

[54] **AUTOMATIC SPRING FEED DEVICE
FOR A SPRING GRINDER**

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[58] Field of Search.....51/80, 215, 215.1, 215.2, 118,
51/145 T, 115

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[57] **ABSTRACT**

An automatic spring feed device for a spring grinder of the type which effects grinding of opposite ends of coiled springs by means of grinding wheels. The device is adapted to automatically insert one coiled spring after another in a number of spring holding openings formed equidistantly in the marginal portion of a rotary table of the grinder.

2 Claims, 6 Drawing Figures

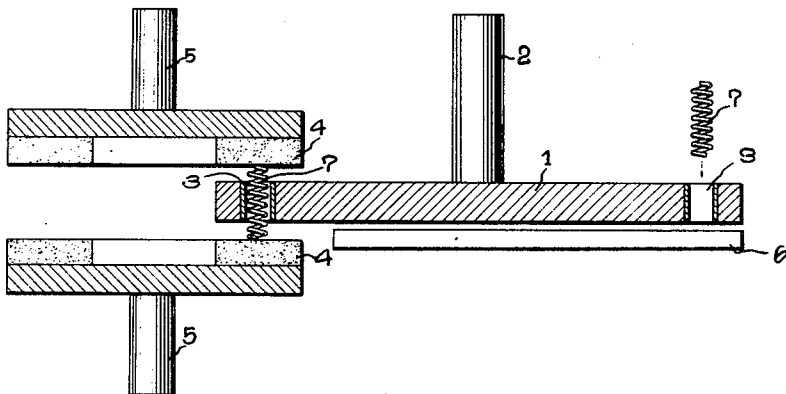
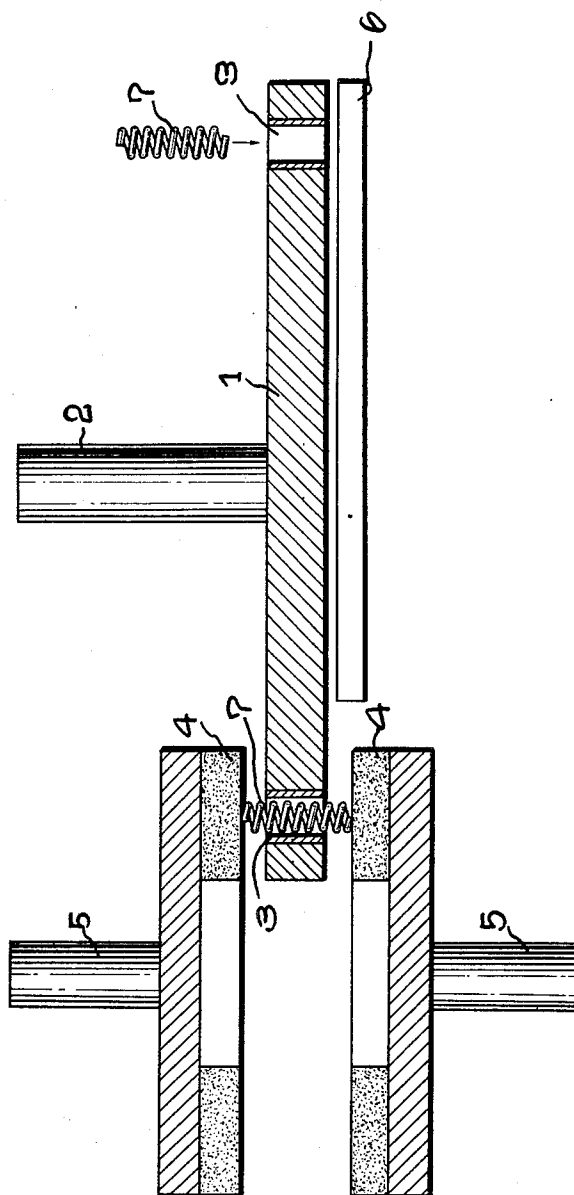


FIG. 1



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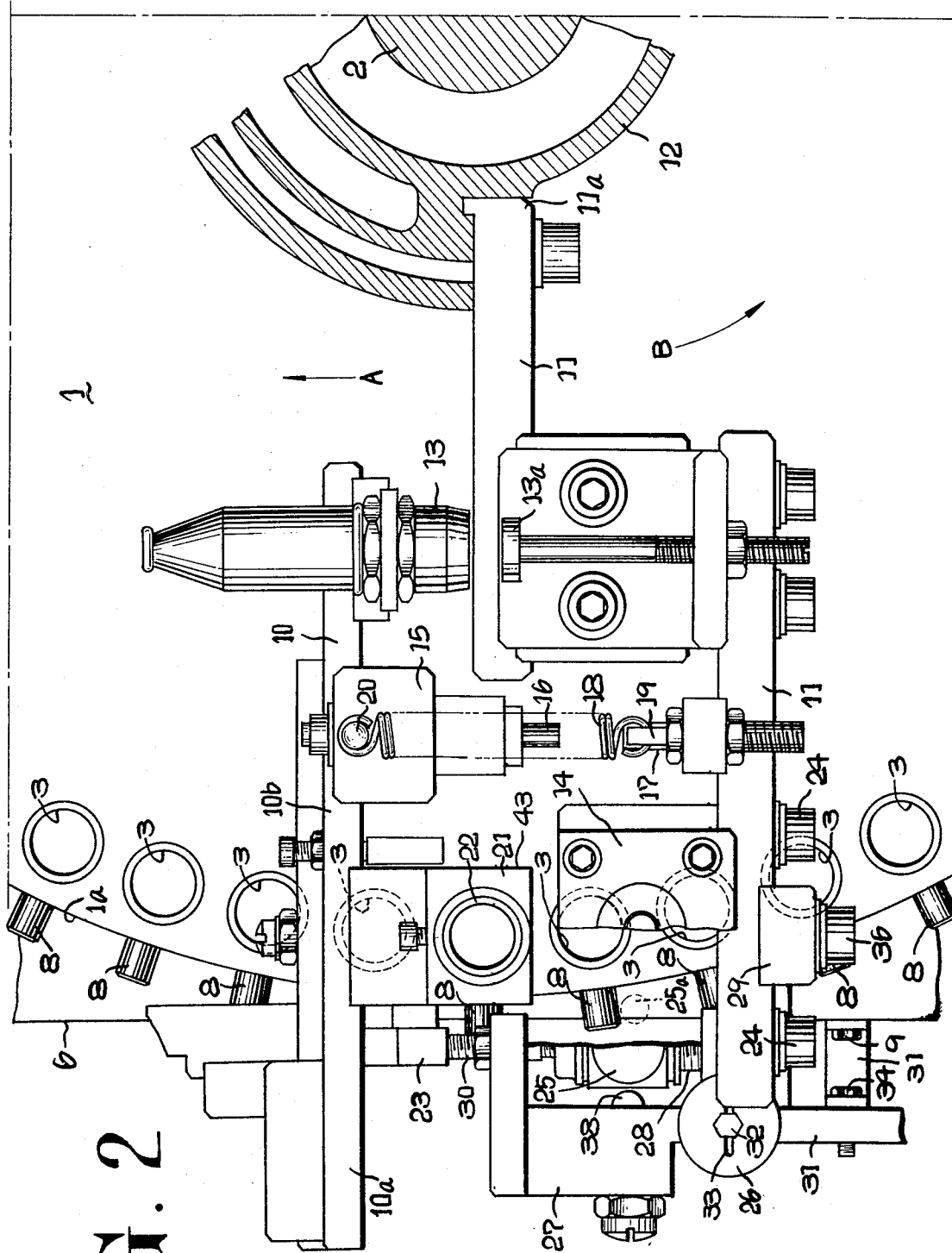


FIG. 2

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FIG. 3

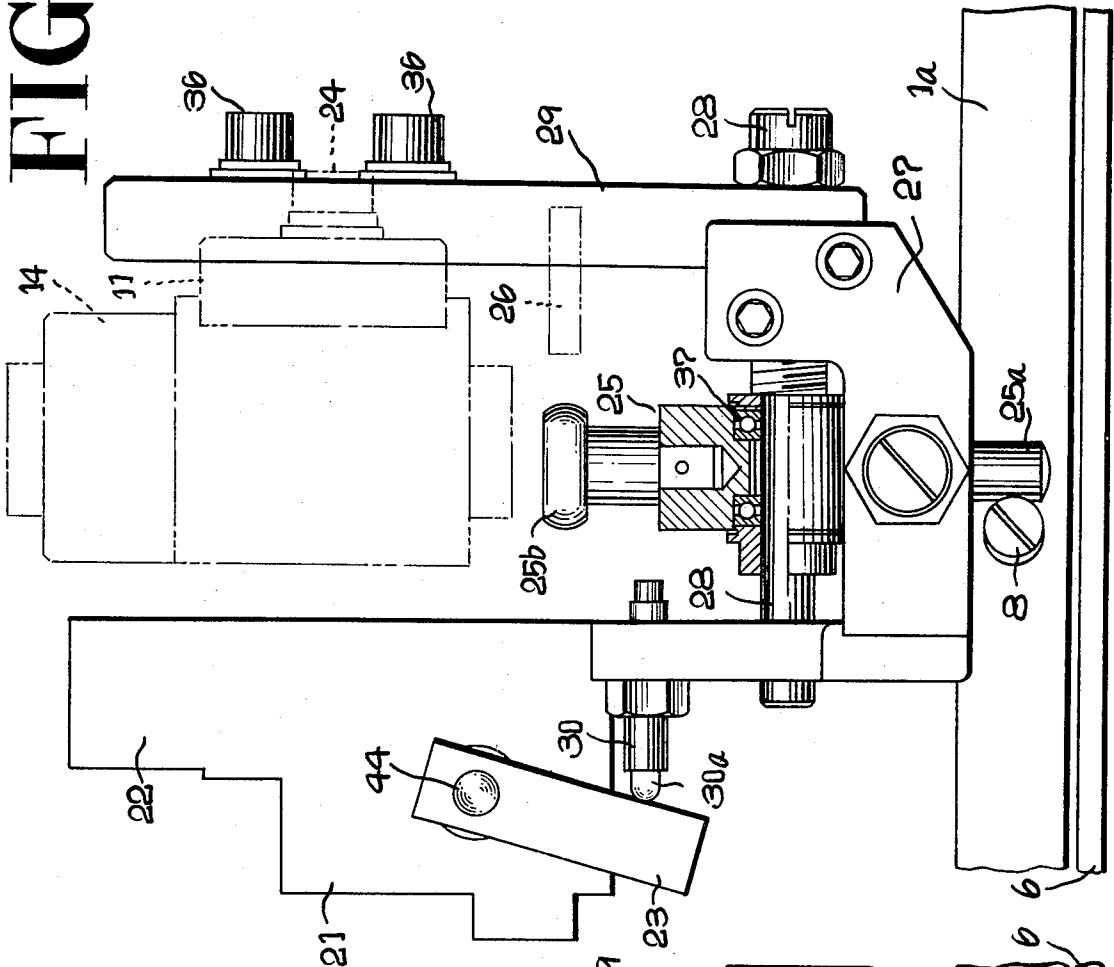
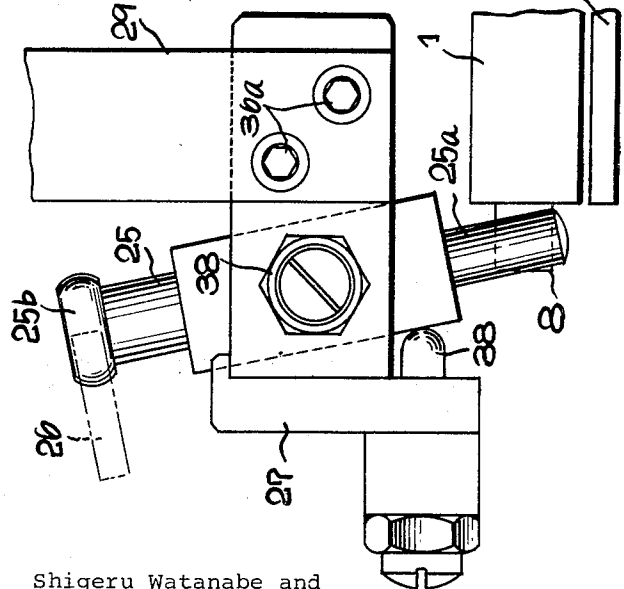
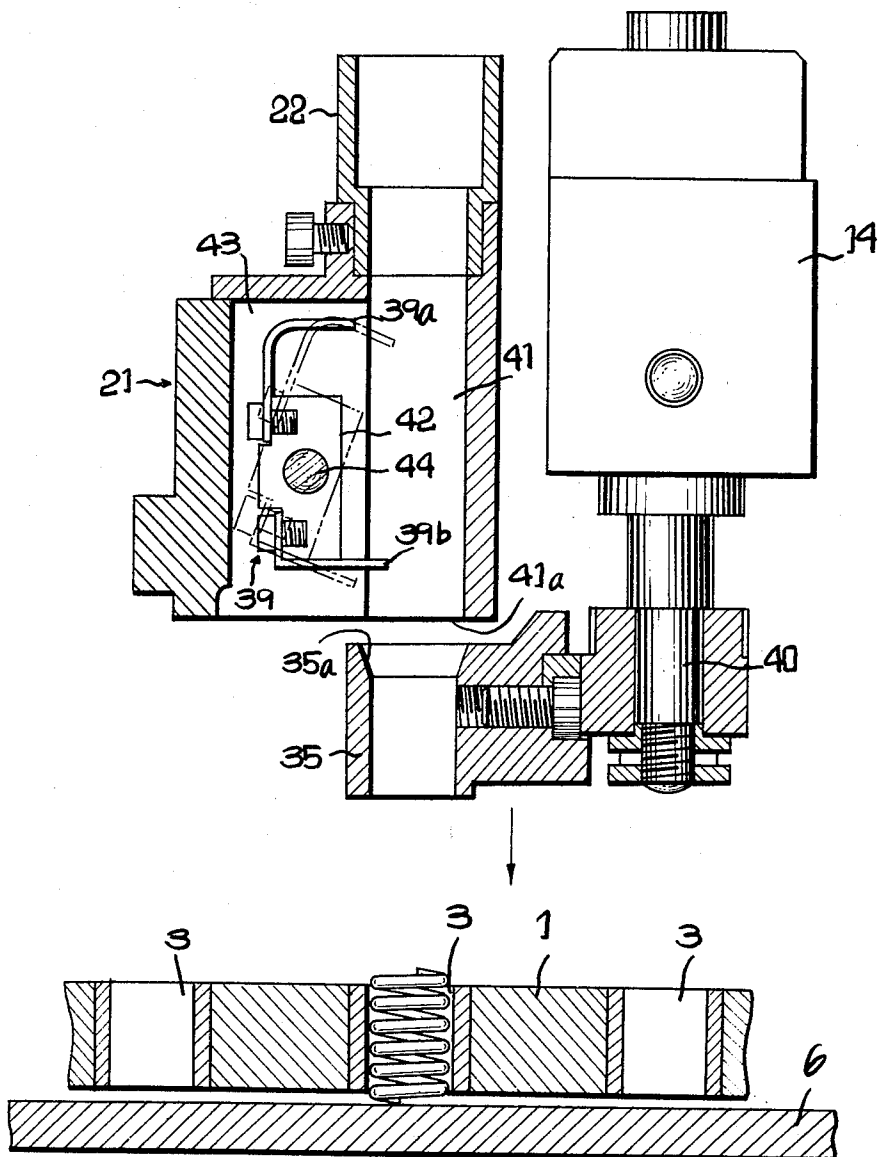


FIG. 4



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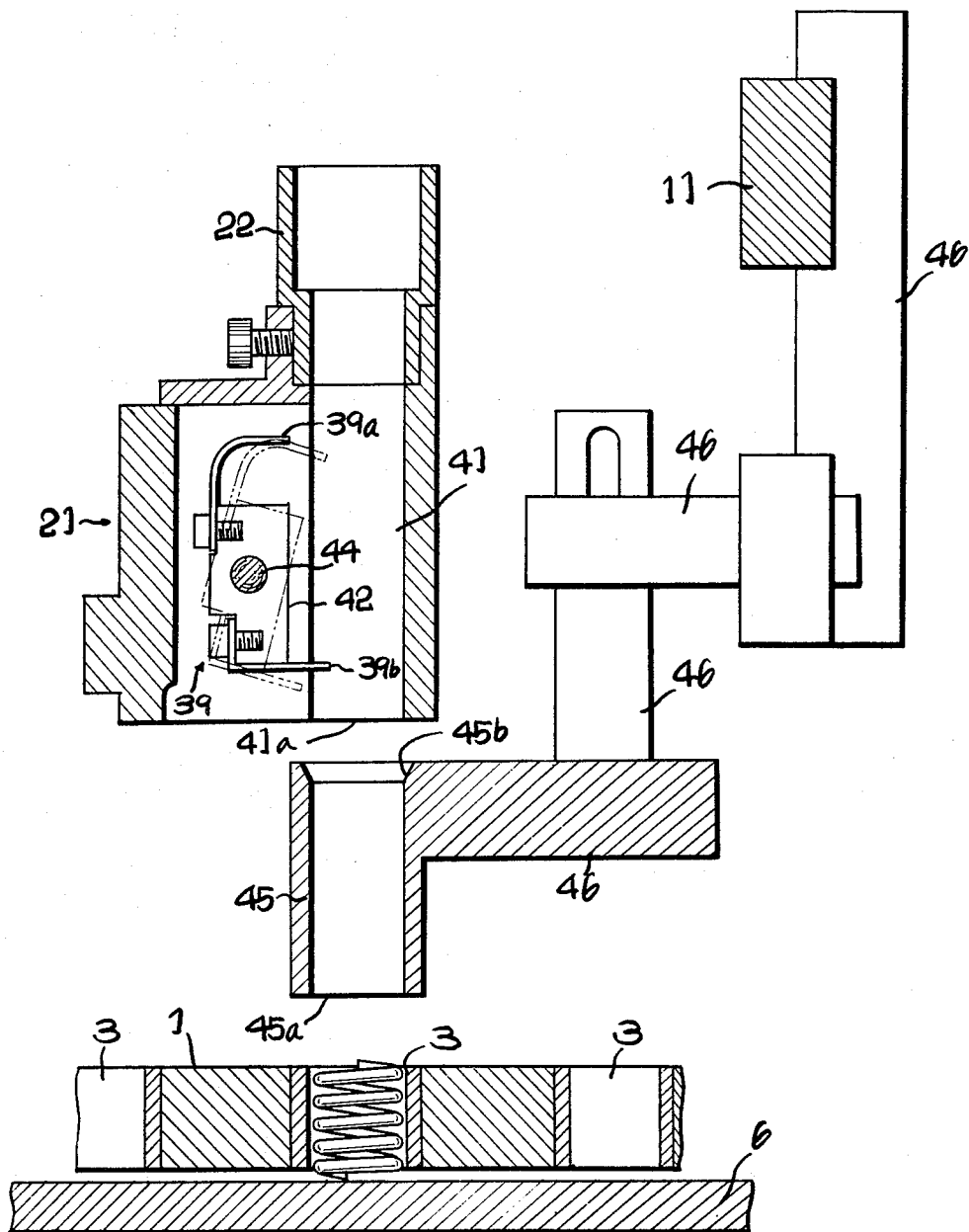
FIG. 5



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FIG. 6



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AUTOMATIC SPRING FEED DEVICE FOR A SPRING GRINDER

DESCRIPTION OF THE PRIOR ART

A spring grinder for effecting grinding of opposite ends of coiled springs generally consists of two opposed grinding wheels and a discal rotary table formed with a number of spring holding openings disposed equidistantly in the marginal portion of the rotary table, the spring holding openings of the rotating table being adapted to pass between the two grinding wheels when the rotary table is operated. The spring grinder operates such that if a spring to be worked on is inserted in any one of the spring holding openings, the spring is brought to a position between the two grinding wheels as the rotary table rotates so that opposite ends of the spring can be ground by the two rotating grinding wheels. It will be evident from the above description that if a number of springs are to be worked on by this type of grinder, coiled springs must be successively inserted in the spring holding openings of the rotary table. Present practice in the operation of this type of grinder requires the manual insertion of springs in the spring holding openings. This manual operation is time-consuming and requires an extra operator. In addition, the efficiency of operation is low.

SUMMARY OF THE INVENTION

This invention relates to an automatic spring feed device for a spring grinder.

This invention has as its object the provision of an automatic spring feed device for a spring grinder which will automatically and successively feed springs to be worked on to a rotary table of the spring grinder.

In one embodiment, the automatic spring feed device for a spring grinder according to this invention comprises a number of projections disposed radially on the outer periphery of a rotary table of the spring grinder in positions corresponding to spring holding openings, a fixed arm affixed to a base of the spring grinder and disposed above the rotary table, a movable arm pivotally supported at one end by a driving shaft of the rotary table and urged by the biasing force of a spring to move toward the fixed arm, spring distribution means affixed to the fixed arm and comprising a spring dropping passage of a diameter slightly larger than the outer diameter of coiled springs to be worked on, a two-step spring release shutter including two stoppers, one of the stoppers being adapted to project into the spring dropping passage as the other stopper is withdrawn therefrom, and an actuating member operatively associated with the spring separating shutter, the lower end of the spring dropping passage being disposed immediately above the circle passing through the centers of the spring holding openings, an engaging bar mounted on the movable arm by a supporter and urged resiliently into a position in which it engages one of the projections, a fixed engagement releasing member for releasing the engaging bar from engagement with each of the projections a push rod mounted on the movable arm and adapted to abut against the actuating member as the movable arm is returned to its original position by the biasing force of the spring so as to move the spring release shutter and permit one spring or work to drop into one of the spring holding openings, and a synchronized guide tube mounted on the movable arm such that when the movable arm is returned to its original position by the biasing force of the spring the upper end of the guide tube is disposed immediately below the spring dropping passage of the spring release means and the lower end thereof is disposed immediately above one of the spring holding openings.

In another embodiment, the automatic spring feed device for a spring grinder according to this invention comprises, in addition to the constituent parts described with reference to said one embodiment, a hydraulic cylinder affixed to the movable arm and including a piston rod on which the synchronized guide tube is mounted, and contactless switch means mounted on the movable arm and fixed arm for operat-

ing an electromagnetic valve for changing the direction of operation of the hydraulic cylinder, the contactless switch means being turned on when the movable arm is returned by the biasing force of the spring to its original position so as to operate the hydraulic cylinder to cause the synchronized guide tube to drop from a position in which it is disposed immediately below the spring dropping passage of the spring distribution means to a position in which it is disposed immediately above one of the spring holding openings, whereby springs to be worked on which are dropped one by one from the spring distribution means can be positively guided and inserted into the spring holding openings.

The features and advantages of this invention will be evident from the detailed description of the embodiments of this invention set forth hereinafter when considered in conjunction with the accompanying drawings in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in explanation of the general construction of a spring grinder to which the present invention is applicable;

FIG. 2 is a plan view, with certain parts being cut out, of an embodiment of the automatic spring feed device according to this invention as it is mounted on the spring grinder of FIG. 1;

FIG. 3 is a front view of the device according to this invention showing the manner in which the engaging bar engages one of the projections and the push rod abuts against the actuating member for moving the spring release shutter, with other constituent parts of the device being omitted in the interest of clarity;

FIG. 4 is a side view of the device according to this invention showing the manner in which the engaging bar engages one of the projections, with other constituent parts of the device being omitted in the interest of brevity;

FIG. 5 is a longitudinal sectional front view of the device according to this invention showing the spring distribution means and the elevational synchronized guide tube, with other constituent parts of the device being omitted in the interest of clarity; and

FIG. 6 is a longitudinal sectional front view of the device according to this invention showing the spring distribution means and the synchronized guide tube, with other constituent parts of the device being omitted in the interest of clarity.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will now be described with reference to the accompanying drawings. FIG. 1 shows the general construction of a spring grinder to which the automatic spring feed device according to this invention is applicable. The grinder comprises a rotary table 1 adapted to be rotated by a driving shaft 2 operatively connected to drive means (not shown).

The table 1 is formed with a number of spring holding openings 3 disposed equidistantly from one another in the marginal portion of the table 1, the line connecting the centers of the openings forming the circumference of a circle. The grinder also comprises grinding wheels 4, 4 arranged one above the other in face to face relationship and disposed such that the spring holding openings 3 of the disc 1 move along a path between the two grinding wheels 4, 4 shafts 5, 5 supporting the grinding wheels 4, 4 respectively are operatively connected to the drive means for operating the rotary table 2. One of or both the shafts 5, 5 can be moved axially so as to gradually move the grinding wheels toward each other. A base 6 is disposed in a position in which it is in close proximity to the underside of the rotary table 1 so as to keep springs 7 in the spring holding openings 3 from being inadvertently dislodged and dropping downwardly. Although not shown, the base 6 is formed with a cutout for discharging the spring therethrough after being ground. In effecting grinding of opposite ends of springs 7 by the coil grinder generally constructed as aforementioned, the springs 7 to be worked on

have hitherto been manually inserted in the spring holding openings 3 while the rotary table 1 is operated. The springs 7 positioned in the spring holding openings 7 have their opposite ends ground by the opposite surfaces of the grinding wheels 4, 4 as the springs 7 in the holding openings 3 move along the path passing between the grinding wheels 4, 4.

FIG. 2 is a plan view showing the automatic spring feed device according to this invention mounted on the spring grinder of the type shown in FIG. 1. As described with reference to FIG. 1, 2 is the driving shaft of the rotary table 1 operatively connected to drive means (not shown), 3 designates spring holding openings formed equidistantly from one another in the marginal portion of the rotating table 1, and 6 is the base. Although not shown in FIG. 2, two grinding wheels are arranged in face to face relationship with the marginal portion of the rotating table being positioned in the space between the two grinding wheels (See FIG. 1). Projections 8 are formed radially on the outer circumferential surface 1a of the rotary table 1 in positions corresponding to the spring holding openings 3. A fixed arm 10 has one end portion affixes to the base 6, the machine frame of the spring grinder or other fixed frame, and the other end portion extending radially of the rotary table 1 to be disposed above the rotary table. A movable arm 11 is fixed, at one end 11a, to a boss 12 which is rotatably supported by the driving shaft 2 through a ball bearing (not shown). Contactless switch means includes switch members 13 and 13a mounted on the fixed arm 10 and movable arm 11 respectively for operating an electromagnetic valve (not shown) for changing the direction of operation of a hydraulic cylinder 14.

A shock absorber 15 mounted on the fixed arm 10 includes a shock absorbing bar 16 which is under the influence of hydraulic pressure. A pin 17 is mounted on the movable arm 11 in a position corresponding to the position of shock absorbing bar 16. A compression spring 18 is mounted between a threaded rod 19 attached to the movable arm 11 and a pin 20 attached to the shock absorber 15. The movable arm 11 pivotally supported, at one end, by the driving shaft 2 is urged by the biasing force of the spring 18 to move in the direction of the arrow A. Spring distribution means 21 is mounted on the fixed arm 10. A spring introducing tube 22 is connected to the upper end of the spring distribution means 21. A actuating member 23 is mounted on the one side wall of the spring distribution means 21. The construction of the spring distribution means 21 is shown in detail in FIGS. 5 and 6. The hydraulic cylinder 14 is fixed to the movable arm by means of bolts 24, 24 and part of it is omitted in FIG. 2. The hydraulic cylinder 14 is shown in detail in FIG. 5.

An engaging bar 25, one half portion of which is shown in FIG. 2, is adapted to come into engagement with one of the projections 8 to impart, to the movable arm 11, and intermittent reciprocating motion along an arcuate path by the action of an engagement release member 26 subsequently to be described, the engaging bar 25 is pivotally mounted, through a bearing, on a shaft 28 secured to a shaped supporter 27 and comprises a lower portion 25a which engages one of the projections 8, said supporter 27 being mounted on the movable arm 11 through a mounting bar 29. The engaging bar 25 and supporter 27 are shown in detail in FIGS. 3 and 4.

A push rod 30 is affixed to the supporter 27 in a position in which it is disposed against the lower portion of the actuating member 23. The relative positions of the actuating member 23 and push rod 30 are shown in detail in FIG. 3.

The engagement release member 26 is mounted on a base plate 6 or other fixed part of the machine frame by means of brackets 31, 31. The engagement release member 26 which is disposed in the arcuate path of travel of the engaging bar 25, is mounted such that its mounting position can be adjusted as follows: by loosening a bolt 32, it can be moved transversely along the major dimension of a slot 33; by loosening a bolt 34, it can be moved longitudinally; and by loosening a bolt 9, it can be moved vertically. Preferably, the engagement release member 26 is mounted in a position in which it releases the

engaging bar 25 from engagement with one of the projections 8 when the engaging bar 25 has moved, from a predetermined original position, a distance substantially equal to the distance between the projections 8.

In FIGS. 3 and 4, the hydraulic cylinder 14 shown in broken lines is mounted on the movable arm 11 by means of the bolts 24, 24 as aforementioned. An elevational synchronized guide tube 35 is omitted in FIG. 3, the hydraulic cylinder 14 being shown in detail in FIG. 5. The mounting bar 29 is secured, by bolts 36, 36, to the movable arm 11 at right angles thereto for mounting thereon the supporter 27 by bolts 36a, 36a. The engaging bar 25 is pivotally mounted, substantially at its central portion through a bearing 37, to the shaft 28 secured to the supporter 27. The lower portion 25a of the engaging bar 25 is adapted to engage one of the projections 8 as the engaging bar 25 is moved in pivotal motion about the shaft 28 as it is pushed by a pin 38 caused to extend from the supporter 27 by the biasing force of a spring built in a cylindrical member bolted on the supporter 27.

The spring distribution means 21 mounted on the fixed arm 10 comprises a two-step spring release shutter 39 subsequently to be described in detail which is mounted on a shaft 44 and disposed inside the spring release means 21 (FIG. 5). The actuating member 23 is also mounted on the shaft 44 and disposed outside the spring release means. The push rod 30 mounted on the supporter 27 as aforementioned is disposed such that its forward end 30a is disposed against the lower portion of the operation bar 23.

FIG. 3 shows the push rod 30 abutting against the actuating member 23 and moving the same in pivotal motion about the shaft 44 following the return of the movable arm 11 to its original position. When the actuation member 23 is in this state, one spring to be worked on is released from the spring distribution means 21 and drops downwardly. The engagement release member 26 is adapted to release the engaging bar 25 from engagement with each projection 8. The brackets 31, 31 for securing the engagement release member are omitted in FIG. 3 in the interest of clarity.

In FIG. 5, the hydraulic cylinder 14 has its direction of operation changed by an electromagnetic valve (not shown) which is operated by the contactless switch means 13, 13a. A piston rod 40 of the hydraulic cylinder 14 mounts a synchronized guide tube 35 of an inner diameter slightly larger than the outer diameter of springs to be worked on.

When the engaging bar 25 is maintained in engagement with one of the projections 8 or, in other words, when the movable arm 11 is in contact with one of the projections 8 radially extending from the outer periphery of the rotary table 1, the synchronized guide tube 35 is disposed immediately above one of the spring holding openings 3 to be indexed therewith. When the engaging bar 25 is released from engagement with one of the projections 8 by the action of the engagement release member 26 and the movable arm 11 has been restored to its original position by the biasing force of the spring 18, the upper end of the synchronized guide tube 35 is disposed immediately below a spring dropping passage 41 which is formed within the spring distribution means 21, the spring dropping passage 41 having a diameter which is slightly larger than the outer diameter of springs to be worked on. The spring introducing tube 22 is connected, at one end, to spring feed means (not shown) through a pipe (not shown). The spring distribution means 21 is mounted on the fixed arm 10 in a position such that a lower end 41a of the spring dropping passage 41 is disposed immediately above the center of each of the spring holding openings 3 to be indexed therewith.

The spring feed means (not shown) may be any one of the conventional part feed means. The spring feed means used in the present device utilizes electromagnetic vibration. The description of the spring feed means of this device will be omitted, the details of the means being disclosed in Japanese Pat. No. 213,939.

The two-step spring release shutter 41 mounted on one side of the spring dropping passage 41 includes stoppers 39a and

39b disposed one above the other. The two stoppers 39a and 39b are spaced apart from each other a distance substantially corresponding to the length of springs to be worked on. The stoppers 39a and 39b are affixed to a member 42 secured to the shaft 44 rotatably supported by opposite side walls 43, 43 of the spring distribution means 21. The shaft 44 also mounts the operation member 23 at its upper portion.

When the operation member 23 is not engaged by the push rod 30 and consequently the shaft 44 is not rotated, the lower stopper 39b projects into the spring dropping passage 41 and receives thereon a spring to be worked on. If the actuating member 23 is operated by the push rod 30 to cause the shaft 44 to rotate, then the upper stopper 39a projects into the spring dropping passage 41 to receive thereon a spring to be worked on. Stated differently, when one of the stoppers 39a and 39b projects into the spring dropping passage 41, the other stopper is withdrawn from the spring dropping passage 41.

The synchronized guide tube 35 is not necessarily required to be mounted on the piston rod 40 of the hydraulic cylinder 14. Other means than the hydraulic cylinder 14 may be used for this purpose. FIG. 6 shows another example of mounting the synchronized guide tube 35. The synchronized guide tube 45 in FIG. 6 is mounted on the movable arm 11 by means of a mounting bar 46 so that when the movable arm 11 is maintained in engagement with one of the projections 8, a lower end 45a of the tube 45 is disposed immediately above one of the spring holding openings 3. When the movable arm 11 is returned to its original position by the biasing force of the spring 18, an upper end 45b of the tube 45 is disposed immediately below the spring dropping passage 41.

Operation of the automatic spring feed device according to this invention which is constructed as aforementioned will now be described. If the rotary table 1 is rotated by the drive means (not shown) in the direction of arrow B (FIG. 2), the movable arm 11 pivoted at the drive shaft 2 will move, in association with the rotary table 1, away from the fixed arm 10 against the biasing force of the spring 18 because the engaging bar 25 is in engagement with one of the projections 8. When the movable arm 11 has moved through a predetermined angle in its arcuate path of travel, the head 25b of the engaging bar 25 will abut against the engagement release member 26, causing the engaging bar 25 to become inclined along the release member 26. This causes the lower portion 25a of the engaging bar 25 to move away from the particular projection 8 with which it is maintained in engagement, thereby releasing the lower portion 25a of the engaging bar from engagement with the projection 8. Upon release of the engaging bar 25 from engagement with the projection 8, the movable arm 11 is freed from restraint and retored to its original position by the biasing force of the spring 18, the shock of the returning movement of the movable arm 11 being absorbed by the shock absorber 15. If the movable arm 11 is retored to its original position, (1) the forward end of the pin 17 will abut against the shock absorbing bar 16 of the shock absorber 15; (2) the engaging bar 25 will come into engagement with the next following projection 8; (3) the synchronized guide tube 35 or 45 will be positioned immediately below the spring dropping passage 41 to be indexed therewith; (4) the push rod 30 will abut against the actuating member 23; (5) the spring release shutter 39 will be actuated so that the lower stopper 39b is withdrawn from the spring dropping passage 41 to permit a spring or work to drop through the spring dropping passage 41; (6) the upper stopper 39a of the spring release shutter 39 will project into the spring dropping passage 41 so that a fresh supply of spring or work may rest on the upper stopper; (7) the contactless switch means 13, 13a will be turned on; (8) the hydraulic cylinder 14 will be actuated to cause the piston rod 40 to move downwardly, with the synchronized guide tube 35 moving downwardly in synchronism with the downward movement of the spring or work to reach a position in which it is disposed immediately above one of the spring holding openings 3 to be indexed

therewith; and (9) the spring or work supplied by the spring distribution means 21 will thus be guided by the synchronized guide tube 35 or 45 and positively inserted in one of the spring holding openings.

The Steps (1) to (9) take place substantially simultaneously as the movable arm is restored to its original position following the release of the engaging bar 25 from engagement with one of the projections 8. If the synchronized guide tube 45 is of the non-elevational type shown in FIG. 6, only the Steps (1) to (6) and (9) will take place with the Steps (7) and (8) being eliminated. If the movable arm 11 pivoted at the drive shaft 2 gradually moves away from the fixed arm 10 again, the following Steps (1) to (6) will take place during its travel through an arcuate path: (1) the contactless switch means 13, 13a will be turned off; (2) the shock absorber 15 will be released from engagement with the pin 17; (3) the piston rod 40 of the hydraulic cylinder 14 will move upwardly to its original position; (4) the elevational synchronized guide tube 35 will move upwardly from the position in which it is disposed immediately above one of the spring holding openings 3; (5) the push rod 30 will be released from engagement with the actuating member 23 so that the latter will be restored to its original position; and (6) the upper stopper 39a of the spring release shutter 39 will be withdrawn from the spring dropping passage 41 and the lower stopper 39b will project into the passage 41 so that the fresh supply of spring or work from the spring distribution means 21 will rest on the lower stopper 39b. It is to be understood that when the movable arm 11 moves in association with the rotary table 1, the synchronized guide tube 35 or 45 is always positioned immediately above one of the spring holding openings 3 to be indexed therewith. If the synchronized guide tube 45 is of the type shown in FIG. 6, only the Steps (2), (5) and (6) take place.

When the movable arm 11 has moved through a predetermined angle along its arcuate path of travel, the engaging bar 25 will be brought into abutting engagement with the engagement release member 26, so that the movable arm 11 is restored to its original position by the biasing force of the spring 18 as aforementioned and a spring or work is inserted in the next following spring holding opening 3. The aforesaid cycle of operations is repeated so that one spring after another is successively and positively inserted into the spring holding openings 3 formed in the rotary table 1 as the movable arm 11 moves in intermittent reciprocating motion through an arcuate path of travel.

From the foregoing description, it will be appreciated that the spring feed device according to this invention can automatically feed springs or work to the rotary table of a spring grinder, making it possible to economize on labor and increase efficiency in operation.

Combined with an automatic spring discharge device developed by the present inventor, the automatic spring feed device of this invention can fully automate the operation of grinding opposite ends of coiled springs. While the invention has been shown and described with reference to a preferred embodiment, it is to be understood that the invention is not limited to the specific forms of the device, and that many changes and modifications may be made therein without departing from the spirit and scope of the invention.

We claim:

1. An automatic spring feed device for feeding springs to a grinder which includes a base and a rotary table having a central drive shaft and spring receiving openings adjacent the periphery thereof; said device comprising a plurality of projections extending radially from the outer periphery of said table at positions aligned with said openings; a fixed arm attached to said base and fixedly extending above said rotary table; a movable arm extending above said rotary table and having a first end pivotally supported by said drive shaft; biasing means connecting said fixed arm and said movable arm for urging said movable arm toward said fixed arm; spring distribution means having therein a spring dropping passage of diameter slightly larger than the outer diameter of the springs to be

worked on, a two-step spring release shutter including two stoppers, one stopper being adapted to project into said spring dropping passage as the other stopper is withdrawn therefrom, and an actuating member operatively associated with said spring release shutter, said spring distribution means being mounted on said fixed arm such that the lower end of said spring dropping passage upon indexing is disposed immediately above each of said openings; an engaging bar mounted on said movable arm and urged into engagement with one of said projections; an engagement release member mounted on said base and having means for releasing said engaging bar from engagement with said projection; a push rod mounted on said movable arm and adapted to abut against said actuating member as said movable arm is urged toward said fixed arm by said biasing means so as to move the spring release shutter and permit one spring or work to drop into one of said openings; and a synchronized guide tube mounted on said movable arm such that when said movable arm is so urged by said biasing

means, the upper end of said guide tube is disposed below said spring dropping passage of said spring distribution means and the lower end thereof is disposed above one of said openings so as to be indexed therewith in synchronism with the downward movement of a spring or work.

2. a device as claimed in claim 1, further comprising a hydraulic cylinder having a piston rod and mounted on said movable arm; contactless switch means mounted on said fixed arm and said movable arm; said synchronized guide tube being of the elevational type and mounted on said piston rod and operated by said hydraulic cylinder as said contactless switch means is turned on when said movable arm is restored to its original position whereby said synchronized guide tube moves downwardly from a position in which it is disposed immediately below said spring dropping passage to a position in which it is disposed immediately above one of said openings.

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