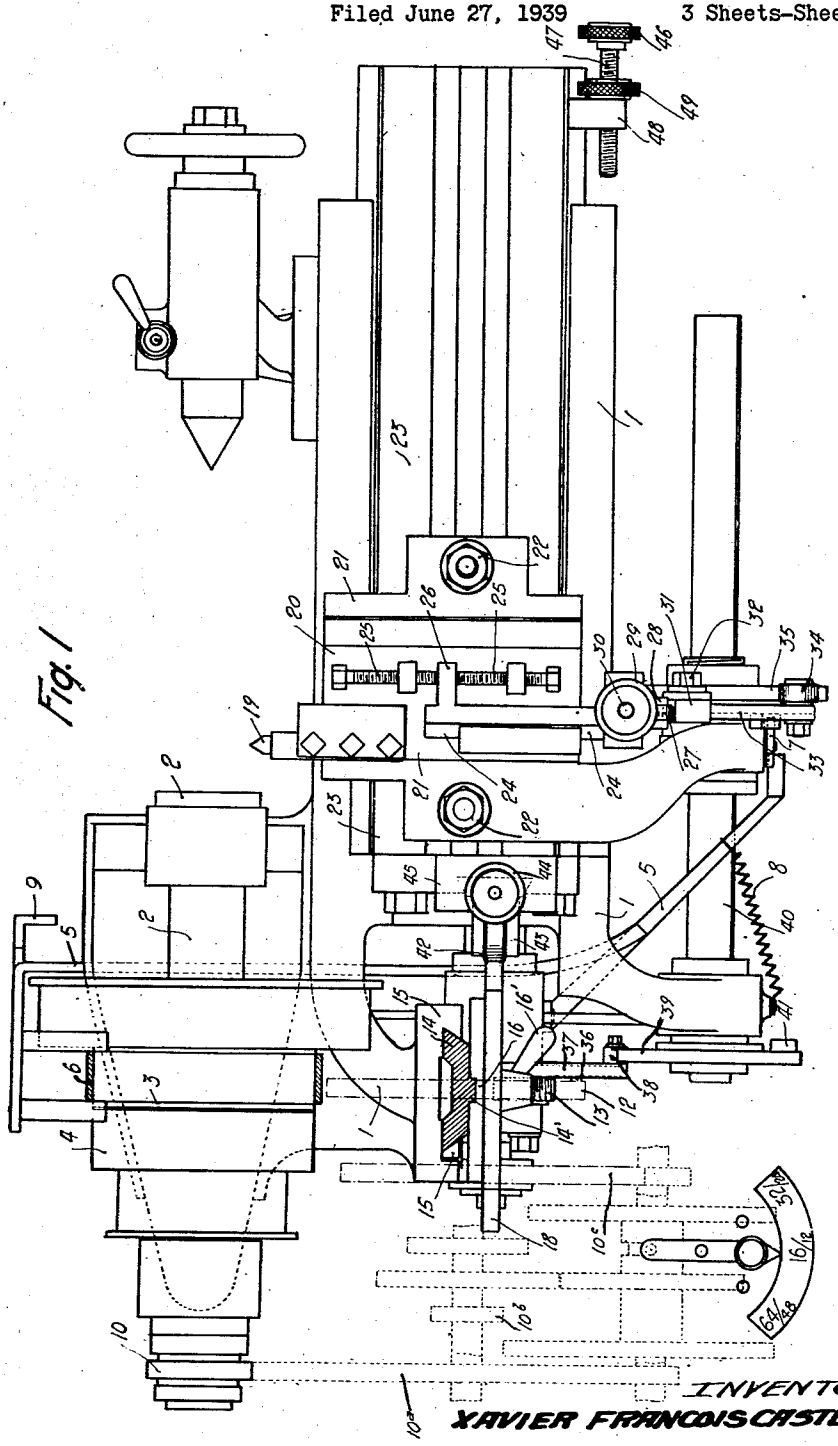
Dec. 9, 1941. X. F. CASTELLI 2,265,265

THREADS CUTTING MACHINE.

Filed June 27, 1939 3 Sheets-Sheet 1

Fig. 1



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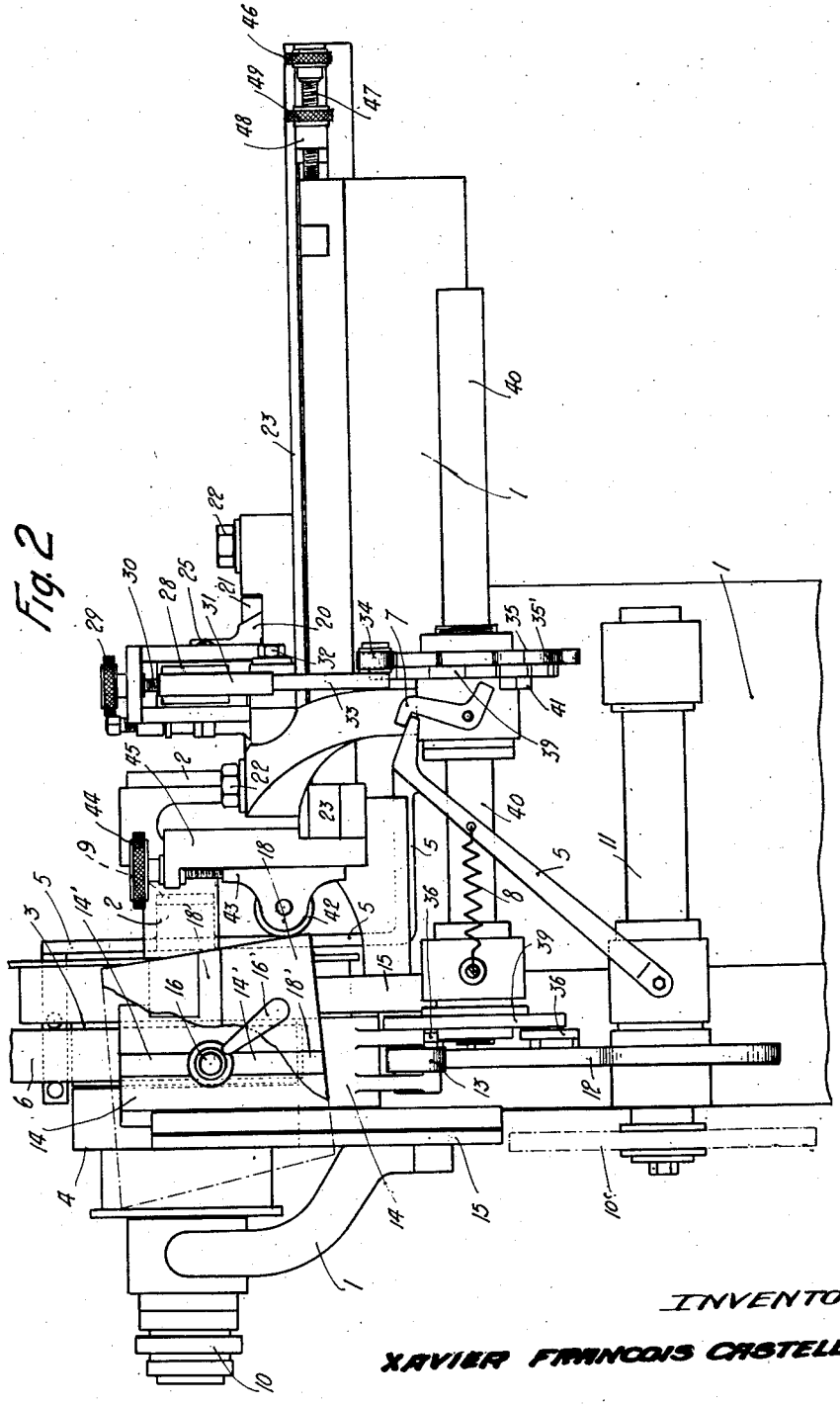
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Fig. 2



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Fig. 3

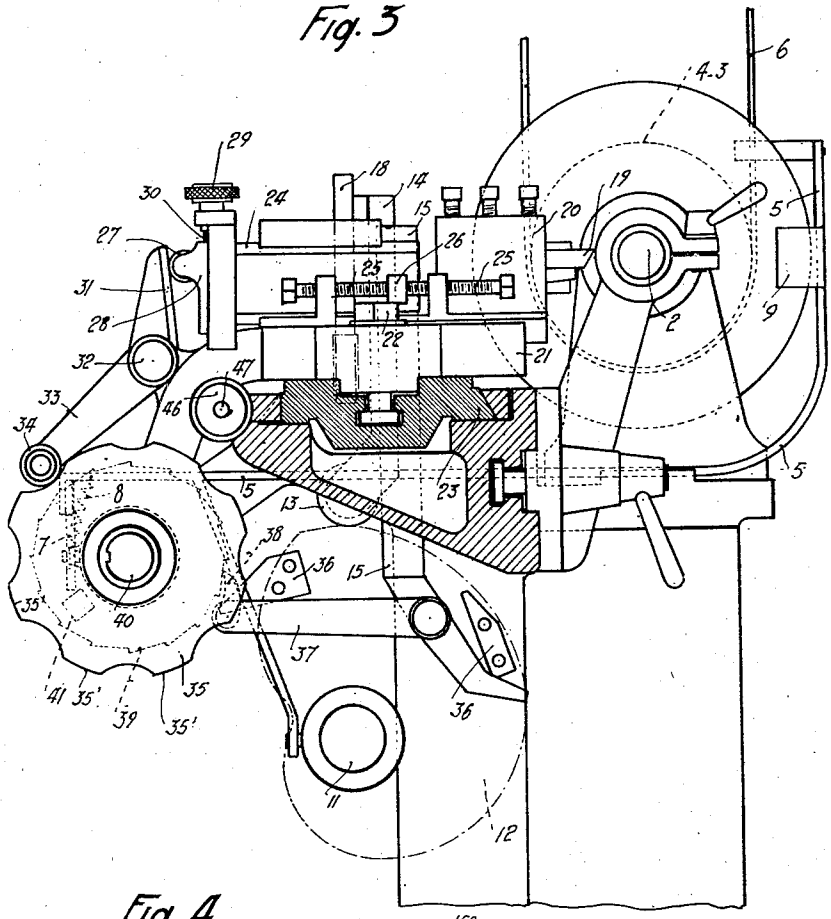
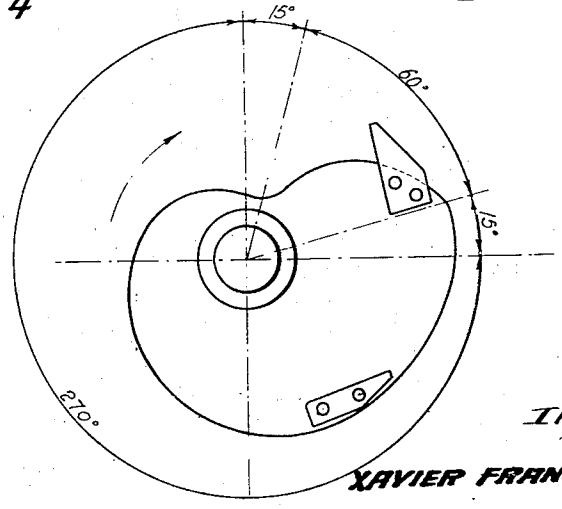


Fig. 4



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2,265,265

UNITED STATES PATENT OFFICE

2,265,265

THREADS CUTTING MACHINE

Xavier François Castelli, Paris, France

Application June 27, 1939, Serial No. 281,466
In France June 28, 1938

5 Claims. (Cl. 82—5)

My present invention has for its object a threads cutting or threading machine which operates as a horizontal lathe, but in which the piece to be threaded is always revolving in the same direction.

Threading is performed in successive passes or courses the number of which depends from the diameter and hardness of the piece to be threaded.

The main features of the said machine consist in that the variations in the pitch of the thread are obtained without the use of gears as in usual threading machines and that the relative depth of the successive passes becomes automatically adjusted according to the overall depth of the thread.

According to my invention the cutting tool is carried by an ordinary lathe tool-holder, secured upon a longitudinally displaceable slide-bar; in order to adjust the pitch of the thread made by the machine, the ratio between the number of revolutions of the machine main driving shaft and the forward longitudinal travel of the tool-holder is adjusted at will, by means of a removable plate provided with oblique sides, which is displaced at right angles to the travel of the tool-holder during a given number of revolutions of the driving shaft (thus acting through one of its sides during such travel upon the tool holder), and is subsequently rapidly carried back to its original position whilst the driving shaft is further revolving.

The said plate may be of rectangular, triangular, trapesoidal, polygonal or any other form, i. e. it may comprise any such desired number of oblique planes. Each of said planes having a different obliquity may, owing to the positioning of the plate on its support, be caused at will to act upon the tool-holder, in order to move it longitudinally by means of any convenient gear.

According to the obliquity of the plane of the plate which will act upon the tool-holder, there will be obtained a thread of different pitch, since the tool-holder will be more or less displaced in the longitudinal direction, depending from the value of said obliquity.

By securing the same plate in different positions on its support, it will thus be possible to obtain as many thread pitches as said plate comprises oblique sides.

Besides, it will be possible to obtain with the same plate so many other series of thread pitches as the available ratios between the number of revolutions of the driving shaft and the shaft which causes the displacement of the plate.

To sum up, a single plate will provide so many thread pitches as such plate comprises oblique sides and as many ratios are available between the number of revolutions of the main driving shaft and of the shaft causing the displacement of said plate.

The displacement of the plate at right angles to the direction of travel of the tool-holder may be obtained by means of a cam carried by the above mentioned shaft.

As stated above, the tool acts by successive passes and its successive travels—at right angles to the axis of revolution of the piece to be threaded (which must be each time more deeply cut by the tool) but with a descending progression—may be obtained by means of a disc carrying on its periphery more or less projecting bosses acting upon the tool-holder through a two-armed linked lever or any other convenient gear.

At the proper times, the said disc is itself successively rotated by fractions of revolutions for instance by means of a pawl and ratchet wheel drive (or otherwise) controlled by the revolution of the shaft which provides for the displacement of the oblique sided plate. Owing to the said arrangement, when the plate having provided a longitudinal displacement of the tool-holder, returns to its original position, the disc is automatically rotated by a fraction of revolution and a new more projecting boss becomes acting upon the tool for causing its deeper penetration during the subsequent pass, in the piece to be threaded.

My invention also comprises other features which will be described below.

The accompanying drawings show by way of example an embodiment of the invention.

In such drawings:

Fig. 1 is a plan view of the machine;

Fig. 2 is a front view;

Fig. 3 is a side view;

Fig. 4 is a detail view of the peripheral side-face cam.

The machine comprises a frame 1 similar to a lathe with its head stock and its bed. A shaft 2 is rotatable at different speeds and carries a clutch gear comprising a fixed pulley 3 and a loose pulley 4; 5 is the clutch lever for transferring the belt 6 from one pulley to the other. The said lever is maintained "in operation" by means of a pawl 7 and is urged by a spring 8 towards the "stopping" position. It carries a brake 9 which is applied on the fixed pulley at the time of disengagement.

The main shaft 2 drives, by means of a set of gears 10, 10a, 10b, 10c, a shaft 11 parallel to the shaft 2. The shaft 11 is rotatable at a number of different speeds with respect to the shaft 2. Three speeds are here assumed, viz. 16, 32 and 64 revolutions of the shaft 2 for one revolution of shaft 11. Said shaft 11 carries a peripheral side-face cam 12, shown Fig. 4, e. g. 270° in a regularly ascending slope, 15° without any slope, 60° in descending slope and 15° without any slope.

The cam 12 operates a roller 13 secured on a part 14 which slides at right angles to the shaft 2 between two slide-bars 15 integral with the frame 1. The part 14 is provided at its center with a threaded rod 16 (Figs. 1 and 2) and a vertical key 14' passing through the axis of the rod 16. Said key is exactly parallel to the slide bars 15. A spring 17 maintains the roller 13 applied against the cam 19.

Plates of different shapes may be secured on the part or member 14, in exactly fixed positions with respect to the key 14' of the number 14, by the threaded rod 16 through the handle 16'. Said plates 18 (rectangles, triangles, trapezoids, polygons) determine the pitch of the thread cut by the machine by varying the ratio between the number of revolutions of the shaft 2 with respect to the longitudinal forward travel of the cutting tool.

The plate 18 may for instance be provided with two grooves 18' in crossing arrangement, any of said grooves fitting on the key 14' according to the position given to the plate 18.

Their operation is as follows:

The threading tool 19 is secured in a support 20 sliding at right angles to the axis of the shaft 2 between two guides 21 attached by means of two bolts 22 in a longitudinal slide bar 23 sliding in parallel direction to the shaft 2 between the guides of the frame 1. The support 20 carries a slider 24 at right angles to the shaft 2 and maintained between two micrometric screws 25 by means of a projecting square piece 26 secured on the slider 24. Such micrometric screws adjust the forward travel of the tool against the piece to be threaded and consequently the diameter of the thread. They form a part of the support 20.

The slider 24 is provided at its end with a roller 27 carried by a slider 28 which is adjustable vertically by means of a knob 29 acting on a micrometric screw 30. Under the action of a spring (not shown) the roller 27 tends to press strongly against a lever 31 pivoting around an axis 32 and carrying a second arm 33 which is longer than lever 31 and is provided at its end with a roller 34.

Under the pressure exerted by roller 27, the roller 34 bears against a disc 35 having eight bosses 35' around its circumference. Said bosses, which are regularly distributed as gear teeth, form different and progressive projections in order to act gradually through the action of rollers 34 and 27, upon the tool 19.

The combination of both lever arms 31 and 33 together with the action of the slider 28 upon the roller 27 enables, by removing the roller 27 from the axis 32 or by drawing it nearer to said axis, to increase or decrease at will the overall forwards travel caused by the action of the eight bosses of the disc 35 which are unvariable. In this way, by the simple manipulation of roller 27, the eight passes may be performed on a thread depth of 3, 4, 5 or 6 mm. (viz. 0.12, 016, 0.20 or 0.24 inches), the forward travel of each pass being proportional to the total depth of the thread and said combination forms a characteristic feature of the machine. A complete revolution of the screw 30 provided with the knob 29 corresponds to a forward travel of 0.1 mm. (viz. 0.004 inch) over the advancing motion of the tool, thus clearly characterizing the degree of sensibility of the machine on account of accuracy.

The bosses 35' may be arranged as to their numbers and thicknesses for threading as follows: either in three passes (and in this case a revolution of the disc corresponds to three threads) or in four passes for two threads per revolution, or in five, six, eight, nine, ten, twelve or fifteen passes. The proportional amplifying or reducing action of the roller 27 is available whatever may be the number of bosses of the disc.

The rotation of the disc 35 is obtained by means of two sectors 36 secured to one face of the cams 12 and acting upon a lever 37 integral with a pawl 38 engaging a ratchet wheel 39 secured to a shaft 40 carrying the disc 35. The action of one of the sectors 36 disengages the roller 34 from one of the bosses of the disc 35 at the time when the roller 13 has completed its path along the 270° slope of the cam 12. The roller 34 is thus between two bosses when the roller 13 runs along the 60° of descending slope of cam 12. At that time takes place the action of the second sector 36 which rotates the disc 35 in order to locate the roller 34 on the subsequent boss. The ratchet wheel 39 is provided laterally with sectors 41 which act upon the pawl 7 and disengage the machine after the last threading pass. One, two, three or four sectors may be provided according to the number of threads cut in a revolution of the disc 35.

The forward and adjusting travels of the tool at right angles to the axis of revolution of the pieces to be threaded are obtained by the action of disc 35; the action of plates 18 secured to the sliding part 14 will now be precized. One of the sides of the plate 18 is in contact with a roller 42 attached on a vertical slider 43, which may be adjusted by a knob 44 between the guides of the frame 45 attached to the longitudinal slider 23 carrying the tool-holder 20. The side of plate 18 which is in contact with the roller 42 is not parallel to the sliders 15, it is arranged obliquely to the sliders and the degree of obliquity is different for each of the four sides of plate 18 (f. i. 6 mm., 12 mm., 18 mm., 24 mm.) (0.24, 0.48, 0.72, 0.96 in.) of slope for 10 cm. (4 in.) in length.

When the machine is set in operation with the ratio of 16 to 1 between the shafts 2 and 11, the cam 12 will lift the plate 18 after twelve revolutions of the shaft 2 (rotation of 270° over 360° of cam 12) and the tool will be displaced in the longitudinal direction of a distance equal to the obliquity of the oblique side or plane of the plate 18 acting upon the roller 42. When said obliquity is of 6 mm. (0.24 cm.), the pitch will be 0.02 in.; if it is 12 mm. (0.48 in.) the pitch will be 0.04 in.; said pitch will be 1.5 mm. (0.06 in.) for the slope of 18 mm. (0.72 in.) and of 2 mm. (0.08 in.) for a slope of 24 mm. (0.96 in.).

With the same plate 18 the obliquity of 6 mm. (0.24 in.) will give 0.25 mm. (0.01 in.) pitches and 0.125 mm. (0.005) pitches if the ratios of 32 and 64 are set between the shafts 2 and 11 by means of the gear 10b.

When the tool has completed the first pass and roller 13 has reached the top of the ascending slope of the cam 12, the sector 36 will act and the roller 34 falls between two bosses of disc 35, thus disengaging the tool from the piece to be threaded. At that time the roller 13 runs along the strongly descending slope of cam 12, the plate 18 is lowered and the tool is brought back to its starting position. A further action of the second sector 36 places the roller 34 on the subsequent boss, more projecting than the preceding one and the tool penetrates more deeply; the cycle is renewed until after completion of the thread, the sector 41 is acting on the pawl 7 to stop the machine.

In order to adjust the longitudinal travel of the tool, the roller 13 is placed at the higher part of the cam 12, and the knob 44 is operated which by causing the roller 42 to run up along the oblique side of plate 18 moves the slider 23 towards the left side of Fig. 2 and thus determines the threading plane located farther at right with respect to the shaft 2. In order to adjust the opposite plane, located farther at left with respect to the shaft 2, which plane constitutes the original plane of the thread the knob 46 is operated, said knob acting on the micrometric screw 47 integral with the longitudinal slider 23 by means of support 48 and acting as a stop on the frame 1. A washer 49 enables to lock the screw 47 when the adjusting operation is completed.

The speed of revolution is the speed admitted as circumferential speed of the cutting tool for the metal being threaded. The speed is constant and the time needed by the tool for returning to its engaging position is only the third of the time taken by threading. The accuracy in the longitudinal range of travel of the tool enables to obtain in mass production very difficult and precise threads.

The use of the oblique planes of the plate 18 for the determination of pitches enables to obtain any kind of pitches. When for instance the oblique plane exerts its action in twelve revolutions of the main shaft, for obtaining a given pitch it is only necessary to take the linear length of twelve threads and to give to the oblique plane, over 10 cm. (4 in.) length an obliquity equal to such linear length. Thus, with a slope of 2 in. per 4 in. and by employing the suitable of the three ratios 16, 32, 64 between the shafts 2 and 11, the pitches of 6, 12 and 24 threads per inch will be obtained. With a slope of 1.5 in. the pitches of 8 and 16 threads per inch will be obtained. By means of two trapezoidal plates 18 all Whitworth pitches comprised between 4 and 24 threads per inch will be obtained.

For special pitches, the plate 18 may be replaced by an alhidade with circular sector provided with a scale and nonius, pivoted about an axis and adjustable by means of a micrometric screw; in this way all angles may be determined and consequently all pitches.

It is understood that the above figures of speed, obliquity of like ratios are only given by way of example.

The machine can operate as separate unit or in combination with another machine. Since threading is performed at the cutting velocity of a tool the threads can be cut in pieces which are revolving on machines for other works, since there is no reversing in the direction of rotation. The time of threading enables indeed to spare labour. With a convenient tool, it is also possible to cut at the same time two threads of same pitches of different diameters.

By the use of curved friction planes instead of straight planes threads with ascending or descending spaces will be obtained.

With broken planes it is possible to obtain, in a same proceeding, different pitches succeeding to one another.

For obtaining left pitches, there shall merely have the main shaft rotated in the opposite direction, the face of the cam and that of the disc turned back, and the cutting tool reversed.

The machine may be realized with hollow shaft for threading tubes, cylinders . . .

When the pieces to be threaded shall be supported by their both ends, a sliding movable head stock or any other member for supporting these pieces may be used.

What I claim is:

1. Threading machine comprising a longitudinally movable tool holder, means for supporting and rotating a work piece, an oblique sliding plate for the adjustment of the pitch of the thread to be cut, said plate comprising at least one oblique side and acting on said tool-holder, a disc, means for intermittently rotating said disc for successive fractions of a total revolution, bosses on the periphery of said disc putting the tool more deeply into the work pieces after each working pass, means for automatically stopping the machine when all bosses have worked on the tool and the threading is ended.

2. Threading machine comprising a longitudinally movable tool holder, means for supporting and rotating a work piece, an oblique sliding plate for the adjustment of the pitch of the thread to be cut, said plate comprising at least one oblique side and acting on said tool holder, an oscillating lever pushing said tool holder towards the object to be threaded, a disc, means for intermittently rotating said disc for successive fractions of a total revolution, bosses on the periphery of said disc, said bosses acting on the oscillating lever for putting the tool more deeply into the work piece after each working pass.

3. Threading machine comprising a longitudinally movable tool holder, means for supporting and rotating a work piece, an oblique sliding plate for the adjustment of the pitch of the thread to be cut, said plate comprising at least one oblique side and acting on said tool holder, an oscillating lever pushing said tool holder towards the object to be threaded, a disc, means for intermittently rotating said disc for successive fractions of a total revolution, bosses on the periphery of said disc, said bosses acting on the oscillating lever for putting the tool more deeply into the work piece after each working pass, and means for varying the actual length of one arm of said oscillating lever.

4. Threading machine comprising a longitudinally movable tool holder, means for supporting and rotating a work piece, an oblique sliding plate for the adjustment of the pitch of the thread to be cut, said plate comprising at least one oblique side and acting on said tool holder, a part mounted slidably on the tool holder, an oscillating lever bearing on said part to push the tool holder towards the work piece, a disc, means for intermittently rotating said disc for successive fractions of a total revolution, bosses on the periphery of said disc, said bosses acting on the oscillating lever for putting the tool more deeply into the work piece after each working pass, and a setting device for displacing the slid-

able part on the tool holder to vary the actual length of the corresponding arm of the oscillating lever.

5. Threading machine comprising a longitudinally movable tool holder, means for supporting and rotating a work piece, an oblique sliding plate for the adjustment of the pitch of the thread to be cut, said plate comprising at least one oblique side and acting on said tool holder, an oscillating lever pushing said tool holder towards the work piece, a disc, means for intermittently rotating said disc for successive fractions of a total revolution by the movement of the plate, bosses on the periphery of said disc, said bosses acting on the oscillating lever for putting the tool more deeply into the work piece after each working pass, means for varying the actual length of one arm of said oscillating lever, and means for automatically stopping the machine when all bosses have worked on the tool and the threading is ended.

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