Dec. 11, 1951 C. O. BACHMAN 2,578,461

WINDING MACHINE

Filed March 8, 1949 5 Sheets-Sheet 1

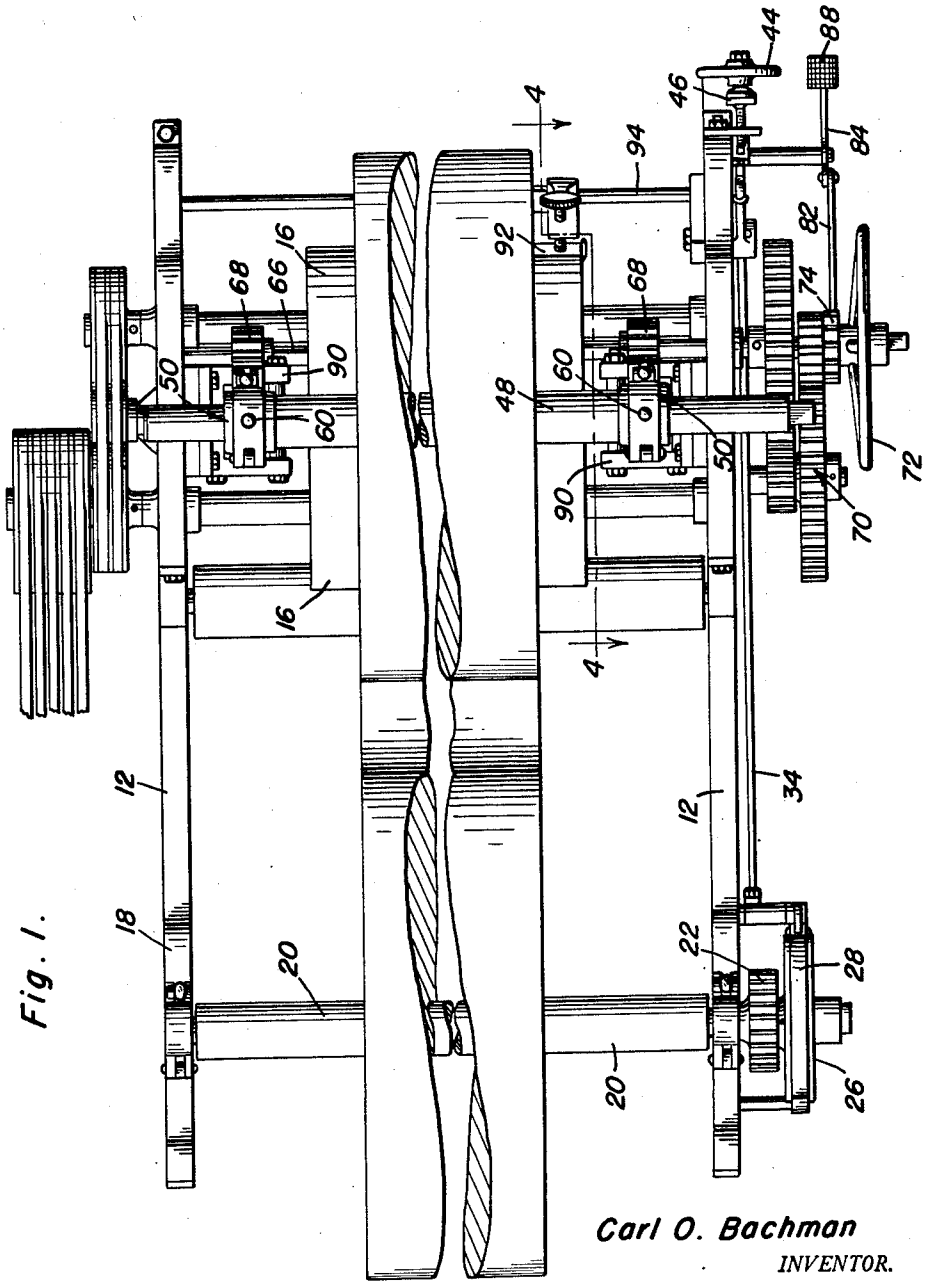

Fig. 1.

Carl O. Bachman
INVENTOR.

BY Thomas A. O'Brien and Harvey B. Jackson
Attorneys

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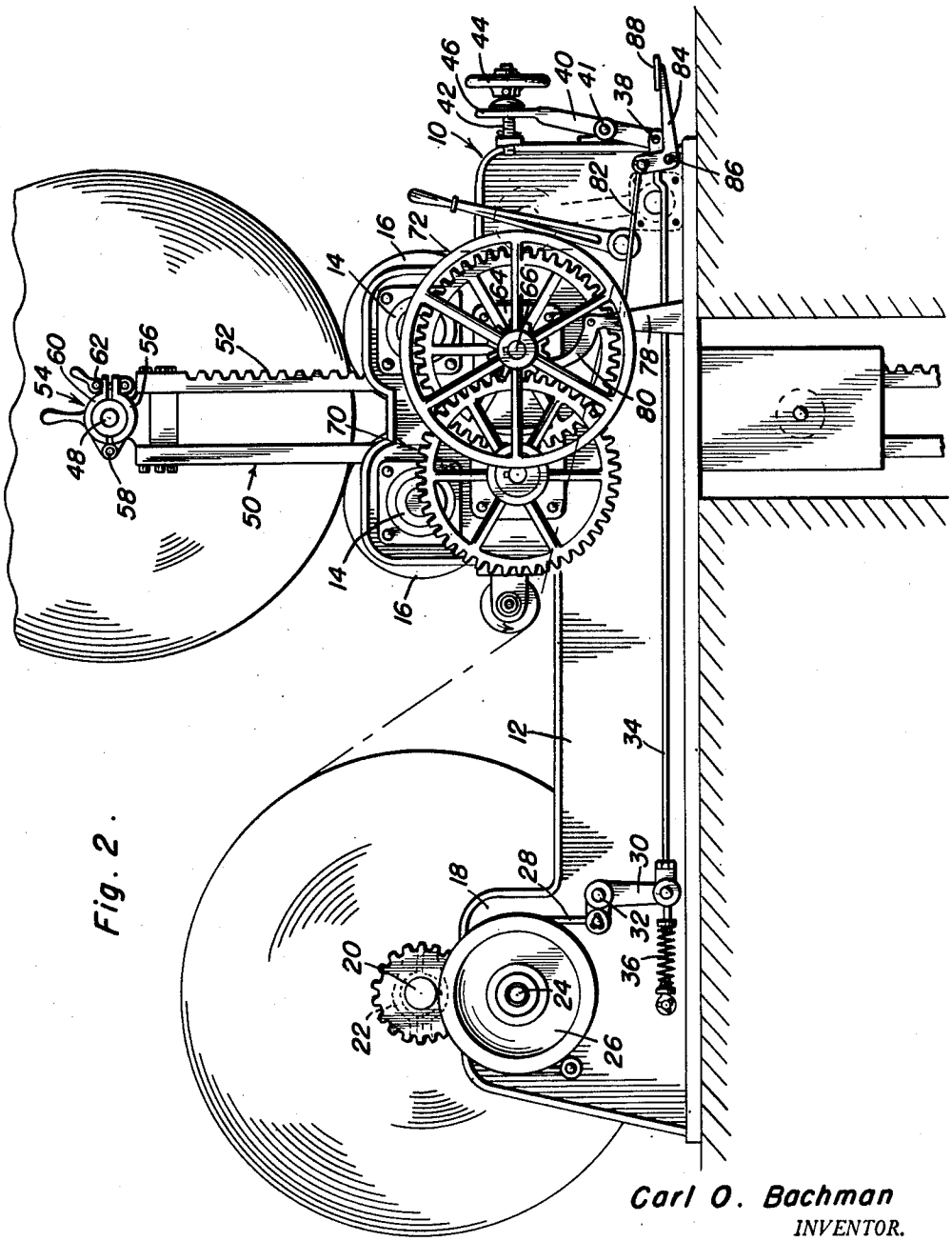

Fig. 2.

Carl O. Bachman
INVENTOR.

BY Clarence A. O'Brien and Harvey B. Jacobson
Attorneys

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WINDING MACHINE

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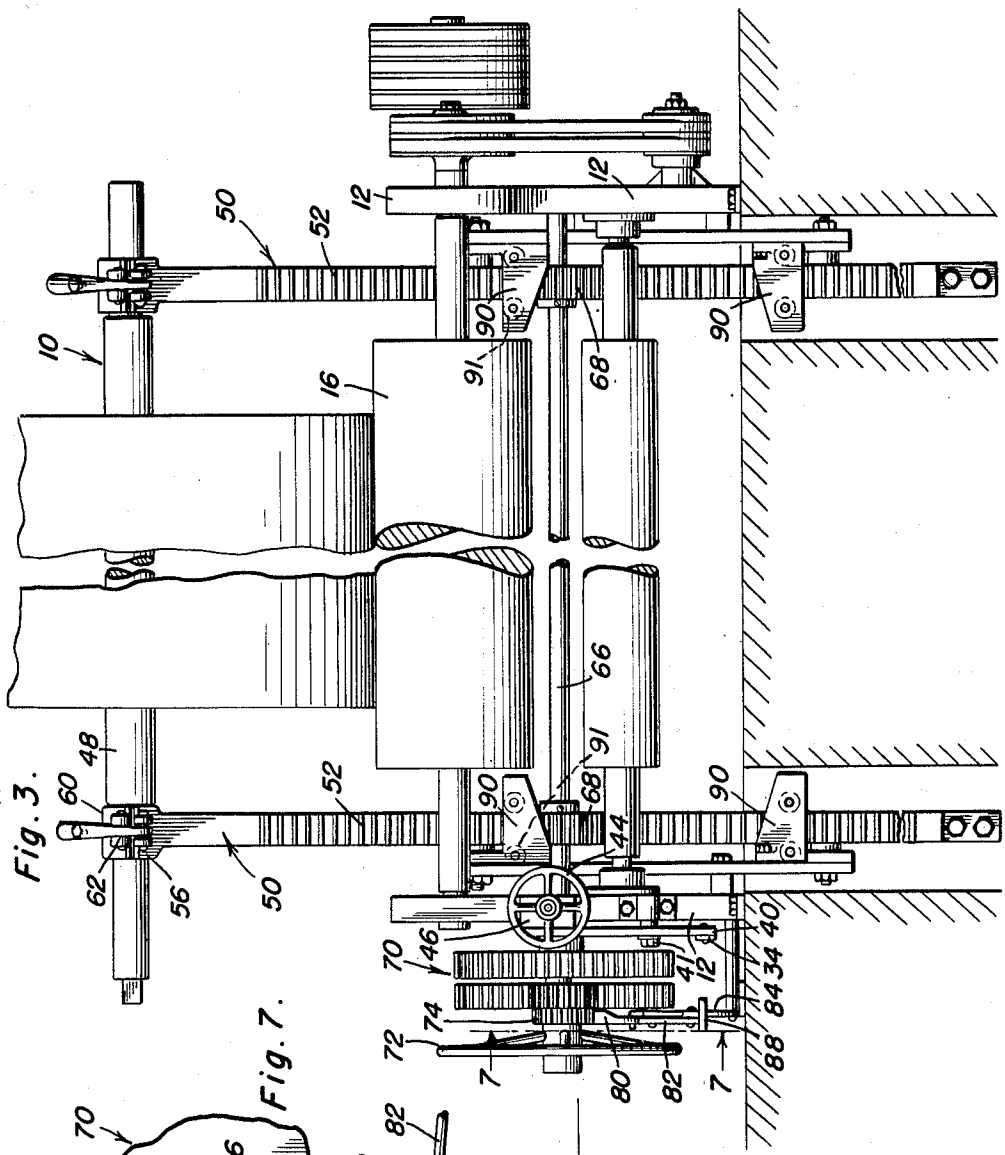

Fig. 3.

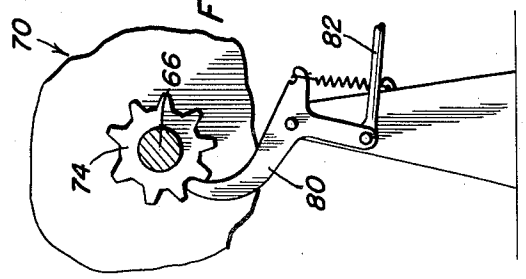

Fig. 7.

Carl O. Bachman

INVENTOR.

BY Clarence A. O'Brien and Harvey B. Jacobson

Attorneys

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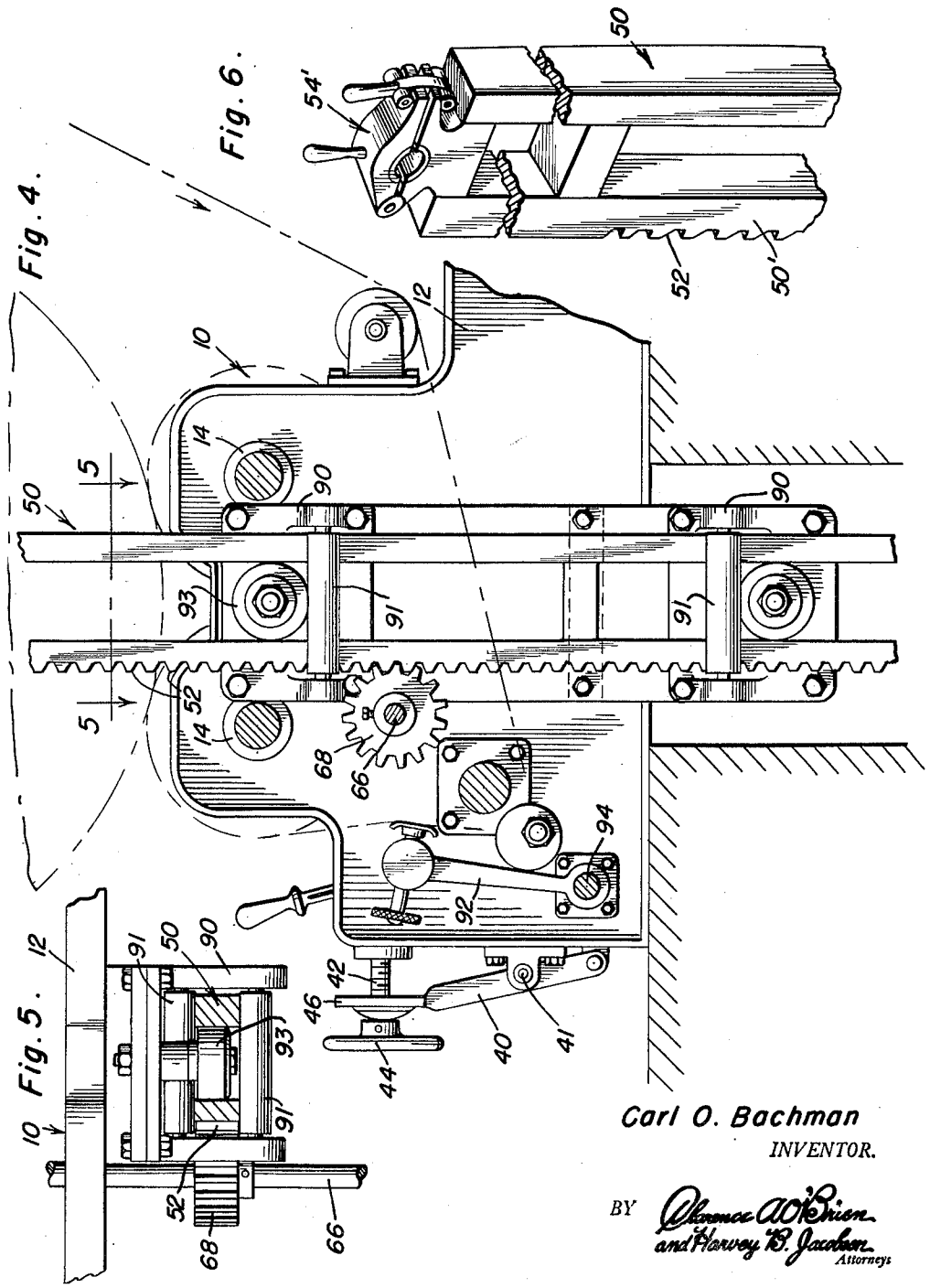
WINDING MACHINE

Filed March 8, 1949 5 Sheets-Sheet 4



Carl O. Bachman
INVENTOR.

BY Thomas A. O'Brien and Harvey B. Jacobson
Attorneys

Dec. 11, 1951 C. O. BACHMAN 2,578,461

WINDING MACHINE

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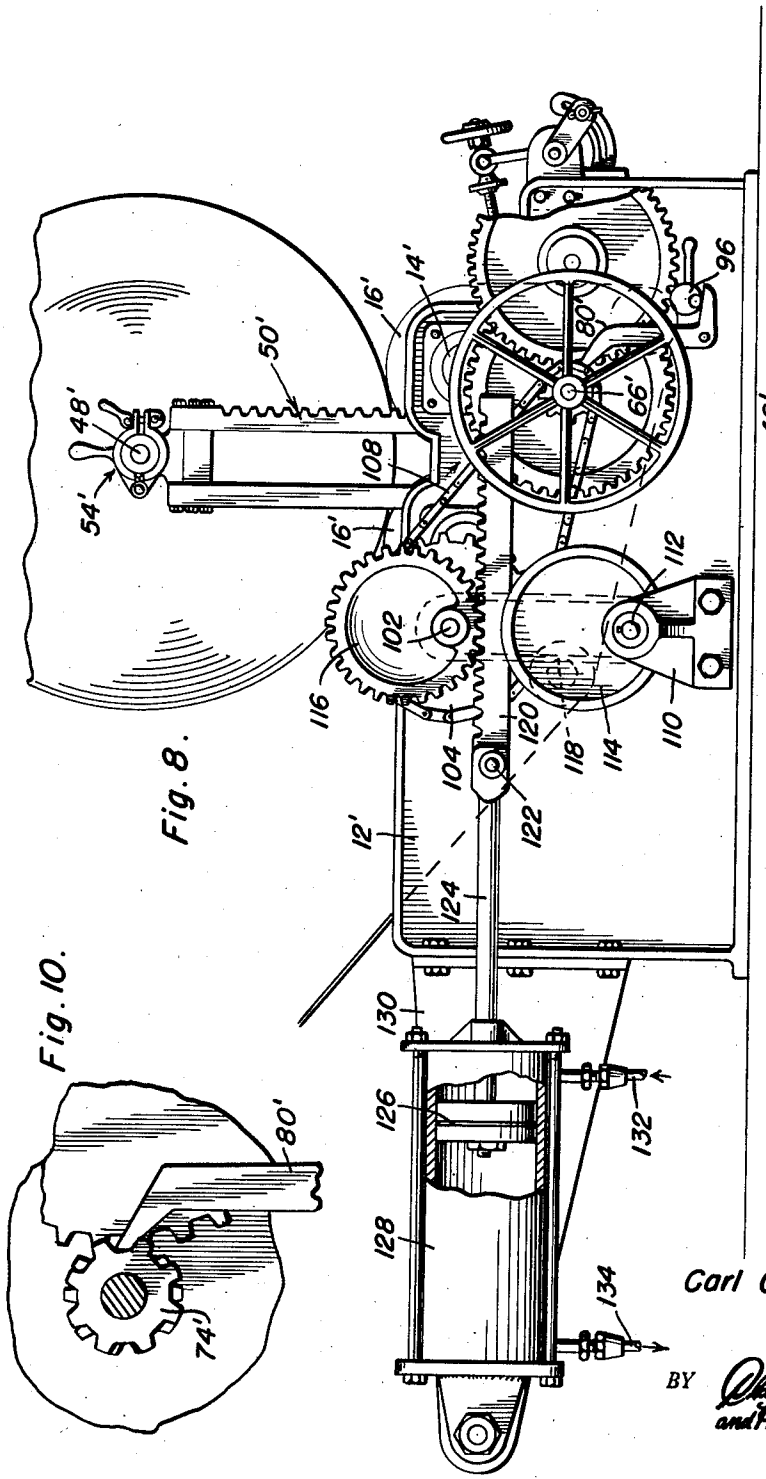

Fig. 8.

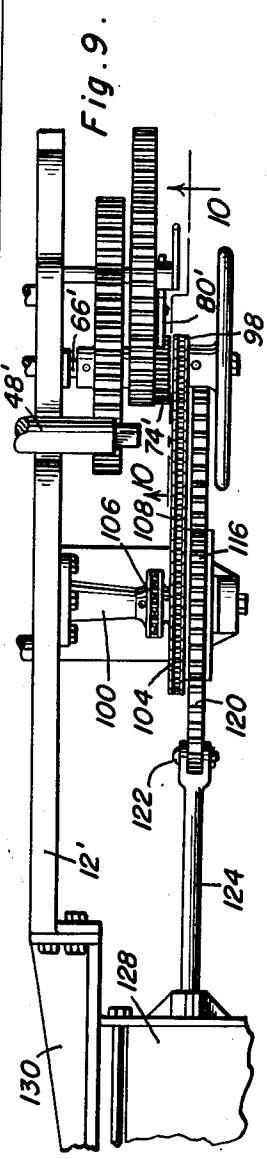

Fig. 9.

Fig. 10.

Carl O. Bachman
INVENTOR.

BY Thomas A. O'Brien and Harvey B. Jackson
Attorneys

Patented Dec. 11, 1951

2,578,461

UNITED STATES PATENT OFFICE

2,578,461

WINDING MACHINE

Carl O. Bachman, Watertown, N. Y.

Application March 8, 1949, Serial No. 80,192

12 Claims. (Cl. 242—66)

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This invention relates to a winding machine, and more particularly to that type of winding machine embodying parallel winding drums mounted to rotate about spaced axes which lie in the same horizontal plane and a winding shaft mounted for vertical movement above and for rotation by the winding drums and about which the web or the like of flexible material such as paper is wound in successive convolutions as the winding drums are rotated. Machines of the type to which this invention relates are exemplified by the disclosures in United States Patents Nos. 1,831,201 and 1,730,552.

So far as I am aware in winding machines of the type to which this invention relates, the winding shaft has been free to move upwardly as successive convolutions of the material being wound build up thereon, with the result that in instances where the thickness of the web is greater on one side than on the other, a conical roll is produced which owing to its shape may seriously hamper subsequent operations to be performed on the web or the like. Also, in machines in which the winding shaft floats freely above the winding drums, the density of the finished roll either remains constant, or increases as the winding progresses owing to the increased pressure of the rolled material on the winding drums. As a consequence, the finished rolls are apt to have the outer convolutions of the web or the like more tightly wound than are the inner convolutions with the result that should the finished roll be dropped so that a corner thereof contacts the ground or other supporting surface, the force of the blow will be sufficient to overcome the tensile strength of the web thus causing it to break and damaging the rolled material to a considerable depth and causing a large portion of the web to be wasted.

The primary object of this invention is to assure the winding of a web or the like into a roll possessing substantially uniform diameter throughout its entire length, so as to avoid the difficulties encountered in handling a roll of conical formation.

Another object is accurately to control the tension exerted on the convolutions of a roll so that as the outer diameter of the roll is being approached, the outer convolutions may be more loosely wound thereby forming a less dense roll near the surface thereof, so that should the roll be dropped on a corner thereof the convolutions of the web being under less tension are less likely to become broken and damaged, and will furthermore serve as a cushion to prevent damage to the more tightly wound convolutions of the finished roll.

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A further and more specific object is to facilitate the unloading from the winding machine of a finished roll, and to give accessibility to the mechanism of the machine both when it is in and out of use.

The above and other objects may be attained by employing this invention which embodies among its features a web winding or re-winding machine of the type employing winding drums mounted to rotate about spaced horizontal axes and a winding shaft mounted above said winding drums to be rotated thereby, and to move upwardly as convolutions of web or the like are wound on said winding shaft, means for holding the winding shaft in parallel relation to the winding drums throughout the entire winding operation comprising rack bars suspended from the winding shaft and movable upwardly therewith during the winding operation, and pinions meshing with the rack bars and interconnected to rotate in unison at the same peripheral speed whereby independent vertical movement of the rack bars will be prevented.

Other features include means connected to the pinions for governing their speed of movement to control the tension on the convolutions of the web being wound on the winding shaft.

Still other features include means connected to the pinions progressively to alter their speed of rotation as the winding of the web on the winding shaft progresses.

In the drawings:

Figure 1 is a fragmentary top plan view of a winding machine embodying the features of this invention;

Figure 2 is a side view of the winding machine illustrated in Figure 1;

Figure 3 is an end view of the winding machine illustrated in Figure 1;

Figure 4 is a fragmentary enlarged sectional view taken substantially along the line 4—4 of Figure 1;

Figure 5 is a fragmentary horizontal sectional view taken substantially along the line 5—5 of Figure 4;

Figure 6 is a fragmentary perspective view of one of the rack bars showing a bearing for the winding shaft at the upper end thereof;

Figure 7 is a fragmentary enlarged sectional view taken substantially along the line 7—7 of Figure 3;

Figure 8 is a fragmentary side view on a slightly enlarged scale of a modified form of the invention;

Figure 9 is a fragmentary top plan view of the form of the invention illustrated in Figure 8; and

Figure 10 is a fragmentary sectional view taken substantially along the line 10—10 of Figure 9.

Referring to the drawings in detail, the machine designated generally 10 comprises a pair of side rails 12 each of which is provided adjacent one end with a pair of journal bearings 14 in which the trunnions of conventional winding drums 16 are mounted to rotate. The side rails 12 are also provided adjacent their opposite ends with pedestals 18 carrying bearings in which a supply roll supporting shaft 20 is journaled in a conventional manner, and carried by the shaft 20 of the supply roll adjacent one end thereof is a spur gear 22 which has meshing engagement with a suitable pinion carried on a stub shaft 24 to which a conventional brake drum 26 is attached. A brake band 28 surrounds the brake drum and is connected at one end to the horizontal arm of a bellcrank 30 which is pivotally supported as at 32 on one of the side rails 12. The vertical leg of the bellcrank 30 has connected thereto one end of a pull rod 34, and a rectractile spring 36 by means of which the bellcrank is rocked about its pivot 32 to release the brake band 28 from engagement with the drum 26. The pull rod 34 extends in a direction opposite the spring 36 and the end of the pull rod remote from the bellcrank 30 is pivotally coupled as at 38 to a rock arm 40 which is pivotally connected as at 41 to the end of the machine remote from the shaft 20. Fixed to one of the side rails adjacent the upper edge thereof is a longitudinally extending screw-threaded stud 42 on which a hand wheel 44 is threadedly mounted, and straddling the stud 42 between the hand wheel 44 and the side member 12 is a forked extension 46 of the rock lever 40. It will thus be seen that by turning the hand wheel 44, the lever 40 may be rocked about its pivot 41 and the pull rod 44 caused to rock the bellcrank 30, to regulate the position of the band 28 relative to the drum 26. In this way it is obvious that the supply roll mounted on the shaft 20 may be held against rotation, or the rotation thereof regulated. As in the conventional machine a winding shaft 48 is mounted above the winding drums 16 to move upwardly as the web or the like is wound thereon, and the diameter of the roll thereof increases.

Suspended from the winding shaft 48 adjacent each end thereof, and moving vertically between the axes of the winding drums 16, are rack bars designated generally 50, each of which is provided with longitudinally spaced rack teeth 52, which extend along one side of each rack bar as will be readily understood upon reference to the drawings. Each rack bar is provided at its upper end with a horizontally split bearing designated generally 54 comprising a lower bearing seat 56 which is permanently fixed to its respective rack bar and has hinged thereto as at 58 an upper bearing seat 60 which when the device is in use embraces the shaft 48 to cause its respective rack bar 50 to move upwardly in unison with the shaft 48 as the roll being wound upon the winding shaft 48 increases in diameter. The upper bearing members 60 are releasably coupled to the lower bearing members 56 by means of any suitable quick releasing device 62.

Mounted for rotation in suitable journal bearings 64 carried by the side members 12 is a pinion shaft 66 which extends transversely of the machine in spaced parallel relation to the winding drums 16, and carries pinions 68 which mesh with the teeth 52 of the rack bars 50. The pinions 68 are of equal diameter and preferably accurately machined so that when the pinions are rotated in unison by the pinion shaft 66, the rack bars 50 will be moved in unison and the parallelism of the winding shaft 48 with the winding drums 16 will be maintained. The structure so far described is admirably suited to attain one of the major purposes of this invention, as it is obvious that when the winding shaft 48 is connected to the rack bars 50, the distance between both ends of the winding shaft and the winding drums will remain uniform, irrespective of varying thicknesses which may occur in the web being wound, so that a cylindrical roll of web or the like will be produced.

In order to control the density of the roll and the tension under which the convolutions of the web in the roll are subjected, the pinion shaft 66 is provided adjacent one end with a speed reducing gear train designated generally 70, which has driving connection with the pinion shaft 66 and is equipped with a hand wheel 72 by which the gear train, and consequently the shaft 66 may be rotated. It will thus be seen that by turning the hand wheel, the pinions 68 will be rotated to cause the rack bars 50 to be raised or lowered in unison, thus causing both ends of the winding shaft 48 to move relative to the winding drums 16 at a uniform rate of speed. Obviously, by holding the hand wheel 72 against rotation, elevation of the winding shaft 48 will be restrained, so that the tension on the convolutions of webbing or the like forming the roll will be varied. This is particularly useful when winding smoothly finished coated papers which may be of a slippery nature as the holding of the hand wheel will tend to increase the downward pressure of the winding shaft 48 on the winding drums 16.

In order to lock the winding shaft 48 at a predetermined distance above the winding drums 16, a suitable toothed wheel 74 is fixed to the pinion shaft 66, and pivotally supported on a suitable bracket 78 adjacent the toothed wheel 74 is a releasable latch member 80 to which is coupled one end of a pull rod 82. The opposite end of the pull rod is connected to an upwardly extending leg of a bellcrank 84 which is pivotally mounted as at 86 adjacent one end of the machine, and carried by the opposite leg of the bellcrank 84 is a treadle 88 by which pull may be exerted on the pull rod 82 to release the latch 80, when the treadle 88 is moved downwardly.

As will be readily understood upon reference to Figures 3, 4 and 5 the rack bars 50 are mounted to move vertically in suitable guide brackets 90 which are carried by opposite side rails 12, between the rollers 91 and on opposite sides of the rollers 93, so that the shaft 48 will be guided throughout its entire upward movement.

The machine is equipped with a conventional paper spreader 92 which is rockably supported on a shaft 94 which extends transversely of the machine between the side rails 12 adjacent the end in which the winding drums 16 are supported.

In the modified form of the invention illustrated in Figures 8, 9 and 10, the machine embodies spaced parallel side rails 12' in which conventional winding drums 16' are journaled to rotate in suitable bearings 14' about spaced horizontal axes. As illustrated, the winding drums 16' rotate about spaced horizontal axes, and a winding shaft 48' is mounted above the winding drums for rotation thereby, and vertical movement with relation thereto. Like the structure previously described, the shaft 48' has coupled

thereto by suitable detachable couplings 54' vertically extending rack bars 50' which correspond in all respects to the rack bars 50 previously described. A horizontally disposed pinion shaft 66' is journaled in the side members 12', and like the pinion shaft 66 previously described, the pinion shaft 66' carries longitudinally spaced pinions which mesh with the teeth of the rack bar 50' so that both rack bars 50' will be moved in unison and at the same rate of speed when the pinion shaft 66' is rotated. A suitable toothed wheel 74' is fixed to the pinion shaft 66', and pivotally supported on the side member 12 of the machine adjacent the toothed wheel 74' is a latch dog 80' which engages in the teeth of the wheel 74' to hold the pinion shaft 66' against rotation. A suitable hand actuated cam member 96 is pivotally supported on the side 12' of the machine adjacent the toothed wheel 74' and engages the latch dog 80' to disengage it from the toothed wheel 74' when the shaft 48' is to be raised or lowered.

Mounted on the shaft 66' adjacent the toothed wheel 74' is a sprocket 98 the purpose of which will more fully be hereinafter described. Mounted for rotation in a suitable bracket 100 carried by the side 12' of the machine adjacent the sprocket 98 is a stub or control shaft 102 carrying a drive sprocket 104 and a driving sprocket 106. The drive sprocket 104 has driving connection with the sprocket 98 through the medium of a conventional endless sprocket chain 108, so that when the shaft 102 is rotated, the pinion shaft 66' will be rotated in unison therewith. A bracket 110 extends outwardly from the frame member 12' carrying the bracket 100 and rotatably supported in the bracket 110 is a shaft 112 carrying an eccentrically mounted supporting disk 114. An eccentrically mounted peripherally toothed gear 116 is carried by the shaft 102 directly above the disk 114, and fixed to the shaft 112 in spaced relation to the disk 114 is a driven sprocket over which an endless drive chain 118 is trained. This drive chain 118 meshes with the teeth of the sprocket 106, so that when the shaft 102 is rotated, the shaft 112 will rotate in unison therewith, thus causing the disk 114, and the toothed wheel 116 to move in unison. A rack bar 120 rests on the disk 114 and the teeth thereof engage the teeth of the gear 116, so that as the rack bar 120 is reciprocated, the gear 116 will drive the shaft 102. Pivotally connected to the rack bar 120 as at 122 is a piston rod 124 which is coupled to a piston 126 which operates within a cylinder 128. This cylinder is supported on a suitable bracket 130 carried by the side frame 12' adjacent the sprocket 98, and leading into the cylinder 128 are feed pipes 132 and 134 through which fluid under pressure may be introduced into the cylinder 128. These feed pipes are connected through a suitable control valve to a source of fluid pressure, so that by moving the control valve in one position, fluid may be admitted into the cylinder through the pipe 132 to retract the piston rod 124 while fluid which has entered the cylinder 128 through the pipe 134 may be discharged through the pipe 134. Obviously, by alternating the direction of flow of the fluid, the piston 126 may be made to reciprocate within the cylinder, so as to impart motion to the rack bar 120 and cause the shaft 102 to be rotated by the eccentric pinion or gear 116. Obviously, as the rack bar 120 moves at a constant rate of speed, the speed of rotation of the shaft 102 will vary, so that the shaft 66' will be rotated at a varying speed and the movement of the rack bars 50' and the winding shaft 48' will vary, so as to produce a variation in the tension under which a web or the like is being wound. As a result, the roll produced by the machine may be made to vary in density according to the desires of the user.

In use it will be understood that the web or the like that is to be wound is led over suitable guider rolls in a conventional manner and thence upwardly over the winding drums 16 or 16' as the case may be. With the winding shaft 48 or 48' in its lowermost position, it will be evident that the web to be wound may be coiled thereabout, and by exerting rotary movement on the pinion shaft 66, the pressure with which the winding shaft 48 contacts the winding drums 16 may be increased as desired. As the winding takes place, and successive convolutions of the web are wound about the winding shaft 48 or 48' as the case may be, the pressure exerted by the winding shaft 48 or 48' on the winding drums 16 or 16' may be made to vary so that a tightly wound roll, or a loosely wound roll may result, according to the desires of the user. Moreover, by varying the pressure exerted by the winding shaft 48 on the winding drums, a roll which varies in density may be produced. Hence, if so desired, a roll having a tightly wound relatively hard inner portion or core, and a loosely wound peripheral portion forming a cushion may be produced. Obviously, by employing the control mechanism illustrated in Figures 8, 9 and 10, the variations in the roll may be mechanically governed and may be made progressively to increase or decrease according to the direction of rotation of the eccentric gear 116.

Owing to the fact that the winding shaft 48 or 48' is held at all times during the winding operation parallel to the winding drums 16 or 16', it is evident that in spite of uneven thickness of the web being wound, the resultant roll will be uniform in diameter, and cone-shaped rolls cannot result from the use of this invention.

Obviously, the machine may be equipped with any suitable attachment, such as a slitter by which the web may be severed longitudinally during the winding operation.

While in the foregoing there has been shown and described the preferred embodiment of this invention it is to be understood that minor changes in the details of construction, combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as claimed.

Having described the invention, what is claimed as new is:

1. In a winding machine of the type employed for winding a web into a roll, said machine including a winding shaft upon which a web is wound into a roll comprising successive superposed convolutions, said shaft being mounted to rotate about a horizontal axis and to move upwardly during the winding operation under the influence of the increase in the number of convolutions of the web as it is wound on said shaft, means for maintaining the winding shaft horizontal and governing the density of the roll produced by the machine comprising vertically movable rack bars suspended from the winding shaft and exerting downward tension thereon, pinions meshing with the rack bars, a speed reducing gear train connected to the pinions for rotating said pinions in unison and a hand wheel connected to the said gear train and regulating

the degree of tension exerted on the winding shaft by the rack bars.

2. In a winding machine of the type employed for winding a web into a roll, said machine including a winding shaft upon which a web is wound into a roll comprising successive superposed convolutions, said shaft being mounted to rotate about a horizontal axis and to move upwardly during the winding operation under the influence of the increase in the number of convolutions of the web as it is wound on said shaft, means for maintaining the winding shaft horizontal and governing the density of the roll produced by the machine comprising vertically movable rack bars suspended from the winding shaft and exerting downward tension thereon, rollers mounted for guiding said racks, pinions meshing with the rack bars and power actuated means connected to the pinions for rotating said pinions in unison at a variable speed and variably regulating the degree of tension that is exerted on the winding shaft by the rack bars.

3. In a winding machine of the type employed for winding a web into a roll, said machine including a winding shaft upon which a web is wound into a roll comprising successive superposed convolutions, said shaft being mounted to rotate about a horizontal axis and to move upwardly during the winding operation under the influence of the increase in the number of convolutions of the web as it is wound on said shaft, means for maintaining the winding shaft horizontal and governing the density of the roll produced by the machine comprising vertically movable rack bars suspended from the winding shaft and exerting downward tension thereon, rollers mounted for guiding said racks, pinions meshing with the rack bars and power actuated means connected to said pinions for rotating said pinions in unison at a progressively variable speed and progressively regulating the degree of tension that is exerted on the winding shaft by the rack bars.

4. In a winding machine of the type employed for winding a web into a roll, said machine including a winding shaft upon which a web is wound into a roll comprising successive superposed convolutions, said shaft being mounted to rotate about a horizontal axis and to move upwardly during the winding operation under the influence of the increase in the number of convolutions of the web as it is wound on said shaft, means for maintaining the winding shaft horizontal and governing the density of the roll produced by the machine comprising vertically movable rack bars suspended from the winding shaft and exerting downward tension thereon, pinions meshing with the rack bars and a pneumatic motor connected to the pinions for rotating said pinions in unison and regulating the degree of tension that is exerted on the winding shaft by the rack bars.

5. In a winding machine of the type employed for winding a web into a roll, said machine including a winding shaft upon which a web is wound into a roll comprising successive superposed convolutions, said shaft being mounted to rotate about a horizontal axis and to move upwardly during the winding operation under the influence of the increase in the number of convolutions of the web as it is wound on said shaft, means for maintaining the winding shaft horizontal and governing the density of the roll produced by the machine comprising vertically movable rack bars suspended from the winding shaft and exerting downward tension thereon, pinions meshing with the rack bars, a pneumatic motor mounted adjacent the machine, and variable speed means connected to and actuated by the motor, said variable speed means being connected to the pinions for rotating them in unison at a progressively varying speed and progressively varying the tension exerted on the winding shaft by the rack bars.

6. In a winding machine of the type employed for winding a web into a roll, said machine including a winding shaft upon which a web is wound into a roll comprising successive superposed convolutions, said shaft being mounted to rotate about a horizontal axis and to move upwardly during the winding operation under the influence of the increase in the number of convolutions of the web as it is wound on said shaft, means for maintaining the winding shaft horizontal and governing the density of the roll produced by the machine comprising vertically movable rack bars suspended from the winding shaft and exerting downward tension thereon, pinions meshing with the rack bars, a control shaft mounted on the machine adjacent the rack bars, means establishing driving connection between the control shaft and the pinions for rotating said pinions in unison and varying the tension of the rack bars on the winding shaft, and means connected to the control shaft for progressively varying the speed of rotation thereof.

7. In a winding machine of the type employed for winding a web into a roll, said machine including a winding shaft upon which a web is wound into a roll comprising successive superposed convolutions, said shaft being mounted to rotate about a horizontal axis and to move upwardly during the winding operation under the influence of the increase in the number of convolutions of the web as it is wound on said shaft, means for maintaining the winding shaft horizontal and governing the density of the roll produced by the machine comprising vertically movable rack bars suspended from the winding shaft and exerting downward tension thereon, pinions meshing with the rack bars, a control shaft mounted on the machine adjacent the rack bars, means establishing driving connection between the control shaft and the pinions for rotating said pinions in unison and varying the tension of the rack bars on the winding shaft, an eccentric gear mounted on and having driving connection with the control shaft for rotating said control shaft at a progressively varying speed to progressively vary the degree of tension exerted on the winding shaft by the rack bars, a rack meshing with the eccentric gear, and means connected to the rack for moving it and rotating said eccentric gear about the axis of the control shaft.

8. In a winding machine of the type employed for winding a web into a roll, said machine including a winding shaft upon which a web is wound into a roll comprising successive superposed convolutions, said shaft being mounted to rotate about a horizontal axis and to move upwardly during the winding operation under the influence of the increase in the number of convolutions of the web as it is wound on said shaft, means for maintaining the winding shaft horizontal and governing the density of the roll produced by the machine comprising vertically movable rack bars connected to said winding shaft a split bearing mounted on the upper end of said rack bars for connecting said winding shaft

to said rack bars for simultaneous movement, pinions meshing with the rack bars, means connected to the pinions for rotating said pinions in unison and regulating the degree of tension that is exerted on the winding shaft by the rack bars, and releasable means mounted on the machine adjacent the pinion rotating means for engaging the pinion rotating means and holding the pinions against rotation.

9. In a winding machine of the type employed for winding a web into a roll, said machine including a winding shaft upon which a web is wound into a roll comprising successive superposed convolutions, said shaft being mounted to rotate about a horizontal axis and to move upwardly during the winding operation under the influence of the increase in the number of convolutions of the web as it is wound on said shaft, means for maintaining the winding shaft horizontal and governing the density of the roll produced by the machine comprising vertically movable rack bars suspended from the winding shaft and exerting downward tension thereon, pinions meshing with the rack bars, a speed reducing gear train connected to the pinions for rotating said pinions in unison, a hand wheel connected to the said gear train and regulating the degree of tension exerted on the winding shaft by the rack bars, a cog wheel connected to the hand wheel and a releasable dog mounted on the machine adjacent the hand wheel for engaging the cog wheel and holding the pinions against rotation.

10. In a winding machine employed for winding a web, said machine being of the type which includes a pair of winding drums mounted to rotate about spaced parallel axes which lie in a common horizontal plane, a winding shaft mounted for vertical movement above and for rotation by said drums, means for regulating the density of the rolls of web and preserving parallelism between the winding drums and the winding shaft comprising spaced parallel rack bars suspended from the winding shaft and movable in vertical paths between the axes of the winding drums, pinions meshing with the rack bars, a pinion shaft connected to the pinions for causing said pinions to rotate in unison at the same peripheral speed, a speed reducing gear train carried by the machine and connected to said pinion shaft for rotating the pinions and a manually actuated hand wheel carried by the gear train and connected thereto for actuating said gear train and increasing or decreasing the pressure exerted by the winding shaft on the winding drums.

11. In a winding machine of the type employed for winding a web into a roll, said machine including a winding shaft upon which a web is wound into a roll comprising successive superposed convolutions, said shaft being mounted to rotate about a horizontal axis and to move upwardly during the winding operation under the influence of the increase in the number of convolutions of the web as it is wound on said shaft, means for maintaining the winding shaft horizontal and governing the density of the roll produced by the machine comprising vertically movable rack bars connected to said winding shaft, a split bearing mounted on the upper end of said rack bars for connecting said winding shaft to said rack bars for simultaneous movement, pinions meshing with said rack bars, means connected to said pinions for rotating said pinions in unison and regulating the degree of tension that is exerted on the winding shaft by the rack bars, and releasable means to arrest rotation of the pinions.

12. In a winding machine employed for winding a web, said machine being of the type which includes a pair of winding drums mounted to rotate about spaced parallel axes which lie in a common horizontal plane, a winding shaft mounted for vertical movement above and for rotation by said drums, means for regulating the density of the rolls of web and preserving parallelism between the winding drums and the winding shaft comprising spaced parallel rack bars releasably and positively connected to said winding shaft and movable in vertical paths between the axes of the winding drums, pinions meshing with the rack bars and interconnected to rotate in unison at the same peripheral speed, and releasable means to arrest rotation of the pinions.

CARL O. BACHMAN.

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