April 21, 1953 J. O. BURMAN, JR 2,635,822

RIBBON WINDING MACHINE

Filed Jan. 12, 1949 4 Sheets-Sheet 1

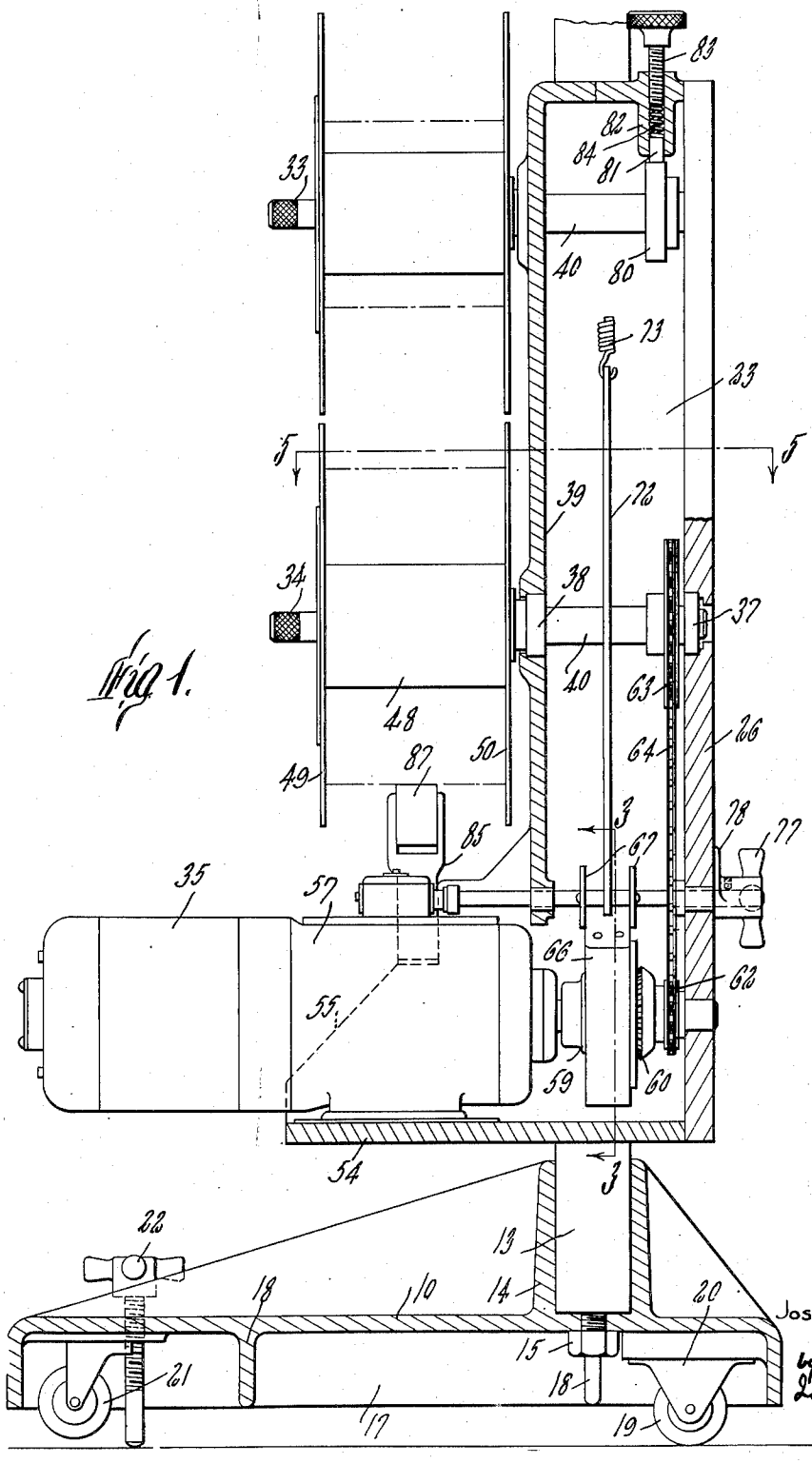


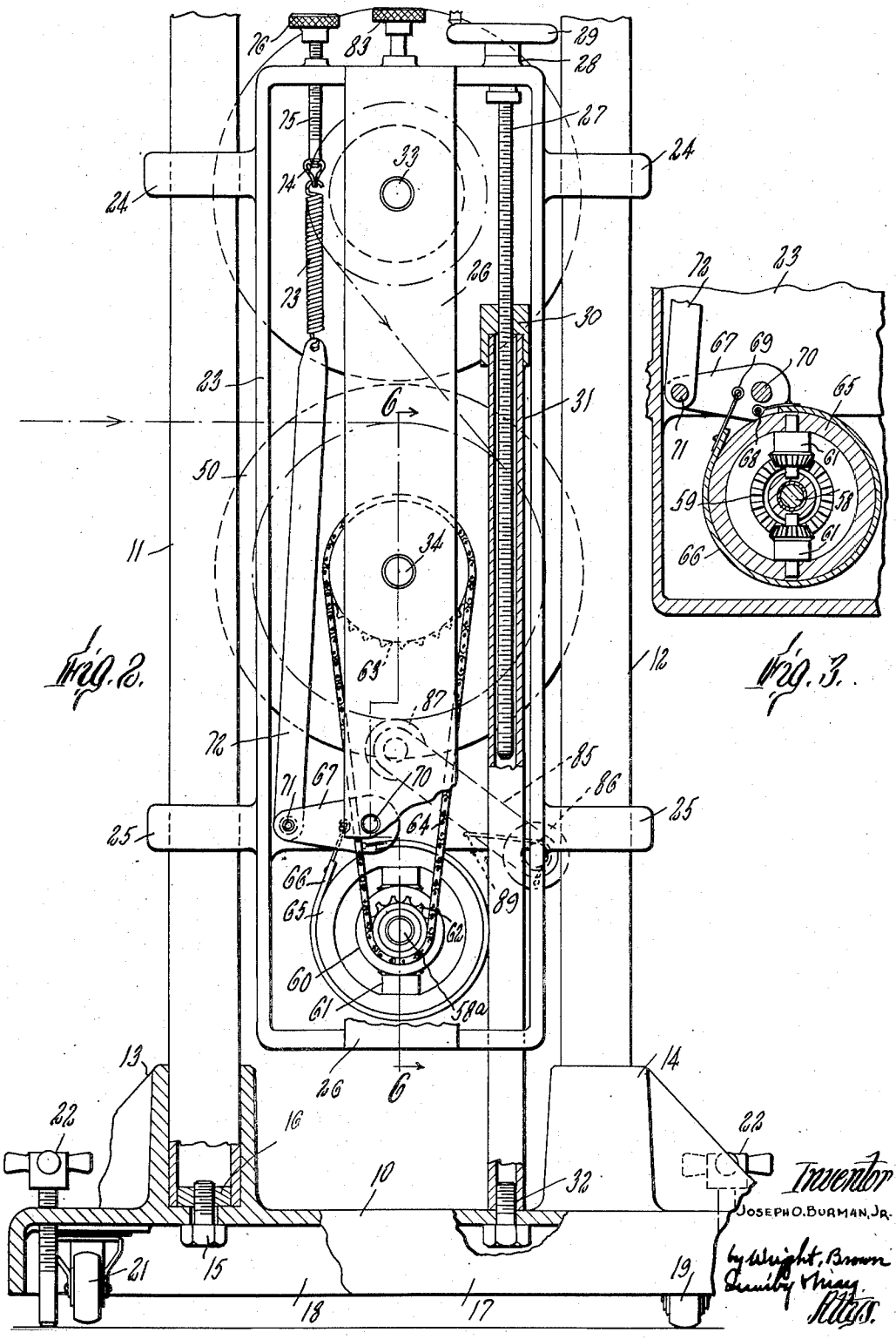
Fig. 1.

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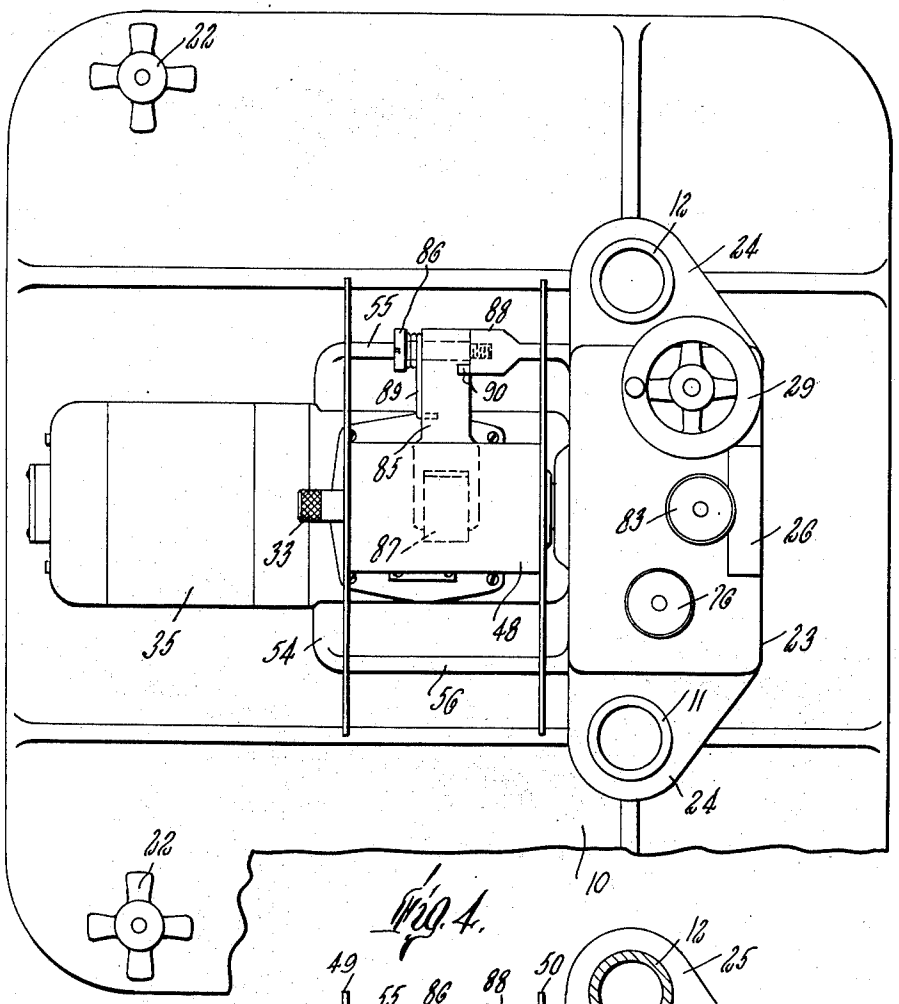


Fig. 4.

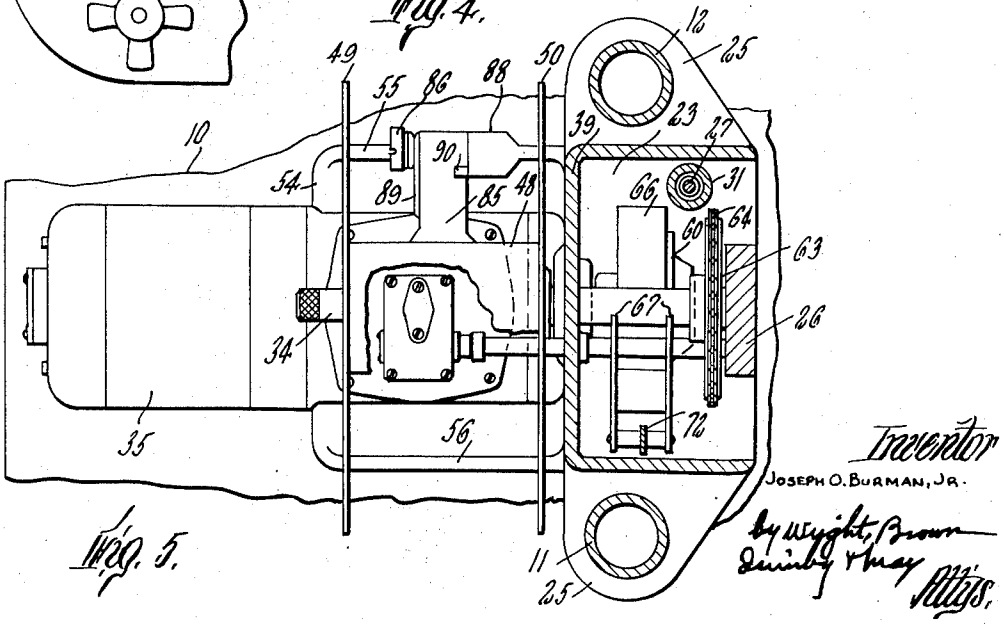


Fig. 5.

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RIBBON WINDING MACHINE

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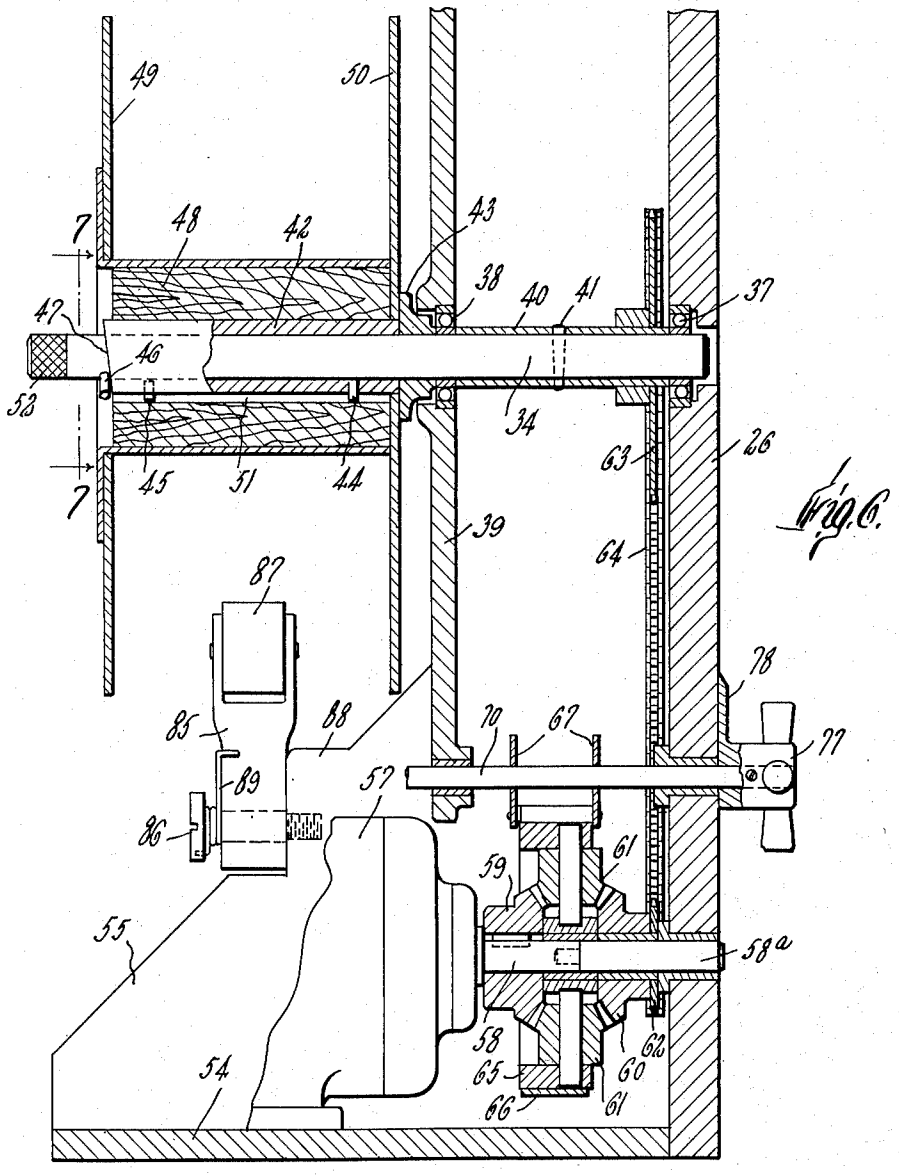


Fig. 6.

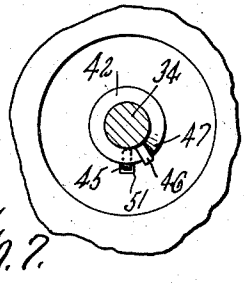


Fig. 7.

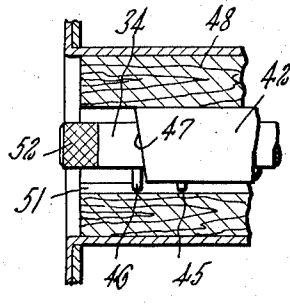


Fig. 8.

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Patented Apr. 21, 1953 2,635,822

UNITED STATES PATENT OFFICE

2,635,822

RIBBON WINDING MACHINE

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Application January 12, 1949, Serial No. 70,551

3 Claims. (Cl. 242—55)

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The present invention is concerned with a machine for winding or coiling elongated thin strips of stock on spools or reels. Among its objects are to provide a supply of material for interleaving between the convolutions of the stock being wound so as to protect the surface of the stock from being marred; to make provision in connection with the foregoing for the wound stock to be drawn off from the reel, and for simultaneously winding up the interleaved material; to provide means for adjusting the height of the winding mechanism in accommodation to the source from which stock being wound is taken or the recipient to which stock is delivered in being unwound; to provide a self contained and readily mobile unit for these purposes which can easily be brought to the source from which the stock is received or to a delivery point for the stock, or to be placed in a storage room or a vault; and withal to combine all of such provisions in a highly efficient machine which can be built at low cost and marketed at a modest price.

These and other related objects, which appear from the following description are accomplished by the machine hereinafter described and illustrated in the accompanying drawings.

One particular use which I have had in mind in designing the present illustrative machine is to take so called gold plate stock from a rolling mill and wind it on a reel with an interposed protective strip of paper. The material here referred to as gold plate is a composite strip composed of a main portion of base metal and a thin surface layer of precious metal (not necessarily gold, but which may be platinum, silver, etc.), or other metal, intimately united at their contact surfaces. Stock of this nature is reduced by a series of pressure rolls from an ingot to a thin ribbon. Such stock produced for various purposes may have thicknesses ranging from about .035" downward and various widths, generally not greater than 6". The universal practice heretofore in making stock of this character has been to deliver the stock from the rolling mill into baskets where it is laid with a multitude of reverse bends. It then occupies a great deal of space in proportion to its mass and is easily subject to injury so that it requires careful handling in being taken from the baskets for further treatment and conversion into manufactured articles; such as annealing and the punching out of blanks for watch cases, cigarette cases, and many other articles. It has never been possible heretofore to wind stock of this character in compact masses on reels and at

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the same time protect the bright, smooth surface of the stock from being marred by scratches or rubbing, or soiled by finger marks. The present invention serves the insistent needs of the industry in this respect.

The invention comprises the combinations of means and structure described in the following specification, not only in the embodiment illustrated in the drawings, but in others having the same essential principles and equivalent means, in greater or less measure, capable of serving not only the specific purpose above mentioned, but other analogous purposes and uses as well.

In the accompanying drawings,

Fig. 1 is a longitudinal vertical section of a winding machine embodying the principles of this invention;

Fig. 2 is a side elevation of the machine as seen from the right of Fig. 1;

Fig. 3 is a detail section taken on line 3—3 of Fig. 1;

Fig. 4 is a plan view of the machine;

Fig. 5 is a plan view and partial cross section taken on line 5—5 of Fig. 1;

Fig. 6 is a fragmentary vertical section taken on line 6—6 of Fig. 2 and shown on a larger scale;

Fig. 7 is a detail section on line 7—7 of Fig. 6 and an elevation of the parts at the right of that line;

Fig. 8 is a view showing the left hand end of the reel shown in Fig. 6, represented as in course of being applied to or removed from the spindle by which it is held and rotated in the winding up operation.

Like reference characters designate the same parts wherever they occur in all the figures.

The supporting structure of the machine comprises a base plate 10 and parallel upright posts 11 and 12 set into sockets 13 and 14 on the upper side of the base plate. These posts are massive tubes which fit closely in the sockets and are anchored to the base plate by bolts 15 threaded into disks 16 which are rigidly secured, preferably by welding, in the lower ends of the tubes.

The base plate is reinforced and stiffened by flanges 17 at its edges and ribs 18 between and parallel to two of its edges. It is of oblong form having substantial length and width for stability, and is equipped with rollers adjacent to all of its four corners to rest on the floor and permit trundling of the machine. Two of the rollers, designated 19 in Figs. 1 and 2, which are adjacent to one of the side edges of the frame, are held by pivots in fixed brackets 20 secured to

the under side of the base and the rollers 21 adjacent to the opposite side of the base are casters connected with the base by swivel mountings so that they can turn about vertical axes. Jack screws 22 are mounted in the base adjacent to the casters 21 and are operable to bear on the floor and elevate more or less the corresponding side of the base. These screws serve both for leveling the machine and as brakes to secure the machine against displacement when in operation.

A frame 23 which carries all the operating parts of the machine is mounted on the supporting structure with provision for vertical movement. It has two lugs 24 and 25 on each side near its upper and lower extremities which are perforated to fit slidingly on the columns 11 and 12 and through which the latter pass. This frame is here made as a shallow box-like casting open at one side, of a width less than the distance between the columns 11 and 12 and a length (height) sufficient to accommodate the spindles and driving means later described. A wide bar 26 of steel, or other suitable metal, is secured to the top and bottom walls of the box-like frame midway between the intermediate front and rear walls thereof. A long adjusting screw 27 is mounted in a bearing 28 in the top wall of the frame, by which it is withheld from endwise movement, and is equipped with a hand wheel 29 by which it may be rotated. This screw is engaged with a nut 30 secured to the upper end of a tube 31 which is secured to the base by a screw 32 and extends upwardly parallel to the columns 11 and 12. By means of screw 27 the frame can be adjusted up and down through the distance permitted by the height of the columns, and is supported at any location within the range of adjustment.

Two spindles 33 and 34 for supporting reels or spools and a driving motor 35 are mounted on the adjustable frame just described. The spindle 34 is shown in detail in Fig. 6. It is supported by ball bearings 37 and 38 mounted in axial alinement in the bar 26 and in the frame wall 39 opposite thereto; this wall and the bar being separated sufficiently to afford a stable support for the spindle. A spacing sleeve 40 is secured by a pin 41 to the spindle between the bearings and abuts at its ends on the bearings, preventing endwise displacement of the shaft in either direction. The spindle extends outwardly from wall 39 having a length sufficiently greater than the axial length of the spool which it is designed to hold.

I have devised a novel and useful locking means for holding spools or reels on the spindle which I will now describe. It comprises a sleeve 42 fitted closely but rotatably on the spindle and an abutment disk 43 which may be either tight or rotatable on the spindle and is confined between the inner race of ball bearing 38 and the adjacent end of sleeve 42. Pins 44 and 45 project radially outward from the sleeve 42. These pins serve the purpose of a key and equivalent elements may be used in their place. That is, I may provide a single key or spline in place of them, or a row of more than two pins.

A radial pin 46 is mounted in the side of the spindle 34 near the outer end thereof and close to the outer end of sleeve 42. It projects beyond the outer circumference of the latter. The adjacent end of the sleeve is beveled or inclined in opposite directions from a point at one side of the axis to a point at the opposite side, forming cam surfaces, one of which is designated 47 in Figs. 6 and 8. These surfaces may be likened to half turns of helices of opposite hands, and small helix angle. The low point of the cam surfaces is in alinement axially of the spindle with the pins 44 and 45. By rotation of the sleeve and spindle, one relatively to the other, all of the pins can be placed in alinement or the pins 44 and 45 angularly displaced from pin 46 and, when so displaced, in either direction of rotation, the pin 46 is caused to ride up on either the cam surface 47 or the corresponding surface at the opposite side and crowd the sleeve against disk 43. The angle of these cam surfaces is so acute with respect to a plane perpendicular to the axis that the pin 46, when angularly displaced with sufficient force, is locked frictionally and will not accidentally slip back. The rotation of the spindle in driving the reel against resistance also tends to advance pin 46 up the rising slope of the cam.

The reel or spool, which comprises a hub 48 and heads or flanges 49 and 50 united together in any suitable manner, contains a keyway 51 in one side of the bore of its hub which is adapted to receive the pins 44, 45 and 46 when all are in alinement. The length of the hub, or at least that part which forms the walls of its bore, is equal, or approximately so, to the length of sleeve 42 at the shortest side of the latter. Hence, when the reel is passed over the spindle until it brings up against the abutment disk 43, the pin 46 emerges from the outer end of keyway 51 and can then be brought by rotation of the reel out of alinement with the keyway and into locked engagement with the end of sleeve 42, which then turns with the reel by means of its keyed engagement. Pin 46, then projecting across the rim of the bore in the reel, becomes a retainer holding the reel on the spindle. A knurled zone 52 is cut in the outer end of the spindle so that the operator may obtain a firm grip when effecting this locking rotation.

The spindle 33 is identical with spindle 34 in respect to its supporting means in the frame and means for connecting a reel with it.

The bottom wall of the frame is extended outward from the wall 39 thereof to provide a shelf 54 reinforced by webs 55 and 56. On this shelf is mounted the driving unit 35 which, in the present illustration, comprises an electric motor connected with a housing 57, in which a changeable speed transmission mechanism is contained and from which a delivery shaft 58 extends toward the bar 26. This shaft drives the spindle 34 through a differential gearing consisting of a sun gear 59 keyed to shaft 58, a second sun gear 60 rotatable on an extension 58a of shaft 58 (both being bevel gears in this instance), planet pinions 61, of which there may be two or more, meshing with the gears 59 and 60 and mounted on a carrier which is freely rotatable about shaft 58 and its extension 58a, a sprocket 62 secured to gear 60, a sprocket 63 keyed to sleeve 40, and a chain 64 passing around both sprockets.

The differential gearing constitutes means by which the reel on spindle 34 may be rotated at progressively diminishing speed as the diameter of the stock accumulation thereon increases, while maintaining a substantially uniform tension on the stock passing to the reel from a rolling mill or other source. For this purpose a frictional braking effect is applied to the pinion carrier with adjustable intensity.

The pinion carrier is constituted in part by a ring 65 having a cylindrical outer circumference

and constituting a brake drum. A flexible brake band **66** surrounds the drum and is connected by its opposite ends to a lever **67** at points **68** and **69**, both of which are radially displaced from the axis of the lever.

Lever **67** is made of two members, as indicated best by Fig. 6, which are mounted to turn on a shaft **70** and are connected together with a space between them by the pins which connect the extremities of the brake band to them and by a pivot **71** which connects a link **72** to the lever near its outer extremity. A helical spring **73** is connected at one end to the upper end of link **72** and at the other end by means of a swivel coupling **74** to an adjusting screw **75** which is threaded through the upper wall of the adjustable frame **23** and carries a knob **76** on its outer end by which it can be rotated to apply more or less tension to spring **73**.

These parts are so arranged that the force exerted through the link **72** tends to rotate lever **67** in the direction which tightens the brake band **66** around the drum **65**. Thus the revolving pinions of the differential gearing are retarded with greater or less force, depending on the position of the adjusting screw **75**, and the gear **60** is rotated in consequence. As the reel can be rotated only as fast as the rate of delivery of the stock permits, the brake drum slips within the band at a progressively increasing rate as the diameter of the accumulation of stock increases, but the resistance to slippage, which is maintained substantially constant by means of the spring **73** while the adjustment continues the same, causes the tension applied to the stock in passing to the reel to be substantially uniform.

In practice the speed of the delivery shaft **58** is set, by suitable adjustment of the transmission mechanism, at a rate such that it would impart to the hub of the reel a surface speed slightly greater than the rate of delivery of the stock if the planet pinions were prevented from revolving and no stock were being delivered. This in order to limit the slip and consequently the wear on the brake drum and brake band. Incidentally the shaft **70** serves as means for shifting the variable speed transmission mechanism of the motor, being rotatably mounted in the bore **26** and wall **39** and carrying a knob **77** on its outer end by which it may be turned and an index **78** for showing delivery shaft speeds by reference to a dial on the outer face of bar **26**.

Shaft **33** is adapted to carry a reel or spool holding a strip of paper or other protective liner to be wound between convolutions of the stock. In order to maintain tension in this interlining material, a brake drum **80** is secured to shaft **33** and a brake shoe **81** is arranged to bear on its circumference. This brake shoe is movable in a guide **82** in the top wall of frame **23** and is pressed against the brake drum by an adjustable screw **83** and spring **84** interposed between the screw and shoe.

In its normal mode of use, this winding machine is trundled to the location where stock to be collected is supplied. If the stock is bimetal ribbon delivered from a rolling mill, the winding machine is brought up to the last pair of rolls of the mill, the adjustable frame **23** is raised or lowered until the hub of the winding reel is at a height suitable for taking stock from the mill, and the jack screws **22** are brought down against the floor to act as brakes to prevent displacement of the winding machine and they are additionally adjusted, if necessary, to bring the

axis of the reel parallel with the rolls of the rolling mill. The end of the stock and the end of the strip of paper carried by the upper reel are secured to the hub of the wind up reel and the motor **35** is started and the speed of its delivery shaft **58** adjusted to a speed in suitable proportion to the delivery speed of the rolling mill, as previously described.

It may be noted at this point that the base **10** is wide in both dimensions, as shown by the plan view, Fig. 4, and the supporting rolls are far apart, both in the direction of the pull of the winding reel and in the direction transverse thereto. This affords a stable base by which the machine is prevented from tilting under the tension applied to the stock, and the differential gearing is compelled to function in the manner precedently described, with slipping of the brake drum **65** in the surrounding band **66**.

When the entire length of stock made from an ingot comes out from the mill, the tension of the stock is suddenly released, which allows the speed of the reel to be increased because the brake applied to the differential gearing then causes the planet pinions to be held stationary. The loose end of the stock would then flap around with the reel, and the coils would be loosened more or less if not prevented. To prevent occurrence of these effects I have provided a spring pressed retainer, which is an arm **85** mounted on a pivot **86** and carrying a roll **87** on its free end. Pivot **86** is screwed into an enlargement **88** of the web **55** and is so located, and the arm is of such length, that the roll **87** is enabled to bear on the stock wound on the reel when the latter is nearly full. A spring **89** is coiled around pivot **86** and engaged at its ends with the arm **85** and the supporting web in such manner as to force the free end of the arm toward the reel. The arm is restrained by a stop **90** from being swung into an inoperative position when the reel is empty and held in readiness to apply pressure to the stock when the accumulation thereof is sufficient for that purpose.

After having received and wound up a quantity of stock, the machine may be shifted to any other location, such as an annealing oven through which the stock is passed in being unwound from the reel, to a stamping or dieing out machine through which the stock is passed for the purpose of having blanks for parts of manufactured articles cut out from it, or to a storage room, etc. When the stock is to be drawn off from the machine, the reel containing it is shifted from the spindle **34** to the spindle **33** and the brake **81** is used to restrain its delivering motion. If a lining strip has been wound between the convolutions of the stock, the reel from which the liner was delivered is transferred to the winding spindle **34** and rotated by the motor to wind up the liner as fast as it is released by unwinding of the stock. The winding mechanism then operates in the manner previously described to take up the liner strip under tension and wind it smoothly and evenly on its holding reel.

The machine here described, while highly efficient for its intended purpose, is at the same time relatively simple in construction and capable of being manufactured at reasonably low cost. It is adapted for winding other flexible strip material than the metal ribbon stock previously referred to; and the principles of the machine may be embodied in machines more or less modified in design and dimensions for winding a great many different kinds of material.

What I claim is:

1. A winding machine comprising a supporting structure, two spindles rotatably mounted on said structure, driving means coupled with one of said spindles for imparting rotation thereto, a sleeve mounted on each spindle having a cam shaped outer end and a key element protruding from its side, a radial pin mounted on each spindle contiguous to the outer end of the adjacent sleeve adapted to be placed, by relative rotation between the sleeve and spindle, either in alinement with said key element or angularly displaced therefrom, said pin when so displaced being brought into binding engagement with the cam shaped end of the sleeve.

2. A winding machine comprising a supporting structure, two spindles rotatably mounted on said structure, driving means coupled with one of said spindles for imparting rotation thereto, a sleeve mounted on each spindle having a cam shaped outer end and a key element protruding from its side, a radial pin mounted on each spindle contiguous to the outer end of the adjacent sleeve adapted to be placed, by relative rotation between the sleeve and spindle, either in alinement with said key element or angularly displaced therefrom, said pin when so displaced being brought into binding engagement with the cam shaped end of the sleeve, and a reel mounted on each spindle, each reel having a hub of which the bore is fitted to slide on and off the spindle sleeve and in which there is a keyway adapted to pass over said key element and pin when the latter are in alinement and when the reel is being placed on or removed from the spindle, the pin, when angularly displaced from the key element, being disposed to project across the rim of the bore in the reel hub and thereby lock the reel on the spindle.

3. In a winding machine, the combination with a spindle and a reel adapted to be mounted on the spindle, of means for detachably locking the reel on the spindle, said means comprising a sleeve rotatably supported on the spindle having a key element in its side and a cam surface at its outer end, and a pin radially mounted in the side of the spindle adjacent to said cam surface and projecting beyond the outer circumference of the sleeve, the reel having a hub with a bore fitted to slide endwise on the sleeve and having a keyway adapted to receive said key element and pin, the spindle on the one hand and the sleeve and reel on the other hand being relatively rotatable to place the key element and pin in alinement and to displace one angularly from the other, the pin when so displaced, being disposed to overlap the reel hub to prevent displacement of the reel from the spindle.

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