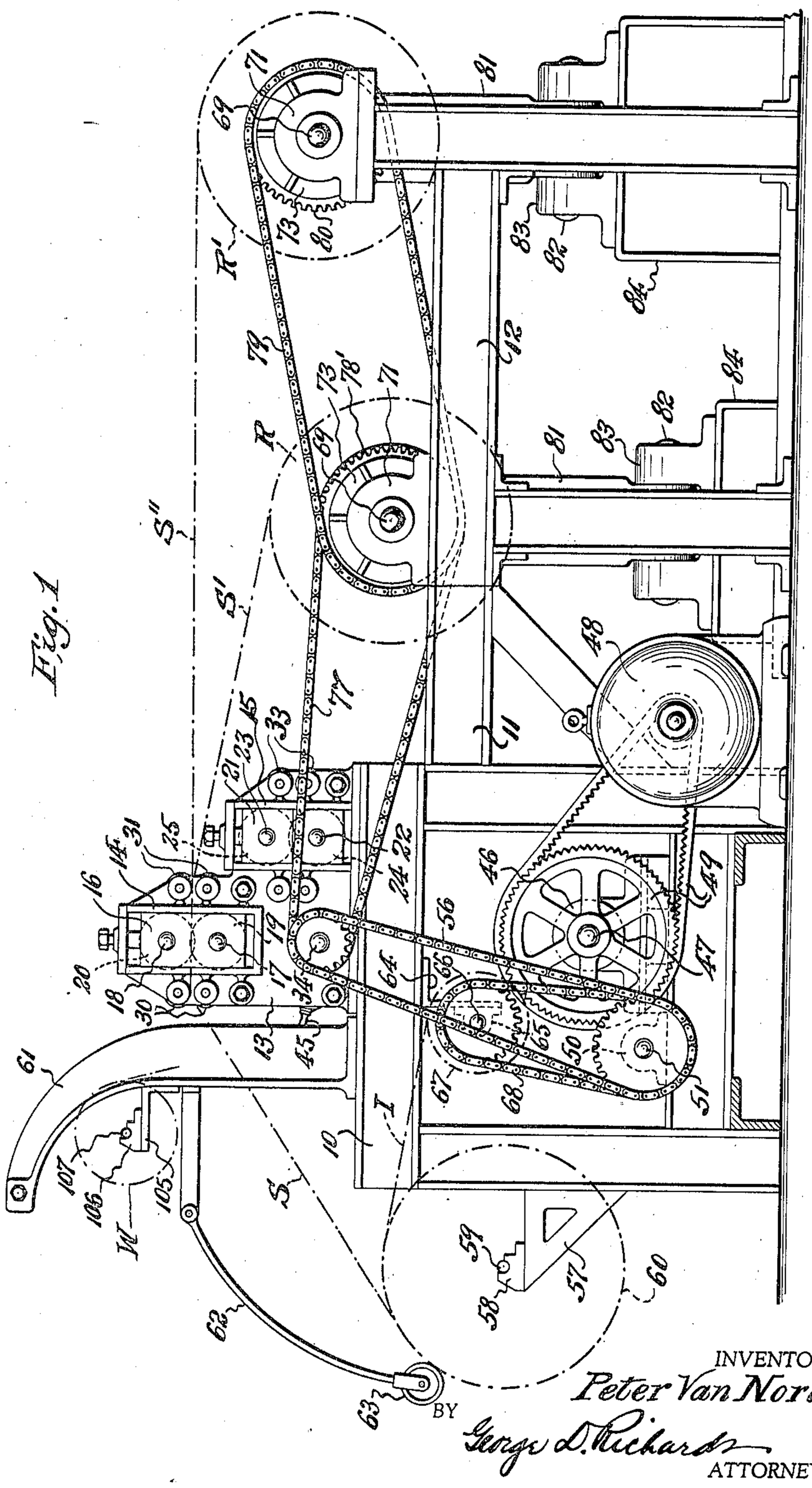
March 7, 1944. P. VAN NORDE 2,343,720

SHEET MATERIAL SLITTING AND WINDING MACHINE

Filed Feb. 2, 1943 5 Sheets-Sheet 1



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SHEET MATERIAL SLITTING AND WINDING MACHINE

Filed Feb. 2, 1943 5 Sheets-Sheet 2

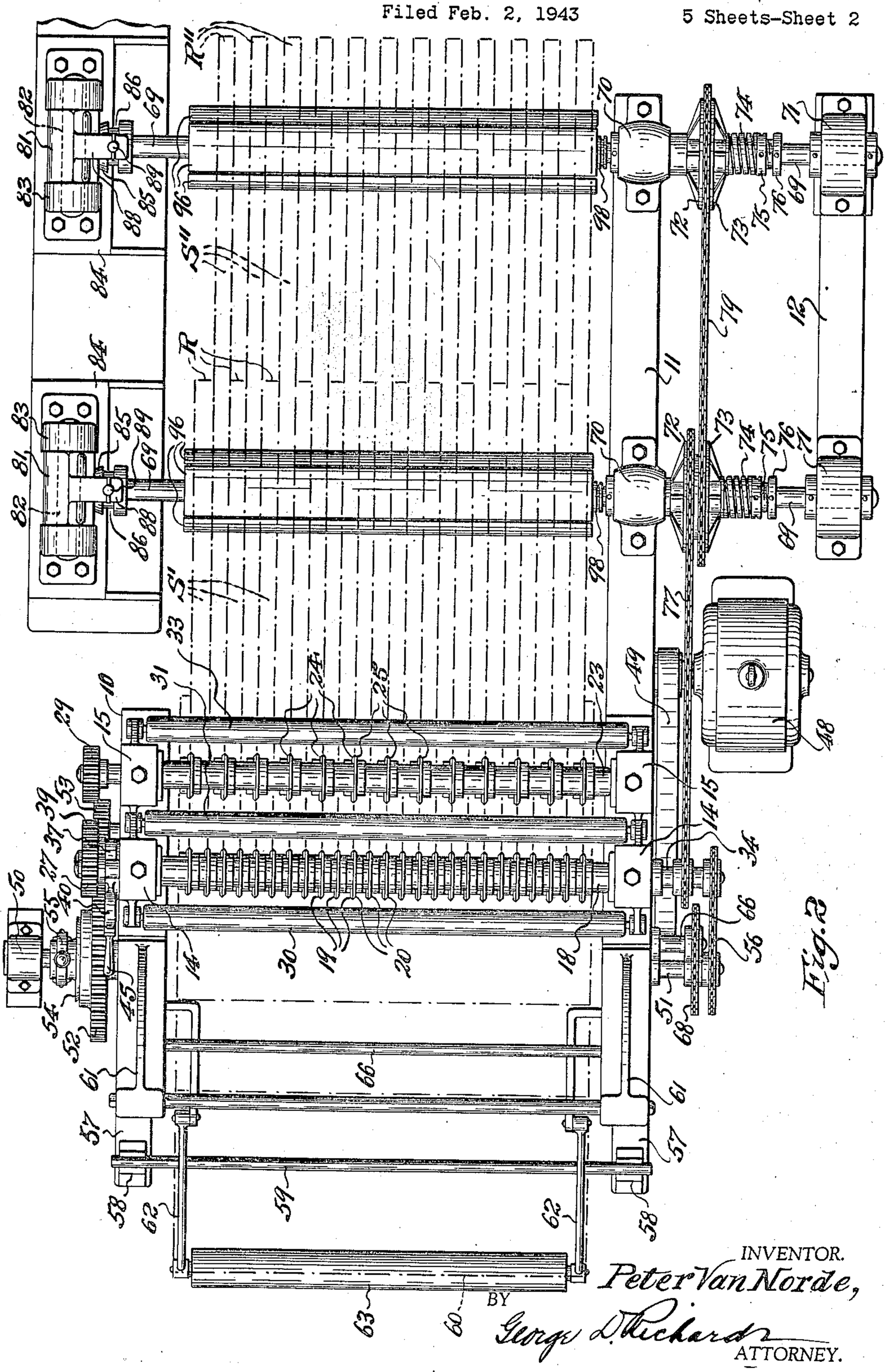

Fig. 2

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SHEET MATERIAL SLITTING AND WINDING MACHINE

Filed Feb. 2, 1943 5 Sheets-Sheet 3

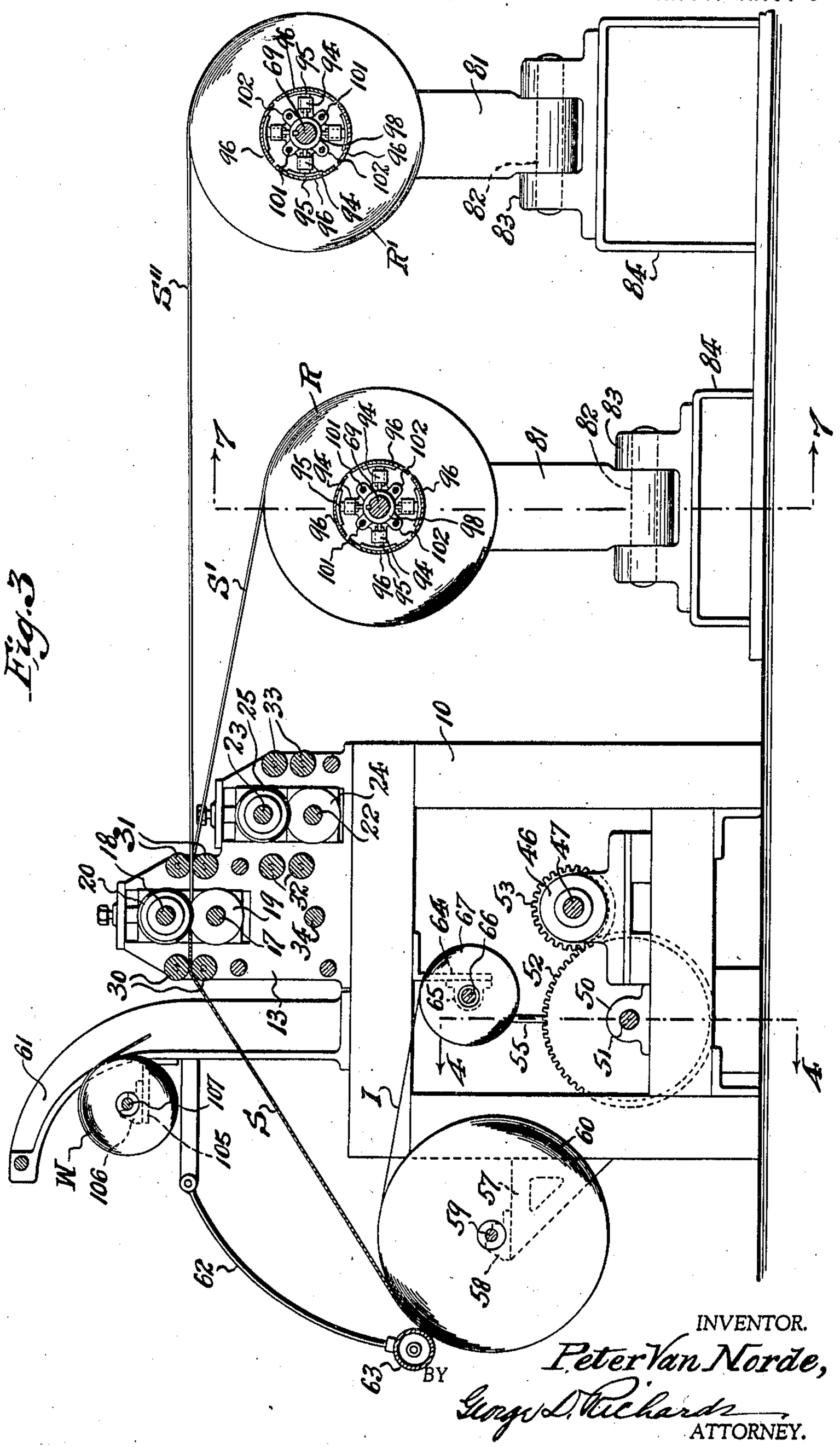

Fig. 3

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SHEET MATERIAL SLITTING AND WINDING MACHINE

Filed Feb. 2, 1943 5 Sheets-Sheet 4

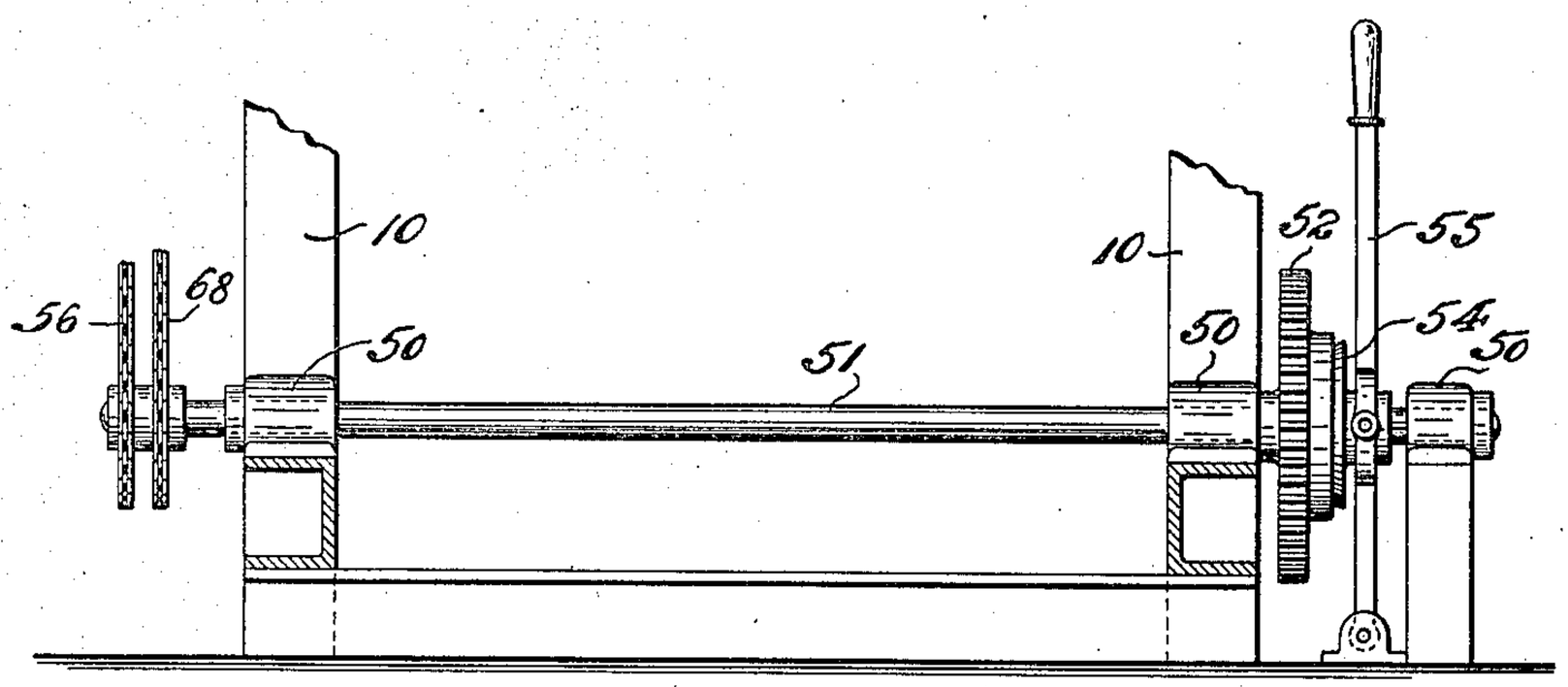

Fig. 4

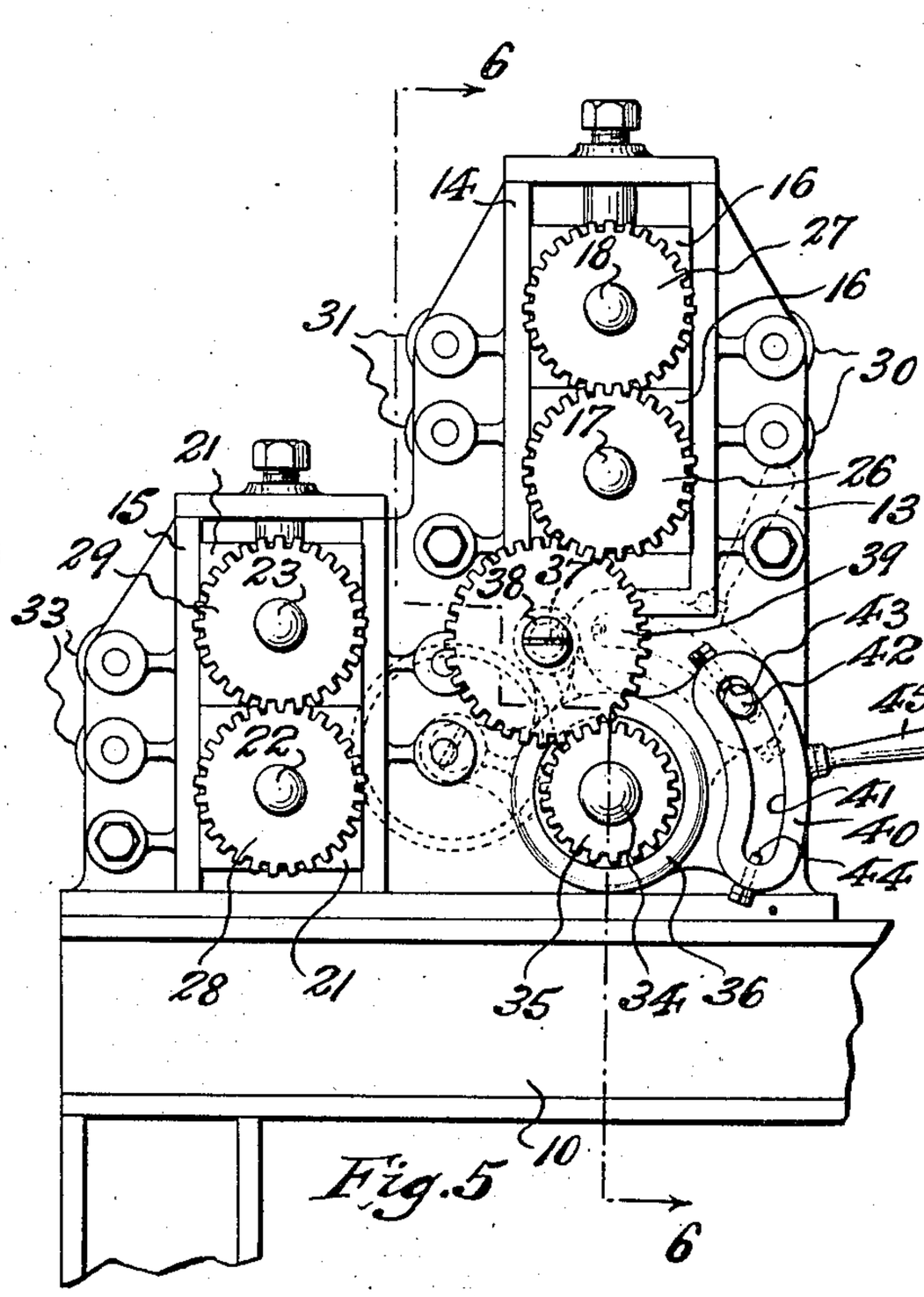

Fig. 5

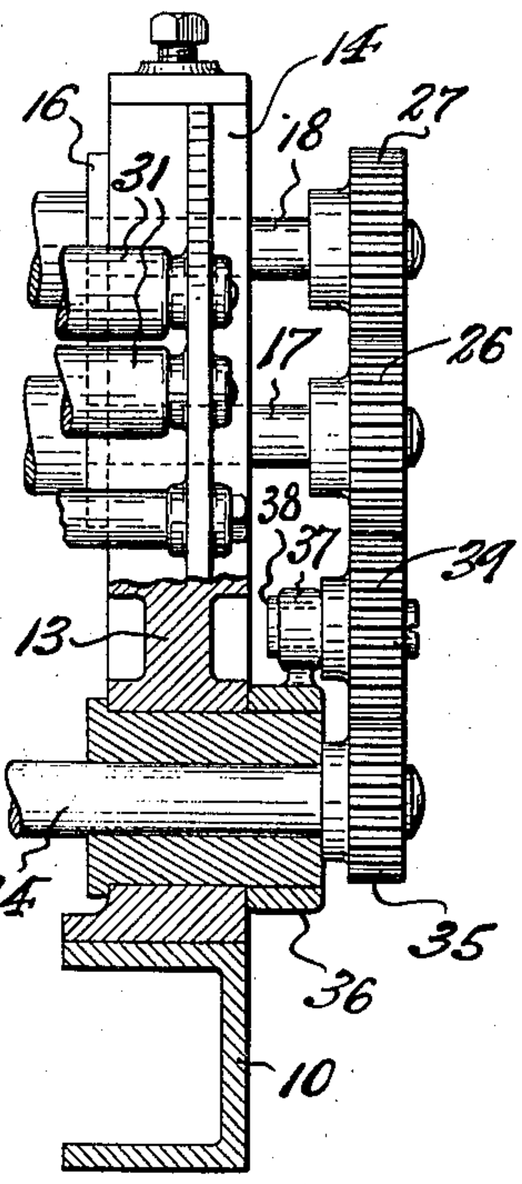

Fig. 6

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SHEET MATERIAL SLITTING AND WINDING MACHINE

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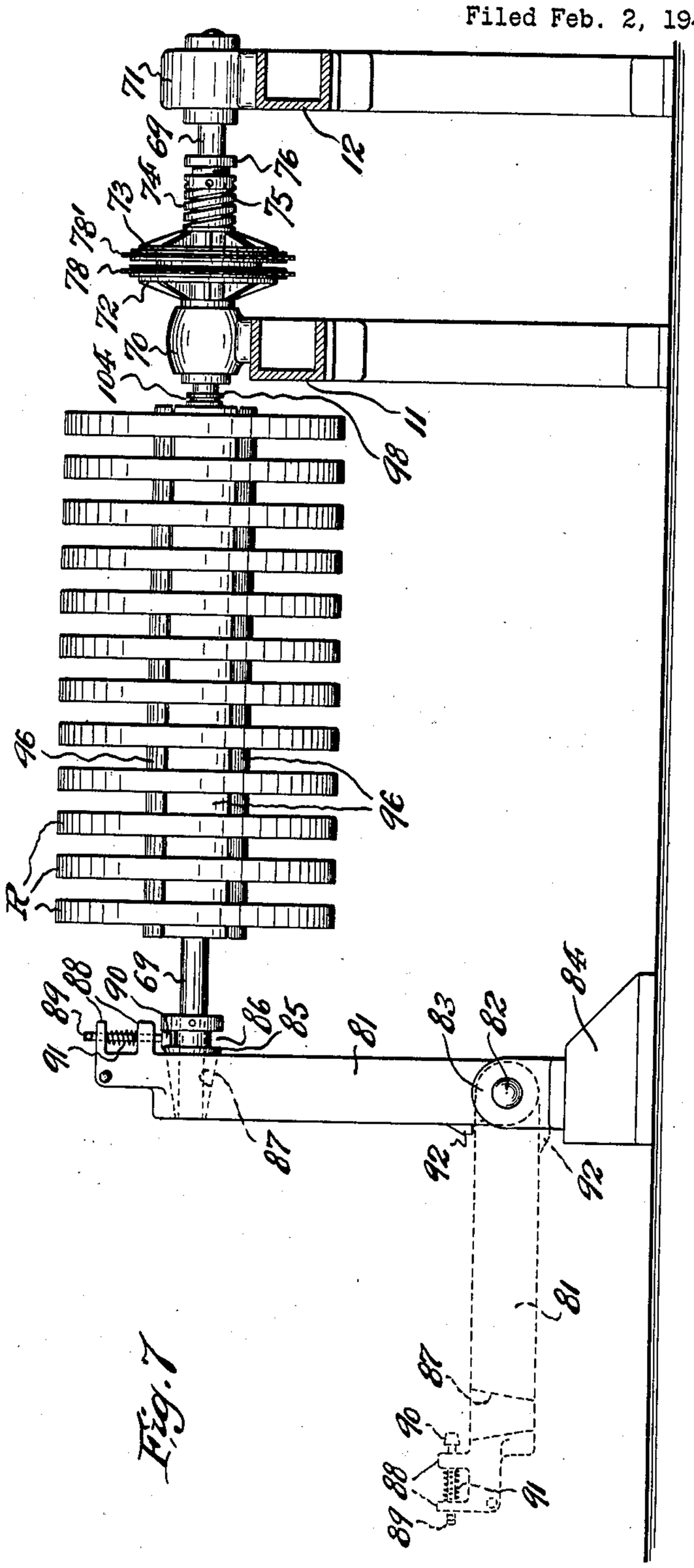

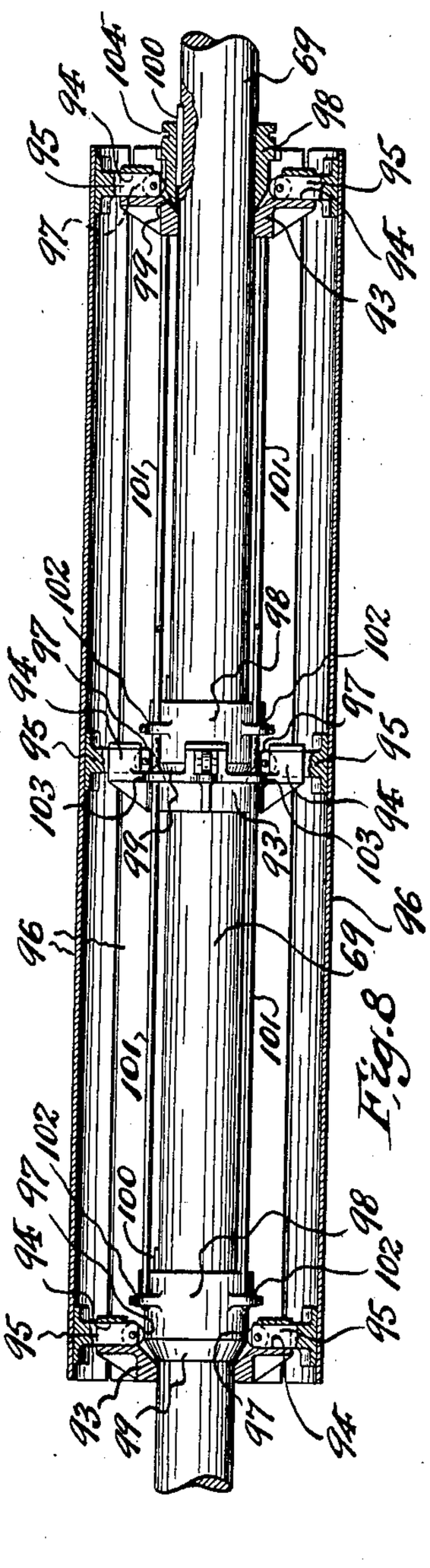

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Patented Mar. 7, 1944 2,343,720

UNITED STATES PATENT OFFICE

2,343,720

SHEET MATERIAL SLITTING AND WINDING MACHINE

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Application February 2, 1943, Serial No. 474,431

6 Claims. (Cl. 164—65)

This invention relates to improvements in sheet material slitting and winding machinery.

The invention has for an object to provide a simple and efficient power driven slitting mechanism and cooperating winding mandrels to receive and form the slit sheet material into rolls for convenient handling, transportation and dispensing for use.

Another object of the invention is to provide a novel construction of slitting head having a plurality of sets of cutting rolls respectively arranged to produce different strip widths; means being provided for shifting operating power transmission from one said set to another at will, according to a selected strip width desired to be produced.

The invention has for a further object to provide a novel construction of strip winding mechanism and self-compensating power transmission means therefor; said winding mechanism including novel contractable mandrel structures having supporting spindles, and displaceably releasable bearing supports for the free ends of said spindles, whereby said supports may be quickly released and displaced from the spindle ends, so as to free the latter and the mandrels from obstruction thereby, and thus permit quick and easy endwise removal of completed wound strip rolls from the mandrels.

Other objects of this invention, not at this time more particularly enumerated, will be understood from the following detailed description of the same.

An illustrative embodiment of this invention is shown in the accompanying drawings, in which:

Fig. 1 is a side elevational view of a sheet material slitting and winding machine according to this invention; the sheet materials being indicated by broken lines; Fig. 2 is a plan view of the machine, the sheet materials being likewise indicated by broken lines in this view; Fig. 3 is a central longitudinal vertical section through the machine, the sheet materials being shown in full line representation; and Fig. 4 is a fragmentary transverse sectional view, taken on line 4—4 in Fig. 3, and showing the clutch shaft of the machine.

Fig. 5 is a side elevational view or the slitting head of the machine, including its power transmission shift means, this view being drawn on an enlarged scale; and Fig. 6 is a fragmentary view of said slitting head in part section and in part elevation, taken on line 6—6 in Fig. 5.

Fig. 7 is a transverse sectional view, taken on line 7—7 in Fig. 3, and showing a winding mandrel and its spindle bearing supports in elevation.

Fig. 8 is a longitudinal sectional view, on an enlarged scale, of a winding mandrel, internal parts being shown in both section and elevation.

Similar characters of reference are employed in the above described views to indicate corresponding parts.

Referring to the drawings, the reference character 10 indicates the main framework of the machine, the same including, at one side, an extension framework 11 and an outwardly spaced parallel cooperating framework 12 for supporting the spindles of the winding mechanism of the machine.

Supported on and across the top of the main framework 10 is the slitting head of the machine. This slitting head includes side standards 13 shaped to provide upper rearward bearing housings 14 and lower forward bearing housings 15. Supported in the housings 14 are the bearings 16 for journaling an upper set of cutting rolls formed by shafts 17 and 18 upon which are respectively affixed the hubs of cooperating circular slitting knives 19 and 20. In like manner, supported in the housings 15 are the bearings 21 for journaling a lower set of cutting rolls formed by shafts 22 and 23 upon which are respectively affixed the hubs of cooperating circular slitting knives 24 and 25. The pairs of slitting knives 19—20 of the upper set of cutting rolls are suitably relatively spaced to slit sheet material passed therebetween into strips of one selected width, while the pairs of slitting knives 24—25 of the lower set of cutting rolls are suitably relatively spaced to slit sheet material passed therebetween into strips of another selected width. The shafts 17—18 of the upper cutting rolls are provided with intermeshing gears 26 and 27, whereby the same are operatively rotated in opposite directions; and, in like manner, the shafts 22 and 23 of the lower cutting rolls are provided with intermeshing gears 28 and 29.

Journaled in and between the side standards 13, for cooperation with the upper set of cutting rolls, is a rearward pair of vertically aligned guide rollers 30 and a forward pair of like vertically aligned guide rollers 31. Also journaled in and between the side standards 13, for cooperation with the lower set of cutting rolls, is a rearward pair of vertically aligned guide rollers 32 and a forward pair of vertically aligned guide rollers 33.

Journaled in and between the side standards 13, below the upper set of cutting rolls and rearwardly of the lower set of cutting rolls, is a power transmission shaft 34 having a drive gear 35 fixed thereon. Manipulatable power transmission shift means is provided for optionally transmitting the power of said transmission shaft to one or the other of said cutting roll sets. Said shift means comprises a bracket 36 mounted to pivotally swing about the axis of said transmission shaft 34, said bracket having a radial arm 37 for the support of a bearing stud 38 upon which is rotatably mounted an idler gear 39 adapted to run in continuous mesh with said drive gear 35. Said bracket 36 is further provided with a slotted extension 40, the slot 41 of which is concentric to the center of pivotal movement of the bracket. Affixed to the adjacent side standard 13 is a stop stud 42 which extends into said slot 41. Carried by the extension 40, respectively for entrance into opposite ends of the slot 41, are adjustable stop screws 43 and 44 which, by engagement with the stop stud 42, limit the swinging movement of the bracket in each direction to that which is sufficient to carry its idler gear 39 into proper meshing engagement with the gearing of the upper or lower cutting roll sets, as the case may be. Affixed to and extending from said bracket extension is a handle member 45 by which the transmission shift means may be manipulated.

Journaled in and between bearings 46 supported in connection with lower parts of the main framework 10 is a power shaft 47, the same being continuously driven from a suitable power source, such, e. g., as an electric motor 48, by suitable transmission means, such, e. g., as the chain belt and pulley means 49.

Also journaled in and between bearings 50, with which the machine framework is provided, is a counter or clutch shaft 51, upon which is rotatably mounted a clutch gear 52 driven from the power shaft 47 by a drive gear 53. Keyed to said counter or clutch shaft 51 is a shiftable clutch means 54 subject to the control of the shift lever 55 (see Figs. 2 and 4).

Power is transmitted from the counter or clutch shaft 51 to the transmission shaft 34 of the slitting head by a sprocket and chain drive 56, or the like.

Affixed to the framework 10, at the rearward end thereof, are transversely aligned bracket extensions 57 carrying open bearings 58. Supported by and extending between said bearings 58 is a shaft 59 adapted to receive and rotatably support a supply roll 60 of the sheet material S to be slit.

Connected with the framework 10, to upstand therefrom adjacent the rearward end thereof, are standards 61. Supported from said standards 61 are pivotally mounted arms 62, to and between the free end portions of which is journaled a drag or momentum brake or roller 63, adapted to bear on said material supply roll 60 so as to prevent over-running thereof when the material is drawn therefrom.

In some cases the supply roll 60 of sheet material S is provided with an interleaf or protective sheet I intermediate and so as to separate its convolutions one from another. Means is provided for separating such interleaf or protective sheet I from the material S as the latter issues from the supply roll 60, and thereupon take up or wind the same into a separate roll. To this end, the framework 10 is provided with suitably disposed brackets 64 provided with bearings 65 to journal a winding shaft 66, by and upon which said interleaf or protective sheet I may be wound into a separate roll 67. Said winding shaft 66 is adapted to be driven from the counter or clutch shaft 51 by a sprocket and chain drive 68.

Forwardly positioned beyond the slitting head are a plurality of slit material or strip winding means, the same being relatively spaced both in vertical and horizontal plane, so that selected strips S' of slit material issuing from the slitting head are led to one winding means whereby to be wound thereby into laterally separated individual rolls R, while alternate strips S'' of said slit material are led to another winding means so as to be wound thereby into laterally separated individual rolls R'.

Each winding means comprises a spindle 69 rotatably supported by one end portion in spaced bearings 70 and 71 respectively mounted on the framework extensions 11 and 12, whereby the spindle 69 extends transversely across the paths of the strips S' and S'' issuing from the slitting head. Each spindle 69 is driven by a self-compensating frictional drive comprising a friction clutch plate 72 fast thereon, and thrust friction clutch plate 73 keyed to the spindle so as to rotate therewith but free for axial movement thereon toward the fixed clutch plate 72 under the tensional thrust of a compression spring 74. The spring 74 is footed on a thrust collar 75 adjustably threaded onto a threaded bushing 76 which is fast on the spindle, whereby the thrust collar 75 may be advanced or retracted so as to adjust or regulate the thrusting tension of the spring 74. One spindle is driven from the transmission shaft 34 by a sprocket and chain drive 77 including a double sprocket 78—78' rotatably mounted on said spindle between the fixed clutch plate 72 and the movable or thrust clutch plate 73, the sprocket and chain drive 77 engaging the sprocket portion 78. The other spindle is driven from the sprocket portion 78' by a chain and sprocket drive 79, the driven sprocket 80 of which is rotatably mounted on said spindle between its fixed clutch plate 72 and its movable or thrust clutch plate 73.

The free end of each spindle 69 is normally suported by a displaceably releasable bearing support. Each said support comprises a bearing standard 81, the lower end of which is pivotally connected by a cross or fulcrum pin 82 to a hinging knuckle 83 which is affixed to a stationary base frame 84. Said bearing standard is thus hingedly arranged to swing toward and from the free end portion of a spindle 69 to be supported thereby. Affixed to the free end of said spindle 69 is a conical bushing 85, provided in its inner end portion with an annular latch receiving channel 86. Formed in the upper free end portion of the bearing standard 81 is a conical bearing seat 87 adapted to receive and fit said bushing 85 when the bearing standard 81 is upswung to its normally erect spindle supporting position. The upper free end portion of the bearing standard 81 is further provided with a manipulatable latch means for releasably retaining the same in spindle supporting position. This latch means may be variously formed, but illustratively, as shown, comprises a pair of spaced lugs 88 projecting inwardly from the bearing standard in overhanging relation to the inner end portion of said conical bushing 85 which is fixed on the

spindle end. Slidably supported through said lugs 88 is the stem 89 of a latch piece 90. Spring means 91 yieldably thrusts said stem and latch piece downwardly, so that the latter enters the annular channel 86 of said bushing 85, whereby to retain said bearing standard in erected spindle supporting position, but subject to release by upward retraction of said stem and latch piece against the thrust of the spring 91. When a bearing standard 81 is released from the restraint of said latch means, the same may be swung outwardly and downwardly away from the spindle end portion, whereby to leave the latter free so that completed strip rolls R or R', as the case may be, can be moved axially over and off of the spindle end, and thus be dismounted from the winding mechanism. The released down swung position of a bearing standard 81 may be determined by a stop nosing 92, suitably formed and located thereon, which is adapted to abut its hinging knuckle 83, when the bearing standard is down-swung.

Each spindle is provided with a winding mandrel upon which the strips S' and S'' are respectively wound into rolls R and R'. The winding mandrel is so constructed as to be diametrically contractible, whereby to facilitate removal of the wound rolls therefrom. To this end, each winding mandrel comprises a plurality of longitudinally spaced spiders 93 affixed to a spindle 69, each said spider having a series of circumferentially spaced, radially projecting slideway boxes 94. Slidably supported in longitudinally aligned boxes are carrier legs 95 which support the segmental peripheral sections 96 by which the circumferential surface of the mandrel is formed. Each leg 95 is provided at its inner end with an anti-friction roller 97. Cooperative with each spider 93 is a mandrel expander collar 98 having an annular wedge-shaped or conical forward end portion 99. These expander collars 98 are slidable on the spindle 69 but are keyed thereto, so as to rotate therewith, by keys 100. The several expander collars 98 are interconnected for common forward and backward sliding movement on the spindle 69; the connecting means comprising link rods 101 which extend through and are affixed to radial ears 102 with which the expander collars are provided. Said link rods are preferably further supported by a sliding engagement thereof through perforate radial guide lugs 103 with which the spiders 93 are provided. An end expander collar 98, exposed at an end of the mandrel structure, is accessible for manipulation, whereby to longitudinally shift the linked group of said expander collars toward the spiders 93 to expand the mandrel, or away from said spiders to contract the mandrel. Said end expander collar may be suitably shaped, as, e. g., by provision of an annular channel or groove 104 therein, to receive application of a suitable manipulating tool for applying shifting force in desired direction. When the group of expander collars 98 are moved from right to left (as viewed in Fig. 8), the wedge or conical end portions 99 thereof will ride against the rollers 97 of the legs 95 so as to slide the latter outwardly until said rollers ride onto the normal periphery of said expander collars. The outward movement of the legs 95 radially project the segmental peripheral sections 96 so as to expand the mandrel to normal maximum operative diameter; which condition is maintained during strip winding operation thereof. When said strip winding operation has been completed, and the machine is stopped, the expander collars 98 are retracted, thus permitting the legs 95 to slide inwardly in their spider guide boxes, thus retracting the segmental peripheral sections 96 so as to contract the mandrel diametrically, whereby to loosen the same from strip rolls wound thereon, and thus facilitate endwise withdrawal and removal of said rolls therefrom.

In the operation of the machine, the sheet material S may be optionally slit into strips of desired selective width by passing the same between one or the other of the pairs of slitting rolls. As shown, the upper rearward set of slitting rolls has its pairs of slitting knives 19—20 spaced to produce a comparatively narrow strip, while the lower forward set of slitting rolls has its pairs of slitting knives 24—25 spaced to produce a comparatively broad strip. If it is desired to use the upper rearward set of slitting rolls, the shift bracket means 36—37 is swung in direction to bring the idler gear 39 into mesh with the gearing 26—27 of the slitting knives 19—20 (as shown by full lines in Fig. 5), thus driving the latter from the drive gear 35 of the driven transmission shaft 34. If, on the other hand, it is desired to use the lower forward set of slitting rolls, the shift bracket means 36—37—40 is swung in direction to bring the idler gear 39 into mesh with the gearing 28—29 of the slitting knives 24—25 (as shown by dotted lines in Fig. 5), thus disconnecting the rearward upper set of slitting rolls and driving the lower set of slitting rolls from the drive gear 35 of the driven transmission shaft 34.

As shown, the material S is led from the supply roll 60 to pass between and be operated upon by the upper rearward set of slitting rolls. The material is passed between the guide rollers 30, thence between the slitting knives 19—20, and thence between the guide rollers 31. Certain strips S' issuing from the slitting knives 19—20 are led to the first winding mandrel and suitably secured thereto, while alternate strips S'' are led to the second winding mandrel and suitably secured thereto. The material S being thus operatively related to the slitting and winding mechanisms, the clutch 52—54 is engaged so as to transmit power to said mechanisms. As the mandrels are revolved the material S will be drawn from the supply roll 60 and passed through the slitting knives 19—20 to produce the strips S' and S'' which will thereupon be respectively wound onto the respective mandrels so as to form the spaced apart rolls R and R' thereof. If the supply roll 60 includes an interleaf or protective sheet I, the same is led to the driven winding shaft 66, so as to be separated from the web of sheet material S, and then wound into a separate roll 67.

As the strips S' and S'' are wound on the mandrels and the rolls R and R' formed therefrom increase in diameter, the pull tension of the material, which tends to increase with the increase of roll diameter, will be equalized or automatically compensated by reason of the friction drive between the spindle clutch plates 72 and 73 and the intermediate sprockets 78—78' or 80 which will permit a tension compensating slippage of the latter relative to the former, and consequently undue tension upon or too rapid movement of the material and strips will be automatically prevented.

After the rolls R and R' are wound to desired size, provision is made for applying a peripheral

cover or wrapper thereon, if desired. To this end, the standards 61 are provided with suitably located brackets 105 to support open bearings 106 in and between which is journaled a shaft 107 provided to carry a roll of wrapper material W. If it is desired to wrap the formed rolls R and R', the machine is temporarily stopped, and the leading end of the wrapper material W is superposed and suitably fastened to the material S, as by an adhesive, adhesive tape, or other suitable fastening, after which the material S is severed behind the point to which said wrapper material is thus attached. This having been done, the machine is again operated whereby to draw the wrapper material through the slitting rolls, and the resultant strip thereof to and around the respective rolls R and R' so as to encircle the same, and thereafter the machine is again stopped whereupon the wrapper strips are severed, and the trailing ends thereof lapped and secured to the applied wrapper body, as by an adhesive, adhesive tape or other suitable fastening means.

The rolls R and R' being thus produced, the same may be quickly removed from the machine, by releasing an displacing the spindle bearing supports 81, to free the ends of the spindles 69 from obstruction thereby, and thereupon contracting the mandrels to loosen the same from the rolls R and R', so that the latter can then be slid endwise off of the same, and thence off of the spindle ends.

It will be understood that various changes and apparently widely different embodiments of this invention could be made without departing from the scope thereof as defined in the following claims. It is therefore intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A sheet material slitting and winding mechanism comprising a slitting head having cutting rolls to slit sheet material into a multiplicity of strips, means to rotatably support a supply roll of sheet material for delivery to said cutting rolls, an interleaf winding means to separate, receive and wind interleaf material from the sheet material issuing from said supply roll, a clutch controlled power transmission shaft, transmission means actuated by said shaft for operating said interleaf winding means, additional transmission means actuated by said shaft for operating said cutting rolls, a plurality of diametrically contractable winding mandrels beyond said slitting head disposed in vertically and horizontally spaced plane relation, whereby alternate strips issuing from the cutting rolls are divergently separated and respectively led to and wound by and upon said respective mandrels, and transmission means for each mandrel likewise deriving power from said clutch controlled shaft, each mandrel transmission means including compensating frictional slip clutch means.

2. A sheet material slitting and winding mechanism comprising a slitting head having cutting rolls to slit sheet material into a multiplicity of strips, means to rotatably support a supply roll of sheet material for delivery to said cutting rolls, an interleaf winding means to separate, receive and wind interleaf material from the sheet material issuing from said supply roll, a clutch controlled power transmission shaft, transmission means actuated by said shaft for operating said interleaf winding means, additional transmission means actuated by said shaft for operating said cutting rolls, a plurality of diametrically contractable winding mandrels beyond said slitting head disposed in vertically and horizontally spaced plane relation, whereby alternate strips issuing from the cutting rolls are divergently separated and respectively led to and wound by and upon said respective mandrels, a spindle to carry each mandrel, means to rotatably support one end of each spindle, a releasably displaceable bearing support to normally journal the opposite free end of each spindle, and transmission means for each spindle likewise deriving power from said clutch controlled shaft, each spindle transmission means including compensating frictional slip clutch means.

3. In a sheet material slitting and winding mechanism, a slitting head having a plurality of sets of optionally usable cutting rolls disposed in vertically and horizontally spaced plane relation, the slitting knives of which are respectively spaced to produce different strip widths, each cutting roll set having actuating gearing, a power transmission shaft and drive gear common to both cutting roll sets, and manipulatable power transmission shift means having an idler gear in continuous mesh with said drive gear, said shift means being movable to operatively engage its idler gear with the actuating gearing of a selected cutting roll set for transmission of operating power thereto.

4. In a sheet material slitting and winding mechanism, a slitting head having a plurality of sets of optionally usable cutting rolls disposed in vertically and horizontally spaced plane relation, the slitting knives of which are respectively spaced to produce different strip widths, each cutting roll set having actuating gearing, a power transmission shaft and drive gear common to both cutting roll sets, manipulatable power transmission shift means having an idler gear in continuous mesh with said drive gear, said shift means being movable to operatively engage its idler gear with the actuating gearing of a selected cutting roll set for transmission of operating power thereto, and pairs of sheet material guide rollers mounted respectively adjacent the sheet material receiving and discharging sides of each cutting roll set.

5. In a sheet material slitting and winding mechanism, a slitting head having a plurality of sets of optionally usable cutting rolls disposed in vertically and horizontally spaced plane relation, the slitting knives of which are respectively spaced to produce different strip widths, each cutting roll set having actuating gearing, a power transmission shaft and drive gear common to both cutting roll sets, manipulatable power transmission shift means pivoted to turn about the axis of said transmission shaft, said shift means having an idler gear in continuous mesh with said drive gear, said shift means being movable to operatively engage its idler gear with the actuating gearing of a selected cutting roll set for transmission of operating power thereto, and adjustable means to limit shifting movements of said shift means.

6. In a sheet material slitting and winding mechanism, a slitting head having a plurality of sets of optionally usable cutting rolls disposed in vertically and horizontally spaced plane relation, the slitting knives of which are respectively spaced to produce different strip widths, each cutting roll set having actuating gearing, a power transmission shaft and drive gear common to

both cutting roll sets, manipulatable power transmission shift means pivoted to turn about the axis of said transmission shaft, said shift means having an idler gear in continuous mesh with said drive gear, said shift means being movable to operatively engage its idler gear with the actuating gearing of a selected cutting roll set for transmission of operating power thereto, adjustable means to limit shifting movements of said shift means, and pairs of sheet material guide rollers mounted respectively adjacent the sheet material receiving and discharging sides of each cutting roll set.

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