Oct. 27, 1964 D. W. HUBBARD 3,154,235

REGISTRATION MECHANISM FOR SHEET FEEDING MEANS

Filed Dec. 3, 1962 2 Sheets-Sheet 1

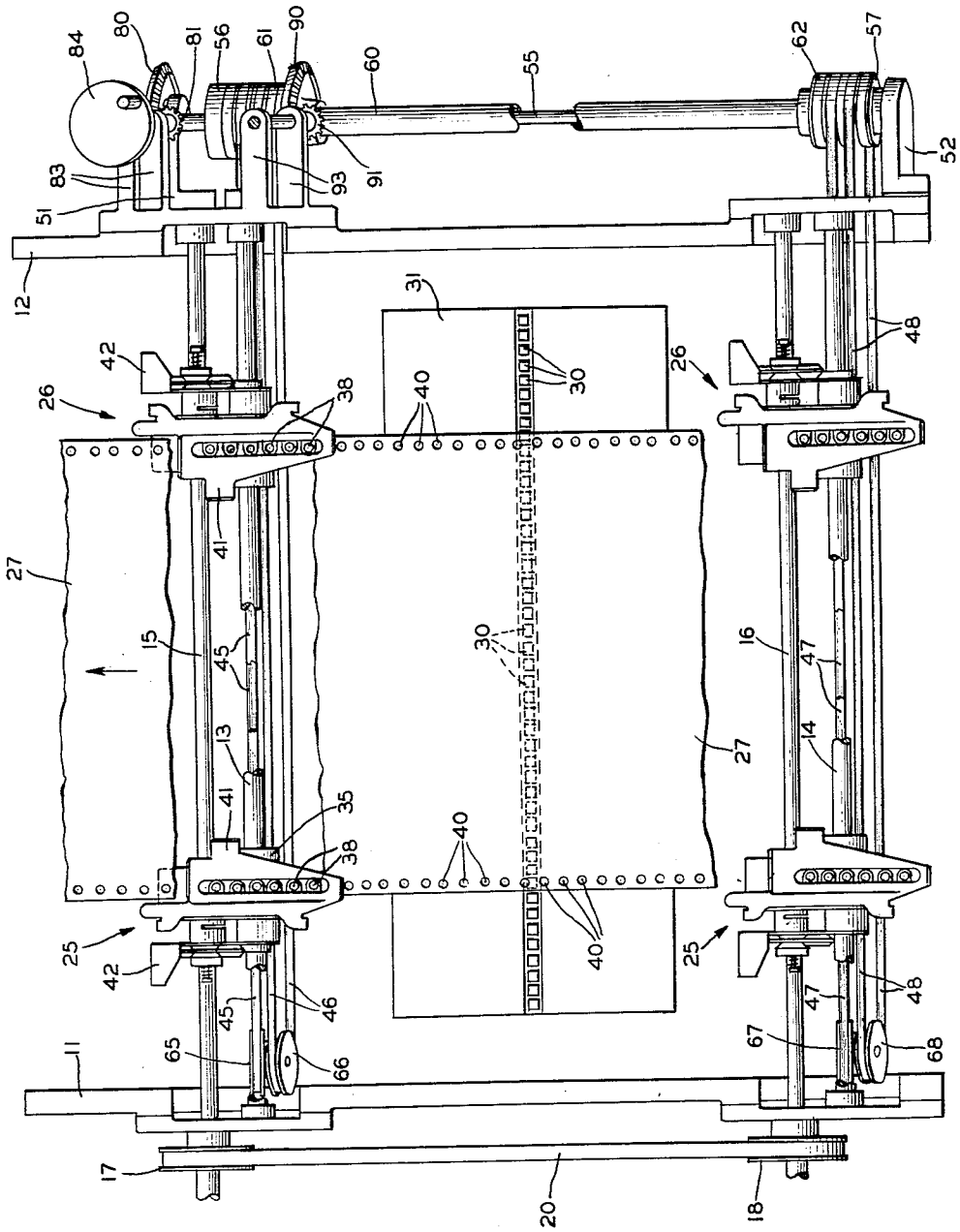

FIG. 1

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FIG. 2

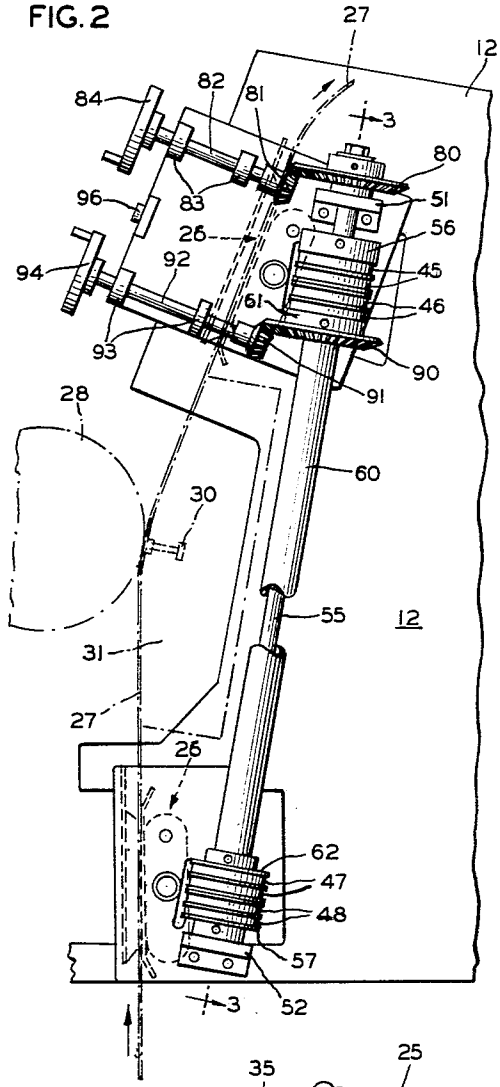

FIG. 3

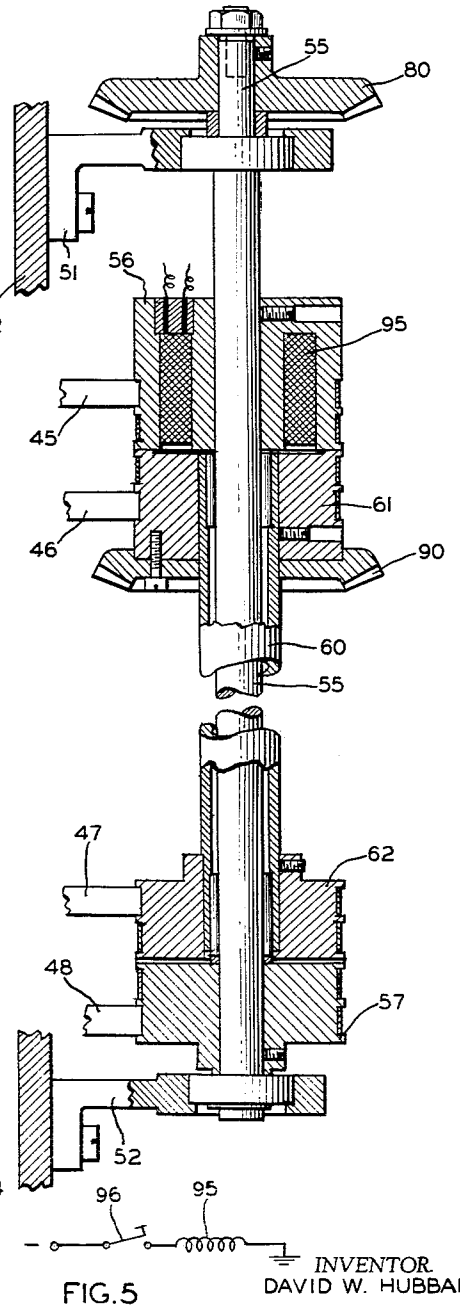

FIG. 4

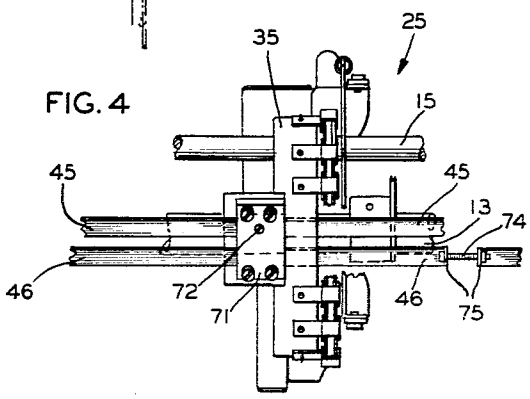

FIG. 5

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REGISTRATION MECHANISM FOR SHEET FEEDING MEANS

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This invention relates generally to sheet feeding mechanism and, more particularly, to means for adjusting the mechanism to accommodate sheets of different sizes and for varying the path of travel of a sheet relative to an operating station.

The invention is disclosed herein in an embodiment adapted for adjusting the position of the line spacing tractors employed in a high speed printer. Machines of this class are ordinarily equipped with a plurality of tractors which are provided with sprocket pins adapted to engage with sprocket holes running along the marginal edges of the form to be fed. In order to accommodate forms of varying widths, the tractors are mounted for lateral adjustment. It has been found, particularly when the form being printed comprises several copies with interleaved carbon sheets or other transfer means between the copies, that correct registration of the form with the printing mechanism requires the provision of a pair of tractors on both sides of the print station, i.e. above and below the print station. Each of the several tractors must be laterally adjustable, and the proper positioning of the several tractors has heretofore been found to be a time consuming operation since the adjustment must be precise to match exactly the width of the paper form being employed so as to achieve and maintain a predetermined amount of tension in the paper form. At the same time, the plurality of tractors must be positioned so as to hold the form in a precise registration with the printing means once their relative spacing has been determined.

The mechanism of the instant invention is designed to simplify the lateral adjustment of the several tractors for accommodating various width forms and also for properly registering the form relative to the print means. In accordance with the invention, a manually operated control member is provided for laterally adjusting simultaneously the tractors which engage one margin of the form, and another manually operated member is provided for simultaneously adjusting the tractors engaging with the other margin of the form. The adjusting means include a plurality of bands which are connected to respective tractors and are wound or unwound in response to the manual actuation of said control members, said bands maintaining the plurality or set of tractors associated with one margin of the form in precise vertical alignment with each other at all times. Means are provided for coupling the means for adjusting one set of said tractors with the means for adjusting the other set of said tractors whereby both sets of tractors are simultaneously positionable by a single adjustment procedure when it is desired to alter the registration of the form relative with the print wheels or drum. This registration adjustment involving simultaneous shifting of both sets of tractors may moveover be accomplished while the machine is in operation and while the tractors are feeding paper line-by-line past the print station, thereby enabling the machine operator to visually observe results of the adjustment while the adjustment is being made.

It is therefore an object of this invention to improve upon means for effecting the adjustment of sheet feeding tractors in order to accommodate sheets of varying widths.

It is a further object of the invention to improve upon mechanism for adjustably positioning sheet feeding tractors to register a sheet columnarily at a printing station.

It is a further object of the invention to provide tractor adjustment means enabling the columnar registration of a sheet at a printing station concurrently with the line spacing operation of the tractor mechanism.

Further objects of the invention together with the features contributing thereto and the advantages accruing therefrom will be apparent from the following description when read in conjunction with the drawing wherein:

FIG. 1 is a view in front elevation of the paper feed mechanism associated with the print head assembly of a high speed printing machine.

FIG. 2 is an elevational view from the right-hand side of the mechanism shown in FIG. 1.

FIG. 3 is a sectional detail view of the paper tractor control shaft shown in FIGS. 1 and 2, together with parts associated therewith.

FIG. 4 is a rear view of one of the paper tractor devices illustrating the means by which it is clamped to an associated adjusting band.

FIG. 5 is a diagram of the circuit employed for controlling the magnetic clutch associated with the tractor control shaft.

Referring now to FIG. 1, the mechanism can be seen to be supported between two upright side frame plates 11, 12 of the machine between which extend an upper tractor support shaft 13 and a lower tractor support shaft 14, the ends of said shafts being suitably fastened to the side frame plates of the machine. Also extending between the side frame plates and suitably journaled therein is an upper tractor drive shaft 15 and a lower tractor drive shaft 16. Shafts 15 and 16 extend beyond the left frame 11 of the machine, and each carries a pulley 17, 18, respectively, around which is wound a belt 20 by which the shafts are driven in unison by any suitable means, not shown.

The shafts 13, 15 support a pair of paper feeding tractors 25, 26 which are adapted to grip the side edges of a continuous sheet or form 27 of paper or the like and advance it upwards in line space increments past the printing station of the machine. The printing station is considered to be that portion of the feed path lying between a type drum 28, see also FIG. 2, and a horizontally extending row of type hammers 30 supported in a print head assembly 31 and selectively actuated to impress the sheet material 27 along with an ink transfer medium, not shown, against type faces on the drum 28 to effect a line of printing on the sheet or form in each print cycle. The tractors 25, 26 may be of any suitable construction. Both possess the same features and are of identical construction except for being designed to engage opposite edges of the form. In the form shown, each tractor comprises a frame 35 of substantially elliptical outline supporting sprocket gear means keyed to the shaft 15 and driving a sprocket chain the links of which carry pins 38 adapted to engage in sprocket holes 40 formed in the marginal side edges of the form sheet 27. Each of the tractors is provided with a pivotal retainer 41 for holding the sheet in engagement with the sprocket pins 38 and which may be opened for removing the sheet from or inserting a new sheet in the machine. Each tractor also includes a clamping lever 42 which secures the tractor in an adjusted position and which may be operated to enable lateral adjustment of the tractors along the shafts 13, 15.

The lower shafts 14, 16 carry an identical pair of tractors 25, 26 which are disposed along the shafts in precise vertical alignment with their counterpart tractors on the upper shafts and thereby serve as means for positively maintaining the sheets at the selected registration position relative to the printing station. It has been

found that provision of only one pair of tractors beyond the printing station, such as tractors on the upper shafts 13, 15 is unable to achieve precise registration of the form at the printing station, particularly in cases where the form consists of multi-parts interleaved with carbon transfer sheets. The provision of a second pair of tractors behind the printing station, such as the tractors on the shafts 14, 16 enables precise registration of the form at the printing station and also enables the tension of the sheet to be maintained at a desired level at all times.

In accordance with the invention, means are provided for avoiding the necessity of individually adjusting each of the four tractors when it is desired to feed a sheet or form of different width or to move a sheet into a different registration relative to the print station. The means provided by the invention, on the other hand, facilitate the setting of the tractors in adjusted position by mechanism operating to adjust both left-hand tractors 25 simultaneously and both right-hand tractors 26 simultaneously, maintaining the respective left-hand and right-hand tractors in precise vertical alignment at all times and furthermore enabling the simultaneous adjustment of all four tractors simultaneously with or without a form in the machine and, in the former instance, regardless of whether or not the form is being fed at the time.

The means for adjusting the several tractors includes a system of belts or bands 45, 46, 47, 48, preferably of steel or the like, of which there is one clamped to each of the tractor devices. The ends of the several bands are wrapped around and secured to manually rotatable drum means carried by shaft means mounted on the outer side of the right-hand machine frame plate 12. As can also be seen in FIG. 3, angle brackets 51, 52 secured to the frame plate 12 support a substantially upright shaft 55 which is suitably journaled in said brackets and carries near its upper end a drum 56 and at its lower end a drum 57. Carried by the shaft 55 between the drums 56, 57 is an independently rotatable hollow shaft or sleeve 60 to the upper end of which is fixed, adjacent drum 56, a drum 61 and to the lower end of which is fixed, adjacent drum 57, a drum 62. Each of the drums 56, 57, 61, 62 is formed with a pair of circumferential grooves upon which are wound, in opposite directions, the opposite ends of a related one of the bands 45–48. The band 45 is associated with the drum 56, one end of the band being wound about the lower groove in the drum, the band running off the front end of the drum and reaching through an opening in the side frame 12 to a pulley 65 suitably mounted on the inner side of the frame plate 11, the belt returning to the rear side of the drum 56 and wrapped around the upper groove of the drum. The belt 46 is associated with the drum 61 on the hollow shaft or sleeve 60, the belt similarly running from the front side of the upper groove of the drum, reaching around a pulley 66 and returning to the rear side of the lower groove of the drum. Belt 47 is associated with the other drum 62 on the sleeve 60 and runs from the front side of the lower groove of the drum around a pulley 67 and returns to the rear side of the upper groove of the drum. Belt 48 is associated with the drum 57 mounted on the lower end of shaft 55 and runs from the front side of the upper groove of the drum, reaching around a pulley 68 and returning to the rear side of the lower groove of the associated drum. Each of the bands is clamped to a respective one of the tractors 25, 26 by means which can best be seen in FIG. 4 which illustrates the clamping of the upper left tractor 25 to the band 45. FIG. 4 is a view of the tractor from the rear wherein it can be seen that a clamping plate 71 is screwed onto the rear face of the tractor frame 35. The inner face of the clamping plate is cut away to form a pair of parallel horizontally extending grooves for accommodating the forward reach of bands 45, 46. The tractor housing or portion thereof underlying the sprocket pins is also cut away to define slots for accommodating the bands 45, 46

which thus are able to pass through the tractor mechanism inside of the sprocket pin supporting chain. Since, as before stated, the band 45 is associated with the left-hand upper tractor 25, a set screw 72 is threaded into the clamping plate 71 so as to bear against the band 45 and securely grip same thus clamping the tractor to the belt. The belt 46 passes freely through the other slot of the clamping plate, said belt being clamped in a similar manner to the upper right-hand tractor 26 wherein the set screw 72 would be located to grip feed belt 46 and enabling free passage of the belt 45. The lower tractors 25, 26 are similarly clamped selectively to the belts 47, 48, the tractor 25 being provided with a clamping plate for gripping the belt 48 and enabling free passage of the belt 47, the lower tractor 26 being provided with a similar clamping plate for gripping the belt 47 and enabling free passage of the belt 48.

Preferably each belt is provided with a tensioning device which is provided in the rear reach of the respective belt and comprises a coupling including a screw 74 threaded into clips 75 fastened to intermediate terminals of the band thus providing means whereby the tension of the respective bands can be readily and easily adjusted.

From the foregoing it will be apparent that rotation of the shaft 55 and the drums 56, 57 fastened thereto will wind up one end of each of the bands 45, 48, at the same time unwinding the other end of the respective bands to shift the two left-hand tractors 25 along their supporting shafts in one direction or another, depending upon the direction of rotation of the drums, to thereby place the left-hand tractors at a selected position. Similarly, rotation of the sleeve 60 along with the drums 61, 62 fastened thereto, will operate through the bands 46, 47 to shift the two right-hand tractors 26 in unison along their supporting shafts.

Rotation of the shaft 55 is accomplished through a beveled gear 80 fastened to the upper end of the shaft and disposed in meshing engagement with a beveled pinion 81 mounted on the end of a shaft 82 rotatably supported in brackets 83 secured to the side frame plate 12 of the machine. The front end of shaft 83 carries a manually rotatable knob 84 disposed at a conveniently accessible position for manipulation by the operator of the machine.

Rotation of the sleeve 60, for adjustment of the right-hand tractors 26, is effected in a similar manner by means of a beveled gear 90 mounted integrally with the drum 61 on the upper end of the sleeve, the beveled gear being disposed in meshing engagement with a beveled pinion 91 mounted on the end of a shaft 92. The shaft 92 is carried in brackets 93 fastened to the side frame plate 12 of the machine and carries at its forward end a manually rotatable knob 94 for manipulation by the operator to adjust the right-hand tractors 26.

The control knobs 84, 94 are operated individually whenever it may be desired to alter the spacing between the left-hand tractors 25 and the right-hand tractors 26 so as to adjust the mechanism for handling sheets or forms of different widths. In any adjusted position of the tractors, the same vertical alignment will always be maintained since the tractors are operated positively through bands of non-yielding material thereby precluding any possibility of misalignment arising between the upper and lower tractors for a respective side of the sheet.

There are instances when it is desired to be able to adjust all four tractors without altering the spacing between the left-hand and the right-hand ones, such as, for example, when it is desired to change the registration of a sheet being fed relative to the printing station. To facilitate this type of adjustment, the invention includes means for operatively coupling the shaft 55 with the sleeve 60 so that by a single adjustment procedure all four tractors, i.e. the two left-hand tractors 25 and the two right-hand tractors 26, may be shifted in unison in one direction or another by the manipulation of one of the control knobs 84 or 94. Referring now to FIG. 3, it will be noted that the drum 56 mounted on a shaft 55 is formed with an

interior annular recess in which is wound a coil 95. The drum 56 together with the adjacently disposed drum 61 on the sleeve 60 are formed of magnetic material thus constituting a magnetic clutching device with the drum 56 serving as a magnetic core and the drum 61 serving as a clutch armature within the magnetic field of said core. The opposing faces of the drum 56 and drum 61 are spaced so as to enable free and independent rotation of either drum when the coil is de-energized but which however provides a low reluctance magnetic circuit for the core when the coil is energized thus creating strong magnetic attraction on the armature to effectively couple the sleeve 60 upon which the drum 61 is mounted with the shaft 55 upon which the core or drum 56 is mounted. This enables operation of the adjusting means for both the left-hand and right-hand tractors 25, 26 by manipulation of either one of the control knobs 84, 94. This feature greatly facilitates adjustments required for registering a sheet at the printing station since it avoids the necessity of adjusting each one of the tractors individually. Furthermore it enables the registration adjustment to be effected while a sheet or form is in feeding position engaged by the tractors and, moreover, permitting the adjustment to be made during the course of sheet feed.

The coil 95, as can be seen by the diagram of FIG. 5, is connected to a suitable power source through a circuit which includes a manually operable switch 96. The switch may be located at any suitable location on the machine and preferably is placed in close proximity to the control knobs 84, 94 so as to keep all of the manually operable controls over the tractor adjusting mechanism within one easily accessible area.

While there has been shown and described what is considered to be a preferred embodiment of the invention, it will of course be understood that variations in form could be made without departing from the spirit of the invention, and it is therefore intended that the invention be not limited to the exact form herein shown and described nor to anything less than the whole of the invention as hereinbefore set forth and as hereinafter claimed.

What is claimed is:

1. In a sheet feeding mechanism for advancing sheet material through an operating station,

(*a*) a pair of members on each side of said operating station the members of each pair being disposable for engaging with the opposite marginal areas of said sheet material,

(*b*) means supporting said members for lateral shifting movement in a direction transverse to the direction of sheet feed,

(*c*) means for driving said members to feed the sheet material engaged by said members,

(*d*) a first adjusting means, including a first shaft member adapted to rotate about its axis, manually operable for shifting in unison the members of each pair engageable with one marginal area of said sheet material,

(*e*) a second adjusting means, including a second shaft member adapted to rotate about its axis, the axes of said first and second shaft members being co-linear, manually operable for shifting in unison the members of each pair engageable with the opposite marginal area of said sheet material, and

(*f*) means for operatively coupling said first and second adjusting means to enable simultaneous shifting of the members engaging both marginal areas of said sheet material, said coupling means comprising a clutch interconnecting said first and second adjusting means to cause each adjusting means to operate in dependence upon one another when said clutch is engaged, said clutch operating magnetically and including a coil integral with one of said shaft members and an armature integral with the other of said shaft members when said clutch is engaged.

2. The invention according to claim 1 wherein each adjusting means includes a band wound drum mounted on the associated shaft member, the drum mounted on one of the said shaft members being formed of magnetic material and shaped to support a coil to constitute the core of said clutch, the drum mounted on the other of said shaft members being formed of magnetic material and disposed adjacent to said core to constitute the armature of said clutch.

3. In a sheet feeding mechanism for advancing sheet material past a work station having a first feed member engaging one edge of the sheet material before said work station, a second feed member engaging said one edge of the sheet material after said work station, a third feed member engaging the opposite edge of the sheet material before said work station, and a fourth feed member engaging said opposite edge of the sheet material after said work station, a mechanism for selectively simultaneously adjusting said feed members or alternatively adjusting the width between feed members engaging opposite edges of the sheet material to accommodate different widths of sheet material, the improvement comprising:

a first flexible belt adapted to be affixed to said first feed member;

a second flexible belt adapted to be affixed to said second feed member;

a third flexible belt adapted to be affixed to said third feed member;

a fourth flexible belt adapted to be affixed to said fourth feed member;

a hollow shaft having

a first drum adapted to engage said first belt, and

a second drum adapted to engage said second belt;

a shaft adapted to rotate concentric within said hollow shaft having

a third drum adapted to engage said third belt, and

a fourth drum adapted to engage said fourth belt;

a first manual control knob;

gearing means coupling said first knob to said hollow shaft;

a second manual control knob;

gearing means coupling said second knob to said concentric shaft; and

means for selectively engaging said shafts to operate in unison.

4. The improvement as claimed in claim 3 wherein:

one of said drums on said hollow shaft and one of said drums of said concentric shaft are adjacently disposed to each other and are formed of magnetic material, one of said two magnetic material drums being formed with an interior annular recess;

an electrical coil adapted to be engaged with said recessed drum;

an electrical switch coupled to said coil; and

means adapted to couple said coil and said switch to an electrical source.

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