April 18, 1939. K. H. WEBER 2,154,793

THREADING MACHINE FOR INSULATOR BLANKS

Filed Feb. 26, 1937 2 Sheets-Sheet 1

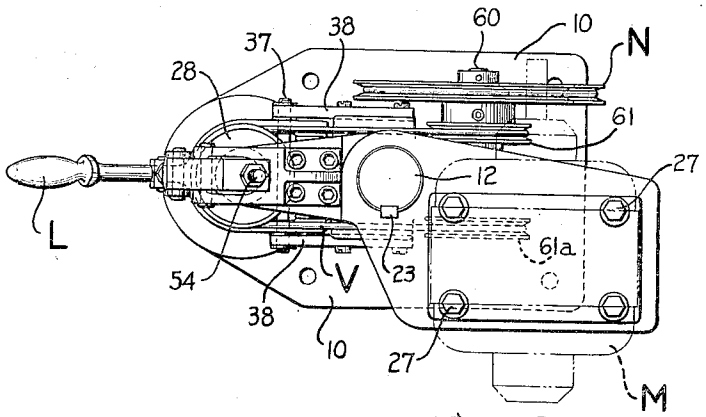



FIG. 2

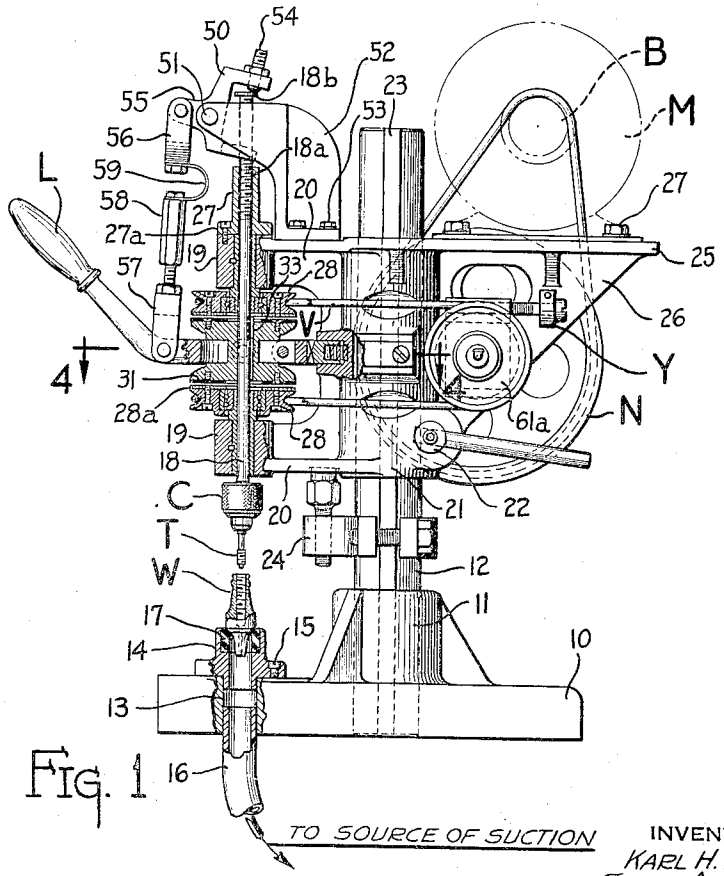



FIG. 1

INVENTOR
KARL H. WEBER
BY Talbot & Stoltenberg
ATTORNEYS

April 18, 1939. K. H. WEBER 2,154,793

THREADING MACHINE FOR INSULATOR BLANKS

Filed Feb. 26, 1937 2 Sheets-Sheet 2

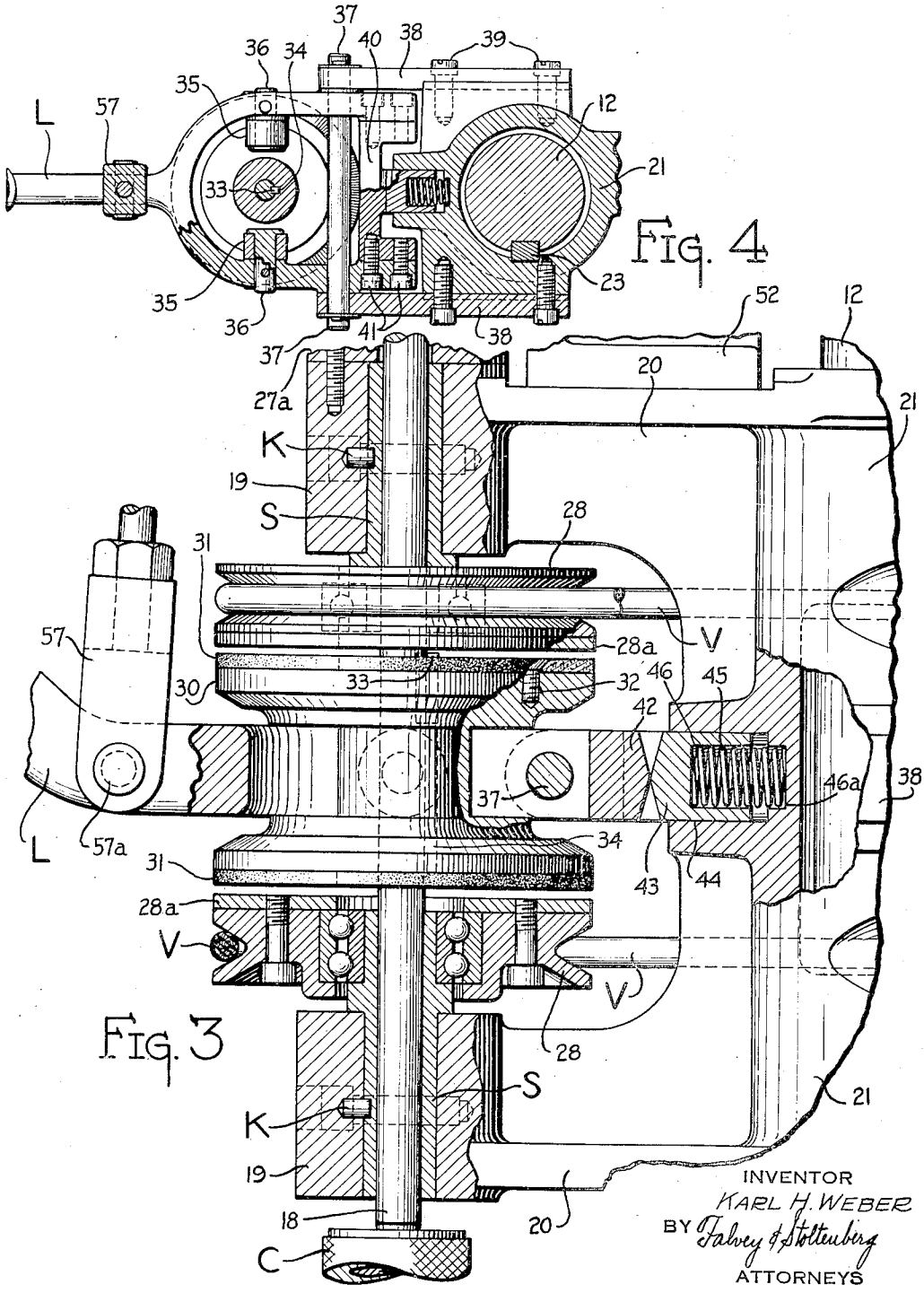



FIG. 4

FIG. 3

INVENTOR
KARL H. WEBER
BY Talbey & Stoltenberg
ATTORNEYS

Patented Apr. 18, 1939 2,154,793

# UNITED STATES PATENT OFFICE

2,154,793

## THREADING MACHINE FOR INSULATOR BLANKS

Karl H. Weber, Toledo, Ohio

Application February 26, 1937, Serial No. 127,874

4 Claims. (Cl. 25—3)

This invention relates to machines used in the manufacture of spark plug insulators, more particularly to a machine adapted to thread a bore in an insulator blank before the same is fired in a kiln.

In the past, threads have been formed on internal bores of unfired ceramic material such as insulators for use in spark plugs for internal combustion engines, by a manual operation in which the thread cutter is carefully turned into the bore to form the thread and then carefully removed by a reverse rotation of the thread cutter. This operation is costly and slow. The present invention contemplates the provision of a machine which will attain cleaner and more uniform results with greater speed and facility than may be obtained by the manual operation. A machine is contemplated in which both hands of the operator are free to place the blanks in position for the threading operation and to remove the same after the threading operation is complete. The machine is designed to be substantially automatic which will reverse its tool relations in proper sequence within predetermined limits without interference on the part of the operator.

It is, therefore, an object of this invention to provide a machine which will cut a thread or make a similar conformation upon a blank of unfired ceramic material without the necessity of an operator controlling the movements of the actuating elements of the machine, the operator being required to place the blanks into and remove them from operative position in the machine.

It is a further object of this invention to provide a machine in which a thread-cutting device is advanced to cutting relation with a work body and after the thread cutting device has advanced a definite distance with relation to the work body, a reversal of rotation is automatically obtained to withdraw the thread cutter from its operative relation with the work body without placing any strain upon the conformed portions of the work body.

It is a further object of this invention to provide a machine in which a working element will advance and retreat with respect to the work body without interference or control by an operator.

Other objects and advantages of this invention relating to the arrangement, operation and function of the related elements of the structure, to various details of construction, to combinations of parts and to economies of manufacture, will be apparent to those skilled in the art upon consideration of the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

Figure 1 is an elevational view, partly in section, of the machine.

Figure 2 is a plan view of the machine.

Figure 3 is an enlarged elevational view, partly in section, showing a detail of the machine.

Figure 4 is a plan view taken along the line 4—4 of Figure 1.

Referring to the drawings, particularly to Figure 1, a base 10 is provided which has an upstanding boss 11 apertured to support in vertical position a column 12 to which the moving portions of the machine are attached as will be described hereinafter.

Adjacent the boss 11, an aperture 13 is provided in the base which is provided with a flanged sleeve 14 cooperating with the aperture 13 and held in operative relation therewith by any convenient means such as, for example, screws 15. The aperture 13 in the base 10 is in communication with a source of suction (not shown) by means of a conduit 16. The sleeve 14 is provided at its upper end with an internal resilient collar 17 positioned flush with the bore. The resilient collar 17 may be formed of soft rubber or the like and is adapted at its upper side to seat a work body W such as, for example an unfired ceramic body shown in the form of a spark plug insulator. The suction in the conduit 16 holds the work body W in position on the collar 17 to allow forming operations to be performed thereon as will be described hereinafter.

In the present embodiment of the invention, as illustrated in the drawings, the work body W is to be provided with a threaded aperture in its upper end as shown. The substance of which the work body W is formed is of a soft chalky nature, extremely frangible and very likely to chip or crush under stress when formed into sections of small diameter such as found in screw threads. It is, therefore, necessary for the formation of a clean accurate thread in the aperture of the work body W that the frangible material of which the work body is formed is not subjected to undue stresses which would tend to chip the material. As shown in Figure 1, a tap T is provided to form the thread in the bore of the work body W. The tap T is held in operable position by means of a chuck C which is well known in

the art and need not be described in detail. The chuck C is mounted for controlled rotation on a vertical shaft 18 which is held in position by means of bearings 19 to align with the bore in the work body W.

The bearings 19 are mounted upon arms 20 which are an integral part of a split collar 21 which embraces the column 12. Clamping means 22 are provided to cooperate with the split collar 21 to allow the collar to be fastened in any position on the column 12, the parts being held in alignment and to prevent relative rotation by means of a key 23 which cooperates with cooperating slots in the column 12 and the collar 21. In this manner, the bearings 19 and the working parts of the machine may be raised or lowered to suit the conditions imposed by the proportions of the work body W. Micrometer adjusting means 24 are provided to cooperate between the column 12 and the collar 21 so that the aforementioned adjustments may be made with facility. This adjusting means is well known in the art and need not be described in detail.

The split collar 21 is provided on the side diametrically opposed from the bearings 19 with a platform 25 which is supported by suitable brackets 26. A motor M is mounted upon the platform 25 by means of bolts 27; the motor mounting is preferably made adjustable to allow tension of driving belt B to be varied which acts between the motor pulley and the driven pulley N. The cooperation between the motor and the moving parts of the machine will be described in detail hereinafter.

The vertical shaft 18 on which the chuck C is mounted is moved in a vertical line to and from operable relation with the work body W by means of a threaded portion 18A on the shaft, preferably adjacent its upper end to cooperate with a partially threaded sleeve 27. An outwardly extending flange 27A on the sleeve 27 is adapted to cooperate with the upper side of the upper bearing 19, and is held in position thereon by any convenient means such as, for example, by screws. The relation between the threaded portion 18A and the sleeve 27 enables the shaft 18 to move downwardly or upwardly, depending upon the direction of rotation of the shaft 18. The threaded portion 18A is preferably designed to have the same pitch as the thread cutters on the tap T so that when the tap T enters the aperture in the work body W, it will be advanced primarily by the threads 18A into the work body W to allow the formation of a clean-cut thread without placing any strain upon the frangible material of the work body. The strain of advancing the tap T into the aperture of the work body W is borne by the thread collar 27. Then, upon reversal of the shaft 18, the tap will be withdrawn from the aperture in the work body by the interaction of the threads 18A and the sleeve 27. In this manner, the frangible material of the work body W is not exposed to stresses which would tend to crumble it during the period in which the tap T is moving into or out of operable relation.

In order that the shaft 18 may be conveniently rotated in both directions, two faced pulleys 28 are mounted adjacent bearings 19, the pulleys being mounted preferably upon sleeves which journal the shaft 18. The sleeves S may be mounted in any convenient manner in the bearing 19 as, for example, by key K. Ball bearings are preferably used to reduce the friction of rotation of the pulley 28 to a minimum. Each pulley is provided with a hardened plate 28A, held in position by means of screws or the like, which forms one portion of a clutch mechanism adapted to transmit the rotation of either pulley to the shaft 18. The pulleys 28 are rotated in opposite directions by means of a belt system to be described hereinafter.

The clutch member, cooperating with the shaft 18, is in the form of a spool 30 which is provided with gripping faces 31 of any suitable friction material, held in position by means of screws 32. The shaft 18 threads the bore of the spool 30 and is provided with a projection 33 preferably in the nature of a key to cooperate with a key-way 34 in the bore so that rotation of the spool 30 will be transmitted to the shaft 18. The movement of the spool 30 relative to the shaft 18 is primarily controlled by means of a manual lever L which is provided at its lower end with a bifurcated portion which embraces the spool 30. Each arm of the bifurcated portion is provided with a roller 35, journaled on a pin 36 fixedly held in position in each bifurcated arm. The roller 35 cooperates with the flanges of the spool to control the movements thereof. On the side adjacent the column 12, the arms of the bifurcated portion are apertured to journal a stub shaft 37 which is fixedly mounted in plates 38 anchored to the split collar 21 by means of screws 39. Cotter pins are preferably used to hold the shaft 37 in position. The shaft 37 forms a fulcrum about which the manual lever L may be moved to control the movements of the spool 30.

The arms of the bifurcated portion of the manual lever L extend considerably beyond the pin 37, and a yoking portion 40 is provided to extend therebetween, being held in position by means of screws 41. Centrally positioned on the yoking portion 40, a boss 42 is provided which is formed with oblique sides to reach an obtuse apex as is clearly shown in Figure 3. The apex of the oblique sides cooperates with a similarly contoured member 43, which is mounted in a square aperture 44 in the split collar 21. The member 43 is thrust in the direction of the spool 30 to cooperate with the boss 42 by means of a helical spring 45 which acts between a bore 46 in the member 43 and the seat 46A formed in the collar 21.

The cooperation between the boss 42 and the member 43 holds the spool 30 in engagement with either of the faced pulleys 28, depending upon which of the oblique sides of the members 42 and 43 cooperate. The manual lever L is available to move the spool 30 from one position to the other as desired. In the illustrations, the spool is shown in a neutral position which is not stable because the apices of the boss 42 and the member 43 are coincident.

For greater convenience in use for manufacturing process where speed is vital, an automatic reverser is provided which will change the direction of rotation of the shaft 18 after it has moved within predetermined limits. The direction of rotation, in turn, determines the longitudinal movement of the shaft as pointed out above. In the modification shown, the movement of the tap T, as controlled by the shaft 18, is the determining factor which controls the limits within which the parts of the machine are to operate. It is, therefore, essential that the shaft 18 is provided with means to control the movements of the spool 30. To attain this objective, the

upper end of the shaft 18 is provided with a head 18B which cooperates with a U-shaped member 50. A pivot 51 is provided to allow limited movement of the U-shaped member 50 in cooperating with the upper end of the shaft 18, the pivot 51 being mounted in a bracket 52 which may be fastened to the arm 20 in any convenient manner as, for example, by screws 53.

The lower arm of the U-shaped member is bifurcated and adapted to embrace the shaft 18 and to cooperate with the head 18B while the shaft 18 is being moved downwardly by its rotation in the threaded sleeve 27. The upper arm of the U-shaped member 50 is provided with a stud bolt 54 which is in threaded relation therewith and is locked in position by a nut after a desirable adjustment between the stud bolt 54 and the head 18B of the shaft has been attained. The stud bolt 54 is adapted to cooperate with the head 18B in the upward movement of the shaft 18. The two arms of the U-shaped member 50 are employed in this manner in establishing limits of movement of the shaft 18 in either upward or downward directions.

Adjacent the pivot 51, an arm 55 is provided which is integral with the U-shaped member 50 and is apertured to receive a stirrup 56 by means of a pin threading aligning holes. A second stirrup 57 is pivoted on pin 57A on the manual lever L at a point adjacent the spool 30 and is adapted to cooperate with the upper stirrup 56 through an adjustable connecting rod 58. A U-shaped spring 59 is provided between the stirrup 56 and the connecting rod 58 to absorb shocks due to the inertia of the moving parts.

The cooperation between the head 18B of the shaft 18, the stud bolt 54, and the lower bifurcated arm of the member 50 gives a control mechanism, which at predetermined times thrusts the member 50 about the pivot 51 to move the arm 55 in an upwardly or downwardly direction. The movement of the arm 55 is transmitted to the stirrup 56, then to the U-shaped spring 59 which, in turn, transmits it to the connecting rod 58, then to the stirrup 57 which, through the medium of the pivot 57A, moves the manual arm L to accord with the movement of the arm 55. The head 18A, moving within the limits prescribed by the stud bolt 54 and the lower bifurcated arm of the member 50, is empowered by this mechanism to move the spool 30 into gripping relation with either of the faced pulleys 28.

As shown in Figures 1 and 3, the spool 30 is shown in a neutral position between the faced pulleys 28 with the apices of the members 42 and 43 adjacent each other, which, as pointed out before, is not a stable condition inasmuch as the helical spring 46 urges the member 43 outwardly tending to force the member L from the neutral position and place the spool 30 in gripping relation with either the upper or the lower faced pulley 28. The oblique faces of the members 42 and 43, in cooperating with each other, form a means for maintaining the spool in driving relation with the pulleys which, as pointed out before, are being rotated in opposite directions.

Referring to Figures 2, there is shown a motor arrangement which is convenient for driving the faced pulleys 28 in opposite directions. For this purpose, a stud 60 is provided which is fitted into the brackets 26 to project laterally to form a journal for two pulleys N and 61 which are preferably made integral. The pulley N has been described before as cooperating with the motor M, being driven by a belt B. In order to get a proper speed reduction from the motor M, the pulley N is preferably made of considerable diameter so that the pulley 61, which is of a definite diameter determined by the distance between the faced pulleys 28, may be driven at a proper speed. A second pulley 61A is mounted on an adjustable stud which may be moved by means of an adjusting bolt Y for belt-tightening purposes on the opposite side of the bracket 26 on which the stud 60 is mounted. The pulley 61A is of the same diameter as the pulley 61 and cooperates therewith by means of a driving belt V which cooperates with the V notch of both pulleys. The arrangement of the belt V is best shown in Figure 1 in which the pulleys 61 and 61A cooperate with the vertical bights while the horizontal bights are in cooperation with the pulleys 28. In this way, one belt cooperates with four pulleys, the driver pulley 61 which cooperates with the large speed-reducing pulley N, the upper and lower faced pulleys 28 and the idler pulley 61A. In this manner, the upper and lower pulleys 28, which are a portion of the reversing apparatus, are driven in opposite directions so that the spool 30 may cooperate with either of them to attain the desirable direction of rotation.

In the operation of the machine, the frangible work body W is first placed in position by the hand of the operator on the seat formed by the resilient collar 17, the work body being held there by the action of the suction. The drawings illustrate an unfired ceramic insulator blank for a spark plug as a work body which is made of brittle chalk-like material unsuitable to carry any stresses such as found in thread cutting operations. A central bore is provided in the work body in which, in this case, a thread is to be cut by the tap T of proper dimension. The machine is then adjusted to give the tap T the proper travel in both upward and downward directions by adjusting the various devices supplied for this purpose such as, for example, the adjustable device 24 for the split collar 21, which adjusts the limit of downward travel of the tap T and the adjustable stud bolt 54 cooperating with the head 18B which controls the limit of upward travel of the tap T.

After the machine has been adjusted with relation to the work body W so that both the lower and upper limits of travel are established for giving a proper length of thread in the bore of the work body, and at the same time will give sufficient clearance to allow convenient insertion and removal of the work body from the resilient collar 17, the motor M is started which immediately begins driving the belt B to move in turn the belt V which drives the pulleys 28. By means of the manual lever L, the spool 30 may be shifted to contact either of the pulleys 28 to rotate the shaft 18 and the tap T in the proper direction, which, in turn, through the interaction of the threaded portion 18A and the partially threaded sleeve 27, causes the shaft to move upwardly or downwardly.

Assuming that the position of the tap T is such that it is preferable to move the shaft 18 upwardly, this movement normally is attained by having the manual lever L in its upper position so that the spool 30 is contacting the upper pulley 28, which is rotating in a proper direction to cause the desired movement of the shaft 18. The manual lever L, through the action of the members 42 and 43, will stay in its upward position until the head 18B contacts the stud bolt 54 and moves the member 50 about the pivot 51.

This movement displaces the arm **55** which tends to thrust the connecting rod **58** downwardly and eventually will cause the lever L to be shifted past the neutral point as determined by the coincidence of the apices of the members **42** and **43** and so cause the manual lever L to shift to its lower position, where it will be held by the other oblique sides of the members **42** and **43** to cause a driving contact between the spool **30** and the lower faced pulley **28**. The lower faced pulley **28**, in the meantime, has been rotating in the opposite direction from the upper faced pulley **28** and will cause a reverse of rotation of the shaft **18**. This reversal will, by its action with the partially threaded sleeve **27**, cause the tap T to move downwardly into operable relation with the work body W. The operator has placed the work body W in operable position upon the suctional holding means provided in the base member **10** while the tap T was adjacent its highest point of travel. The parts of the mechanism will remain in this position until the shaft **18** has been advanced downwardly to a position where the under side of the head **18B** will cooperate with the bifurcated lower arm of the U-shaped member **50**.

Before this condition is obtained, the tap T has engaged the bore of the work body W, and has penetrated a sufficient distance to conform the bore with the proper threads. When a sufficient depth of thread has been attained, the cooperative relation between the head **18B**, as pointed out above, will be attained so that the lever **55** is again displaced to pull the manual lever L upwardly through the medium of the connecting rod **58**. When the manual lever L has again been shifted to the "up" position, the rotation of the shaft **18** will again be reversed by having the spool **30** again engage the upper faced pulley **28** which causes the tap T to be backed or withdrawn from the aperture in the work body W.

As pointed out before, the pitch of the threads **18A** is the same as the pitch of the thread cutter T so that no strain will result upon the frangible material of the work body W. In this manner, it is possible to advance the tap T into the work body W to cut a thread and after the cutting operation is complete, upon reversal of rotation, it can again be withdrawn without causing stresses which will tend to crumble the frangible material.

It is to be understood that the above detailed description of the present invention is intended to disclose an embodiment thereof to those skilled in the art, but that the invention is not to be construed as limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of being practiced and carried out in various ways without departing from the spirit of the invention. The language used in the specification relating to the operation and function of the elements of the invention is employed for purposes of description and not of limitation, and it is not intended to limit the scope of the following claims beyond the requirements of the prior art.

I claim:

1. In a device of the class described, holder means adapted to cooperate with a work body, spindle means adapted to move in a line with the work body to advance and withdraw a work member to and from the work body, a pair of plates cooperating with the spindle means and rotating in opposite directions, means cooperating with the spindle means and the plates to reverse the rotation of the spindle means, holding means cooperating with the means to reverse the rotation of the spindle means to hold the same in a predetermined cooperative position with one of the plates, automatic means to release the holding means and to shift the means to reverse the rotation of the spindle means into cooperation with the other plate.

2. In a device of the class described, holder means adapted to cooperate with a work body, spindle means adapted to move in line with the work body to advance and withdraw a work member with reference to the work body, spool-like means to rotate the spindle means, a pair of positively rotating plates cooperating with a spool-like means to reverse the rotation of the spindle means by selective contact with the spool-like means, automatic means to control the plates selectively to reverse the rotation of the spindle means after the spindle has performed predetermined functions and manual means to overcontrol the automatic means and determine the rotation of the spindle means both for direction of rotation and speed of rotation.

3. In a device of the class described, holder means adapted to maintain a work body in a predetermined position and to prevent rotation thereof, spindle means to control a threading tool to move the threading tool in a predetermined line with the work body, means on the spindle to advance and withdraw the threading tool having substantially the same rate of advance as the pitch of the threading tool, a pair of plates cooperating with the spindle means and adapted to rotate in opposite directions, control means cooperating with the spindle means and selectively with the plates to control the rotation of the spindle means, and automatic means to cooperate with the control means to reverse the rotation of the spindle means after the threading tool has moved between predetermined limits.

4. In a device of the class described, fixed holder means to maintain a work body in a predetermined fixed position, a threading tool cooperating with the work body and adapted to form threads thereon, spindle means cooperating with the threading tool and adapted to move in a predetermined line with reference to the work body, a pair of plates adapted for rotation in opposite directions, control means cooperating with the spindle and selectively with either one of the pair of plates to control the direction of rotation of the spindle, a second control means cooperating with the spindle to advance and to withdraw the threading tool in substantially the same rate as the pitch of the threading tool, and automatic means cooperating with the first control means to reverse the rotation of the spindle after the tool has moved between predetermined limits.

KARL H. WEBER.