Dec. 22, 1953 A. MOTTU 2,663,292

DEVICE FOR TRUING THE GRINDING WHEELS OF GRINDING MACHINES

Filed Oct. 18, 1952 3 Sheets-Sheet 1

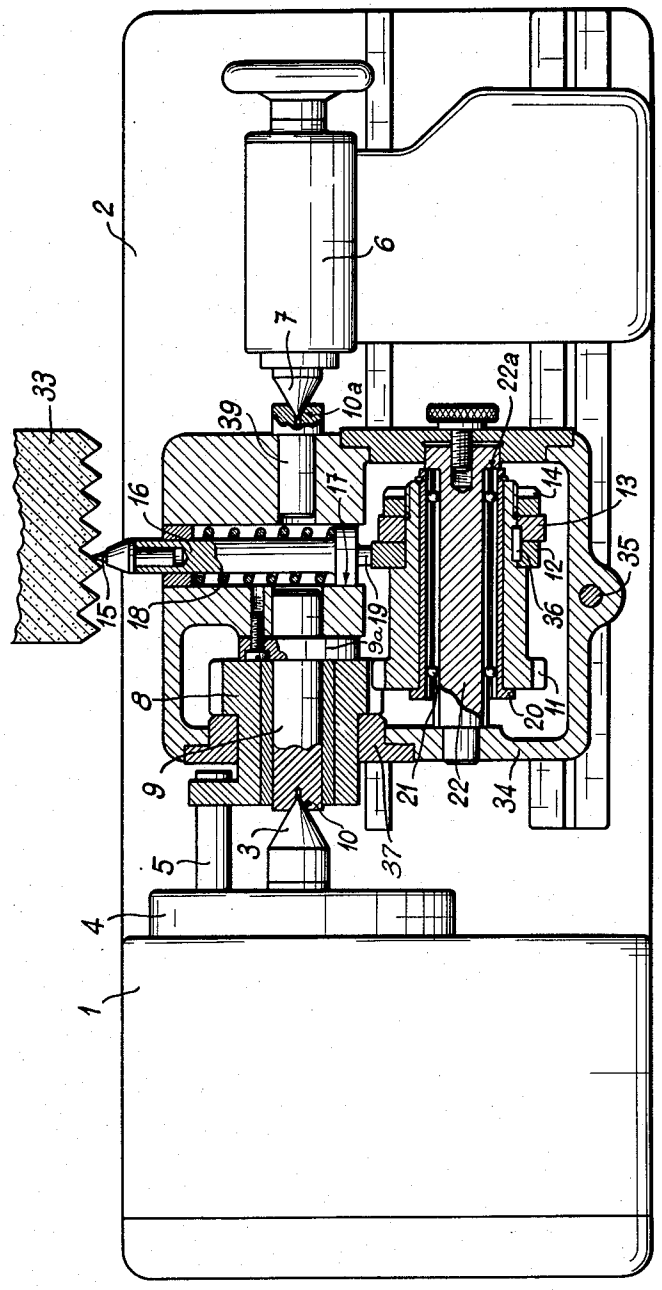

FIG. 1

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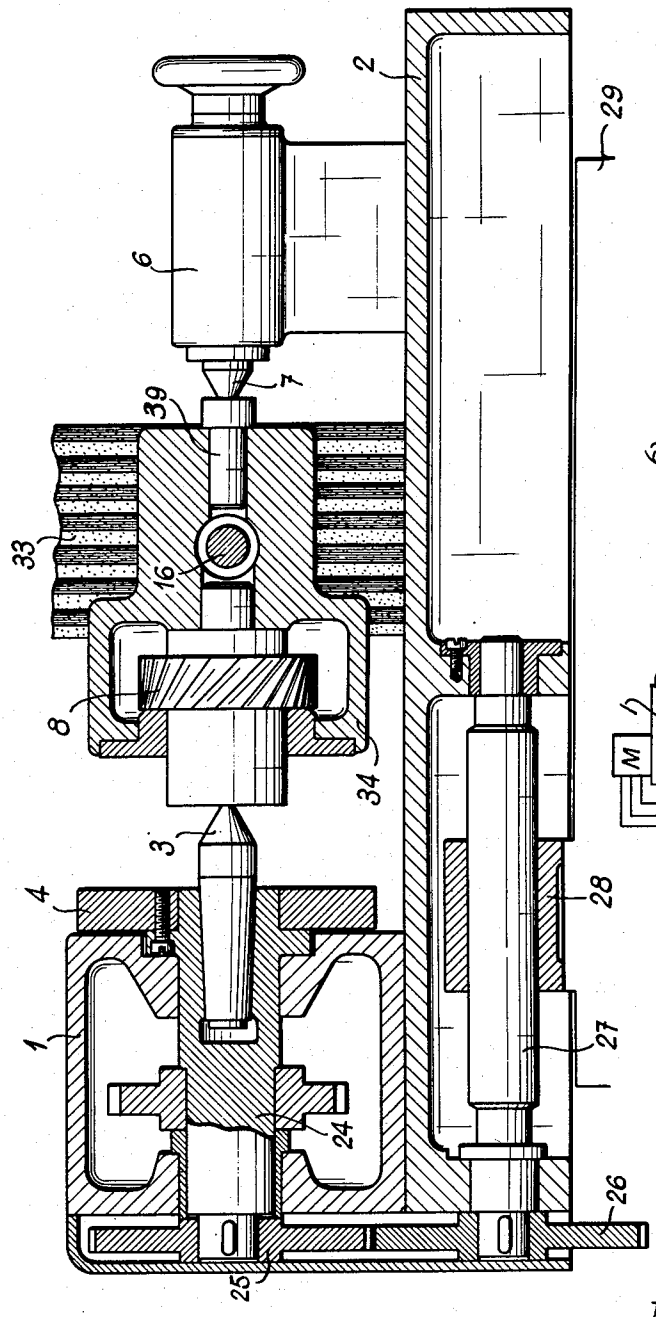

FIG. 2

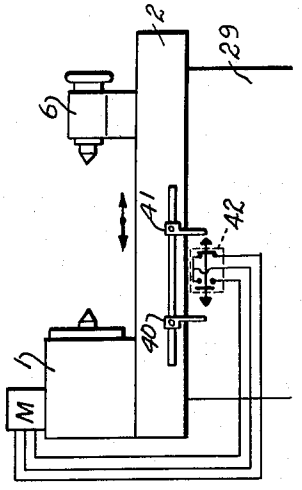

FIG. 8

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DEVICE FOR TRUING THE GRINDING WHEELS OF GRINDING MACHINES

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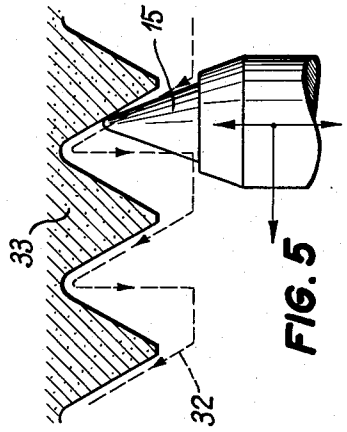

FIG. 5

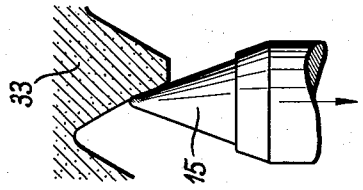

FIG. 7

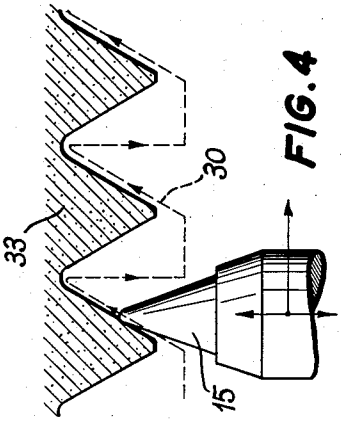

FIG. 4

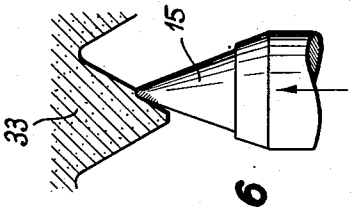

FIG. 6

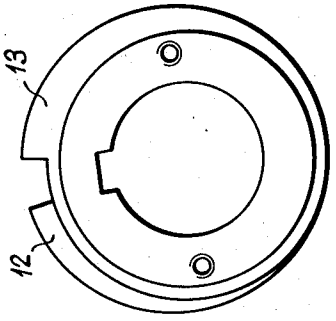

FIG. 3

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UNITED STATES PATENT OFFICE

2,663,292

DEVICE FOR TRUING THE GRINDING WHEELS OF GRINDING MACHINES

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Claims priority, application Switzerland November 10, 1951

6 Claims. (Cl. 125—11)

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My invention has for its object a device for truing the grinding wheel of a grinding machine and it is chiefly applicable in the case of a thread-grinding machine.

Numerous devices have already been proposed for truing grinding wheels. One of these includes a suitably shaped cam adapted to impart a reciprocating movement to the tip of the diamond cutter, said movement being perpendicular to the axis of the grinding wheel, and being associated with a continuous translational movement shifting the diamond cutter along a line parallel with the axis of the grinding wheel, whereby the two associated movements cause the tip of the diamond cutter to produce the desired outline on the operative surface of the grinding wheel. This prior arrangement is generally secured to the table of a grinding machine in order to obtain the translational movement parallel with the axis of the grinding wheel, whereas the reciprocating movement produced by the cam is controlled by the rotary movement of the spindle of the machine.

This prior arrangement shows various drawbacks which are chiefly ascribable to the fact that the deformation of the diamond cutter tip, as it wears very quickly, changes the outline generated by it on the surface of the grinding wheel and thereby the cutting operation is not performed under favourable conditions. As a matter of fact, when the diamond is shifted towards the axis of the grinding wheel, it operates through its tip, while it cuts through its sides when it moves away from the axis of the grinding wheel; this is illustrated in Figs. 6 and 7 of accompanying drawings which show the operative parts of the diamond in conventional machines, viz. the tip and the sides respectively, as shown by hatchings, said parts engaging the surface of the thread as mentioned hereinabove.

Now, my invention has for its object to remove such drawbacks. The machine as provided by my invention includes the usual diamond carried by a slider and submitted, with reference to the grinding wheel, to a movement which is constituted by the combination of a longitudinal shifting of the table and a reciprocating transverse shifting of the slider, both last mentioned shiftings being controlled by the rotation of the machine spindle.

According to my invention, there are provided two cams acting selectively on the diamond for obtaining its reciprocation against the action of a spring with a different timing according to the direction of progression of the table, the

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substitution of the cams being produced automatically at the end of each stroke of the table in either direction and providing an operative inward stroke of the diamond along the sections of the outline to be sharpened that recede as they engage the diamond progressing with the table in the direction to be considered.

The substitution of these cams is preferably provided by two interengaging spiral wheels carried inside a casing secured between the head-stock and the tail-stock centers on the table of the machine, one of said spiral wheels being controlled by the rotation of the spindle and being held against axial movement while the second spiral wheel is adapted to slide axially between two stops under the action of the first spiral wheel; the two cams arranged side by side and rigid with the second spiral wheel are arranged in a manner such that, according to the direction of rotation of the spindle and the corresponding direction of the movement of the table, one of said cams is selectively urged by the relative axial thrust exerted between the spiral wheels into cooperation with the end of a pusher member sliding transversely and carrying at its free end the sharpening diamond cutter, the outline of said cams being such that the diamond cuts in succession the two sides of the outline of the thread formed on the grinding wheel through an action directed permanently towards the axis of the grinding wheel, to cut one of the sides of the outline during the shifting of the table in a predetermined direction and the other side during the movement of the table in the opposite direction.

As the outline on the surface of the grinding wheel is cut by the diamond only while the latter moves towards the axis of the driving wheel, the wear of the diamond is reduced by reason of its operating only through its tip.

I have illustrated by way of example in accompanying drawings a preferred embodiment of my invention. In said drawings:

Fig. 1 is a plan view of the table of a machine intended for the truing of threads, said view showing in horizontal cross-section the truing device according to my invention.

Fig. 2 is a vertical partial cross-section through the axis extending through the head-stock and tail-stock of the machine.

Fig. 3 is a side view of the cam structure.

Figs. 4 and 5 illustrate the paths followed by the diamond for executing the outline of the operative surface of the grinding wheel.

Figs. 6 and 7 illustrate, as disclosed herein-

above, the operation of a diamond cutter machining on a grinding wheel in conventional systems.

Fig. 8 is an elevational view of the machine illustrating schematically the reversing means of the direction of progression of the table.

Turning to Fig. 1, 1 designates the head-stock of the grinding machine, said head-stock being carried by the movable table 2 and incorporating the spindle 24 (Fig. 2) driven by a motor that is not illustrated. A center 3 and a driving plate 4 provided with a dog 5 are rigid with the spindle and revolve integrally therewith. 33 designates the actual grinding wheel to be trued, the axis of which, that is not illustrated in Fig. 1, is parallel with that of the spindle 24.

The table 2 also carries the tail-stock 6 provided with a center 7 coaxial with the center 3 of the head-stock.

The truing device includes a casing 34 secured to the table 2 by means of a screw 35 and clamped between the centers 3 and 7 engaging the center-holes 10 and 10a in two stationary spindles 9 and 39 rigid with the casing 34.

A pinion 8 is revolubly carried by the spindle 9, rigid with the casing, and is prevented from being axially shifted, by a shoulder 9a of the spindle 9 and by a sleeve 37, secured to the casing 34. This pinion 8 is driven by the dog 5 and transmits the rotation thus imparted to it to another pinion 11 carrying side by side two cams 12 and 13 that are held fast on said pinion or spiral wheel by a nut 14 and a key 36 engaging the spiral wheel. The cams 12 and 13, the outline of which is shown in Fig. 3 which is a side view thereof, are intended for the production of a reciprocating movement of the diamond 15 which latter is rigid with a rod 16 sliding in the bearing 17 rigid with the casing 34. The rod 16 that is urged towards the cams 12 and 13 by a spring 18 carries, at its end facing the location of the cams, a pusher member 19 bearing against the cam registering selectively with said rod as disclosed hereinafter.

The pinion or spiral wheel 11 is fitted on a sleeve 20 and may revolve round the latter while it is held axially against shifting thereon; said sleeve 20 is provided with inner longitudinal grooves inside which may run balls 21 bearing against the surface of the spindle 22 rigid with the casing. The sleeve 20 and the wheel 11 may thus slide axially with slight friction over said spindle 22. The pinions or wheels 8 and 11 carry a series of helical teeth and consequently, according to the direction of rotation of the wheel 8, the wheel 11 is urged into axial movement in either direction. Its axial stroke is limited by the fact that the sleeve 20 abuts on the left hand side against the casing 34 of the device and on the right hand side against a bearing 22a on the spindle 22. At each reversal of the rotary movement of the spindle 24 and consequently of the direction of progression of the table 2, the wheel 11 is shifted axially so as to move the cam system and to bring one of the cams in front of the pusher member 19, which latter is urged against the said cam by the spring 18; each cam is thus operative with reference to said pusher member selectively according to the direction of progression of the table 2.

Fig. 2 shows an arrangement which allows a translational movement of the table while the diamond 15 executes its reciprocating movement through the selective action of the cams 12 and 13. The spindle 24 controlled by any suitable or known means, that need not be illustrated, drives a toothed wheel 25 meshing in its turn with a toothed wheel 26 driving in its turn a leading screw 27 the axis of which is stationary with reference to the table; the leading screw 27, as it revolves round its axis, screws into a nut 28 rigid with the frame of the machine 29, said frame being provided with slideways, not illustrated, that serve for guiding the table 2. This produces a shifting of the table 2 over the frame.

Fig. 4 shows in dotted lines at 30 the path followed by the diamond cutter 15 when the table moves from left to right. The diamond cutter engages the grinding wheel 33 under the action of the thrust exerted by the cam 12 and sharpens the left hand sides of all the indentations of the outline of the grinding wheel, the shape of the cam being such that the diamond recedes speedily without engaging any point of the right hand sides of said indentations.

When all the left hand sides of the outline to be sharpened on the grinding wheel have been trued, the movement of the spindle 24 and consequently that of the table 2 are reversed and the right hand sides of the outline, as illustrated in Fig. 5, are cut by the diamond which follows the path shown at 32. After reversal, the cam 13 is substituted for the cam 12 and imparts to the diamond a reciprocating movement in a direction perpendicular to the axis of the grinding wheel, the shifting of the cams, substituting the cam 12 for the cam 13, being operated automatically as soon as the spindle 24 has reversed its direction of rotation, by reason of the relative thrust exerted between the two spiral wheels 8 and 11 and urging the latter wheel 11 towards (or away from) the wheel 8.

The outline of the cam 13 is such that it produces a reciprocating movement of the diamond that is the reverse of that produced by the cam 12. Obviously the number of reciprocations of the table depends on the conditions of operation.

The cutting or truing of the grinding wheel 33 is thus performed for each direction of movement of the table only from the outside of the grinding wheel towards the inside and consequently, the wear of the diamond 15 is greatly reduced, the tip alone of said diamond being used and operating always under the best conditions of operation.

The reversal of the direction of rotation of the spindle 24 and the consequent change in the direction of progression of the table 2, which are provided simultaneously, are obtained through means schematically illustrated in Fig. 8. Stops 40 and 41, carried by the table 2, define the ends of the travel of said table, said stops actuate a switch 42 reversing the direction of rotation of the motor driving the spindle 24; these stops, the positions of which should be adjustable, are located in a manner such that the reversal of the direction of operation may be obtained at the end of each stroke for a position for which the diamond is entirely released with reference to the grinding wheel.

The outlines of the cams 12 and 13 and their angular setting are designed in a manner such that for this reversal position, the pusher member 19 may be shifted smoothly from one cam onto the other, without meeting any obstacle. The suitable angular setting of the cams is provided by insertion of the key 36.

A special set of cams is furnished for each

outline to be provided for the thread on the grinding wheel. Furthermore, it is necessary, for each different pitch of thread, to modify the ratio between the speeds of the spindle and of the table. This is done by changing the ratio of reduction gearing between the wheels **25** and **26**, a special set of wheels being used for each different pitch to be obtained.

What I claim is:

1. In a grinding machine, comprising a grinding wheel, a head-stock and a tail-stock the common axis of which stocks is parallel with the axis of the grinding wheel, a table adapted to move longitudinally in a direction parallel with the axis of the head- and tail-stock and carrying said head- and tail-stock, and a lead screw operatively connected with said table for controlling its longitudinal reciprocation; a device adapted to true the grinding wheel and including: a casing located between said head- and tail-stock, a cutter-holder mounted in said casing so as to reciprocate in a direction perpendicular to the axis of the head- and tail-stock, a cutter carried by said cutter-holder, two rotary and axially movable cams operatively connected with said lead screw and adapted to selectively engage the cutter holder to impart thereto intermittently a movement towards the axis of the grinding wheel to true the outline thereof, a spring urging the cutter back during the idle periods of the rotation of the operative cam and means controlling the axial displacements of said cams, said means being actuated by the change of direction of rotation of said lead screw for urging axially the corresponding cam into position to provide an operative inward stroke of the cutter progressing with the table in the direction to be considered.

2. In a grinding machine comprising a grinding wheel, a head-stock and a tail-stock the common axis of which stocks is parallel with the axis of the grinding wheel, a table adapted to move longitudinally in a direction parallel with the axis of the head- and tail-stock and carrying said head- and tail-stock, a lead screw operatively connected with said table for controlling its longitudinal reciprocation; a device adapted to true the grinding wheel and including: a casing located between said head- and tail-stock, a cutter-holder mounted in said casing so as to reciprocate in a direction perpendicular to the axis of the head- and tail-stock, a cutter carried by said cutter-holder, two rotary and axially movable cams operatively connected with said lead screw and adapted to selectively engage the cutter-holder to impart thereto intermittently a movement towards the axis of the grinding wheel to true the outline thereof, a spring urging the cutter back during the idle periods of the rotation of the operative cam, a first helical wheel in permanent driving connection with the lead screw and coaxial therewith, means preventing the axial shifting of the first helical wheel, a second helical wheel rigid with said cams and in permanent engagement with the first helical wheel, the axis of said helical wheels being parallel with that of the head- and tail-stock, said second helical wheel being axially shiftable in either direction under the action of the relative thrust exerted between the helical wheels according to the direction of revolution of the lead screw, whereby said cams are axially shifted and are brought selectively into register with the cutter holder for engagement therewith according to the position assumed by the second helical wheel under the action of the revolution of the lead screw in either direction.

3. In a thread-grinding machine comprising a grinding wheel the edge of which assumes transversely a threaded outline, a head-stock and a tail-stock the common axis of said stocks being parallel with the axis of the grinding wheel, a table adapted to move longitudinally in a direction parallel with the axis of the head- and tail-stock and carrying said head- and tail-stock, and a lead screw the axis of which is parallel with that of the grinding wheel, operatively connected with said table for controlling its longitudinal reciprocation; a device adapted to true the grinding wheel and including: a casing secured to the table between the two stocks, a cutter-holder adapted to reciprocate inside said casing in a direction radial with reference to the grinding wheel, a cutter for the grinding wheel carried by said cutter-holder, a spring urging said holder away from the grinding wheel, two interengaging helical wheels revolubly carried inside the casing and the axes of which are parallel with the axis of the grinding wheel, means whereby the lead screw controls the rotation of the first helical wheel, means for preventing the axial shifting of the first helical wheel, means whereby the second helical wheel is adapted to slide longitudinally on its axis, means whereby the lead screw controls the progression of the table, means whereby the lead screw is constrained to revolve alternatingly in either direction, two cams fitted side by side over the second helical wheel in planes adapted to register selectively with the axis of the cutter-holder according to the axial position assumed by the second helical wheel under the action of the thrust exerted in either direction on the latter by the revolving first helical wheel and a pusher member rigid with the cutter-holder and urged by the spring acting on said holder against the cam registering with the axis of the cutter-holder, the operative section of each cam being adapted to produce an outward movement of the cutter-holder against the action of its spring during the registering with the cutter of the surfaces of the threaded outline of the grinding wheel that face a predetermined axial direction.

4. In a thread-grinding machine comprising a grinding wheel the edge of which assumes transversely a threaded outline, a head-stock and a tail-stock, the common axis of said stocks being parallel with the axis of the grinding wheel, a table adapted to move longitudinally in a direction parallel with the axis of the head- and tail-stock and carrying said head- and tail-stock, and a lead screw the axis of which is parallel with that of the grinding wheel, operatively connected with said table for controlling its longitudinal reciprocation; a device adapted to true the grinding wheel and including: a casing secured to the table between the two stocks, a cutter-holder adapted to reciprocate inside said casing in a direction radial with reference to the grinding wheel, a cutter for the grinding wheel carried by said cutter-holder, a spring urging said holder away from the grinding wheel, two interengaging helical wheels revolubly carried inside the casing and the axes of which are parallel with the axis of the grinding wheel, means whereby the lead screw controls the rotation of the first helical wheel, means for preventing the axial shifting of the first helical wheel, means whereby the second helical wheel is adapted to slide longitudinally of its axis, means whereby the spindle is

constrained to revolve alternatingly in either direction, a set of two cams removably fitted side by side over the second helical wheel in planes adapted to register selectively with the axis of the cutter-holder according to the axial position assumed by the second helical wheel under the action of the thrust exerted in either direction on the latter by the revolving first helical wheel and a pusher member rigid with the cutter-holder and urged by the spring acting on said holder against the cam registering with the axis of the cutter-holder, the operative section of each cam being adapted to produce an outward movement of the cutter-holder against the action of its spring during the registering with the cutter of the surfaces of the threaded outline of the grinding wheel that face a predetermined axial direction.

5. In a thread-grinding machine comprising a grinding wheel the edge of which assumes transversely a threaded outline, a head-stock and a tail-stock, the common axis of said stocks being parallel with the axis of the grinding wheel, a table adapted to move longitudinally in a direction parallel with the axis of the head- and tail-stock and carrying said head- and tail-stock, and a lead screw the axis of which is parallel with that of the grinding wheel, operatively connected with said table for controlling its longitudinal reciprocation; a device adapted to true the grinding wheel and including: a casing secured to the table between the two stocks, a cutter-holder adapted to reciprocate inside said casing in a direction radial with reference to the grinding wheel, a cutter for the grinding wheel carried by said cutter-holder, a spring urging said holder away from the grinding wheel, two interengaging helical wheels revolubly carried inside the casing and the axes of which are parallel with the axis of the grinding wheel, means whereby the lead screw controls the rotation of the first helical wheel, means for preventing the axial shifting of the first helical wheel, means whereby the second helical wheel is adapted to slide longitudinally of its axis, means whereby the spindle is constrained to revolve alternatingly in either direction, a set of two cams removably fitted side by side over the second helical wheel in planes adapted to register selectively with the axis of the cutter-holder according to the axial position assumed by the second helical wheel under the action of the thrust exerted in either direction on the latter by the revolving first helical wheel, a pusher member rigid with the cutter-holder and urged by the spring acting on said holder against the cam registering with the axis of the cutter-holder, the operative section of each cam being adapted to produce an outward movement of the cutter-holder against the action of its spring during the registering with the cutter of the surfaces of the threaded outline of the grinding wheel that face a predetermined axial direction, and means for reversing the direction of rotation of the spindle at each end of the stroke of the table.

6. In a thread-grinding machine comprising a grinding wheel the edge of which assumes transversely a threaded outline, a head-stock and a tail-stock, the common axis of said stocks being parallel with the axis of the grinding wheel, a table adapted to move longitudinally in a direction parallel with the axis of the head- and tail-stock and carrying said head- and tail-stock, and a lead screw the axis of which is parallel with that of the grinding wheel, operatively connected with said table for controlling its longitudinal reciprocation; a device adapted to true the grinding wheel and including: a casing secured to the table between the two stocks, a cutter-holder adapted to reciprocate inside said casing in a direction radial with reference to the grinding wheel, a cutter for the grinding wheel carried by said cutter-holder, a spring urging said holder away from the grinding wheel, two interengaging helical wheels revolubly carried inside the casing and the axes of which are parallel with the axis of the grinding wheel, means whereby the lead screw controls the rotation of the first helical wheel, means for preventing the axial shifting of the first helical wheel, means whereby the second helical wheel is adapted to slide longitudinally of its axis, means whereby the spindle is constrained to revolve alternatingly in either direction, two cams fitted side by side over the second helical wheel in planes adapted to register selectively with the axis of the cutter-holder according to the axial position assumed by the second helical wheel under the action of the thrust exerted in either direction on the latter by the revolving first helical wheel, said cams being mirror images of each other and including semi-circular operative sections and radial idle portions at the ends of their operative sections, the setting of the cams being such as to align the generating lines corresponding to the beginning of the operative section on each cam, and a pusher member rigid with the cutter-holder and urged by the spring acting on said holder against the cam registering with the axis of the cutter-holder, the operative section of each cam being adapted to produce an outward movement of the cutter-holder against the action of its spring during the registering with the cutter of the surfaces of the threaded outline of the grinding wheel that face a predetermined axial direction.

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