Oct. 20, 1942. C. H. SHAFFER 2,299,505

SPRING SIZING MACHINE

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Fig. 1.

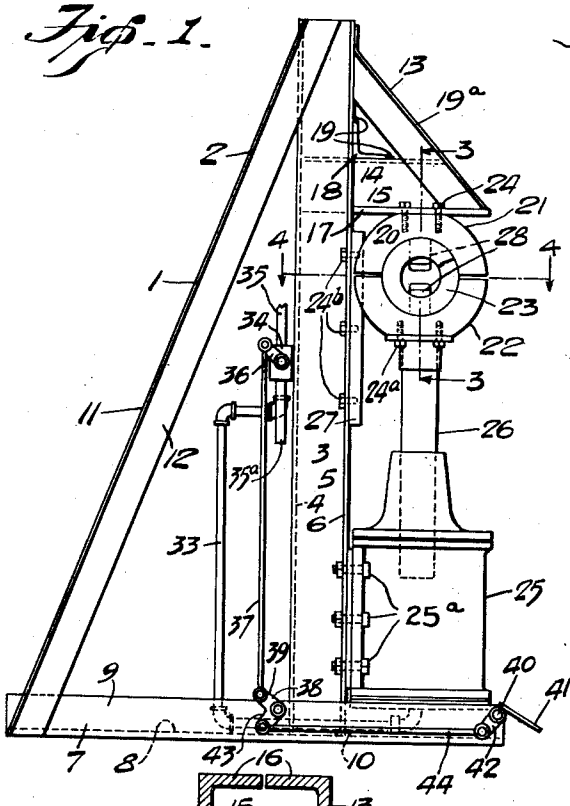
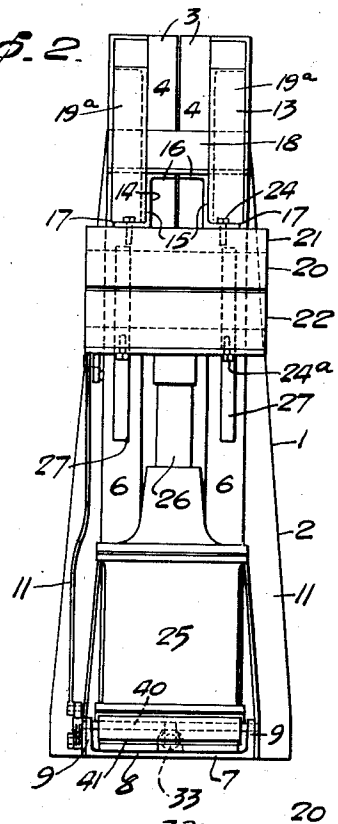


Fig. 2.



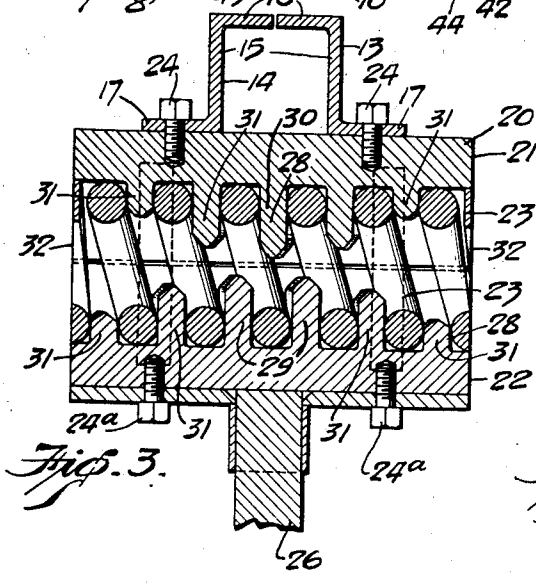


Fig. 3.

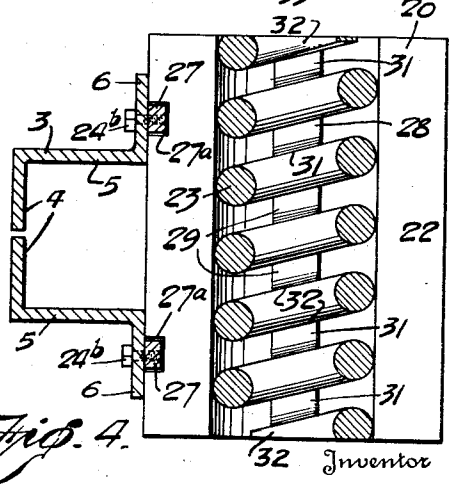


Fig. 4.

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SPRING SIZING MACHINE

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8 Claims. (Cl. 140—89)

The invention pertains to a coil or helical spring sizing machine.

In the manufacture of coil or helical springs and particularly those of a compression type wherein the coils, volutions or turns are spaced apart a predetermined distance, the coils are, at times, found ultimately to be spaced at unequal distances. This undesired result is obtained by the particular method by which the springs are formed. When wire of appreciable thickness or diameter is employed to form a spring it is heated to a predetermined degree and inserted into a coiling machine, usually of a lathe type, which is provided with a chuck or dog of some order to lock an end of the wire. The coiling machine is also provided with a retractable mandrel and a lead screw so associated that as the bar is fed into the machine the lead screw, which revolves at a certain predetermined speed, guides the wire to provide the pitch or spacing of the spring coils as the spring is wound on the retractable mandrel. After coiling, the retractable mandrel is withdrawn so that the coil spring can be removed from the machine. The spring, still in heated condition, tends to adhere to the mandrel with the result that the coils or turns of the spring are displaced from their formed position or pitch relation.

An object of the invention, therefore, is the provision, in a spring sizing machine, of means arranged to enter between successive turns or coils of a helical spring to return the coils to their proper or normal pitch position so as to be equally spaced throughout the length of the spring.

Another object of the invention is the provision of a plurality of dies having means so constructed and arranged that adjacent coils successively are urged to a predetermined position.

An added object of the invention is the provision of die means forming an open-ended cylinder for returning coils of a compression spring to normal position and exposing the ends of the spring so that hammer blows may be imparted thereto.

The above and numerous other objects will become apparent from the succeeding description considered together with the accompanying drawing which discloses an exemplification of the present invention and wherein:

Figure 1 is a side elevational view of a spring sizing machine embodying the present invention.

Figure 2 is a front elevational view of the spring sizing machine illustrated in Figure 1.

Figure 3 is an enlarged vertical cross sectional view taken along the lines 3—3 of Figure 1.

Figure 4 is an enlarged horizontal cross sectional view taken along the lines 4—4 of Figure 1.

Referring now in detail to the drawing, wherein like reference characters designate like parts, the numeral 1 is employed to indicate in a general manner a spring sizing machine embodying the present invention. The machine generally comprises a frame 2 formed by a plurality of or two vertical standards or beams 3, desirably of Z-formation in horizontal cross section, to present rear contiguous legs 4, transverse webs 5 and oppositely directed front legs 6. The standards upstand from a horizontal base plate 7 comprising a web 8 and vertical upwardly directed, transversely spaced flanges 9. Any means, such as the welds 10, may be employed to secure the standards to the web of the base plate. Diagonal braces 11, preferably L-shaped, extend between an extremity of the base plate and upper extremity of the standard to rigidify the latter against any service loads imparted thereto. The beams each have an extremity of a leg 12 thereof secured to the web 5 of an associated standard, while the other extremity of the same leg overlies and is secured to the related base flange outwardly thereof.

Associated with the upper extremity of the standards is a shelf, abutment or barrier 13 formed, in part, by outwardly extending arms 14 each having a vertically directed web 15 bearing against and secured to the web of an associated standard and an inwardly extending upper leg 16. Extending outwardly of the arm webs and preferably adjacent the lower extremities thereof are bottom legs 17 which may abut the standard front legs 6. An angularly shaped gusset bar 18 is positioned at the juncture of the standards and arms to be secured to legs thereof by any desired means, such as the illustrated welds 19. The outer or free extremities of the arms are joined to the upper or free extremities of the standards by means of a plurality of angular diagonal braces 19a to rigidify the shelf against any turning or hinging moments about the standard-arm junctures.

A die means 20, formed by upper and lower segmental, semi-cylindrical, horizontally disposed upper and lower die sections 21 and 22, respectively, is associated with the frame and adapted to accommodate or receive a coil or helical spring 23 so that the volutions or turns thereof may be brought or returned to a predetermined relation. The upper die section is desirably stationary or fixed with respect to the frame, and accordingly

since this section is downwardly opening or facing, a plurality of cap screws 24, extending through the legs 17 of the arms and into the upper die section, retain the latter in a predetermined position. The lower die section 22, in subjacent relation with respect to the upper die section, is supported and actuated in a reciprocatory manner by a vertically disposed and force transmitting, fluid pressure actuated cylinder 25. The cylinder 25 is carried by the oppositely directed front legs 6 through bolts 25a so as to space the cylinder about the base plate. The lower die section is secured to a plunger 26 of the cylinder through the medium of cap screws 24a and is adapted to be moved away from and toward the upper die section. So as to overcome lateral thrusts imparted to the die sections axially of the spring or cylindrically formed die means, guide means, characterized by bars 27, are secured to the front legs 6 by means of a plurality of cap screws 24b and arranged to extend into suitably formed grooves 27a in the die sections.

The die sections are provided with diametrically opposed teeth or coil separators 28 arranged in such a manner that they are capable of entering between coils of the spring to assure a predetermined relationship between the spring turns. If the teeth are formed of equal height or extent the sizing machine may not operate or function as intended for it is quite possible that the adhesion between the mandrel and the spring may be of such degree that no space between the coils remains. Further, even after a compression spring has been in service an appreciable length of time the space between the coils may be materially reduced to vary the pitch between successive coils and it may be desired to resize these springs by first heating them and inserting them into the structure of the present invention. In either of these cases if some arrangement has not been provided the teeth may strike the center of the coils instead of between them to crush rather than separate the coils. Accordingly, to avoid such a contingency the teeth on each die section are graduated in height or extent so that they may successively enter between successive coils of the spring.

As illustrated particularly in Figure 3 of the drawing, two spaced teeth 29, adjacent the central portion of the lower die, are of equal height so as to support the spring through the central coil thereof. Disposed substantially in a plane between the two teeth 29 is a tooth 30 depending from the upper die and of an extent substantially equal to that of the teeth 29 so that upon an approaching or closing action of the die sections the teeth 29 and 30 will act upon associated coils of the spring in a spreading action thereof. Of graduated or lesser extent or height are teeth 31 spaced longitudinally of the die section to decrease in height as both of the ends of the dies are approached so that as the teeth 29 and 30 pass between coils of the spring the next succeeding coils are urged toward the lateral limits of the dies to be engaged by associated teeth until the dies are brought to a completely closed or mated relation. Since the wire forming the spring is, when introduced into the die, in heated condition, the coils will take a definite set as directed by the oppositely disposed teeth. The teeth of both die sections are tapered or inclined with respect to a vertical plane passing through the axis of the cylindrical dies so as to conform to the normal pitch of the spring coils, and because of this disposition of the teeth appreciable surface bearing areas are arranged between the teeth and coils.

Consideration has also been given to assure, within certain limits, substantially flat end bearing surfaces on the springs. As will be noted, the ends of the wire forming the coil springs are, before coiling, scarfed or tapered, as at 32, so that after coiling the spring ends of the wire will approach and lie against the end coils to present substantially flat bearing surfaces. Toward this end, as previously indicated, the die sections are horizontally disposed so that after being brought together to encase a coil spring therebetween the ends or extreme coils of the springs will be exposed. The operator of the sizing machine can, as the spring is being held by the die sections, impart hammer blows to the scarfed sections of the wire and thereby urge the free extremity of the wire into bearing relation with the associated coils.

Means has been provided in the machine to selectively actuate the cylinder plunger, and for the accomplishment of this purpose there is, as illustrated, a fluid pressure supply line 33 communicating with the lower extremity of the cylinder to be positioned between the cylinder and base plate and to extend vertically or upwardly along the standard flanges 4 where it communicates with a port of an operating valve 34. Extending from the upper extremity of the operating valve is a pipe or conduit 35 which is in direct communication with a source of supply of fluid pressure. Positioned adjacent to and desirably on the same side of the valve as the supply line is an exhaust tube or valve vent 35a so that when the valve is actuated to cut off the fluid pressure from the source of supply, the pressure built up within the power cylinder may escape to the atmosphere through the vent and thus cause a downward movement of the plunger and lower die away from the upper die for the removal of the fabricated spring. Outstanding from the operating valve, away from the standard, for controlling the flow of fluid pressure through the valve is a handle 36 having, depending from the free extremity thereof, an actuating rod 37. Pivotally mounted on one flange of the base plate, outwardly thereof, is a bell crank 38 having a horizontally disposed arm 39 to which is secured a lower extremity of the connecting rod. Forwardly of the power cylinder and extending between and journaled to the flanges of the base plate is an axle 40 having secured thereto intermediate its ends a treadle or foot plate 41 by any desired means or method. Fixedly associated with one of the free extremities of the axle, outwardly of the related base flange, is a lever 42 which is pivotally connected to a depending arm 43 of the bell crank through a horizontal, longitudinally movable link 44.

By reason, therefore, of the present arrangement a pivotal movement of the treadle plate in one direction will result in fluid pressure passing from the conduit through the operating valve and supply line into the cylinder to impart an upward or vertical movement to the lower die, while a pivotal movement of the treadle in the opposite direction will cause the fluid pressure in the conduit to be cut off and exhaust the cylinder through the vent to cause the lower die to move downwardly away from the upper die section for the removal of the fabricated coil spring.

From the above description, considered with the accompanying drawing, it will be noted that various changes and alterations may be made to

the illustrated construction without departing from within the spirit of the invention and the scope of the appended claims.

I claim:

1. In a coil spring sizer, the combination of a stationary segmental die, a movable segmental die, means for actuating said movable segmental die toward and away from said first named die, a plurality of spaced teeth on one of said dies staggered with respect to a plurality of oppositely disposed and spaced teeth on the other of said dies the teeth on both dies being of graduated height so that they may successively enter between coils of a spring.

2. In a coil spring sizer the combination of a pair of segmental dies forming a cylinder open at both ends and adapted to accommodate a coil spring therein, selectively operated means for moving one of said dies relative to the other, and a plurality of spaced teeth on one of said dies staggered with respect to a plurality of oppositely disposed and spaced teeth on the other of said dies, said teeth being of graduated height so that they may successively enter between coils of said spring.

3. In a coil spring sizer, the combination of a pair of segmental dies forming a cylinder open at both ends and adapted to encase a coil spring, one of said dies being stationary and the other of said dies being actuated by a selectively controlled means toward and away from said stationary die, and a plurality of spaced teeth on one of said dies staggered with respect to a plurality of spaced teeth on the other of said dies; said teeth being of graduated height so that they may successively enter between coils of said springs; the teeth of the respective dies having substantially opposed teeth of equal height.

4. In a sizer for heated coil springs, the combination of a pair of segmental dies forming a cylinder open at both ends and adapted to encase a helical spring, the cylinder being of a length substantially equal to the normal free height of said spring, means secured to one of said dies for moving it toward and away from the other of said dies, a plurality of teeth on one of said dies disposed in substantially staggered relation with respect to a plurality of teeth on the other of said dies; said teeth being of graduated height and arranged so as to decrease in height as the ends of the cylinder are approached, all of said teeth being angularly inclined relative to a vertical plane passing through the axis of said cylinder.

5. In a coil spring sizer, the combination of a stationary segmental die, a movable segmental die, means for actuating said movable segmental die toward and away from said first named die, a plurality of spaced teeth on one of said dies staggered with respect to a plurality of oppositely disposed and spaced teeth on the other of said dies, the teeth on both dies being of graduated height so that they may successively enter between coils of a spring, and guide means for directing said movable segmental die along a fixed path.

6. In a sizer for heated coil springs, the combination of a frame, a pair of segmental dies forming a cylinder open at both ends, one of said dies being secured to said frame and the other of said dies being moved relative to said frame by a selectively controlled power means, guide means on said frame associated with said last named die, said dies having diametrically disposed teeth graduated in height so that the teeth adjacent the center of said cylinder will first enter between coils of a spring.

7. In a sizer for heated coil springs, the combination of a frame, a pair of segmental dies forming a cylinder open at both ends, one of said dies being fixedly secured to said frame and the other of said dies being moved relative to said first named die by a selectively controlled power means, said dies having diametrically disposed teeth graduated in height with the longer of said teeth being positioned adjacent the central portion of said cylinder and all of said teeth being inclined to conform to the normal pitch of coils of said spring.

8. In a sizer for coil springs, the combination of a frame, a barrier outstanding from said frame, a stationary die secured to said barrier, guide means on said frame, a movable die associated with said guide means and actuated by selectively controlled means to be directed toward and away from said stationary die, and means diametrically disposed and of graduated height on said dies adapted to successively enter between coils of said springs, said means decreasing in height from adjacent the central portion of said dies toward the extremities thereof.

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