

[72] Inventor **René Perrenoud**
Rue des Sugits 14, 2114 Fleurier,
Switzerland
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[56]

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Primary Examiner—Charles W. Lanham

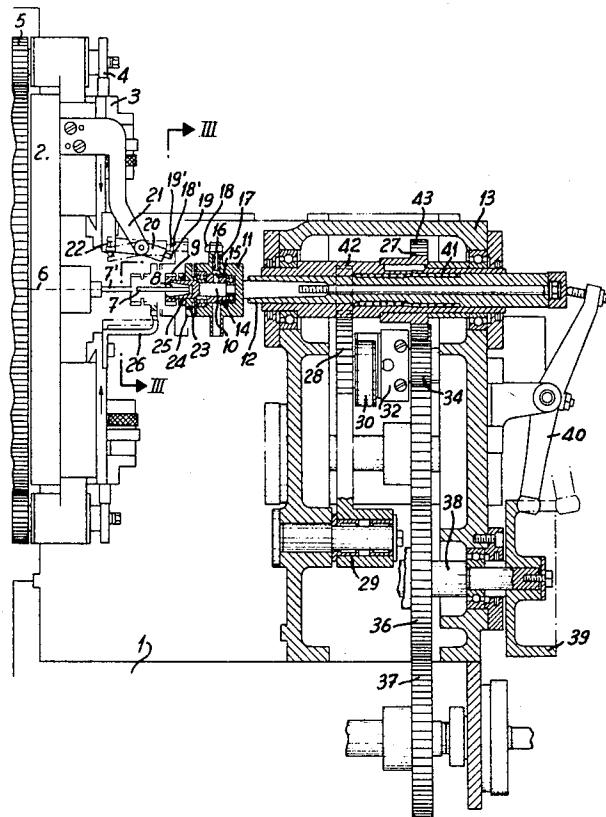
Assistant Examiner—R. M. Rogers

Attorneys—Robert E. Burns and Emmanuel J. Lobato

[54] **AUTOMATIC MACHINES FOR MAKING STEEL WIRE SPRINGS**
5 Claims, 5 Drawing Figs.

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[51] Int. Cl.	B21f 3/00, B21d 3/02
[50] Field of Search	140/102, 103; 72/115

ABSTRACT: A machine for making steel wire springs intended particularly for the watchmaking industry has a tray on which are mounted shaping tools movable towards the center of the tray where is positioned a rolling stud. Means are provided for moving, clamping and cutting the steel wire and comprises a spindle rotatably mounted in front of the rolling stud. The spindle is also mounted for longitudinal movement and means are provided for controlling both the longitudinal advancement and rotation of the spindle to effect winding of the steel wire at a given angle around the rolling stud.



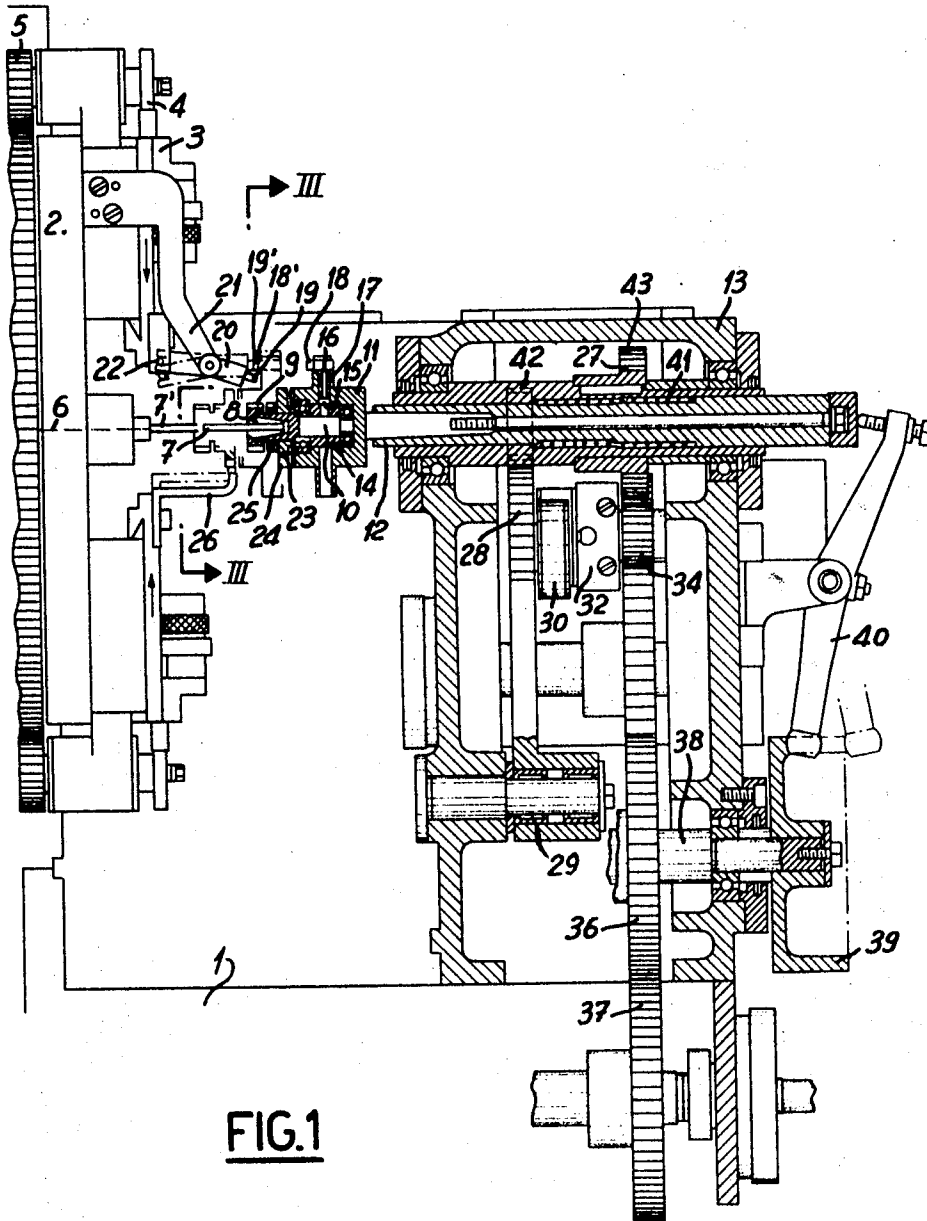
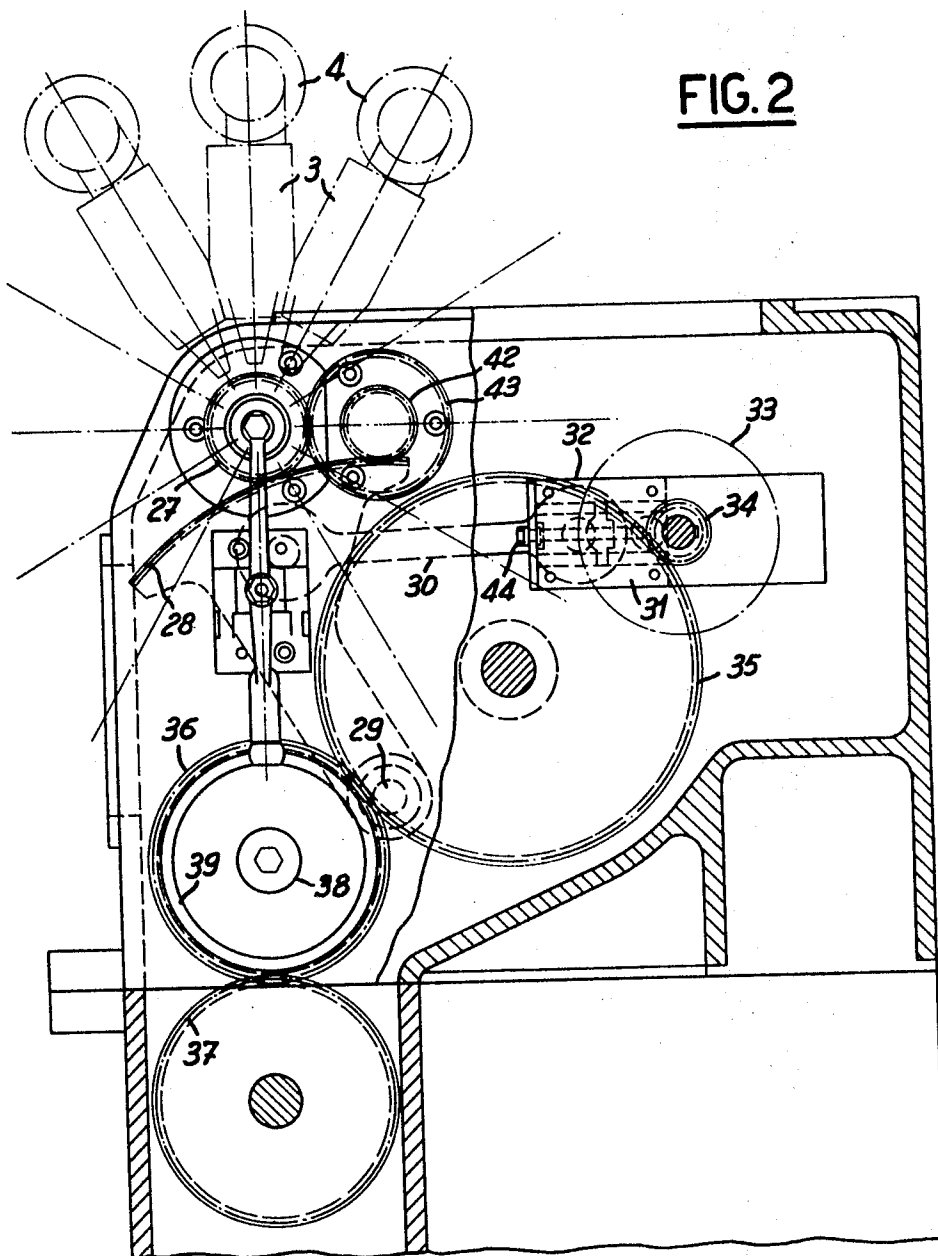


FIG. 2



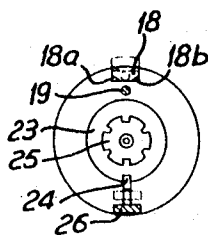


FIG. 3

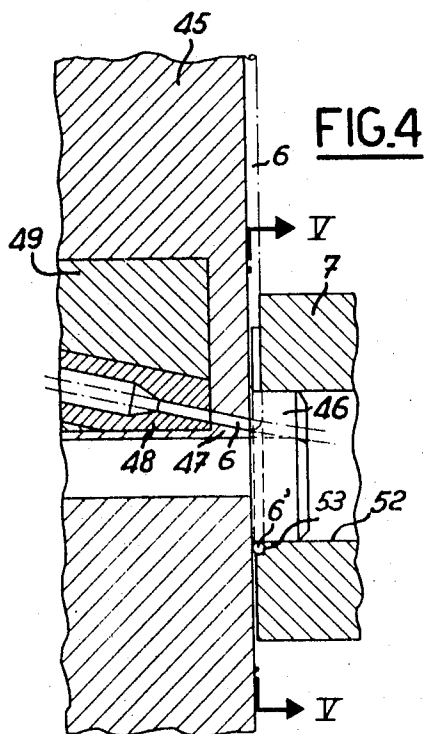


FIG. 4

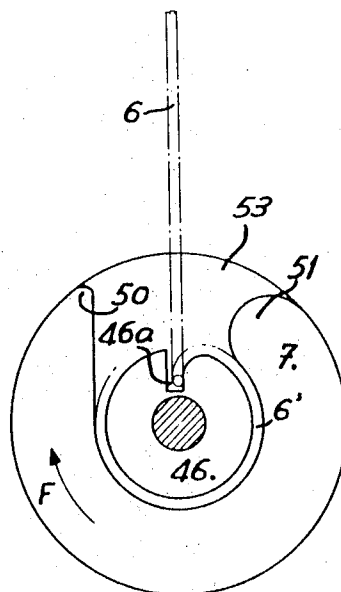


FIG. 5

AUTOMATIC MACHINES FOR MAKING STEEL WIRE SPRINGS

The present invention has for its object an automatic machine for making springs from steel wire having particular applicability to the watch-making industry. Such a machine must render possible the obtaining of springs of a regular shape and having for example a loop on the left and a loop on the right, such as pawl springs and other timepiece springs.

The machine according to the invention comprises a tray on which are movably mounted shaping tools operating towards the center of the tray where is positioned a cylindrical rolling stud, means for moving, clamping and cutting the steel wire, and is characterized by a spindle rotatably mounted in the front of the rolling stud and adapted to move longitudinally to a work position in which it surrounds, by its hollow extremity, the rolling stud to wind the wire at a given angle around the stud, and means are provided for controlling the advance and angular displacement of the spindle.

The accompanying drawings represent by way of example one of the embodiments of the invention:

FIG. 1 shows a partially longitudinal cross-sectional view of a machine embodying the principles of the present invention;

FIG. 2 shows a front view thereof;

FIG. 3 shows a partial cross-sectional view along the line 3—3 of FIG. 1;

FIG. 4 shows an enlarged scale view of the spindle; and

FIG. 5 shows a cross section along the line V—V of FIG. 4.

The machine according to the present invention comprises a frame 1 on which is mounted a tray 2 carrying thereon twelve toolholders 3 which are radially directed and distributed on the tray. The toolholders slide in radial slides and their movement is controlled by a clamp 4 mounted on a pinion shaft 5. The tools secured on the respective tool holders move successively in a direction toward the center of the tray and function to either directly shape the spring or to control such an operation. The wire 6 is then advanced to the center of the tray to be shaped either by the tools or the rolling stud or anvil or by spindle 7.

Spindle 7 is secured in a clamp 8 and held in place by a nut 9. The clamp 8 is integral with a spindle holder 10 mounted on a ball bearing in a head portion 11 secured at one end of a shaft 12 which is rotatably and slidably mounted in a frame 13.

On the spindle holder 10 is secured a ring 14, having therein an opening 15, which engages a piston 16 urged by a spring 17 to couple the spindle holder 10 and head 11 together for rotation. The head portion of the piston 16 is provided with a shoulder 18 having two inclined sides 18a and 18b (FIG. 3). The shoulder 18 cooperates with a stud 19 secured at the end of a lever 20 to reciprocally actuate the piston 16. The lever 20 is pivotally mounted on support 21 secured to the tool holder and driven by a pin and slot connection 22 by a toolholder. The spindle holder additionally comprises a locking device comprising a disc 23 having therein a radial slit 24 which can be releasably locked in the desired angular position by a trysquare member 26.

By means of a nut 29, the slit 24 cooperates with an end of a trysquare 26 mounted on a toolholder and able to move therewith for the angular locking of the spindle.

The shaft 12 has connected thereto a pinion 27 meshing with a gear 43 integral with a pinion 42. The pinion 42 is in meshing engagement with a cam section 28 pivoting at 29 (FIG. 2) and which is driven in alternating oscillatory movements by a pin 30 having a head connected to a crank 32 mounted on a wheel 33 whose pinion 34 meshes with a gear 35. The gear 35 is in meshing engagement with a gear 36 driven by a motor shaft carrying a gear 37. Gear 36 is mounted on a shaft 38 at the end of which is secured a bell cam 39 driving a lever 40 which controls the advance of the shaft 12 and therefore that of the spindle, the return of that shaft 12 being assured by a biasing spring 41.

The cam section or segment 28 drives shaft 12 through the pinion 42 and gear 43 meshing with gear 27. The gear train composed of the cam segment 28 and the gears 27, 42 and 43 functions to convert the oscillatory movement of the cam segment 28 into a suitable angular displacement of the shaft 12.

Crank 32 has a slide 31 in which is secured a slider to which is secured the head of the pin 30.

A screw 44 allows adjustment of the position of the slider, and consequently the path of the cam segment 28.

FIGS. 4 and 5 show an enlarged view of the end of the spindle 7.

On a flange 45 mounted on the tray 2 is secured a cylindrical rolling stud 46 having therein a nick or groove 46a which receives and engages the steel wire 6 extending out of a hole 47 provided in the flange 45 and coinciding with the hole formed in a sleeve 48 mounted in a sleeve-carrying shaft 49 and ensuring its rotation on the one hand, the tightening of the wire during its shaping and then cutting of the wire by shearing. The drawing shows the wire folded against the flange 45 by one of the tools on the tray and in a position to be rolled on the stud 46 by spindle 7. To this effect, the spindle has a cylindrical hole of the same diameter as the stud 46 and a shoulder 53 aided on one side by a pusher nose 50 and on the other side by a round shoulder 51. By rotating in the direction of arrow F, the nose 50 effects folding of the wire and winds it round the stud 46 in order to form a loop 6'. It is then possible to form a second loop around spindle 7 immobilized by means of the tools on the tray by the insuccessive action from the overlapping extremity of spring 6 around spindle 7. The spindle 7 can have shapes other than that shown in the drawing to obtain springs of various shapes.

In the position shown in heavy lines of FIG. 1, the spindle holder is coupled continuously to the head portion 11 by piston 16 and the spindle is given a continuous operating movement. When the spindle next enters into play, the cam 39 effectively advances the shaft 12 and the spindle into position 7'. Simultaneously, the lever 20 is actuated and the stud 19 is raised to position 19' without however meeting the shoulder 18 of the piston 16.

The rolling of the spring can then take place at the desired angle around the rolling stud 26. The angle of rolling is defined by the relative angular positions between the lever 20 and the shoulder 18. When the latter meets the stud 19 at position 19', piston 16 is raised and the spindle holder 10 is disconnected. If the spring is to be finished on the spindle 7, the spindle holder is locked angularly by the trysquare 26 and the lever 70 retains its pressure against shaft 12. When the spring is finished, shaft 12 is urged rearwards by its biasing spring 41. Piston 16 is relaxed but generally does not penetrate into the hole in ring 14. The reconnection takes place automatically in the correct angular position when the spindle is once again advanced into position owing to the rotation of the spindle holder.

The different operations take place in continuous manner and are perfectly synchronized by a precise transmission through gears. The tool holders on the tray 2 as well as the spindle are controlled from the same control shaft of gears.

What is claimed is:

1. In a machine for making springs from a length of steel wire, a tray; a rolling stud centrally mounted on said tray; forming tools positioned on toolholders slidably mounted on said tray for radial movement towards the center thereof; means for advancing, clamping and cutting a length of steel wire; a spindle rotatably mounted in front of said stud and having therein means defining a hollow extremity dimensioned to surround said rolling stud in a working position thereof and operative in response to rotation thereof to wind said wire at a given angle around said stud, means mounting said spindle for longitudinal movement towards and away from said rolling stud, means for controlling the longitudinal advancement and rotation of said spindle; and locking means actuated in response to radial movement of one of said tool holders to releasably lock said spindle in said working position.

2. Machine according to claim 1, wherein said spindle is mounted on a spindle holder, said spindle holder being rotatably mounted at an end of a rotary and slidable shaft, said spindle holder having a support and a coupling device for coupling said spindle holder to said support and being actuated by one of said tool holders.

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3. Machine according to claim 2, wherein said coupling device comprises a movable piston, spring means urging said piston into coupling position, said piston having a head portion with inclined sides, a stop member cooperating with said head portion, and a lever carrying said stop member and actuated by said toolholder for raising said piston to disconnect said spindle holder from said support.

4. Machine according to claim 1 wherein said locking means comprises a disc adjustably and lockably mounted on

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said spindle holder, said disc having means therein defining a slit allowing locking of said disc at a given angular position.

5. Machine according to claim 2, wherein said rotary and slidable shaft has a pinion, means including a cam segment for effecting rotation of said pinion, a pivotally mounted lever having one end in contact with said shaft, and a bell cam controlling the pivotal movement of said lever for ensuring the longitudinal advance movement of said shaft.

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