

[54] **TWISTING MACHINE**

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219/10.75, 10.73, 10.57, 156, 159

[56] **References Cited**

UNITED STATES PATENTS

3,384,730 5/1968 Easley219/10.67 X
3,198,926 8/1965 Melmoth.....219/7.5

1,891,831 12/1932 Okochi et al.....219/153
2,667,204 1/1954 Jaycox.....219/153 X
2,761,958 9/1956 Cook et al.....219/153

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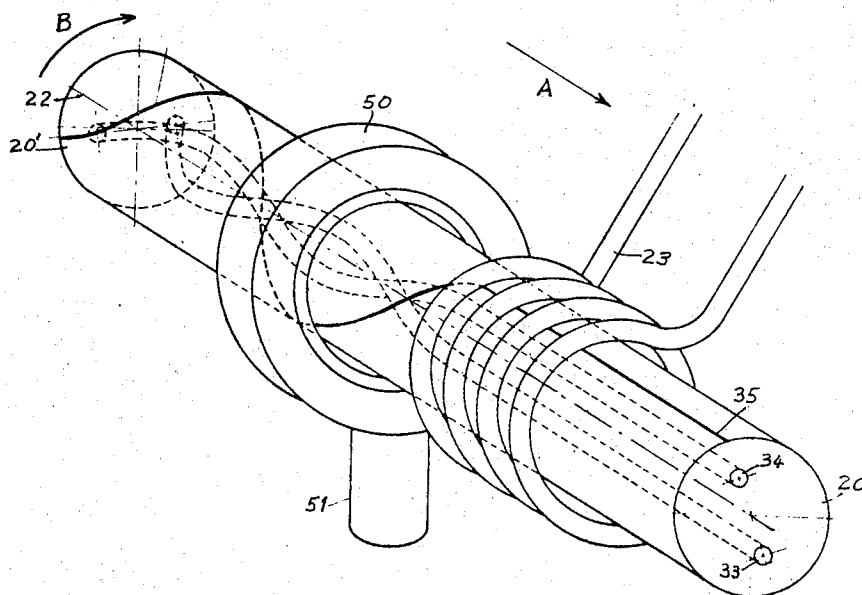
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[57] **ABSTRACT**

Machine for twisting a bar between two puppets, said machine having a two-track bed, a carriage which moves along one of the tracks, the other track being provided at one extremity with a fixed puppet and with a sliding puppet at the other extremity, a high-frequency heat generator the housing of which is mounted on said carriage, a computing unit which furnishes the control signals for the heating characteristics of an inductor, the linear speed for the displacement of said carriage along its track and the angular rotational speed of the puppet spindles.

2 Claims, 9 Drawing Figures



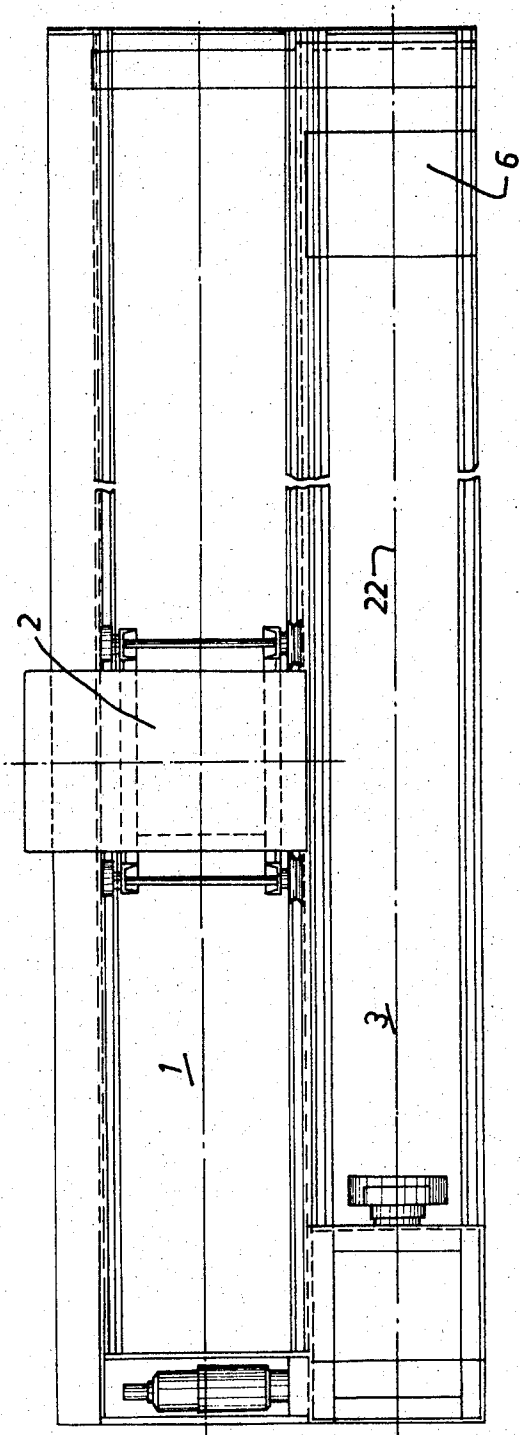


FIG. 1

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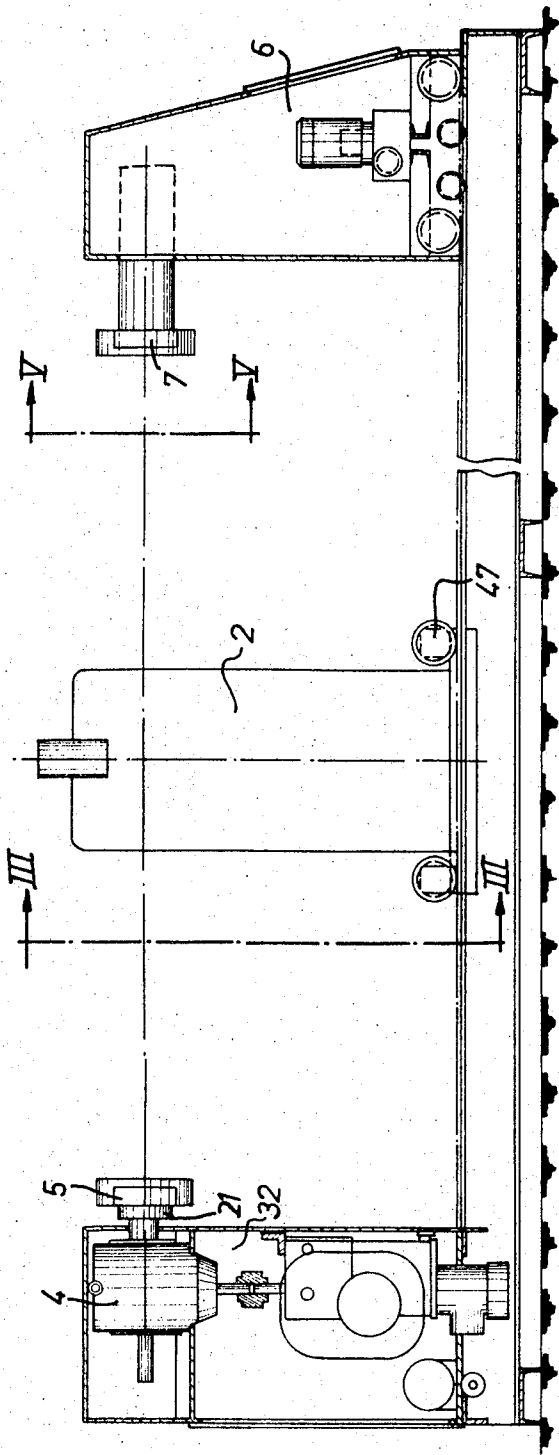
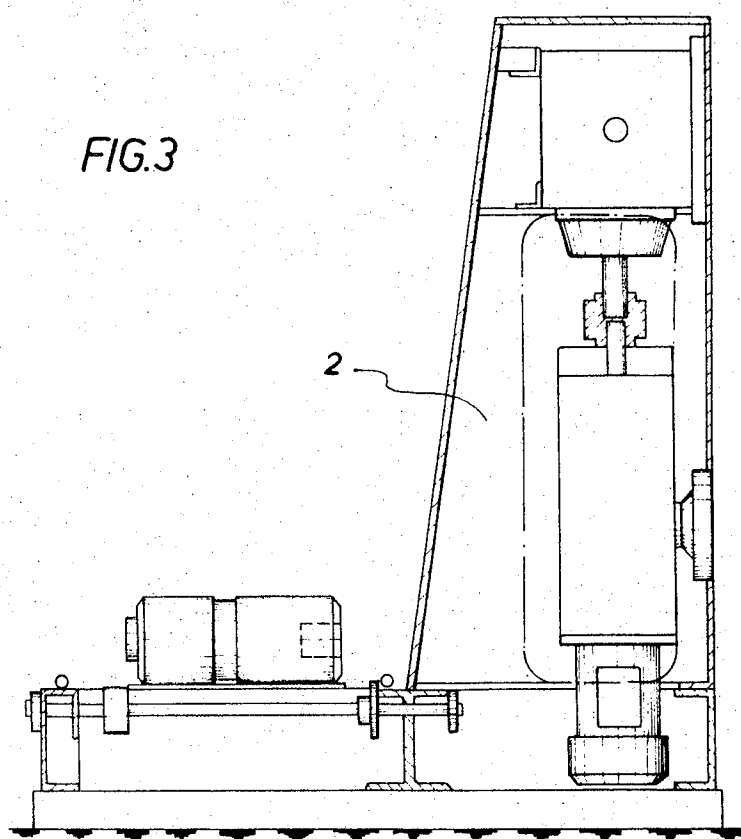


FIG. 2

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7 Sheets-Sheet 5



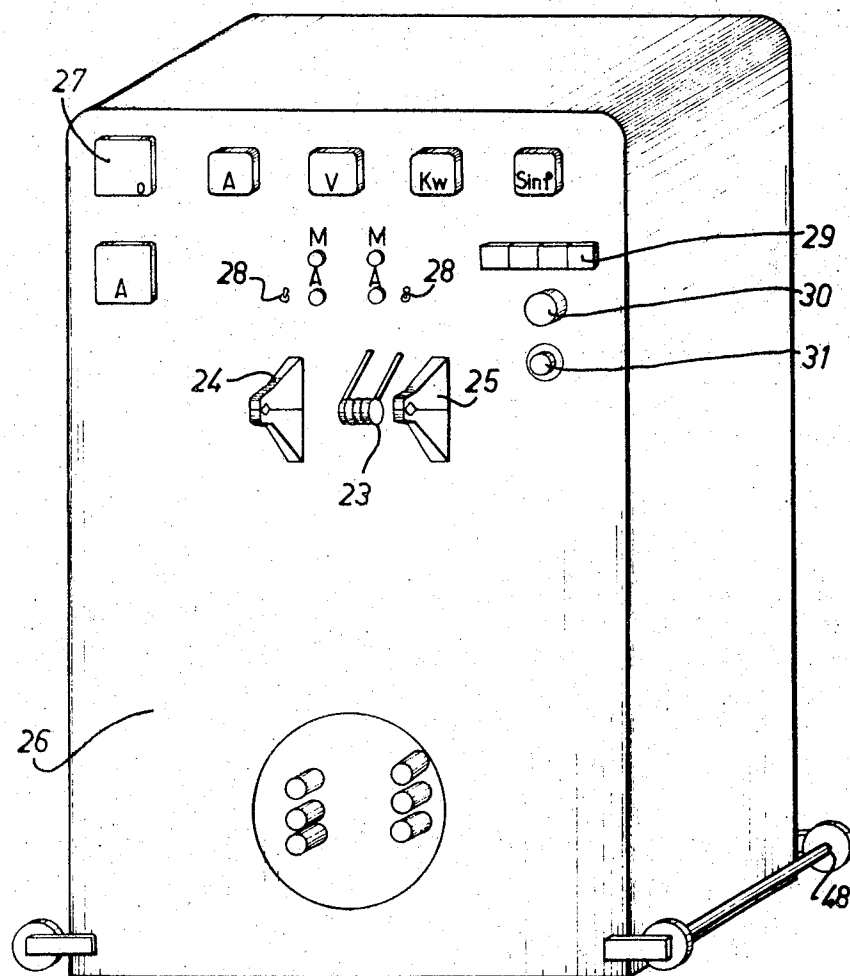
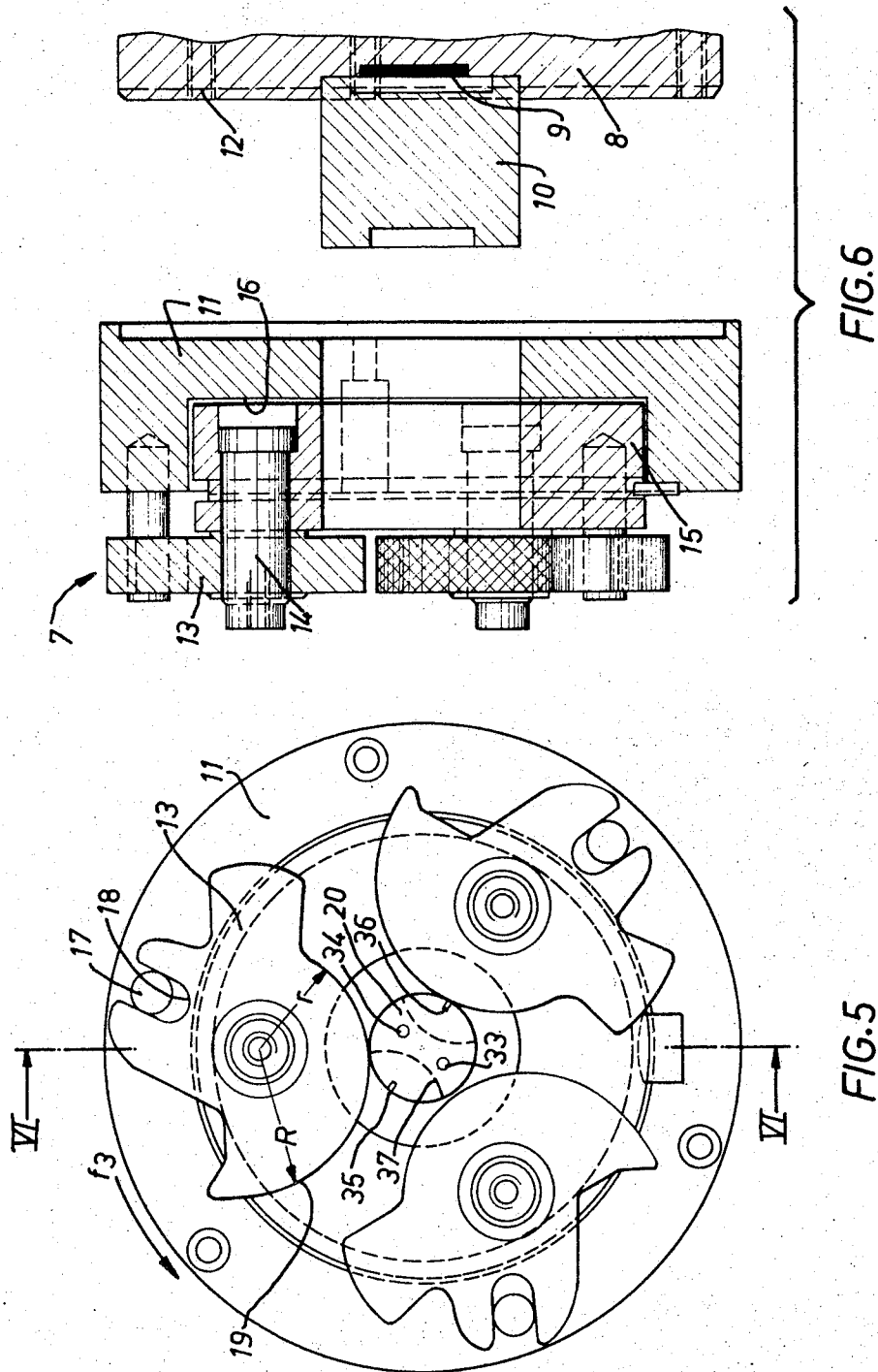
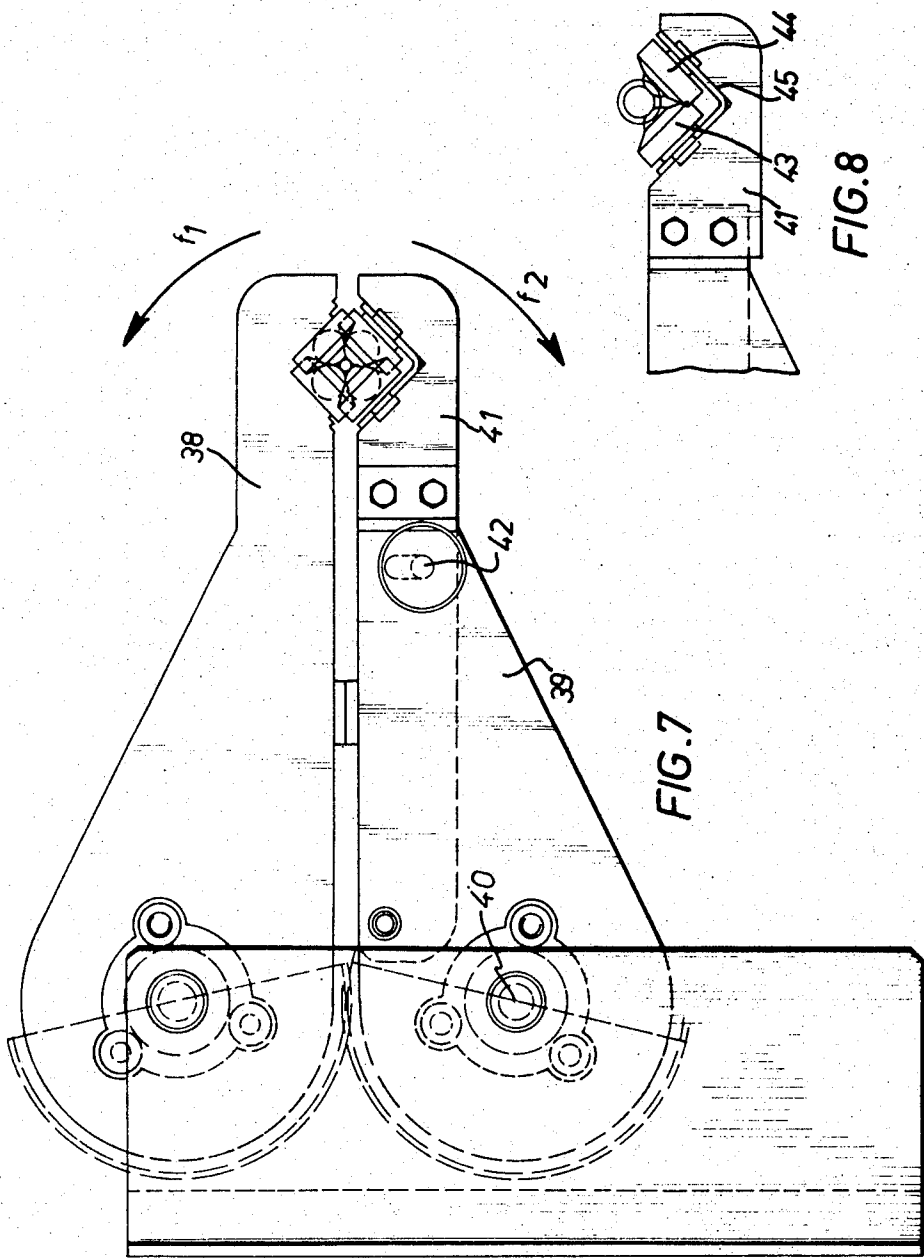


FIG. 4





TWISTING MACHINE

The present invention relates to a twisting machine and, more particularly, to a twisting machine which applies an even helicoidal torsion to very long, commercially available round bars, in which a generator, which assures local heating of the bar by means of an inductor located between two centering consoles, can travel the length of the bar during the helicoidal torsion applied to the bar according to operational parameters introduced into the machine by a computing unit in accordance with predetermined data for the helix formed on the finished drill.

As is well known, it is advantageous to form two channels in the drill, for example for cooling the cutting edges of said drill and for the removal of metal shavings by circulation of a fluid. By the very existence of the helicoidal removal grooves which characterize a drill, the channels provided for oil circulation must necessarily be situated in the solid part of the bar, i.e. must themselves be helicoidal.

The prior art technique consists of machining or extruding rectilinear grooves on straight bar, drilling at least one channel for the circulation of a coolant in the solid part of the stock and finally twisting the stock, with or without heating, in order to obtain the finished drill.

One disadvantage of twisting a stock to obtain a final drill is that by starting with this stock provided with grooves having their final shape, the twisting of such a profile generates certain geometrical dissymmetries which highly detract from the cutting properties of the helicoidal drill.

Thus the present invention proposes a machine for twisting commercially available round bars, said machine having a two-track bed, a carriage or car mounted on the first track, a fixed puppet provided at one extremity of the bed on the second track, a sliding puppet located at the other extremity of said second track, retractable stays distributed along the bed, said carriage supporting a heat generator and two centering consoles located on either side of an inductor, an electronic computing unit into which is introduced data corresponding to the magnitude of the angle of the helix or the length of the desired pitch, said unit providing control signals which impose upon the machine the satisfactory parameters pertaining to the heat intensity, the angular speed of the drive chuck and the linear speed for advancing the carriage, in order to obtain a bar which, after twisting, exhibits an absolutely helicoidal torsion of the fibers, from the surface of the bar right to its center without any cross-sectional slide of the metal.

These and other advantageous objects of the invention will become apparent through a consideration of the following detailed description taken in conjunction with the attached drawings in which:

FIG. 1 is a top plan view of the bed of a machine constructed in accordance with features of this invention;

FIG. 2 is a side view of the machine represented in FIG. 1;

FIG. 3 is a view of the drive chuck power unit taken along lines III—III of FIG. 2;

FIG. 4 is a perspective view of the heat generator of FIG. 3;

FIG. 5 is a view taken along lines V—V of FIG. 2 showing the self-clamping cams provided on each chuck of the puppets;

FIG. 6 is a view taken along lines VI—VI of FIG. 5;

FIG. 7 is a view of a set of centering and

FIG. 8 is a view of a detail of FIG. 7; and

FIG. 9 illustrates the process by which a drill is manufactured according to the present invention.

FIG. 1 shows a machine bed having two tracks 1 and 3. A carriage 2 moves along track 1 and at the extremity of track 3 is provided a fixed puppet 4 which supports a clamping chuck assembly 5. At the other end of track 3 is providing a sliding puppet 6 mounted on wheels and which supports a clamping chuck assembly 7.

Assembly 7 is shown in FIGS. 5 and 6. A spindle 8 having a permanent magnet 9 allows positioning and rapid disassembly of a bar centering mechanism 10 upon which is engaged a movable chuck 11 rotated by keys 12. Chuck 11 is provided, for example, with three self-clamping cams 13. Each cam 13 freely pivots about an axle 14 housed in a ring 15 which loosely turns in a housing 16 of chuck 11.

Spindle 8 drives the self-clamping cams 13 by means of studs 17 which freely slide in a driving slideway 18 provided on each cam 13. The eccentric profile 19 of cam 13 is such that radius r is less than radius R . Consequently, if cam-bearing chuck 11 is driven in the direction of arrow f_3 , the self-clamping cams 13 are applied with a certain force against the cylindrical surface of one extremity 20 of the bar to be twisted.

Spindle 21 of fixed puppet 4 drives cam-bearing chuck assembly 5 which is identical to assembly 7 and, in operation, rotates facing said assembly 7 in the opposite direction and drives the other extremity 20' (not shown) of the bar to be twisted. The centerline of the bar to be twisted (20,20') is depicted by the dot-dash line 22 on the twisting bed (FIG. 1).

The bar (20,20') is passed through an inductor 23 located between two centering consoles 24 and 25 mounted on housing 26. Housing 26 contains the heat generator which applies current to inductor 23. Said current has a frequency chosen, for example, in the 6 to 15 kilocycle range, in order to obtain an even deep heating and avoid skin formation.

The generator housing 26 is provided with a preheating timer control 27, two levers 28 for adjusting said consoles, a panel 29 for displaying the pitch, a knurled button 30 for regulating the excitation and an emergency stop button 31. A unit 32 calculates the optimum parameters necessary to obtain an integrally twisted bar. Depending upon the pitch of the helix to be produced, unit 32 furnishes the signals which control heating of the bar inside the inductor 23, the angular speed of the spindles 8 and 21 which bring about the twisting and the linear advance speed of carriage 2. Carriage 2 is mounted on wheels 47 and its movement along track 1 is brought about by means of chains (not shown) attached, for example, to drive mechanisms 48.

FIG. 7 shows the gripping devices 38 and 39 of one of the centering consoles 24 and 25. Each device 38 and 39 swings out in the direction of arrows f_1 and f_2 on a ball bearing 40 about an axle which forms an integral part of housing 26 which moves along carriage 2. The precise positioning of sliding arms 41 of the gripping

devices which act as guides and which are provided on the centering consoles is assured by an eccentric stud 42.

FIG. 8 shows that each arm 41 is provided with two right-angle ball and socket mechanisms 43 and 44. The positioning of mechanisms 43 and 44 which respectively slide on their supports 45, enables one to fix at will the precision guiding of the bar (20,20') through consoles 24 and 25 located on either side of the inductor 23, within a given diameter range for the bar.

While carriage 2 is in motion, retractable stays (not shown) positioned along track 3 maintain the bar (20,20') at the proper height and retilinear position. The chuck holder mounted on longitudinal needle bearings within sliding puppet 6 follows the path of bar extremity 20 along track 3 during the linear contraction brought about by the twisting operation.

Two ports 33 and 34 can be seen at the extremity 20 of the bar to be twisted. They are the channels through which the coolant flows during use of the finished drill. Two small surface cuts 35 and 36 may also be provided and they are located along a diametral line which is normal to the theoretical line joining the centers of the two channels 33 and 34 or along the bisectrix of the radial plans of the channels if the latter are circularly distributed in a number greater than two.

It is absolutely necessary to provide a cylindrical shower furnishing a constant flow of air or vapor in the immediate vicinity of the solenoid inductor, in order to limit as much as possible the length of bar being twisted at any given moment.

The process of making a torsion drill according to the instant invention is illustrated in FIG. 9. According to the invention inductor 23 is disposed around bar (20,20'), which is mounted on chuck assemblies 5 and 7 (not shown). Cooling shower assembly 50 is located behind inductor 23 and as illustrated includes an annular portion disposed around the bar (20,20') and coolant receiving portion 51. The cooling medium may conveniently be compressed air introduced into shower assembly 50 through an opening in the bottom of receiving portion 51 and thereafter circulated around the bar (20,20') by the annular portion. As the temperature of bar (20,20') is raised by inductor 23, and 20' is rotated in the direction of the arrow B relative to end 20, with twisting of the bar taking place in the area between the cooling shower assembly 50 and inductor 23. Twisted portions of bar (20,20') are clearly visible by reference to helical paths of passages 33 and 34 and surface cut 35 extending from the last coil of inductor 23. In the process of twisting bar (20,20') inductor 23 and cooling shower assembly 50 travel in the direction of arrow A. Thus the length of the bar being twisted at any given moment is limited by cooling shower 50.

Twisting of bars at a temperature below the austenite transformation point (below 780° C. for high speed steel) greatly contributes to the production of a regular lead and is highly beneficial in avoiding any special annealing of the bars after twisting; the physical properties of the steel are identically the same before and after this operation.

In fact only a section by section heating assures a local and continuous twisting throughout the entire

length of the bar: a bar which is heated throughout its entire length to 780° C. by any means (even by means of an inductor whose length equals that of the bar) and which is twisted at this temperature, does not have a constant helix having the desired pitch; and twisting of a cold bar locally heated by a short inductor which moves at a constant speed along said bar does not result in the desired constant pitch if a partial cooling shower which stops the twisting is not located immediately behind said inductor.

Therefore, following the twisting operation, the cuts 35 and 36 are present as helices at the surface of the bar and their presence enables the drill manufacturer to machine the conventional grooves by using the location of the helices as a guide for the machining operation. The profile of these helices is shown in dotted lines at 37 in a hollowed out region located outside the region in which are formed the helicoidal channels 33 and 34. These channels 33 and 34 are formed in the solid part of the bar and are invisible to the machinist.

It is found that the integral torsion produced in the bar after twisting and in accordance with the process of the invention is absolutely helicoidal from the surface of the bar right to its center. Therefore the cleavage of the cutting edges of the drill after grinding rigorously follows the plane of the fibers of the metal — such is not the case of drills produced by the conventional process of twisting a stock upon which the rectilinear grooves have been hollowed out before the twisting operation. In fact, the irregularities and surface tensions created by conventional twisting of a grooved stock in those regions which will undergo grinding to form the cutting edges (for example, in the case of high speed steels which is generally chosen for producing drills) being about discontinuities in the torsion and fiber sectioning which detract from the quality of the precision drilling operation required of finished drills in use and also detract from the life of said drills.

Moreover, the very long round bars twisted by the machine according to the invention enable the user to dispose, on the channeled bar, of a solid tool shank which is integrally formed with the drill, the same set of channels running through the entire length of the assembly.

I claim:

1. A process for obtaining an integral torsion drill which comprises the following steps:

- a. one starts with a commercially available bar which is provided with at least one axial lubrication channel;
- b. the bar which is placed between a fixed and a sliding puppet is passed through an inductor which moves along on a carriage, a partial cooling shower being located behind said inductor; and
- c. the inductor, which is furnished with a medium frequency current, is moved along the bar during the linear advance of the carriage and while the chuck-bearing spindles on the fixed and sliding puppets rotate.

2. The process as recited in claim 1 wherein said bar is twisted at a temperature below the austenite transformation point within the inductor.

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