P. J. DREHER.

SHEET WINDING MECHANISM.

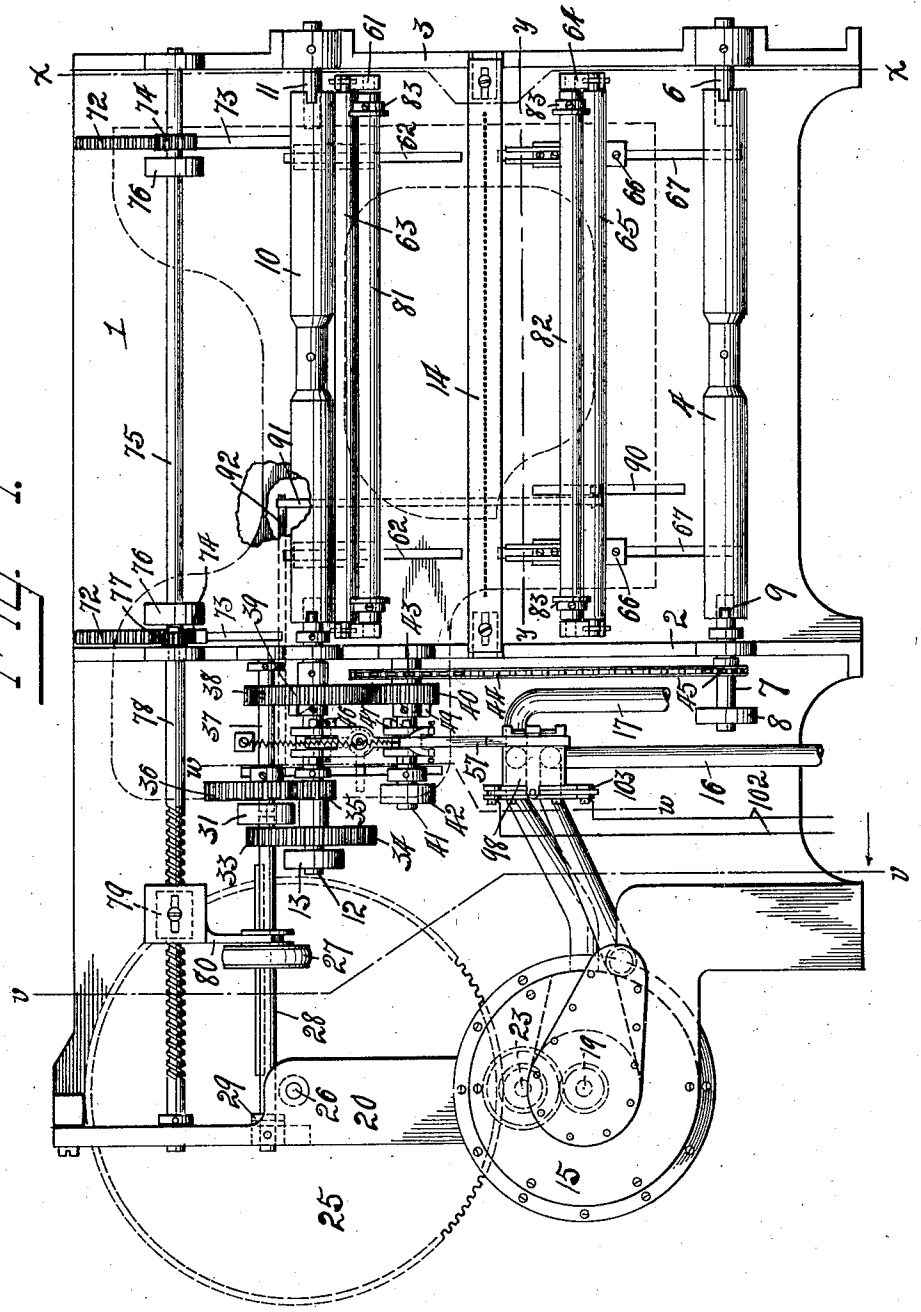
APPLICATION FILED MAR. 27, 1912.

1,066,590.

Patented July 8, 1913.

5 SHEETS—SHEET 1.

Fig. 1.



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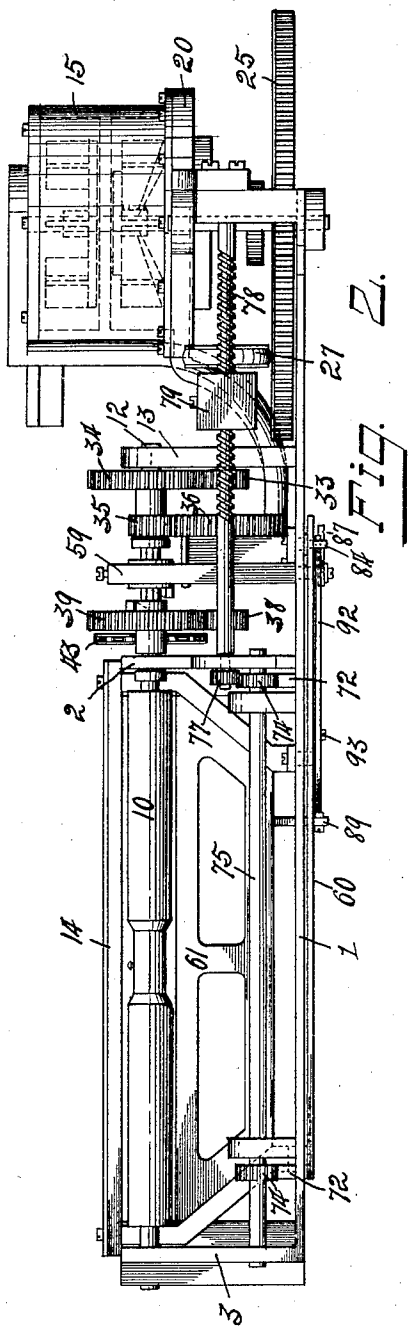

Fig. 2.

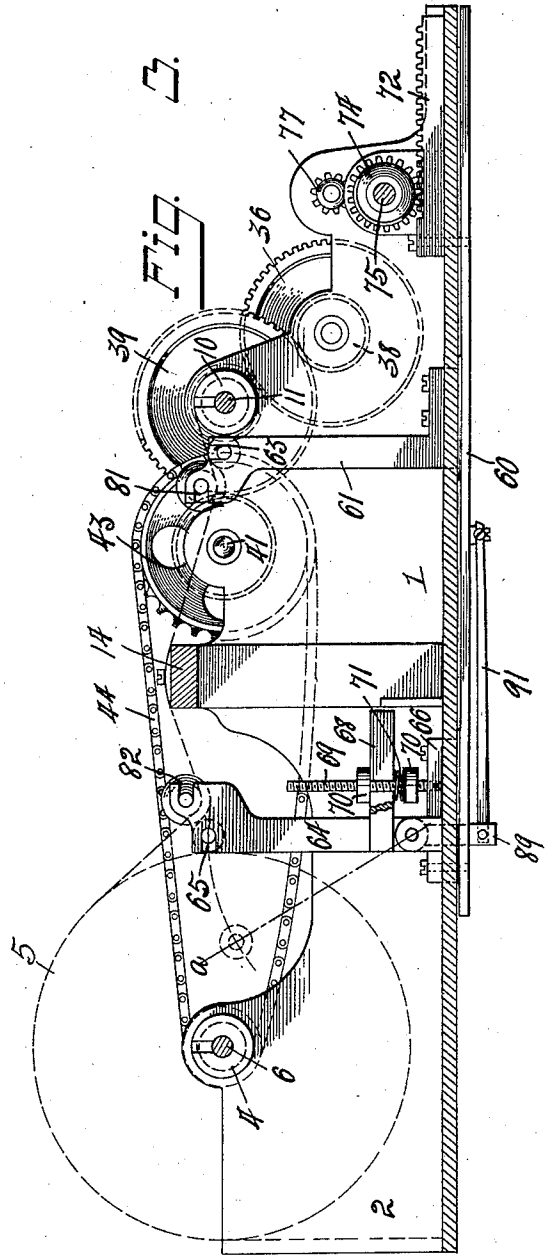

Fig. 3.

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Fig. 4.

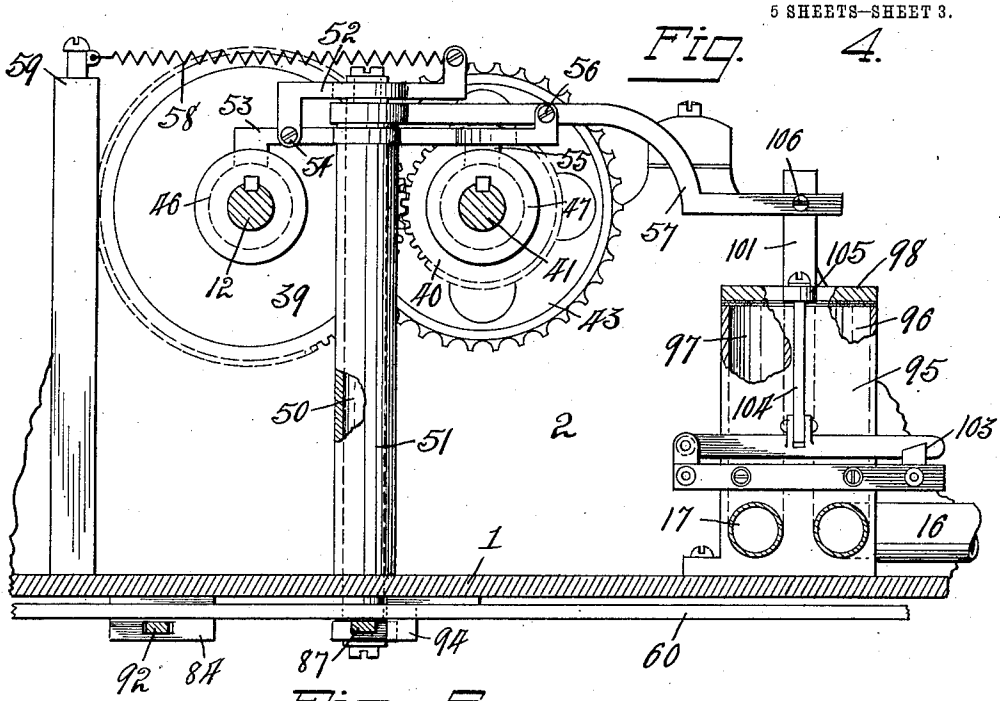
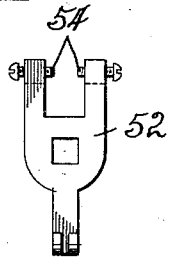


Fig. 6.

Fig. 5.



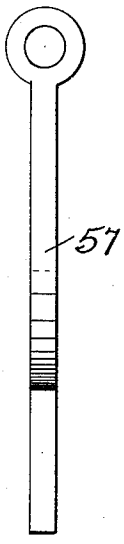
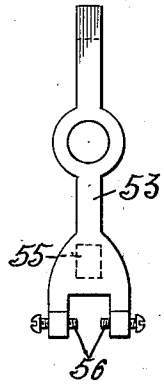


Fig. 7.



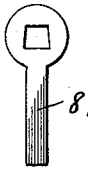


Fig. 8.

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5 SHEETS—SHEET 4.

Fig. 9.

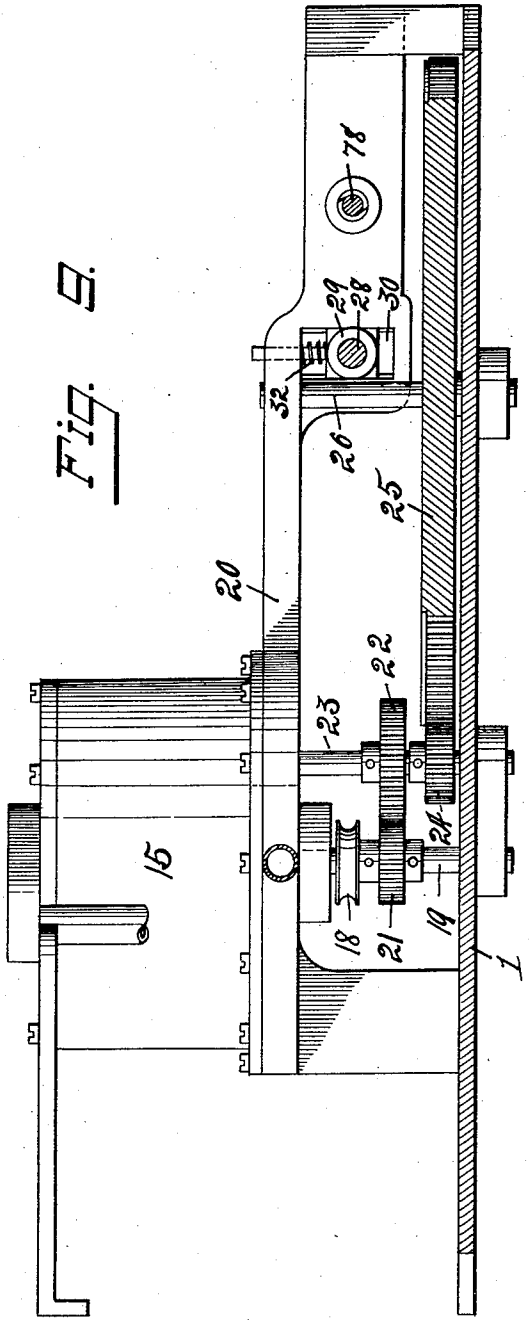
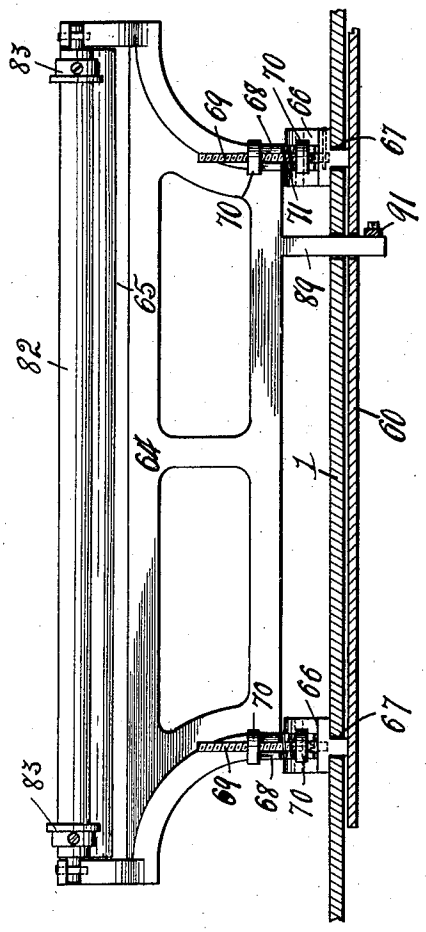


Fig. 10.



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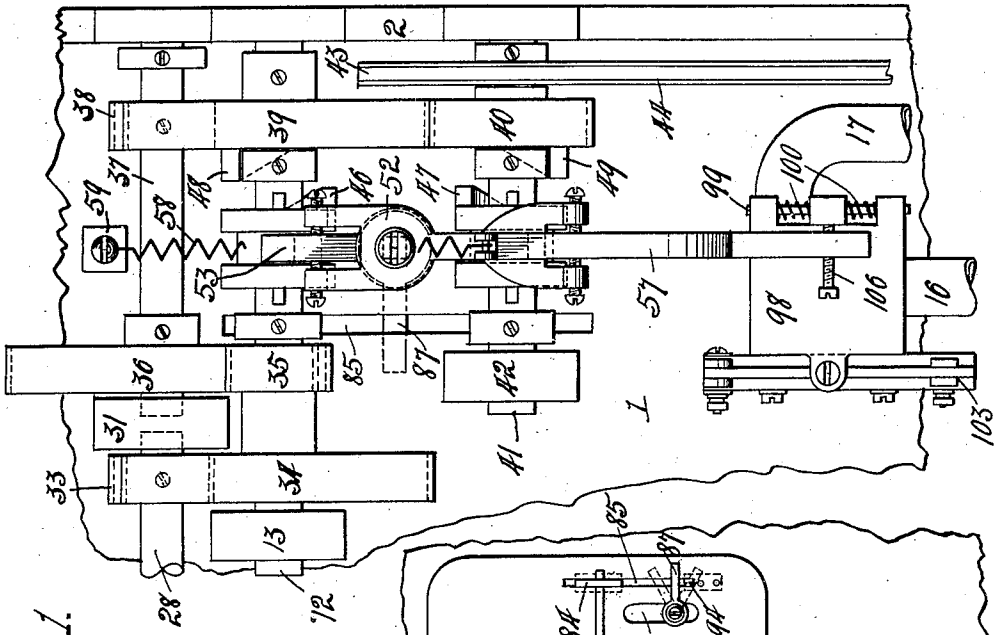

Fig. 11.

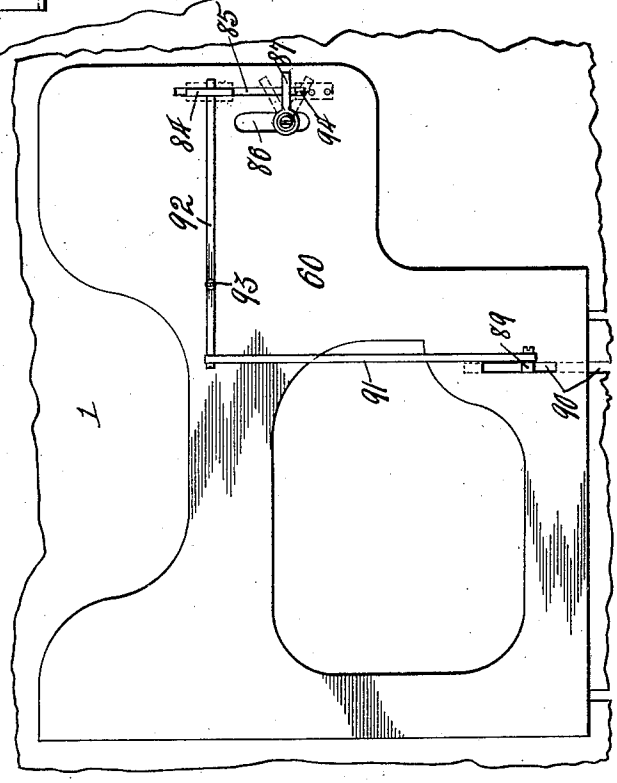

Fig. 12.

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SHEET-WINDING MECHANISM.

1,066,590. Specification of Letters Patent. Patented July 8, 1913.

Application filed March 27, 1912. Serial No. 686,481.

To all whom it may concern:

Be it known that I, PHILLIP JACOB DREHER, a citizen of the United States, and a resident of Toledo, in the county of Lucas and State of Ohio, have invented a certain new and useful Sheet-Winding Mechanism; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

My invention relates to pneumatically operated musical and other instruments and machines of the perforated sheet or apron controlled type, and has particular reference to mechanism for automatically controlling the unwinding of a perforated control sheet or apron from one roll to another and the rewinding of such sheet upon the first roll to automatically place the control sheet in repeating position.

The object of my invention is the provision of simple and efficient mechanism of this character, which, when used in connection with a musical instrument, is automatically operable to effect a repeating of the playing of a piece or a number of pieces represented by the perforations on a sheet, as many times as desired, and which, upon a rewinding of the sheet, automatically operates to render the player parts inoperative until the rewinding has been completed.

A further object of my invention is the provision of simple means in an apparatus of this character for controlling the speed of winding of the control sheet from one roll to another of a pair, whereby the speed of movement of the sheet across a tracker or other part may be maintained uniform irrespective of the gradually increasing size of the winding roll.

Other objects and advantages of my invention will be apparent from the following description thereof.

The invention is fully described in the following specification, and while, in its broader aspect, it is capable of embodiment in numerous forms a preferred embodiment thereof is illustrated in the accompanying drawings, in which,—

Figure 1 is a top plan view of a mechanism embodying the invention, with a part broken away. Fig. 2 is a side view thereof. Fig. 3 is a cross-section on the line *x x* in Fig. 1, with a part broken away. Fig. 4 is an enlarged section on the line *w w* in Fig. 1, with parts broken away. Figs. 5, 6, 7 and 8 are details of the different levers shown in Fig. 4. Fig. 9 is an enlarged section on the line *v v* in Fig. 1. Fig. 10 is an enlarged section on the line *y y* in Fig. 1. Fig. 11 is an enlarged plan of the clutch mechanism and associated parts, and Fig. 12 is a bottom plan of the movable table and associated parts.

Referring to the drawings, 1 designates a stationary frame part or platform, which, in the present instance, is disposed in a horizontal plane and has the spaced webs 2 and 3 rising therefrom and extending transversely thereof to form bearings for the shafts and parts hereinafter referred to. A roll 4 for carrying a perforated sheet-roll, as shown by dotted lines at 5 in Fig. 3, is mounted for rotary movements intermediate the webs 2 and 3 adjacent to one of the ends thereof, and has its ends socketed to adapt one to fit over the inner end of a stub shaft 6 and the other to fit over the inner end of a shaft 7, which latter shaft is journaled in the web 2 and a standard 8 rising from the platform. The shaft 7 serves as the drive shaft for the roll 4, and for such purpose has clutch engagement therewith, as at 9. The drive means for the shaft 7 will be hereinafter described.

A second roll 10, upon which the perforated control-sheet winds from the roll 4 during a playing of the associated instrument, is mounted between the webs 2 and 3 in spaced relation to the roll 4, and has its ends socketed to adapt one to loosely fit over the inner end of a stub shaft 11 projecting from the web 3 and its other end to fit over the inner end of a drive shaft 12, which is journaled in the web 2 and in a suitable bearing 13 without such web.

A tracker 14 of the usual or any suitable construction is carried at its opposite ends

by the webs 2, 3 and is disposed intermediate the rolls 4 and 10 for the perforated sheet to pass over in its travel from one to the other of said rolls, as is well understood in the art. A combination blower and suction mechanism 15, of any suitable construction, is associated with the platform 1 at one end portion thereof and has its suction chamber in communication through a tube 16 and suitable connections with the pneumatically operated parts of the instrument which are controlled by the admission of air thereto through the tracker passages, as is well understood in the art. The blower chamber of the mechanism 15 is connected through a pipe 17 with the flutes or other similar musical parts, should the same be provided in connection with the instrument, as is very frequently the case. As the means for operating the pneumatically controlled parts forms no part of the present invention the same will not be specifically described.

The apparatus may be driven from a motor or other suitable source of power (not shown) which may connect with a pulley 18 (Fig. 9) on a shaft 19, which shaft is journaled in the platform 1 and a superimposed part 20 and serves as the shaft for the rotary parts of the suction and blower mechanism 15, said mechanism being supported in the present instance by the frame part 20. The shaft 19 carries a gear 21 in mesh with a gear 22 on a shaft 23, which is journaled in the frame parts 1 and 20 in parallelism with the shaft 19 and carries a pinion 24 in mesh with a disk-gear 25, the shaft 26 of which is also journaled in the frame parts 1 and 20, as best shown in Fig. 9.

A friction-wheel 27 is in peripheral engagement with a side of the disk-gear 25, and is feathered to a shaft 28 for axial movements thereon substantially radially of the shaft 26 to permit of a varying of the speed of driving of the shaft 28 from the gear 25. The shaft 28 is journaled at one end in a bearing-box 29, which is mounted in a guide opening 30 in the frame-part 20 for yielding movements laterally of the disk gear 25, and has its opposite end journaled in a bearing 31 rising from the frame part 1. A spring 32 acts on the bearing-box 29 to yieldingly move the same in the direction of the gear 25, thus tending to retain the gear 25 and wheel 27 in yielding frictional engagement. The means employed for effecting an automatic movement of the wheel 27 longitudinally of its shaft to vary the speed of driving of the shaft 28 to compensate for the constantly changing diameter of the perforated sheet roll on one or the other of the rolls 4, 10 during a winding of the sheet from one to the other of such rolls will be hereinafter described.

The shaft 28 carries a fixed gear 33 in mesh with a loose gear 34 on the shaft 12, and fixed to the gear 34 for loose rotation therewith upon the shaft 12 is a pinion 35 in mesh with a fixed gear 36 on a shaft 37, which shaft has one end journaled in the bearing 31 and its other end journaled in the web 2 rising from the frame part 1. A small pinion 38, on the shaft 37, meshes with a loose gear 39 on the shaft 12, and this gear in turn meshes with and drives a loose pinion 40 on a shaft 41, which is mounted at one end in a bearing 42 rising from the frame part 1 and at its other end in the frame web 2. A sprocket-wheel 43 is fixed to the shaft 41 and has connection through a chain 44 with a sprocket-wheel 45 fixed to the shaft 7, which drives the roll 4.

Movable clutch members 46 and 47 are respectively mounted for longitudinal shifting movements on the shafts 12 and 41, the former being movable into or out of engagement with a companion clutch surface 48 on the gear 39, and the latter being movable into or out of engagement with a companion clutch surface 49 on the gear 40, as best shown in Figs. 4 and 11. A shaft 50 extends upward from below the frame part 1 through a hollow standard 51, extending upward from said frame part between the shafts 12 and 41, as best shown in Fig. 4. A lever 52 is fixed to the upper end of the shaft 50, having its shaft receiving opening squared for such purpose, as shown in Fig. 5, and has one end forked with the terminals of the furcations thereof extended downwardly and straddling the associated end portion of a clutch-shifting lever 53, which lever is loosely mounted on the upper end portion of the shaft 50 beneath the lever 52. The lever 53 is engaged at opposite sides thereof by set-screws 54, threaded through the terminals of the forked end of the lever 52, and has one end provided with a boss for fitting into the peripherally grooved race of the clutch member 46 and its other end provided with a boss 55 for working in a similar race in the movable clutch member 47, as best shown in Figs. 4 and 11. The end of the shift-lever 53 adjacent to the clutch-member 47 is forked with the terminals thereof projecting upwardly and carrying set-screws 56 for embracing opposite sides of a lever 57, which lever is loosely mounted at one end upon the shaft 50 intermediate the levers 52 and 53 and has its opposite end extended beyond the end of the shift-lever to which it is attached for the purpose hereinafter described.

The shift-lever 53 and associated parts are shown in Fig. 11 as being in neutral position, and it will be apparent that upon a shifting of the lever in one direction the clutch member 46 will be moved into engagement with the coöperating clutch surface of the gear 39 to effect a driving of the shaft 12 and a consequent driving of the

sheet winding roll 10, upon which roll the perforated sheet winds during a playing of the associated mechanism. Should the lever 53 be shifted in the opposite direction the clutch member 47 will be moved into engagement with the pinion 40 to effect a driving of the shaft 41, and rotation will then be communicated from such shaft to the shaft 7, driving the roll 4, through the medium of the chain and sprocket connection 43, 44, 45, thus effecting a turning of the roll 4 in a direction to rewind a perforated sheet thereon from the roll 10. A coiled contraction spring 58 attaches at one end to the upturned end of the lever 52, which end is opposed to that attaching to the lever 53, and the spring has its opposite end fixed to a standard 59 which rises from the frame part 1. It will be noted by reference to Figs. 1 and 11 that the line of pull of the spring 58 is in longitudinal alinement with the levers 52, 53 and 57 when such levers are in the neutral position shown in said figures, so that upon a shifting of said levers in one or the other direction from neutral position, the spring will then act to continue the shifting movement of the levers to throw their clutch member 46, 47 into engagement with its clutch gear, as the case may be, and to yieldingly maintain such engagement.

The mechanism employed for actuating the shifting movements of the clutches 46 and 47 to drive either roll 4 or 10, as it may be desired to unwind the perforated sheet from the roll 4 or to rewind it thereon, and also for automatically controlling the speed of driving of the rolls 4 and 10 to compensate for the gradual varying diameter of a sheet roll as it is wound from one to the other of said winding rolls, whereby the perforated sheet is moved with uniform speed across the tracker 14, will now be described.

Mounted beneath the frame part or platform 1 for parallel transverse reciprocatory movements relative thereto is a table 60 which has studs working up through slots in the frame part 1 to guide the relative movements thereof. 61 designates a movable roll standard, which rises above the frame part 1 at the inner side of the roll 10, as best shown in Figs. 2 and 3 with its feet having portions working through slots 62, 62 in said frame part and attached to the table 60 to adapt said standard and table to move in unison. A gage-roll 63 is carried at its ends by the end portions of the standard 61 and is intended to peripherally bear against the roll 10, or a sheet winding thereon, whereby to effect a movement of the standard 61 and table 60 in the direction of the winding roll 4 as the diameter of the roll 10 increases upon a winding of a control sheet thereon.

A standard 64, which is similar to the standard 61, rises above the frame part 1 at the inner side of the winding roll 4 and carries a gage-roll 65 at its upper end for bearing against the material wound upon the roll 4. The lower portion of the standard 64 is pivoted adjacent to its ends to feet 66, which have portions working through guide-slots 67 in the frame part 1 and attached to the table 60, as best shown in Figs. 3 and 10. The standard 64 has slotted arms 68 projecting from the lower portion thereof over the feet 66 and in opposition to the winding-roll 4. A screw 69 is pivoted at its lower end to each foot 66 and works upwardly through the slot of the associated arm 68. Nuts 70 are threaded to the screw 69 above and below the arm 68 and are adjustable on the screw to effect an adjustment of the standard 64 on its pivots for the purpose hereinafter described, it being apparent that an upward adjustment of the nuts 70 on the screw 68 will effect an inclination of the standard in the direction of the dotted line *a*, shown in Fig. 3 as radiating from the standard axis. A coiled compression spring 71 is interposed between the lower nut 70 and the arm 68 to enable the roll 65 to have a yielding bearing against the sheet-roll 5 to compensate for a varying in the space between the rolls formed by the portions of the perforated sheet which are wound upon the rolls 4 and 10, which variance is occasioned by the diameter of the smaller roll increasing in size more rapidly than the decrease in the diameter of the larger roll until such rolls have become of approximately the same size, and vice versa, as it will be apparent that the unwinding of a single convolution of the sheet from a large roll will make several convolutions when wound upon a small roll. From the above it will be evident that the rolls 63 and 65 are intended to work closely against the respective sheet rolls which are wound upon the rolls 4 and 10, so that the table 60 will be moved in one direction upon a diminution of the size of the sheet roll wound upon the roll 4 and an increasing of the diameter of the sheet roll winding upon the roll 10, and will be moved in the opposite direction when the reverse winding action is present.

The table 60 has rack-bars 72, 72 extending upward therefrom through registering slots 73 in the frame part 1 and extending in the direction of movement of the table, and each of these racks meshes with an associated pinion 74, which pinions are carried by a shaft 75 that is journaled in bearings 76 rising from the frame part 1 intermediate said rack-bars and at its ends in the webs 2 and 3. The pinion 74, which is adjacent to the frame web 2, meshes with a small pinion 77, which is fixed to an end of a worm-shaft 78 that is journaled adjacent to one

end in the web 2 and at its other end in the frame part 20. This shaft is disposed in parallelism with the shaft 28 upon which the friction-wheel 27 is feathered and has a block 79 threaded thereto and provided with an adjustably attached arm 80 in forked engagement with the peripherally grooved hub portion of the wheel 27, as best shown in Fig. 1. It is thus apparent that a turning of the worm-shaft 78 effects a shifting of the friction-wheel 27 toward or away from the axis of the friction-drive disk 25 to change the speed of driving of the respective rolls 4 and 10 as a winding of a sheet from one to the other thereof may require to maintain uniform the speed of movement of such sheet across the tracker 14.

The standards 61 and 64, in addition to carrying the rolls 63 and 65, also carry idler rolls 81 and 82, respectively, under which the perforated control-sheet passes intermediate the winding rolls, said idler-rolls serving to hold the sheet down upon the tracker 14 in its passage thereover, as best shown in Fig. 3. Each of these idler-rolls carries a set of sheet-guiding flanges 83, which coact with the side edges of a sheet to properly guide its course over the tracker 14 and are adjustable to suit the width of the sheet.

A block 84 is carried by the table 60 for movements therewith and is adjustable relative to such table longitudinally of the direction of movement thereof in a slot 85 therein, for the purpose hereinafter described. The lower end of the clutch-lever-carrying shaft 50 projects below the frame part 1 and through a slot 86 in the table 60, as best shown in Fig. 12, and has a finger 87 projecting laterally therefrom below the table in the path of movement of the block. The block 84, at a predetermined point in its longitudinal movement with the table 60 relative to the frame part 1, is intended to engage the finger 87 and move it from one to the other of the dotted line positions shown in Fig. 12, thus effecting a rocking of the attached shaft 50 and a consequent swinging of the attached shift-levers 52, 53 to disengage the clutch-members 46 and 48, which were acting to drive the winding roll 10, and to engage the clutch members 47 and 49 to impart a rewinding movement to the winding roll 4, rotation being communicated from the shaft 41 to the shaft 7 through the chain and sprocket connection 43, 44 and 45. The block 84 need only move the finger 87 past the center of its movement, or beyond the full line position shown in Fig. 12, as the spring 58 associated with the clutch mechanism then acts to throw the clutch member 47 into engagement with its companion and to complete the outward throwing movement of the clutch member 46. For the purpose of adjusting this clutch operating mechanism to render it operable to disengage one and engage the other of the clutches at any predetermined point in a movement of the table 60, as the full size of the perforated control sheet roll may require, I have provided a simple mechanism in coöperation with the swinging feature of the gage-roll standard 64. In carrying out this feature of my invention I project an arm 89 downwardly from the lower edge of the standard 64 through registering slots 90 in the frame part 1 and table 60 and connect the arm 89 below the table 60 by a bar 91 to an end of the lever 92. This lever is fulcrumed to the front side of the table 60, as at 93, and has its free end working loosely through an opening in the block 84 whereby a swinging of the standard 64 toward the winding-roll 4, as indicated by the dotted line *a* in Fig. 3, will move the bar 91 and lever 92 to effect an adjustment of the block 84 toward the finger 87. It will thus be apparent that a swinging adjustment of the standard 64 toward the axis of the winding-roll 4 will effect a proportional adjustment of the block 84 relative to the finger 87, so that the time of engagement of the block 84 with the finger 87 for throwing the clutches may be gaged by the size of the control sheet roll. For instance, should a control-sheet roll, which is half the size of the roll 5 shown in dotted line in Fig. 3, be employed, the standard 64 is swung into position for its gage-roll 65 to rest against the outer surface of such roll. Upon a swinging of the standard in this manner the block 84 will be adjusted to diminish the space between it and the finger 87 substantially one-half of that shown in full lines, or in the same proportion that the space between the gage roll 65 and the axis of the winding roll 4 is diminished by the adjustment of the standard 64, so that when the control sheet shall have been transferred from the winding roll 4 to the winding roll 10 the table 60 will have moved a sufficient distance for the block 84 moving therewith to engage and throw the clutch control finger 87.

When the control-sheet has entirely rewound upon the roll 4 from the roll 10, a block 94, which is preferably adjustably carried by the table 60, moves into engagement with the clutch control finger 87 and moves it, in coöperation with the spring 58, to effect a reversal of the position of the clutch mechanism so that the rewinding mechanism is thrown out of engagement and the winding mechanism, or that which drives the roll 10 to wind the control sheet thereon from the roll 4, is thrown into engagement.

The conduits 16 and 17 extending from the blower and suction mechanism 15 lead through a box 95, which is mounted on the frame part 1 below the outer or free end of

the lever 57, which projects from the clutch control shaft 50. This box has the two chambers 96 and 97 into which the pipes 16 and 17 respectively open, said chambers being open at their tops to the atmosphere except when a door 98 is closed thereover, said door being hinged to one side of the box, as shown at 99 in Fig. 11, and being normally retained in closed position by the action of springs 100 thereon. It is apparent with this construction that upon an opening of the door 98 the pneumatically operated parts of the instrument are rendered inoperative due to the air from the blower pipe 17 being discharged to the atmosphere through the open top of the chamber 97, and the suction air, which is drawn to the mechanism 15, being admitted through the chamber 96. The door 98 has an arm 101 rising from its hinged edge in position to be engaged by the free end of the lever 57 and moved to open the door 98 when said lever is moved with the shift lever 53 upon a throwing of the rewinding clutch 47 into engagement with the driving gear 40, thus effecting an automatic opening of the door 98 upon a throwing into engagement of the rewinding mechanism.

In musical instruments of the class with which my invention is intended to be associated, it is customary to provide a battery energized circuit for effecting an electrical operation of the bells, anvil and other similar player parts, and in order to prevent a playing of such parts during a rewinding of the perforated control sheet such battery circuit, which is designated 102 in Fig. 1, has a switch 103 in circuit therewith. This switch is attached to a side of the box 95 and has its movable part, which, in the present instance, is of knife form, pivoted at one end to the stationary part and is connected intermediate its ends by a link 104 to a tongue 105 projecting from the free edge of the door 98. This connection is such that when the door is closed the switch is closed, and when the door is opened the movable switch part is opened therewith, thus rendering inoperative the electrically operated parts which are in circuit with the switch. The lever 57 has its contact with the door arm 101 regulated by an adjusting screw 106.

The operation of my invention is as follows: A perforated sheet roll 5, having been mounted on the winding roll 4, has its outer or free end passed under the idler-rolls 82 and 81 and over the tracker 14 prior to being engaged to the winding-roll 10 to permit a winding of the sheet thereon from the roll 4. The clutch mechanism is then moved by hand from the neutral position shown in Figs. 1 and 11 with the clutch member 46 engaging the coöperating clutch part of the driven gear 39, thus communicating a winding action to the roll 10, which is mounted on the shaft 12 with said clutch parts. When the entire perforated sheet, or a predetermined length of the same, has been transferred to the winding roll 10 from the roll 4, the block 84, which has been properly adjusted for such purpose by a tipping of the guide roll standard 64, will have moved into contact with the clutch control finger 87 on the lower end of the clutch shaft 50 and moved such finger and attached parts a sufficient distance to release the direct winding clutch 46—48 and engage the rewinding clutch 47—49 to communicate a rewinding movement to the roll 4 from the shaft 41 through the chain and sprocket connection 43, 44 and 45, the coiled contraction spring 58, which is associated with the clutch, coöperating with the block 84 in imparting the shifting movements to the clutch parts. Upon a throwing of the rewinding-clutch into engagement the lever 57 is moved in a direction to effect an opening of the door 98 covering the box 95 to place both the blower and suction parts of the mechanism 15 in free communication with the atmosphere to render the pneumatically operated parts of the instrument inoperative, and to also open the switch 103 to open the battery circuit 102 which controls the playing of the bells, anvil and similar parts of the instrument. By the use of the box 95 and associated parts, six operating bellows which are customarily employed in instruments of this class are rendered unnecessary. When the rewinding of the control sheet from the roll 10 to the roll 4 has been completed the block 94, which moves with the table 60, acts on the clutch control finger 87 to reverse the position of the clutches and automatically start a winding of the roll 10 to again wind the control sheet thereon from the roll 4 for playing the instrument. Upon such shifting of the clutch mechanism the door 98 is permitted to close under the action of the springs 100, thus making operable the pneumatically controlled parts and closing the switch 103 of the battery circuit. During a winding of the control sheet from one to the other of the rolls 4, 10 the table 60, which has its gage-rolls 63 and 65, that are carried by the table standards 61 and 64, in contact with the inner sides of the rolls formed by the portions of the control-sheet which are wound upon the respective winding rolls, is moved toward the axis of the winding roll 4 by the constantly increasing size of the sheet roll which is winding upon the roll 10. The movement which is thus imparted to the table 60 actuates the rack-bars 72, carried by said table, to rotate the pinions 74 meshing therewith and to communicate a consequent rotation to the work shaft 78 due to a pinion 77 on said shaft meshing with one of the rack pinions 74.

The turning of the worm-shaft 78 moves the friction-wheel 27 through the medium of the shifting parts 79 and 80, so as to diminish the distance between such wheel and the axis of the friction drive disk 25 to retard the speed of driving of the roll winding parts to compensate for the gradual increasing diameter of the roll 10 upon which the control sheet is winding, thus causing such control sheet to move for its entire length at uniform speed across the tracker 14. In order to adjust the time of engagement of the block 84 with the clutch control finger 87 to suit the size and consequently the length of the control sheet roll, which is winding from one to the other of the rolls 4, 10, it is only necessary to adjust the inclination of the standard 64 so that its gage-roll 65 will coact with the associated sheet-roll surface when the gage-roll 63 is in contact with the surface of the roll 10, as such movement of the standard 64 moves the block 84 to lessen the distance between it and the control finger 87 proportional to the size of the sheet-roll.

It is apparent that I have provided simple and efficient mechanism for automatically controlling the winding and rewinding of a perforated control sheet from one to the other of the rolls 4, 10, and for automatically varying the speed of driving of the roll upon which the sheet is winding to compensate for the gradual increasing size of such roll, whereby the sheet will be moved for its entire length at uniform speed across the tracker; and also that such mechanism automatically renders the playing parts inoperative during a rewinding of the control sheet, thus very materially increasing the practicability and commercial value of apparatus of this class. It is also apparent to persons skilled in this art that my mechanism obviates the use of a large number of pneumatics which have heretofore been necessary in the operating of musical instruments of the class in connection with which my invention is more particularly intended for use.

I wish it understood that while I have particularly described my invention for use in connection with a musical instrument, it may be used in any other connection for which it may be adapted or appropriate; and also that the invention is not limited to any specific construction or arrangement of the parts except in so far as such limitations are specified in the claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is,—

1. In combination, a sheet-winding roll, mechanism for driving said roll and having frictional coacting drive and driven parts, the driven part being axially shiftable relative to the drive part, a member movable in transverse relation to said roll and having a part projecting therefrom and in peripheral contact with said roll whereby a changing of the size of the roll imparts movement in one direction to said member, a rack-bar carried by said member, a worm shaft having connection with and movable by a movement of said rack-bar, and means threaded to said shaft and having engagement with the driven part of the drive mechanism to axially shift said driven part to change the speed of driving of said roll to compensate for the gradual increasing diameter thereof.

2. In combination, a frame part, a sheet winding roll carried by said frame part, mechanism for driving said roll having frictional coacting drive and driven parts, the driven part being axially shiftable relative to the axis of the drive part, a table guided by said frame part for movements transversely of said roll and having a standard projecting therefrom and carrying a part for contact with the periphery of said roll, said part and table being movable by the roll as its size increases, a rack-bar movable with said table, a worm shaft having connection with and driven by a movement of said rack-bar, a member threaded to said shaft and engaging said driven part to axially change its position relative to the drive part axis when the shaft is rotated whereby to vary the speed of driving of said roll to compensate for the increasing diameter thereof.

3. In combination, two sheet winding rolls, drive mechanism for said rolls having shiftable clutch parts for connecting either roll with such mechanism, and mechanism operable by an increasing of the size of one roll for automatically operating the clutch parts of said driving mechanism to stop the winding of a sheet on one roll and to effect a rewinding of the sheet upon the other roll.

4. In combination, a pair of rolls from one to the other of which a sheet may wind, drive mechanism for said rolls, clutch means connected with such mechanism and operable to place either roll in driving connection with said mechanism, and reciprocatory means movable by an increasing of size of the roll upon which a sheet is winding and operable at a predetermined point in the winding of a sheet to actuate said clutch means to reverse the winding action of the rolls.

5. In combination, a set of rolls from one to the other of which a sheet may wind and vice versa, mechanism for driving said rolls, said mechanism having clutch means which is operable to alternately place said rolls in driving connection with said mechanism, a reciprocatory member having a part in engagement with the periphery of one of said rolls whereby said member is moved by an

increasing of the diameter of the roll, said member being operable at a predetermined point in the winding operation to move the clutch means to disconnect one and to connect the other of said rolls with the driving mechanism for rewinding purposes.

6. In combination, a pair of winding rolls from one to the other of which a sheet may wind and vice versa, mechanism for driving said rolls, said mechanism having clutch means which is operable to throw either of said rolls into driving engagement with said mechanism, and means interposed between said rolls and movable by the increasing diameter of either roll as a sheet winds thereon to operate said clutch means to alternately connect and disengage the rolls relative to the drive mechanism at predetermined points in a winding of a sheet thereon.

7. In combination, a pair of rolls from one to the other of which a sheet may wind and vice versa, driving mechanism capable of alternately connecting with said rolls and means having parts in engagement with the peripheral portion of each roll and movable in opposite directions as a sheet winds on one or the other of said rolls and increases its diameter, said means having parts which coöperate with a part of the driving mechanism at predetermined points in the opposite direction of movement of said means to first place one and then the other of said rolls in driving engagement with the mechanism.

8. In combination, a pair of rolls from one to the other of which a sheet may wind and vice versa, means having parts in engagement with each of said rolls for moving the means in reverse directions when the diameter of first one and then the other of said rolls is increased by the winding of a sheet thereon, and drive mechanism for said rolls operable at a predetermined point in the movement of said means in one direction to place one roll in driving engagement therewith and at a predetermined point in the movement of said means in the opposite direction to release the first roll and place the other roll in driving engagement therewith.

9. In combination, a pair of rolls from one to the other of which a sheet may wind and vice versa, a member movable transversely of said rolls and having parts in peripheral engagement with opposite sides of said rolls whereby said member is moved in opposite directions by an increasing of the diameter of first one and then the other of said rolls, driving mechanism for said rolls, and clutch means connected with said driving mechanism and operable at predetermined points in the movements of said member in opposite directions to place first one and then the other of the rolls in driving engagement with said mechanism.

10. In combination, a pair of rolls from one to the other of which a sheet may wind, means having a part in peripheral contact with one of said rolls and movable by the increasing of the diameter thereof, drive mechanism for said rolls, said mechanism having clutch means which is operable at a predetermined point in a movement of said movable means in one direction to move said clutch means to disengage the driving means from the winding roll, and mechanism operable by a movement of said movable means to vary the speed of driving of the winding roll to compensate for the increasing diameter thereof.

11. In combination, a pair of rolls from one to the other of which a sheet may wind, means movable by the increasing diameter of one of said rolls as a sheet winds thereon, mechanism for driving said rolls and automatically operable at a predetermined point in a movement of said means to stop the driving action of said rolls, and mechanism operable by a movement of said means to change the speed of driving of said winding roll to compensate for the increasing diameter thereof.

12. In combination, a pair of rolls from one to the other of which a sheet may wind, a member having a part in contact with the periphery of the winding roll and movable by an increasing of the diameter of such roll, mechanism for driving said winding roll and automatically operable by said member at a predetermined point in its movement to stop the driving action of said winding roll, said mechanism having relatively shiftable drive and driven parts, and means operable by a movement of said member to shift said driven part to change the speed of driving of the winding roll to compensate for the varying of its diameter.

13. In combination, a pair of rolls from one to the other of which a sheet may wind and vice versa, means movable in one direction by the increasing in the diameter of one roll by the winding of a sheet thereon and in the other direction by the winding of a sheet thereon, mechanism for driving said rolls operable by said means at a predetermined point in its movement in one direction to drive one and release the other of said rolls and operable by said means at a predetermined point in its movement in the opposite direction to drive the other of said rolls, and means operable by a movement of said first means to change the speed of driving of one of said rolls to compensate for the increasing diameter of such roll.

14. In combination, a pair of rolls from one to the other of which a sheet may wind and vice versa, a member having engagement with each of said rolls and movable in one or the other of two directions by the increasing of the diameter of one or the

other of said rolls by the winding of a sheet thereon, driving mechanism operable by said member at a predetermined point in its movement in one direction to connect and drive one roll and release the other and at a predetermined point in its movement in the opposite direction to reverse the driving action of said rolls, said mechanism having relatively shiftable frictional drive and driven parts, and means operable by a movement of said member to change the speed of driving of one of said rolls to compensate for the increasing diameter thereof.

15. In combination, a pair of rolls from one to the other of which a sheet may wind and vice versa, a member having a part coacting with one of said rolls and movable by an increasing of the diameter of such roll, a sheet guiding idler roll carried by said part, and mechanism in driving connection with the roll with which said part coacts and operable by said member at a predetermined point in its movement to stop driving one and to drive the other roll for rewinding purposes, and means operable by a movement of said member to change the speed of driving of said mechanism as a roll increases in size.

16. In combination, a pair of rolls from one to the other of which a sheet may wind and vice versa, a member having parts for coöperating with opposite sides of said rolls whereby the increasing of the diameter of either roll will move said member in one or another direction, idler rolls carried by said parts for assisting in guiding the course of a sheet intermediate said winding rolls, and driving mechanism for said rolls automatically operable by said member at predetermined points in its movement to alternately engage and release said winding rolls to drive first one, then the other thereof.

17. In combination, a pair of rolls from one to the other of which a sheet may wind, means having a part in engagement with one of said rolls and being movable by an increasing of the diameter of such roll, mechanism for driving said rolls and automatically operable by said means at a predetermined point in its movement to disconnect one roll and connect the other therewith to stop the winding of a sheet upon one roll and effect a rewinding of the same upon the other roll, and means operable to adjust the time of engagement of said first means with said mechanism to suit the size of the sheet roll being wound from one to the other of said winding rolls.

18. In combination, a pair of rolls from one to the other of which a sheet may wind and vice versa, a member having parts in engagement with said rolls to move the member in one or the other direction as the diameter of one or the other of said rolls is increased, one of said parts being adjustable to suit the space intermediate said rolls, mechanism for alternately driving said rolls and automatically operable by said member at predetermined points of its movement in either direction to reverse the driving action of the rolls, and means operable by an adjustment of said adjustable member part to change the time of engagement of the member with said mechanism to suit the size of a sheet roll being wound from one to the other of said winding rolls.

19. In combination, a pneumatically operated mechanism, a perforated control sheet therefor, a pair of rolls from one to the other of which said sheet may wind and vice versa, mechanism operable to wind a predetermined length of said sheet on one and then the other of said rolls, air suction and blowing means, a member movable to open or close the communication between said means and the atmosphere intermediate said means and the sheet, an electric circuit, a switch in said circuit, said switch being closed when said member is closed, and means automatically operable to open said member and said switch when a sheet is winding from one to the other of said rolls.

20. The combination with pneumatically operated mechanism, a perforated control sheet therefor, and means operable to move said sheet in first one and then the other direction, of air suction and blowing means for said pneumatically operated mechanism, a member movable to open and close the communication between said means and the atmosphere to render the same inoperative and operative, respectively, and means automatically operable to control the opening and closing movements of said member whereby it stands in opened and closed positions during different predetermined portions of the movements of said sheet.

21. The combination with pneumatically operated mechanism, a perforated control sheet therefor, and means operable to move said sheet in first one and then the other direction, of air suction means for said mechanism, a member independent of said sheet movable to open and close the communication between said suction means and the atmosphere to render the same inoperative or operative, respectively, and means automatically operable to control the opening and closing movements of said member whereby it stands in opened and closed positions during different predetermined portions of the movements of said sheet.

22. In combination, a pair of rolls from one to the other of which a sheet may wind, means operable to alternately drive said rolls in reverse directions, mechanism automatically operable to reverse the driving action of said rolls, and means adjustable to

vary the reversing of said drive means at predetermined points in a winding of a sheet.

23. In combination, a pair of rolls from one to the other of which a sheet may wind, mechanism for driving said rolls and automatically operable by the changing diameter of the winding roll to reverse the driving action of the rolls, and means adjustable to regulate the point of reversal of the driving action in the winding of a sheet.

In testimony whereof, I have hereunto signed my name to this specification in the presence of two subscribing witnesses.

PHILLIP JACOB DREHER.

Witnesses:

C. W. OWEN,

M. Q. OPPENHEIM.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."