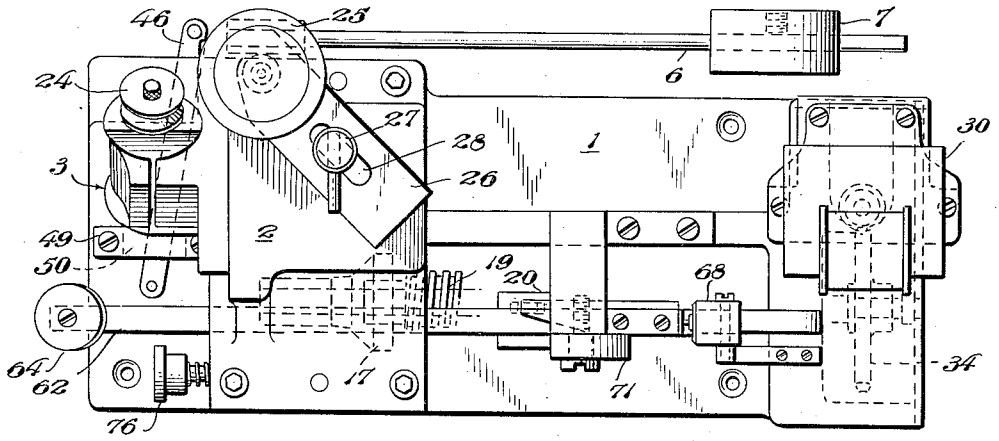
Aug. 14, 1945. R. B. MENTZER 2,382,940

SURFACING MACHINE

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FIG. 1.



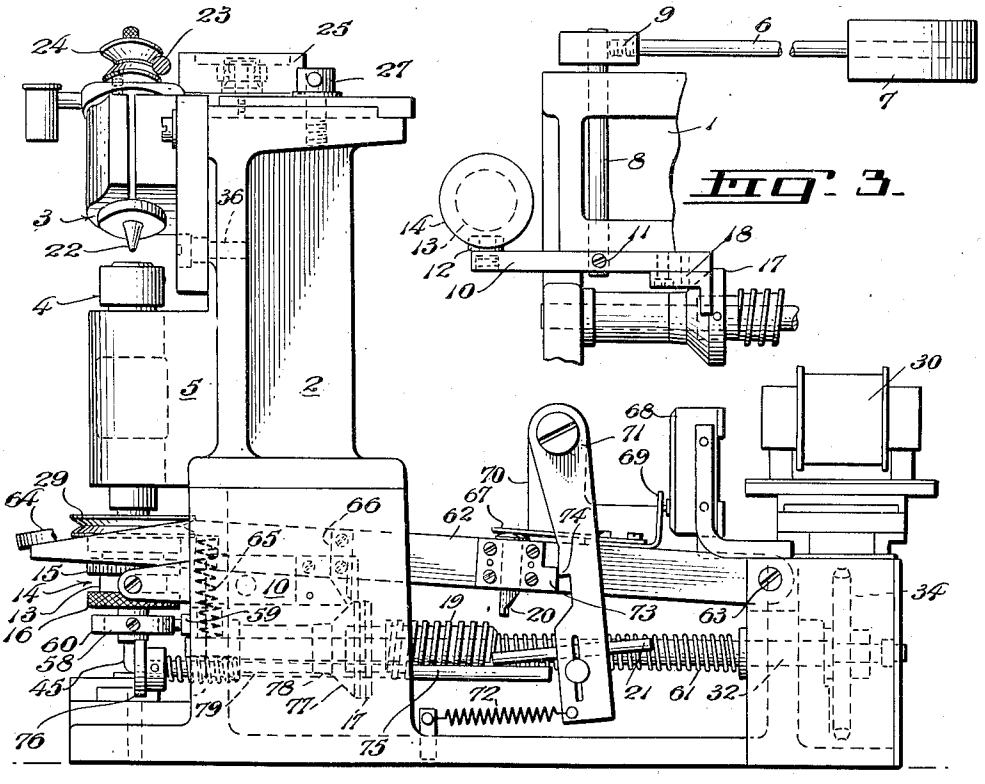


FIG. 2.

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Fig. 4

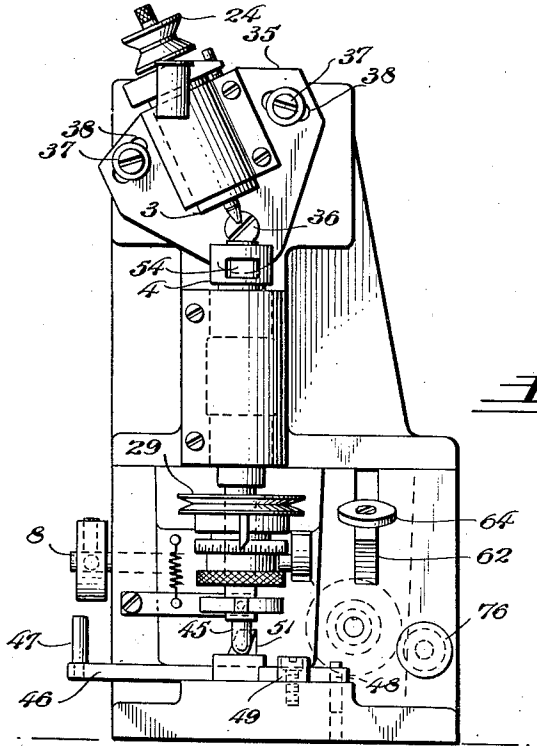


Fig. 6

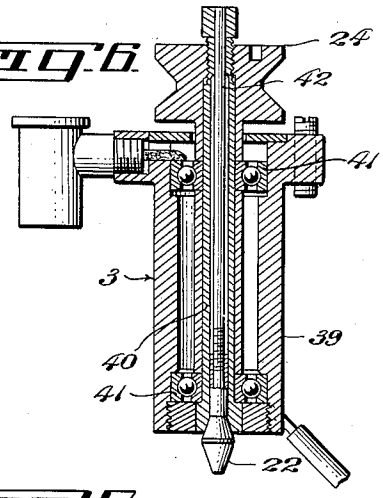


Fig. 7

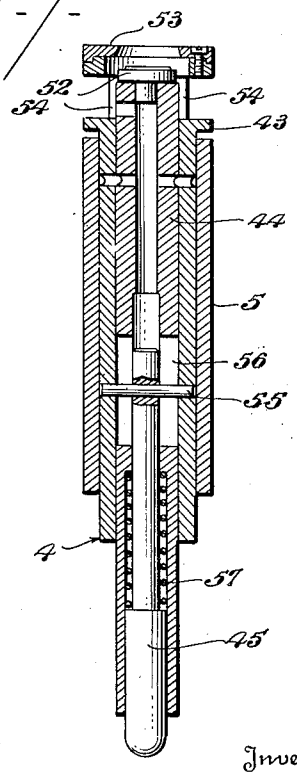
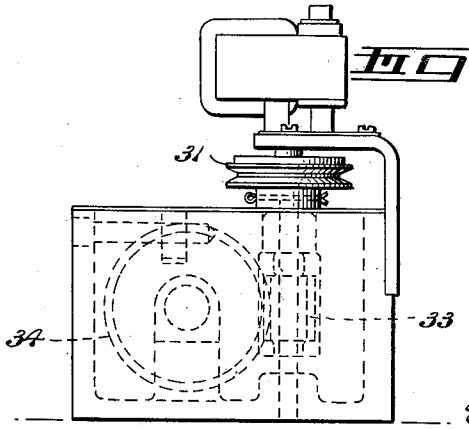


Fig. 5



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SURFACING MACHINE

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Application August 18, 1942, Serial No. 455,265

4 Claims. (Cl. 51—71)

This invention relates to automatic machines and has for its object the provision of improved means and method of automatically controlling and carrying out the operation of such machines.

Another object is to provide means and method of timing the operation of automatic jewel machines.

Another object is to provide means and method of conjointly controlling the relative movement between a toolholder and a workholder of, and timing the operation of, automatic jewel machines.

Another object is to provide, in an automatic jewel machine, cam controlled yielding pressure in a tendency to produce relative movement between a toolholder and a workholder in conjunction with timing means adapted to automatically terminate the operation of the machine.

Other and further objects will be apparent from the following specifications and from the drawings.

Referring to the drawings:

Fig. I is a plan view of a machine embodying an illustration of this invention;

Fig. II is a side elevation of the structure of Fig. I;

Fig. III is a view in part of the machine of Fig. I, taken in plan, and illustrating an arrangement of a cam controlled yielding pressure producing mechanism;

Fig. IV is a further view of the machine of Fig. I in end elevation from the left as the structure is laid out in Fig. II;

Fig. V is a further view of the machine of Fig. I in end elevation from the right as the structure is laid out in Fig. II;

Fig. VI is a vertically centrally sectioned view of the tool holding assembly; and

Fig. VII is a vertically centrally sectioned view of the work holding assembly.

This invention is directed to an automatic machine in which it is desired to provide a gentle and gradual approach between tool and work to prevent breakage of either or both as well as a control of the extent of the operation of the tool on the work, as regards pressure, depth, and time of operation. A workholder and a toolholder are mounted for relative movement toward each other as governed by a cam controlled yielding pressure in conjunction with a timing arrangement adapted to automatically terminate the operation of the machine.

As an example, and as illustrated in the accompanying drawings, as a weighted lever tends to lift a workholder toward a toolholder, this tendency is governed and limited by a cam, and a timing device so operates the cam as to bring into play its governing effect and the different limits of its various surfaces.

One effective arrangement of this machine is to have the tool mounted for high speed, the timing device for slow speed and the workholder for medium slow speed.

The machine of this invention may readily be used to rough out the cup and bevel contours of a timepiece jewel. The cup is formed with a male tool and the bevel with a female tool.

As in Fig. II, a base 1 is provided with an upright 2 on which a toolholder assembly 3 and a workholder assembly 4 are mounted. The immediate support of workholder assembly 4 is a laterally extending portion 5 of the upright 2 and the assembly 4 is slidable vertically in the portion 5 toward and away from toolholder assembly 3.

A constant tendency to move the workholder assembly 4 toward the toolholder assembly 3 is provided by an arrangement comprising (see Fig. III) a lever 6 having a weight 7 mounted adjacent one end thereof and adjustable to different positions along the lever 6 to increase or decrease the strength of the tendency to move the workholder assembly, a pivot bar 8 to one end of which the unweighted end of the lever 6 is secured as at 9, and a lever 10, centrally secured to the other end of the pivot bar 8, as at 11. A pin 12 is mounted on one end of the lever 10, and is adapted to lie in an annular slot 13 formed in a nut 14 adapted to micrometrically adjust the workholder assembly 4 toward or away from the toolholder assembly 3. The nut 14 comprises an upper shoulder 15 calibrated with suitable indicia of measurement and a lower shoulder 16, which is peripherally knurled to provide a finger grip to facilitate turning of the nut and the consequent adjustment of the workholder assembly 4.

In order to control the workholder assembly movement tendency which is initiated by weight 7, a cam 17 (Fig. III) is provided on which a finger 18, mounted on the opposite end of lever 10, bears to overcome the tendency of weight 7 to move workholder assembly 4. As the cam 17 is moved the finger 18 rides on the cam surfaces until the tool is brought into contact with the work. Continued movement of the cam then results in the finger 18 riding in air and the force of the weight 7 being applied directly in pressing work in workholder assembly 4 against a tool in toolholder assembly 3. As the tool eats into the work, the finger 18 is again brought into

contact with the limiting surfaces of cam 17 and the pressure of the weight 7 is removed from the tool and work and applied to the cam 17.

The timing mechanism essentially comprises an exteriorly threaded sleeve 19, a finger 20 adapted to engage and ride in the thread of sleeve 19, and an automatic stop finger 21. This timing mechanism terminates the operation of the machine regardless of whether the tool has completed its operation on the work, that is, regardless of whether finger 18 is in contact with the cam 17. If the operation has not been completed, the timing mechanism may be reset to starting position and the machine again operated for a set period of time.

Power is supplied to the structure at three points. The tool chuck 22 in the toolholder assembly 3 is rotated through the action of a belt 23 on pulley 24 when brought into engagement therewith by adjustment of idler pulley 25. The belt 23 is so arranged that its path of travel normally keeps it out of contact with the tool pulley 24 and engagement or disengagement of the belt 23 and pulley 25 may be accomplished by adjustment of the slide plate 26 on which the pulley 25 is mounted. The slide plate 26 is mounted in a recess in the upper face of the upright 2 and may be locked in adjusted position through the arrangement of the lock bolt 27 in the slot 28 formed in the slide plate 26.

The workholder of the workholder assembly 4 is rotated by a belt drive as applied to pulley 29, and the cam 17 and timing sleeve 19 are driven from a motor 30 mounted on the base 1 at a point removed from the upright 2, as shown in Fig. II. A pulley 31 (Fig. V) is driven by motor 30 and in turn, through a belt drive connection with pulley 29 (Fig. II), drives the workholder assembly 4. The cam 17 and timing sleeve 19 are both mounted on a shaft 32 for rotation therewith and longitudinal movement with respect thereto. The shaft 32 is driven by motor 30 through worm gear 33 and shaft gear 34.

The toolholder assembly 3 is mounted on the upright 2 for angular adjustment in a vertical plane such that the working point of a tool in the chuck 22 is given relatively small movement in the angular adjustment of the toolholder assembly. This angular adjustment permits ready variation of the cutting angle of the tool with respect to the work and is a means of obtaining, as nearly as possible, maximum tool periphery action over the center dead spot of the work. This adjustment is accomplished by means of a plate 35 which forms the immediate support for the toolholder assembly 3 and which is secured to the upright 2 through a pivot screw 36 and a pair of locking screws 37. The plate 35 is provided with slots 38 through which the locking screws 37 extend and along which they travel as the plate 35 is pivoted about the screw 36 to provide angular adjustment of toolholder assembly 3.

Fig. VI illustrates the details of the toolholder assembly in vertical and central section. It comprises an outer housing 39 with a sleeve 40 mounted therein for rotation in bearings 41 as driven through pulley 24. The tool chuck 22 is mounted in the lower end of sleeve 40 and drawn thereinto in clamping relation with the tool and so as to rotate with the sleeve 40 by means of a holding shaft 42 mounted within the sleeve 40 from the upper end thereof. The toolholder is also adjustable longitudinally of its axis of rotation.

Fig. VII illustrates the detail of the workholder assembly 4 in vertical and central assembly. It is designed to clamp and support the mounting of a workpiece, for instance, a timepiece jewel. In connection with the machine of this invention it is customary to have the jewel set in a mounting and located in the machine by locating and clamping action of the workholder assembly 4 on the jewel mounting. It is to be understood in reference to holding the workpiece that the holding action may be on such a mounting of the workpiece or on the workpiece itself since the dimensions and contours of the clamping portions of the workholder assembly 4 could readily be made to permit direct holding and clamping of the jewel.

The laterally extending portion 5 of the upright 2 (Fig. II) is represented in section in Fig. VII as sleeve 5. The workholder assembly 4 comprises an outer sleeve 43, an inner sleeve 44 and an inner shaft 45.

There are two general actions possible with the structure of the workholder assembly 4 as shown in Fig. VII. One is the movement of the whole assembly within the sleeve 5 to move the workholder toward or away from the toolholder. This is accomplished either through the action of the weight 7 to move the work into contact with the tool during the operation of the machine or by adjustment of the nut 14 (Fig. II) to achieve the desired adjusted relation of the work to the tool as a preliminary to the operation of the machine.

Both of these actions are accomplished by applying the moving force to the inner sleeve 44 adjacent its lower end. The nut 14 is mounted on the exposed portion (Fig. VII) of the inner sleeve 44 so that movement of the nut, either by manual rotation for adjustment or by sliding movement in operation, through the action of pin 12 in slot 13 will move the workholder assembly 4 toward or away from the toolholder.

The second general action is the movement of the outer sleeve 43 with respect to the inner sleeve 44. This is for the purpose of loading or unloading the workpiece in the assembly 4 and is accomplished by moving the inner shaft 45 with respect to the inner sleeve 44. Such movement of the shaft 45 may be readily accomplished in a number of ways, one of which is illustrated in Figs. I, II and IV. A lever 46 provided with a handle 47, is pivoted to the base 1 as at 48, for movement in a horizontal plane. Lever 46 is limited in the extent of its pivotal movement by a guide 49 having a slot 50 through which the lever 46 extends. Immediately adjacent the lower end of inner shaft 45, a cam 51 is mounted on the lever 46 in such a manner and so formed that movement of the lever 46 about its pivot 48 in one direction will so engage cam 51 with the lower end of the inner shaft 45 as to move that shaft upward and movement in the other direction will permit the shaft 45 to move downward.

Referring to Fig. VII, the outer sleeve 43 and the inner sleeve 44 together form a clamp for holding a workpiece. The inner sleeve 44 is provided with a work support 52 at its upper end, and the outer sleeve 43 is provided with a work clamping cap 53 at its upper end. The outer sleeve 43 is also provided with side wall loading apertures 54, one of which is shown in Fig. IV. The outer sleeve 43 is moved upward until the apertures 54 are on a level with the work support 52 and the workpiece may then be inserted through one of the apertures 54 and mounted on the work

support 52. The outer sleeve 43 is then permitted to move downwardly, thus clamping the workpiece between the cap 53 and the work support 52.

The inner shaft 45 is pinned as at 55 to the outer sleeve 43 and the pin 55 lies in a vertical slot 56 formed in the inner sleeve 44. Thus the spring 57 normally urges the shaft 45 and sleeve 43 downward so as to clamp a workpiece between the cap 53 and work support 52. The spring 57 is so arranged and formed that upward movement of the shaft 45 will produce greater upward movement of the sleeve 43 than of the sleeve 44, thus permitting the apertures 54 to be raised to the level of the work support 52. Movement of the sleeve 44 upward will cause upward movement of the whole assembly through the action of the work support 52 on the cap 53 either directly or through a workpiece.

As shown in Figs. II and IV, the sleeve 44 has secured thereto a locator member 58. When the machine is at rest it is desirable to have one of the loading apertures facing whatever direction is most desirable for loading. A spring pressed pin 59 is mounted on a lever horizontally pivoted to the base 1 and the locator member 58 is provided with oppositely disposed vertical slots 60 into either of which the pin 59 drops when the workholder assembly 4 is moved downwardly and is still rotating. The slots 60 and loading apertures 54 are so positionally related as to locate the apertures 54 in desired position when pin 59 drops into one of the slots 59 from below under the action of a spring on the horizontally pivoted lever.

In the timing and control mechanism, the cam 17 and threaded sleeve 19 are mounted on the driven shaft 32. The sleeve 19 is keyed to the shaft 32 for rotation therewith and is slidable longitudinally of the shaft 32. The cam 17 is secured to the sleeve 19 for rotation and longitudinal movement therewith. Normally, when the machine is not in operation the cam 17 and sleeve 19 are positioned as shown in Fig. II, held adjacent one end of shaft 32 by the action of spring 61.

A starting lever 62 is pivoted on the base 1 at 63, adjacent the motor 30, and extends to a point adjacent the workholder assembly 4, at which end it is provided with a finger button 64. The lever 62 is normally, when the machine is not in operation, held up in the position shown in Fig. II, being supported by a spring 65, seated in a downwardly facing recess in the lever 62 and an upwardly facing recess in the base 1.

The lever 62 supports a cam finger 66 adapted when the machine is started to contact the cam 17 and to impart an initial movement to cam 17 and sleeve 19 along the shaft 32 against the action of spring 61. The thread following finger 20 is slidably mounted on the lever 62 and held in position by a spring 67.

When the lever 62 is moved downwardly about its pivot 63 into operative position, the finger 20 engages and rides in the thread of sleeve 19. Since the pin 20 is fixed against movement longitudinally of the shaft 32, continued rotation of the sleeve 19 in accordance with the drive of shaft 32 causes the sleeve 19 and consequently the cam 17 to continue the movement longitudinally of the shaft 32 which was initiated by the action of finger 66 on cam 17.

A microswitch 68 is mounted on base 1 and an arm 69, mounted on lever 62 is adapted to hold the switch open when the lever 62 is out of operation as in Fig. II, by engaging the contact button of the switch 68. As soon as the lever 62 is depressed the contact button is released, the switch 68 is closed, and the motor 30 is thereby started.

An upright 70, mounted on the base 1, pivotally supports a holding lever 71, on which, in turn, the stop finger 21 is adjustably mounted. A spring 72 holds the lever 71 against an abutment 73 until the lever 62 is depressed. Then the lever 71 is so moved by the spring 72 that a shoulder 74 thereof engages the top of the abutment 73 and prevents the lever 62 from being lifted by the spring 65.

As the cam progresses along the shaft 32 it reaches a point at which the stop finfier 21 engages the approaching end of cam 17 so that further motion of the cam along the shaft 32 pushes the finger 21 and lever 71 against the action of the spring 72 sufficiently to disengage the shoulder 74 from the top of the abutment 73 and allow the lever 62 to move upward. This action disengages finger 20 from the thread of sleeve 19 and opens microswitch 68, thus stopping the machine.

Similar action may be accomplished at will through the manual stop finger 75 operable by pressing finger button 76.

The machine may be made to operate for any desired time interval through the use of threaded timing sleeves of different diameters and pitch of thread, by adjusting the automatic stop finger 21, or by using the manual stop finger 75.

Cam 17 is provided with a sharply pitched approach surface 77, a less sharply pitched approach surface 78, and a substantially level limiting surface 79. Movement of the finger 18 down the cam surface 77 brings the workholder assembly 4 quickly to a position adjacent to the toolholder assembly 3. In this position the tool is adjacent but not touching the work. Further movement of the finger 18 along and down cam surface 78 brings the workholder assembly more gradually toward the tool holder assembly so that a tool and workpiece will come to operative contact gradually and gently at first. This is of real importance in the formation of timepiece jewels particularly in view of the fragile tools commonly used in such operations.

The operation of the machine is as follows: The tool holder assembly 3 is adjusted to desired angularity by adjusting plate 35 about its pivot 36. The workholder assembly 4 is adjusted to desired initial positional relation with respect to the toolholder assembly 3 by manual adjustment of the nut 16, weight 17 is so located on shaft 6 as to produce the desired tendency to move the workholder toward the toolholder, and the automatic stop finger 21 is adjusted to the length necessary to terminate the operation of the machine at the end of the desired time period.

In the workholder assembly, cap 53 and work support 52 are separated by using lever 46 to cam the shaft 45 upward, a workpiece is loaded through an aperture 54, and clamped on work support 52.

The toolholder assembly is set in rotation by adjusting the plate 26 and roller 25 so as to engage the driven belt 23 with the pulley 24, and the workholder and timing assemblies are set in motion by depressing the starting lever 62.

The depression of the starting lever 62 starts motor 20 by closing switch 68, and the motor 20 drives the workholder assembly 4 in rotation through a belt connection between pulleys 29 and 31 as well as driving the timing assembly of the

cam 17 and threaded sleeve 18 through gears 33 and 34 and shaft 32.

Several actions occur substantially simultaneously. Lever 71 engages its shoulder 74 with the upper face of abutment 73 to hold the starting lever 62 in operation, finger 66 engages surface 77 of cam 17 to give initial movement to the cam 17 and sleeve 19 along shaft 32 against spring 61 and finger 20 engages the thread of sleeve 18 to insure continuation of the movement of the cam and sleeve along shaft 32. Travel of the finger 66 down surface 77 of cam 17 also lifts the workholder assembly 4, thus disengaging the slot 60 from the pin 56 and permitting rotation of the workholder assembly.

The operation of the machine continues until stopped automatically by the action of stop finger 21 against cam 17, or at will by the manual stop finger 75.

Having described my invention, I claim:

1. In a device of the character described, a workholder and a toolholder mounted for relative movement with respect to each other, means adapted to apply cam controlled yielding pressure in a tendency to produce said movement, and timing means adapted to operate said cam and to automatically terminate the operation of said device, said timing means including an exteriorly threaded member secured to said cam and mounted for longitudinal and rotational movement, means for rotating said threaded member, a finger adapted to engage said thread and thereby cause said member to move longitudinally in accordance with its rotation, and a stop member adapted to operate when said sleeve reaches a given position on said shaft.

2. In a device of the character described, starting means normally held out of operation, means adapted to hold said starting means in operation during the operation of said device, a workholder assembly and a toolholder assembly mounted for relative angular and micrometric straight line adjustment and straight line sliding movement with respect to each other, means adapted to apply cam controlled yielding pressure in a tendency to produce said sliding movement, and timing means including stop means adapted to throw said starting means out of operation and terminate the operation of said device, said workholder assembly including a clamping sleeve having a holding portion adjacent one end thereof, and a central shaft within said clamping sleeve and having a base on one end thereof, said clamping sleeve and shaft being so movable with respect to each other as to provide such separation and closing action between said holding portion and said base as will permit loading and unloading of a workpiece in said workholder assembly.

3. In a device of the character described, starting means normally held out of operation, means adapted to hold said starting means in operation during the operation of said device, a workholder assembly and a tool holder assembly mounted for relative angular and micrometric straight line adjustment and straight line sliding movement with respect to each other, means adapted to apply cam controlled yielding pressure in a tendency to produce said sliding movement, timing means adapted, at the end of a predetermined period, to throw said starting means out of operation and terminate the operation of said device, said timing means including an exteriorly threaded sleeve secured to said cam and mounted for longitudinal movement with respect to, and for rotational movement with, a driven shaft, a finger adapted to engage said thread and thereby cause said sleeve to progress along said shaft in accordance with said rotational movement, and an automatic stop member adapted to operate when said sleeve reaches a predetermined position on said shaft, and additional stop means adapted to be operated at will.

4. In a device of the character described, starting means normally held out of operation, means adapted to hold said starting means in operation during the operation of said device, a workholder assembly and a toolholder assembly mounted for relative angular and micrometric straight line adjustment and straight line sliding movement with respect to each other, means adapted to apply cam controlled yielding pressure in a tendency to produce said sliding movement, timing means adapted, at the end of a predetermined period, to throw said starting means out of operation and terminate the operation of said device, said workholder assembly including a clamping sleeve having a holding portion adjacent one end thereof, and a central shaft within said clamping sleeve and having a base on one end thereof, said clamping sleeve and shaft being so movable with respect to each other as to provide such separation and closing action between said holding portion and said base as will permit loading and unloading of a workpiece in said workholder assembly, said timing means including an exteriorly threaded sleeve secured to said cam and mounted for longitudinal movement with respect to and for rotational movement with, a driven shaft, a finger adapted to engage said thread and thereby cause said sleeve to progress along said shaft in accordance with its rotational movement, an automatic stop member adapted to operate when said sleeve reaches a predetermined position on said shaft, and additional stop means adapted to be operated at will.

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