United States Patent

Herckelbout

[15] **3,676,957**

[45] **July 18, 1972**

[54] SPRING GRINDING MACHINES

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[22] Filed: **April 22, 1970**

[21] Appl. No.: **30,691**

[30] **Foreign Application Priority Data**

April 25, 1969 France 6913219

[52] **U.S. Cl.** **51/118**

[51] **Int. Cl.** **B24b 7/16**

[58] **Field of Search** 51/109, 111, 117, 118, 165.79

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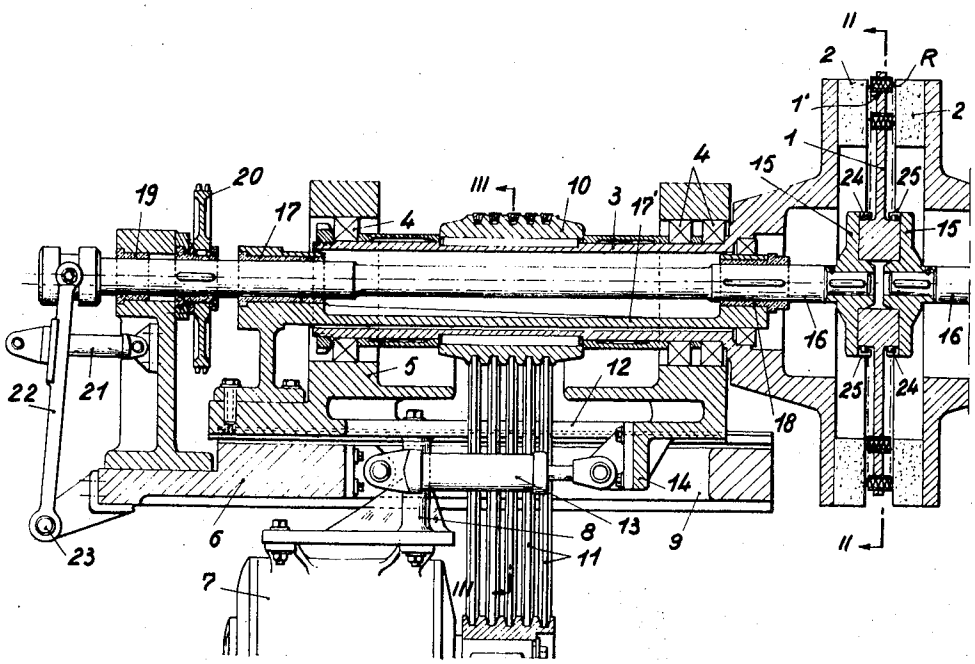
[57] **ABSTRACT**

The present invention concerns a machine for grinding helicoid springs which simultaneously permits all the springs to be ground, carried by a magazine-plate which is circular, rotary and removable, to the abrasive action of two grindstones while ensuring a uniform wear of the latter.

5 Claims, 6 Drawing Figures



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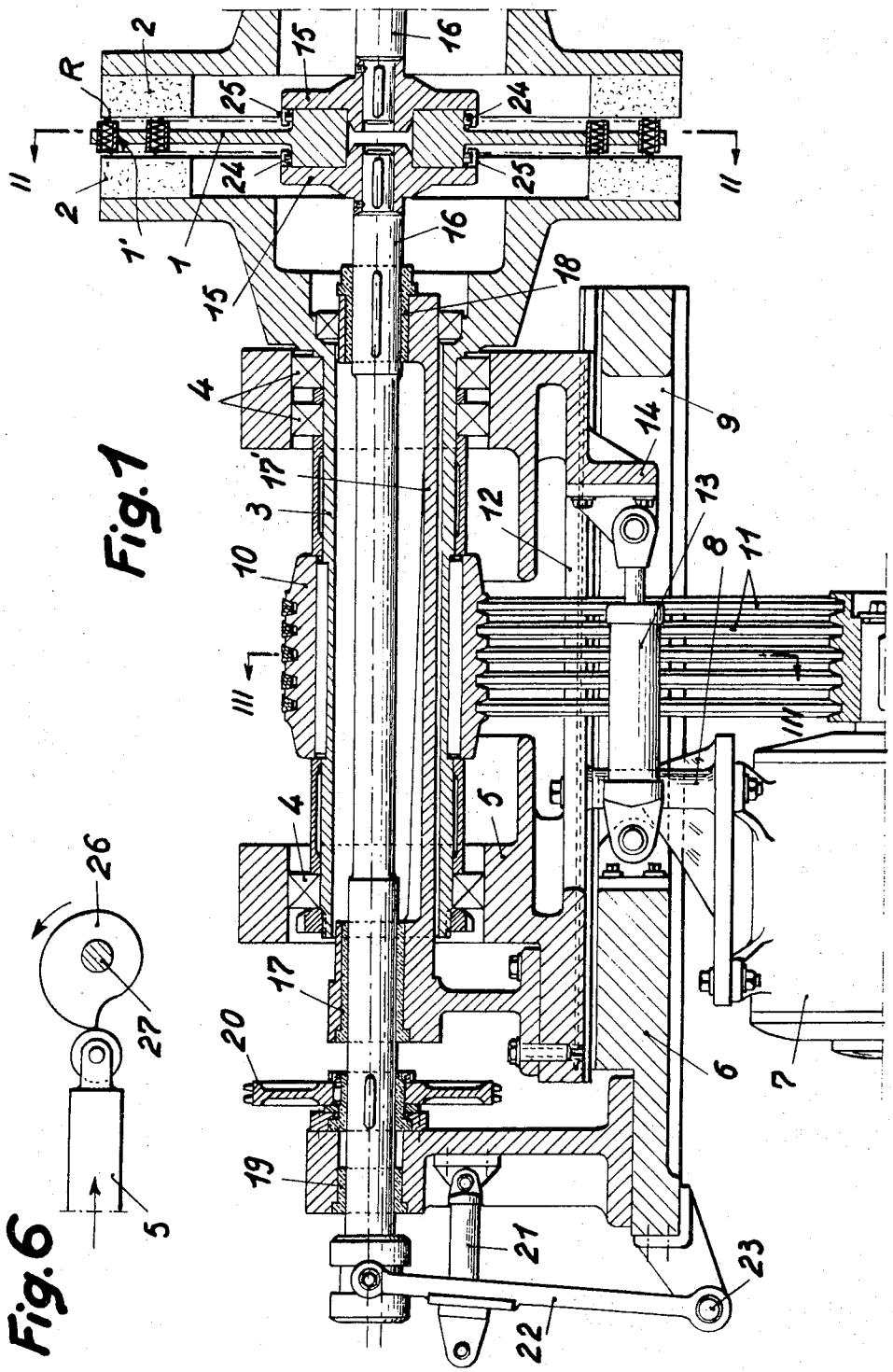

Fig.1

Fig.6

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Fig.2

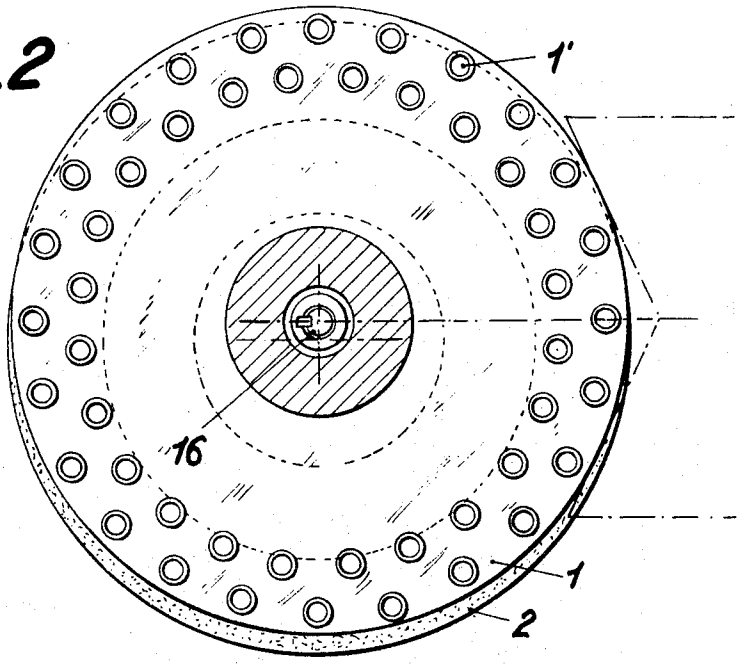

Fig.3

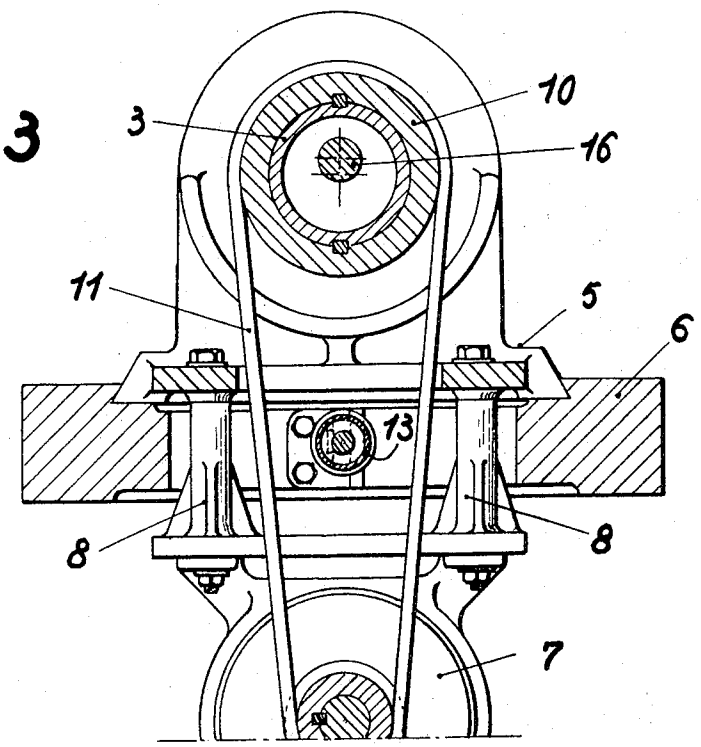

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Fig. 4

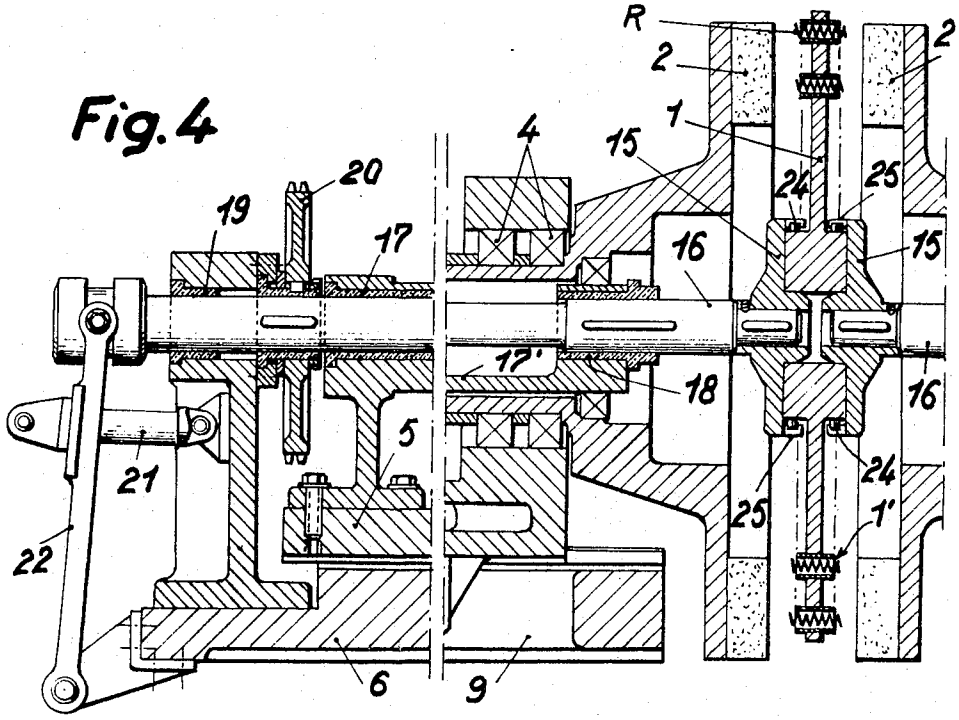
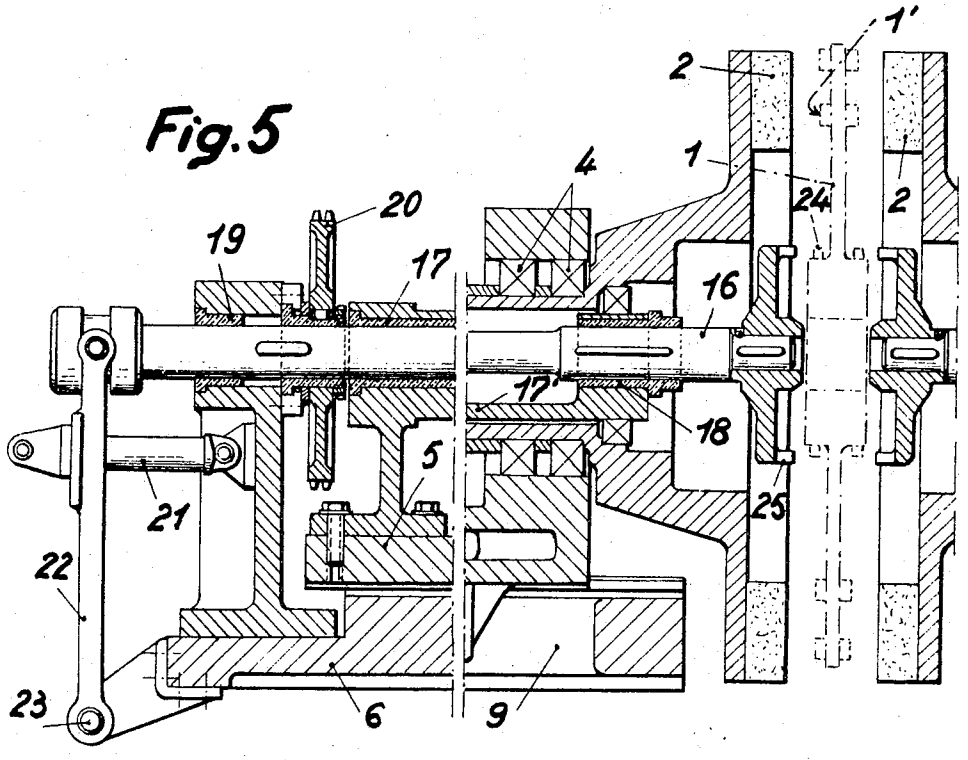


Fig. 5



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SPRING GRINDING MACHINES

The present invention concerns improvements in machines intended to grind the extremities of helicoid springs and other rectilinear parts.

Such machines are known, formed principally by two grindstones placed facing one another and whose shafts are placed along a same axis, said grindstones being moveable along said axis.

The springs are supported by a magazine and their extremities extend beyond the faces of said magazine to be placed between the faces of the grind stones.

A magazine is known, constituted by a plate of small surface with respect to the active face of the grindstones, and comprising holes in each of which a spring is introduced axially, said plate being mounted at the extremity of an oscillating arm allowing to move the springs substantially radially with respect to said grindstones and in a to and fro motion so as to ensure a uniform wear.

One also knows a magazine constituted by a circular plate comprising one or several concentric rows of holes in which the springs to be ground are introduced.

The grinding is done by introducing a portion of the magazine plate between the grindstones.

The magazine plate is driven in rotation at slow speed, or freely mounted on an axis parallel to those of the grindstones.

The two types of magazines referred to above, each of which allows, by different means, to solve the problem of uniform wear of the grindstone, are not satisfactory however for the number of springs ground per hour is too small.

In fact, the time necessary to grind a spring depends on the speeds of advance and of rotation of the grindstones, their quality, the power of the machine, the desired finish of the surfaces, and is therefore independent of the number of springs subjected to the abrasive action of the grindstones.

In the first case, the oscillating plate can comprise but a fairly small number of springs for one is limited by the dimensions of the grindstones; an increase in their diameter leads to machines which are too cumbersome.

In the second case practically the same thing applies, for if the magazine plate can comprise a large number of springs, only a fraction of them is constantly subjected to the action of the grindstones.

The present invention, which remedies these drawbacks, concerns a machine of the type referred to above, with a magazine plate driven in rotation independently of the grindstones, characterized in that the magazine plate is removable and can be arranged between the grindstones so that all the springs it supports are simultaneously subjected to the action of said grindstones, the axis of rotation of said plate being parallel to that of the grindstones so that each of the extremities of each of the springs describes, with respect to said grindstones, an eccentric circumferential trajectory, means being additionally provided to ensure the holding and driving of said plate.

Holding of the plate between the grindstones is provided by at least one shaft sliding inside the shaft of the corresponding grindstone, and one of the extremities of which can engage in the hub of the plate.

Other characteristics will appear more clearly from the following description and in reference to drawings attached only by way of example, on which:

FIG. 1 is a view in longitudinal section of the device for operating one of the two grindstones and a portion of the second grindstone according to the present invention;

FIG. 2 is a view in section taken along line II—II of FIG. 1 and limited to the magazine-plate and to one of the two grindstones;

FIG. 3 is a view in section taken along line III—III of FIG. 1;

FIGS. 4 and 5 are views similar to FIG. 1, limited to its extreme portions showing in particular the possibility of moving axially the supporting shaft of the magazine-plate independently of the grindstones;

FIG. 6 is a diagrammatic view illustrating the possibility of advancing the grindstones according to a predetermined law.

Referring to the drawings and according to one form of execution, the magazine-plate 1 is constituted by a disk comprising, towards it periphery, one or several eccentric rows of holes 1' whose axes are parallel to those of said plate and in which one introduces the springs R to be ground.

According to the invention, the plate 1 can be placed between the two grindstones 2, whose active part is limited to a peripheric crown, so that the extremities of all the springs R can be subjected simultaneously to the action of said grindstones.

The device for the positioning of the plate 1, not represented because it is not within the framework of the invention, can be constituted by a pincer with two jaws surrounding the periphery of said plate and made solidary with a carriage sliding under a rectilinear guide arranged above the machine perpendicularly to the axis of said plate.

Each of the grindstones 2 is fixed to the extremity of a hollow shaft 3 which can revolve within bearings 4 fixed in a carriage 5 guided in translation, along the axis of said shaft, on a fixed table 6 forming the upper part of the frame of the machine, not represented.

The shaft 3 is connected axially to the carriage 5.

The driving in rotation of the shaft 3 is provided by an electric motor 7 arranged under the table 6 and connected to the carriage 5 by a supporting bracket 8 traversing said table 6 which has, for this purpose, an opening 9. The movement of rotation is transmitted to a pulley 10 keyed to the shaft 3, by belts 11 traversing an opening 12 of the carriage and opening 9 of table 6.

The axial movement of each of the grindstones can be provided by a jack 13, situated in the opening 9, one extremity of which is connected to the table 6, while the other is connected to a bracket 14 of the carriage 5 extending in said opening 9.

The retention of plate 1 in working position is provided by the extremities 15 of two shafts 16 lodged inside shafts 3, driving the grindstones.

Each of the shafts 16 can revolve and slide in three bearings 17, 18 and 19. Bearings 17 and 18 are mounted on the carriage 5, said bearing 17 having an extension 17' extending inside the shaft 3 and terminating in bearing 18. Bearing 19 is mounted on the table 6 and it rotatably supports a pinion 20 driving the shaft 16 by means of a sliding keyway.

The axial movement of the shaft 16 is provided by a double acting jack 21, attached to and bearing against the table 6 and acting on a lever 22 articulated at 23 on said table, by one of its extremities, the other extremity of lever 22 has a fork to drive said shaft.

The driving in rotation of plate 1 is provided by a simple device such as spurs 24 carried by said plate and situated on the trajectory of fingers 25 carried by the extremity 15 of the shafts 16.

The axes of shafts 3 and 16 are parallel so that plate 1 is off-center with respect to the grindstones 2, the value of this off-center dimension being determined so that all the springs carried by said plate are always in contact with the abrasive surfaces, as shown in FIG. 2, and wear them down in a uniform manner.

Actually, to be certain of obtaining a uniform wear of the grindstones 2, the aforementioned off-center dimension is given a value such that the springs R extend beyond the abrasive surfaces, towards the outside as well as towards the inside, by an amount substantially equal to the diameter of the wire used in making said springs.

FIG. 1 represents the position of the different elements of the machine during grinding.

When the extremities of the springs are ground to the desired dimension, the grindstones separate, driven by the carriages 5 under the action of the double acting jacks 13 (FIG. 4).

During this recoil or immediately after, the mobile jaw device surrounds the periphery of plate 1, the jacks 21 are then actuated so as to determine the return of the shafts 16 (FIG. 5) to free said plate which is then withdrawn by said forementioned device.

The placement of a new plate is done by a reverse operation.

For machines of small dimensions, the plate **1** can be placed by hand, the positioning being assured in simple manner by means of a centering Vee, as shown schematically in FIG. **2**.

During a grinding cycle such as described above, the speed of advance of the grindstones must vary according to a precise mathematical law, but such precision cannot be obtained by controlling the advance of the grindstones by means of hydraulic jacks.

In order to obviate this disadvantage, each of the carriages **5** is applied by means of the corresponding jack **13**, against a cam **26** driven by a shaft **27** revolving through one complete rotation for one cycle (FIG. **6**) and whose profile is calculated to allow the advance of the grindstones according to a predetermined law of speeds.

The speed of rotation of the shaft **27** can be modified at will and at any moment thus allowing, particularly with the same cam and without loss of time, to bring the grindstones together under optimal conditions with respect to the degree of grinding envisioned.

Finally, when the carriages **5** have advanced by an amount equal to the maximum permitted by the cams, an end-of-travel contact (not represented) controls the inversion of the jacks and, consequently, the rapid return of the grindstones, the value of this return being greater than the advance permitted by said cams.

As the apparatus for operating both grindstones **2** is the same, only that for the left hand grindstone is shown and described in detail.

Naturally, and without departing from the framework of the invention, it is possible by means of levers and the like, to use a single cam to determine the advance of both carriages.

I claim:

1. In a machine for grinding the extremities of helicoid springs, in combination, a detachable circular magazine-plate having peripheric holes to receive the springs, a pair of grindstones placed facing one another and one either side of said magazine-plate so that all the springs being supported are subjected simultaneously to the action of said grindstones and, for operating of each of said grindstones, a fixed table, a carriage moveable in translation on said table, bearings on said carriage, a hollow shaft in these bearings, said shaft having its axis parallel to the direction of movement of said carriage and carrying at one of its extremities the corresponding grindstone, an opening in said table, a bracket under said carriage extending beyond said opening to support an electric motor to drive said hollow shaft in rotation, a second bracket under said carriage extending in said opening, a hydraulic jack in said opening having one extremity connected to said table while its other extremity is connected to said second bracket, a stop movable according to a mathematical law against which said carriage bears during its advance and means to drive the magazine-plate in rotation independently of said grindstones and to ensure its centering and its retention.

2. In a machine for grinding the extremities of helicoid springs, in combination, a removable circular magazine-plate having peripheric holes to receive the springs, a pair of grindstones placed facing one another and one either side of the magazine-plate so that all the springs being supported are subjected simultaneously to the action of said grindstones and, for operating each of said grindstones, a fixed table, a carriage guided in translation on said table, bearings on said carriage, a hollow shaft in said bearings, said hollow shaft having its axis parallel to the direction of movement of said carriage and carrying at one of its extremities the corresponding grindstone, an opening in said table, a bracket under said carriage extending beyond said opening to support an electric motor to drive said hollow shaft in rotation, a second bracket under said carriage extending in said opening, a hydraulic jack in said opening having one end connected to said table while its other end is connected to said second bracket, a stop mobile according to a mathematical law against which said carriage bears during its advance, a shaft moveable axially and in rotation inside said hollow shaft whose extremities extend beyond those of the hollow shaft and whose axis is parallel to that of said hollow shaft and means at one of the extremities of said shaft to ensure simultaneously the retention, centering and driving of said magazine-plate and means at the other extremity of said shaft to control its axial movement and, on the other hand, to drive it in rotation.

3. In a machine for grinding helicoid springs according to claim **2** in which the movable stop to limit the advance of the carriage is constituted by a rotary cam against the periphery of which said carriage bears.

4. In a machine for grinding helicoid springs according to claim **2** in which the movable stop to limit the advance of the carriage is constituted by a cam, with variable speed of rotation, against the periphery of which said carriage bears.

5. In a machine for grinding helicoid springs according to claim **2** in which the movable stop to limit the advance of the carriage is constituted by a rotary cam making one complete revolution per grinding cycle.

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