions 50, 51 are rotated and the support means 22 moved to any required position along the platform 14 as the pinions roll along the racks, the base plates 44, 45 and blocks 53, 54 acting to prevent the support means 22 from skewing across the slats 18, 19.

Extending through the gap between the slats 18 and two holes formed in the base plate 45 are two rods 55 (only one of which is visible in the drawings) provided with enlarged end portions which extend below the slats 18 between adjacent slats 16 and are of such dimensions that they cannot pass between the slats 18. The rods 55 extend upwardly beyond the plate 45 through a cross piece 56, which is prevented from being lifted off the rods by nuts screwed on to the rods. A bracket 57 is fixed to the top of the plate 45 and pivoted to the bracket is a lever 58 one end of which is hooked, as shown at 59, and which extends between the base plate 45 and the cross piece 56. The other end of the lever 58 is pivotally connected to a block 60 through which passes a bar 61. The parts numbered 55 to 59 described above are associated with the slats 18 and the base plate 45. A similar construction of parts, shown at 62 to 66, is associated with the slats 19 and base plate 44, but will not be described in detail as they correspond to the parts 55 to 59 respectively. The end of the lever 65 remote from the hooked end 66 is pivotally connected to the right hand end (as viewed in FIG. 3) of the bar 61. The bar 61 extends to the left (as viewed in FIG. 3) beyond the block 60 and has a knob 67 screwed on to its end. A tubular sleeve 68 extends between the knob 67 and the block 60 and the bar 61 is arranged to slide in the sleeve 68.

A shaft 69 extends between the side plates 33, 34 and a lever 70 is pivotally connected at one end to the shaft. The other end of the lever 70 is pivotally connected at 71 to one end of a link 72 which in turn is connected at its other end to a pin 73 carried on the carriage 39.

A further shaft 74 extends between the side plates 33, 34 and carried on the shaft is a pneumatic cylinder 75. The free end of the piston rod 76, associated with the cylinder 75, is pivotally connected by a pin 77 to one end of a short link 78, the other end of which is similarly connected at 78*a* to the lever 70. The pin 77 has a roller (not shown) freely mounted at each end, the rollers running in slots 79 formed in plates 80 (only one of each of the slots 79 and plates 80 being visible in the drawings). The geometry of the lever 70, link 72, short link 78, piston rod 76, the paths along which the pins 73, 77 travel respectively, and the position of the connection 78*a* on the lever 70 are such that a linkage is provided having a constant mechanical advantage over its operating range i.e., between the full line and chain-dot line positions shown in FIG. 3. To meet this requirement certain conditions have to be met and these will now be explained with reference to FIG. 4.

For ease of description, in FIG. 4 the centre of shaft 69 is shown as A, the pivot 71 as B, the centre of pin 73 as C, the pivot 78*a* as D and the centre of pin 77 as E; the line CF represents the path along which the point C moves and the line EG represents the path along which the point E moves as the carriage 39 is moved along the rails 37, 38. The dimensions of the various parts of the linkage described above are such that if H represents the distance in a straight line between the points A and B; J represents the distance between the points A and D; K represents the distance between the points B and C and L represents the distance between the points D and E, then H divided by J equals K divided by L. Additionally, at all positions in the operating of the linkage, angle CBA equals angle EDA and angle FCB equals angle GED. Also provided within the support means 22 are a pressure valve 81, a pressure gauge 82, and two push buttons 83, 84.

The support means 23 is similar to the support means 22 described above but is built as a mirror image thereof. This is done so that the support means 22, 23 may operate as a pair in supporting a core on which a reel of paper is to be wound, as will be described later. In other words the chuck 41 of the support means 22 and the corresponding chuck of the support means 23 may be inserted into opposite ends of the same core. The support means 30, 32 are identical with the support means 22 and the support means 29, 31 are identical with the support means 23 so that the support means 29, 30 and 31, 32 each form a pair between which a reel may be supported.

The operation of the apparatus in forming a reel of paper and unloading the completed reel from the apparatus will now be described.

It will be assumed that the web 1 is to be slit into three equal width webs each of which is to be wound into a reel. The machine operator moves the support means 22 to the position shown in FIG. 2 by operating the handle 52 which causes the pinions 50, 51 to rotate and roll along their respective racks 20, 21. When the support means 22 is at the required position the operator turns the knob 67 which has the effect of pulling the rod 61 to the left, and pushing the sleeve 68 to the right, as viewed in FIG. 3. These movements combined cause the levers 58, 65 to rotate on the brackets 57, 64 in clockwise and anti-clockwise direction respectively, as viewed in FIG. 3. This causes the hooked ends 59, 66 to lift the cross pieces 56, 63 and thus the rods 55, 62 respectively, which movement causes the enlarged end portions of the rods 55, 62 to engage the lower surfaces of the slats 18, 19 respectively and clamp the base plates 44, 45 against the slats on which they slide, thus holding the support means 22 against further movement along the slats 18, 19. One end of a hollow core, of known form is then pushed over the chuck 41, and the support means 23 is then moved towards the support means 22 so as to insert the chuck 41 carried on the support means 23 into the other end of the core. The support means 23 is then clamped to the platform 14 in the same way as the support means 22. The pairs of support means 29, 30 and 31, 32 are then moved to the positions shown in FIG. 2 in the same way, with a core supported by the chucks of each pair. As all the reels are formed in the same manner, only the formation to be wound on the core supported between the support means 22, 23 will be described. With the support means in the positions shown in FIG. 3, all the rails 37, 38 horizontal.

It is preferable that the push buttons 83, 84 on each of the support means are duplicated on a common control panel (not shown) and where reference is made to either button in the following description it may be either the button on the support means or the control panel.

The operator attaches the end of the web to the core and then depresses the button 84 which causes air to be admitted into the cylinder 75 so that the piston rod 76 moves to the right, as viewed in FIG. 3, and through the short link 78, lever 70 and link 72 causes the carriages 39 to also move to the right until the core engages the winding roll 5. The machine is then started by the operator and the winding roller 5 is driven so that it rotates in the direction shown by the arrow in FIG. 1. The roller 5 frictionally drives the core in an anti-clockwise direction, as viewed in FIG. 1, thus winding the web onto the core. As the reel increases in diameter so that carriages 39 on the support means 22, 23 move along the rails 37, 38 away from the roller 5.

To form an acceptable reel of paper the tightness with which each layer is wound onto the reel has to be controlled, and the tightness of the reel is governed to a (e.g., extent by the nip pressure exerted between the surface of the reel being wound and the surface of the winding roller 5. The nip pressure referred to above is created by applying a force to the carriages 39 which opposes the movement of the latter away from the roller 5. The magnitude of this force is dependent upon the air pressure applied to the cylinder 75 and a controlled leakage (i.e., a needle valve) in the pneumatic system, the pressure in the cylinder 75 being varied by means of the valve 81.

With the form of linkage described above connecting the piston rods 76 to the carriages 39, the nip pressure between the reel and the roller 5 is directly proportional to the pressure applied to the cylinder 75 for moving the carriages 39 towards the roller 5, and remains substantially constant throughout the period during which the reel is being formed.

The nip pressure does, in fact, decrease as the reel increases in diameter, due to the nip point moving upwards round the circumference of the winding roller 5. Due to the fact that the rails 37, 38 are horizontal the increasing weight of the reel has no effect on the nip pressure, so once the pressure in the cylinders 75 has been set, by the operator (the value of this pressure being dependent upon the type of material being wound) there is no need for it to be changed, unless of course the type of material being wound is such that, to obtain the best results, a greater decrease in nip pressure is necessary than is obtainable by the nip point moving as mentioned above. This extra decrease in nip pressure may be obtained either by the operator reducing the pressure of the air being applied to the cylinder 75, by resetting the valve 81 at intervals during formation of the reel, or by controlling the valve 81 automatically by any convenient known means so that the air pressure to the cylinder 75 is progressively decreased.

It has been found that to obtain the best results in winding a satisfactory reel the relative positions of the winding roller 5 and the core, when it is first brought into engagement with the roller 5, as described previously, are of some importance, and this will now be discussed with added reference to FIG. 5. In FIG. 5, CO represents the core and X represents the angle between the radius of the drum 5 through the nip point, indicated at NP, and the horizontal plane, indicated at PL, containing the axis of rotation of the roller 5. When formation of the reel is started, the nip pressure needs to be of such a value that the web is tightly wound on to the core CO. For best results the angle X should be between 20° and 60° and preferably between 30° and 50°, the actual angle chosen being dependent upon the material or materials to be wound. It will be appreciated that said angle is determined by the layout of the machine, in particular the height of the rails 37, 38 above the floor 7 relative to the position of the roller 5, and also the diameter of the core CO. The various dimensions are selected so that the angle X, at the start of reel formation is suitable for the material to be wound or, more commonly, a compromise between the angles required to give the best result for a variety of different materials. Any difference in nip pressure required which is outside that resulting from the chosen layout of the machine, is obtainable by suitably adjusting the air pressure applied to the cylinder 75. Once the angle X, during formation of a reel, reaches a value in the region of 30°, the difference in nip pressure, due to the nip point NP moving nearer the plane PL, becomes negligible and need not be considered.

When the reel is of the required diameter the operator stops the machine, cuts that part of the web 1 which has been wound to form the reel R1, and attaches the end of the web to the reel.

The operator then depresses button 83 which operates a valve (not shown) which causes the air being fed into the cylinder 75 to be fed to the opposite side of its associated piston so that the carriages 39, and thus the reel R1, are moved to the left, as viewed in FIG. 1, along the rails 37, 38. This movement continues until the roller 40*a* engages the operating arm 43 of the microswitch 42, when the air supply to the cylinder 75 is interrupted and that the reel R1 stops in a rest position, adjacent that end of the rails 37, 38 remote from the winding roller 5. Pressure air is then fed to the cylinders 13 so that by means of the levers 11, the platform 14 and thus the support means 22, 23 and reel R1 are swung in an anti-clockwise direction, as viewed in FIG. 1, about the axis of the shaft 10 until the surface of the reel R1 engages the floor 7. The reel R1 is shown in this position in chain-dot lines on the left hand end of FIG. 1. If the next reel to be wound is of the same width as the reel R1 the operator then extracts the chucks 41 from the core by moving the chucks axially in their mountings in their respective carriages 39. The new core may then be fitted on to the chucks 41 without any movement of the support means 22, 23. Alternatively the operator unclamps the support means 22, 23 from the slats 19, 18 respectively, by turning the knob 67 in the opposite direction to that when the base plates were clamped to their respective slats, as described previously, and moves the support means 22, 23 along the racks 20, 21 by means of their respective handles 52 away from the reel R1 so as to extract the chucks 41 from the core. The reel R1 may then be removed in any convenient manner and the support means 22, 23 returned to the position shown in full lines in FIG. 1 ready for a further reel to be wound in the same manner as described above. This alternative way of extracting the chucks 41 from the core would preferably be used in cases where the next reel to be wound is to be a different width to that of the reel R1.

In the case where the reels wound between each of the pairs of support means 29, 30 and 31, 32 are of the same diameter when completed, the reels are moved to a rest position and then lowered to the floor 7 in the same manner as described above with respect to the reel R1. It should be noted that, in this case, both reels are lowered to the floor in unison due to the support means 29–31 being mounted on a common structure, i.e., the platform 24.

It is also possible to wind and unload reels of different diameters on the same side of the winding roller 5. It will be assumed that the reels R2 and R3, having different diameters when completed, are to be wound and lowered to the floor. A core is positioned between the support means of each of the pairs of support means 29, 30 and 31, 32, the cores being moved into engagement with the winding roller 5 and the forming of the reels started, all as previously described with reference to the reel R1.

When the reel being wound on the core held between the support means 29, 30 reaches a predetermined diameter, the machine is stopped and the reel is lowered to the ground by feeding pressure air to the cylinders 27 which causes the platform 24 to be swung in a clockwise direction, as viewed in FIG. 1, about the axis of the shaft 25. The reel is removed from the support means 29, 30 which are then returned to their original position. A new core is then placed between the support means 29, 30 and the end of the web attached to it. It will be obvious that the reel being formed between the support means 31, 32 will also be lowered to the floor at the same time, but as this reel is not yet of the required diameter it is not removed and will unwind slightly, and create some slack web between it and the roller 5. This slack may be taken up by the operator turning the reel by hand.

The machine is then started again and the web is wound on to the new empty core as well as the partially formed reel. When both the reels, i.e., the reels R2, R3, have each reached the required diameter, the machine is again stopped and the reels R2, R3 are each caused to be moved to a rest position by depression of the appropriate buttons 83. As each reel reaches the rest position the associated switch 42 is actuated, and the circuitry is such that air is prevented from being fed to the cylinders 27 until all the switches 42 have been actuated. When this occurs pressure air is fed to the cylinders 27 so that the platform 24 is swung in a clockwise direction, as viewed in FIG. 1. At this time the reels are in axial alignment, but due to its larger diameter the periphery of the reel R3 engages the floor 7 first, and on continued pivotal movement of the platform 24 the carriages 39 mounted on the carrier means 31, 32 move relative to their respective rails 37, 38 in a direction opposite to that when the reel was being formed. This movement is possible due to the fact that no air is now being fed to the cylinders 75 mounted inside the support means 29 to 32. Pivotal movement of the platform 24 is stopped when the periphery of the reel R2 engages the floor, the reels R2, R3 being shown in this position at the right hand side of FIG. 1, and both reels may now be removed as previously described with reference to reel R1.

If the tightness of the reel is uneven, due for example, to the caliper of the web varying across its width, the nip pressure across the width of the web may be varied by feeding air at different pressures to the cylinders 75 mounted in the support means between which the reel in question is supported.

In the apparatus so far described the nip pressure is obtained by applying pressure only through the chucks 41 which are inserted into opposite ends of the core on which the reel is being wound. With this arrangement it is possible, especially in the case of reels formed from web of considerable width, that the nip pressure may be less towards the middle of the reel than at its ends. In order to apply an even nip pressure across the whole width of the reel the apparatus of FIGS. 1 and 2 is modified as shown in FIG. 7, which will now be described.

The platform 14 (FIGS. 1, 2) is modified by removing part of the wide plate 17 so that only a portion 17A (FIG. 7) remains. Extending across all the arms 15 and fixed to the upper surface thereof are two slats 85, 86 and fixed to the top of the latter are two further slats 87, 88 respectively. Slidably mounted on the slats 87, 88 is a support bracket 89 comprising a bottom plate 90 and two side plates 91, only one of which is visible in the drawing, the plate 90 having blocks 92, 93 fixed to it so that they engage the under surface of the slats 87, 88 respectively. Rods 55A (corresponding to rods 55, FIG. 3) are provided for clamping bracket 89 in a selected position, the rods 55A being each provided with a threaded upper end carrying a nut (not visible in the drawing) for this purpose. The support bracket 89 is mounted on the slats 87, 88 between the support means 22, 23 (FIG. 2) and is moved to any desired position therebetween by means (not shown) which may be similar in construction and operation to that described previously for moving the support means 22, 23 along the slats 18, 19. Extending between, and journalled at its ends in the side plates 91 is a shaft 94 to which is fixed one end of a pair of curved arms 95 (only one being visible in the drawing) and a pinion 96. Fixed to a pin 97 on one of the side plates 91 is a bracket 98 which carries a pneumatic cylinder 99. A piston rod 100 of the cylinder 99 carries at its free end a toothed rack 101 which is arranged to mesh with the pinion 96, a roller 102 carried on the bracket 89 being provided to guide the rack 101 and keep it in mesh with the pinion. The arrangement is such that by applying pressure air to the cylinder 99 the arms 95 may be swung about the axis of the shaft 94 as will be described later.

Fixed between the other ends of the curved arms 95 is a short shaft 103 on which two plates 104 (only one being visible in the drawing) are pivotally mounted. Extending between the plates 104 are two rollers 105 freely rotatably mounted on shafts which are fixed at their ends to the plates 104. Each curved arm 95 is provided with a pin 106 which engages in an arcuate slot 107 so formed in the adjacent plate 104 that the plates 104, and thus the rollers 105, can swing about the axis of the shaft 103 between limits defined by the ends of the arcuate slots 107.

In operation, after setting up the machine, as described previously, and prior to starting up the machine, the operator clamps support bracket 89 to the slats 87, 88 in a position half-way between the support means 22, 23. Air is then fed to the cylinder 99 so that the rack 101 is moved to the left (as viewed in FIG. 7), which causes the curved arms 95 to be swung clockwise about the axis of rotation of shaft 94, until the rollers 105 engage the core. The pressure of the air fed to the cylinder 99 is such that the nip pressure between the core and the roller 5 is substantially constant over the width of the core. The machine is then started and the web is wound on to the core as previously described. As the reel increases in diameter it is necessary that both rollers 105 remain in contact with the reel, and this is made possible by the plates 104 being able to swing about the axis of shaft 103. As explained above, with reference to FIG. 5, it may be necessary to reduce the nip pressure by progressively reducing the air pressure applied to the cylinder 75, and in such circumstances the air pressure applied to the cylinder 99 is similarly

reduced so that the nip pressure applied through the rollers **105** reduces in step with that applied through the chucks **41**.

When the reel reaches a diameter such that it is stiff enough to prevent bowing across its width, the rollers **105** no longer serve any useful purpose. When this condition is reached air is fed to the cylinder **99** so that the rack **101** is moved to the right as viewed in FIG. **7**, so that the arms **95** are swung anti-clockwise about the axis of the shaft **94** until they reach the position shown in chain-dot lines in FIG. **7**. Any suitable known means may be used for monitoring the size of the reel being formed so that at any predetermined stage of winding the rollers **105** are moved out of engagement with the reel. Conveniently a switch (not shown) may be placed in the path of the arm **70** (FIG. **3**) so that, when the switch is operated actuated by the arm, a solenoid valve is operated to feed air to the cylinder **99** to obtain the desired movement of the arms **95**.

The platform **24** (FIG. **2**) is modified in a similar manner to the platform **14**, the only difference being that a support bracket **89** is positioned between the support means **29**, **30** and also between the support means **31**, **32**.

I claim:

1. Apparatus for handling reels of paper or like material comprising a pair of rotatable chuck means adapted to be inserted into opposite ends of a hollow core on which a reel is to be formed, a carrier for each of said chuck means, support means for each of said carriers, a platform, means for movably connecting said support means having a surface along which one of said carriers is arranged to be moved, a fixed mounting, means pivotally connecting said platform to said fixed mounting, the axis of said pivotal connection being parallel to the axis of said core when the latter is engaged by said chuck means, operating means connected to said platform, separate drive means extending between each of said support means and its associated carrier for moving said carriers along the respective surfaces of said support means, said carriers being arranged to be moved in one direction along the respective surfaces on said support means by both said drive means during formation of the reel to a rest position prior to said operating means becoming operable, said operating means being operable after complete formation of the reel to cause said platform to move relative to said fixed mounting about said pivotal connection so as to move the completed reel to an unloading position, and control means adjacent at least one of said surfaces at said rest position for actuating said operating means and arranged so that actuation of said operating means is inhibited until said carrier has reached said rest position to actuate said control means.

2. Apparatus as claimed in claim **1** adapted to accommodate at least two reels simultaneously and comprising at least two pairs of chuck means each with its associated carrier, support means, platform and fixed mounting disposed in a generally symmetrical arrangement.

3. Apparatus as claimed in claim **1** in which said operation means is a pneumatic cylinder and said control means comprises a microswitch operable by said carrier and a solenoid valve operable by said microswitch for controlling the flow of air to the pneumatic cylinder.

4. Apparatus for forming reels of paper or like material including at least one pair of chuck means on which a reel can be supported for rotation during its formation by insertion of said chuck means respectively into opposite ends of a hollow core on which said reel is wound, comprising a driven rotatable winding roller, a carrier for each of said chuck means, support means for each of said carriers, said support means each having a horizontal surface along which the associated carrier is movable, and at least one operating means arranged to retain the peripheral surface of the reel in contact with the peripheral surface of said winding roller as the reel is wound and said carriers move along said horizontal surface away from said winding roller, said operating means including first moving means and a constant ratio linkage connecting said moving means to one of said carriers, said constant ratio linkage comprising a pivotally mounted lever connected at different radii from the axis of its pivot to the first moving means and to the associated carrier.

5. Apparatus as claimed in claim **4** in which a first moving means and a constant ratio linkage is provided on each of the support means.

6. Apparatus as claimed in claim **5** in which said first moving means is a pneumatic cylinder to which pressure air is supplied.

7. Apparatus as claimed in claim **6** including valve means connected to said pneumatic cylinder and adapted to be actuated to control the pressure of the air supplied to said pneumatic cylinder.

8. Apparatus as claimed in claim **7** including means to automatically actuate said valve means so that as the reel being formed increases in diameter the pressure of the air supplied to said pneumatic cylinder is progressively decreased.

9. Apparatus as claimed in claim **4** in which the layout of the apparatus is such that, on commencement of forming the reel, the angle between the horizontal plane containing the axis of rotation of said winding roller and the radius of the winding roller through the point of contact of said winding roller with the core is between 20° and 60°.

10. Apparatus as claimed in claim **9** in which said angle is between 30° and 50°.

11. Apparatus as claimed in claim **4** in which said operating means further includes a bracket positioned between a pair of said support means between which the core is supported by said chuck means, second moving means carried by said bracket, a pair of arms pivotally connected at one end thereof to said bracket, two plates pivotally connected to the other ends of said pair of arms, and a pair of rollers rotatably mounted between said plates, said second moving means being operable to cause said arms to swing about their pivotal connection to said bracket so as to move said pair of rollers into contact with the peripheral surface of the core prior to commencement of formation of said reel and maintain said rollers in contact with the peripheral surface of said reel as it is wound.

12. Apparatus as claimed in claim **11** in which said second moving means comprises a pneumatic cylinder, a piston rod movable upon actuation of said cylinder, a toothed rack fixed to said piston rod, and a pinion fixedly connected to said pair of arms and in mesh with said rack, so that on actuation of said pneumatic cylinder said rack is moved to cause rotation of said pinion.

13. Apparatus as claimed in claim **12** including means for sensing when a reel being wound attains a

preselected size, and means under control of said sensing means for actuating said pneumatic cylinder to swing said arms so that said pair of rollers move away from said reel.

14. Apparatus as claimed in claim 5 for winding at least two reels simultaneously and comprising at least two pairs of chuck means symmetrically disposed on either side of said winding roller.

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