March 12, 1935. C. J. COBERLY 1,993,957

TIMING MACHINE

Original Filed Feb. 4, 1930 2 Sheets-Sheet 1

Fig. 1.

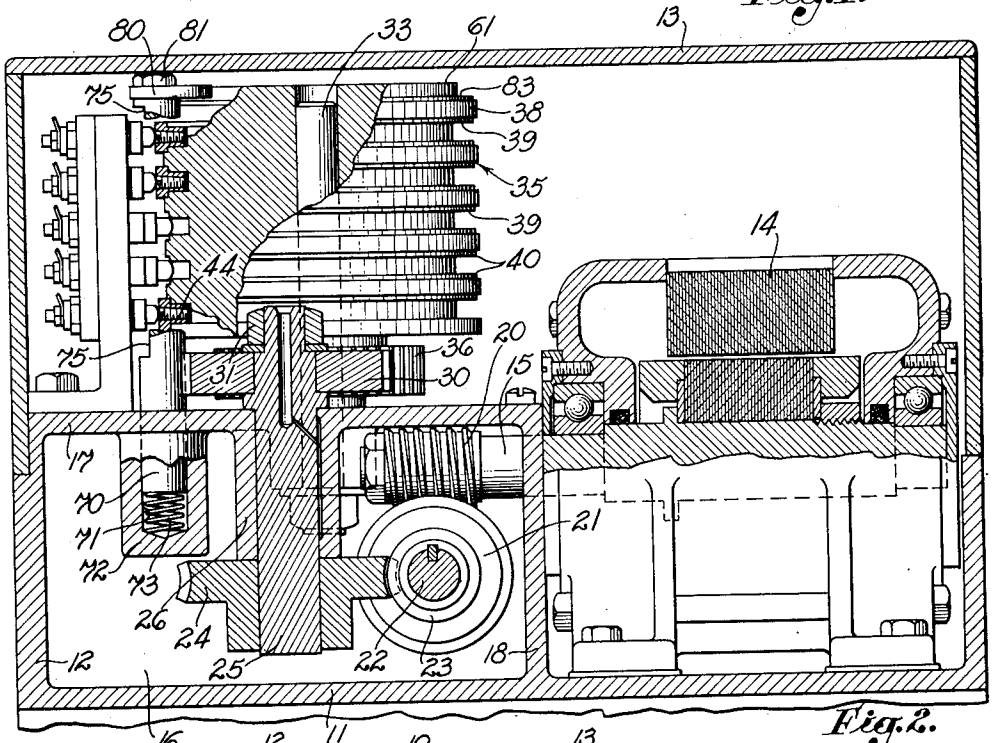
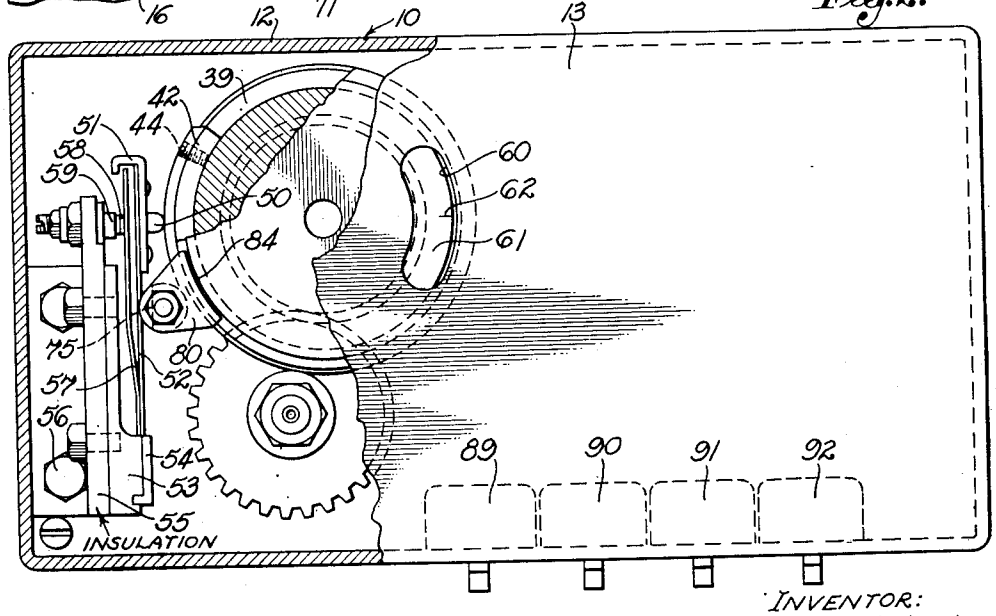


Fig. 2.



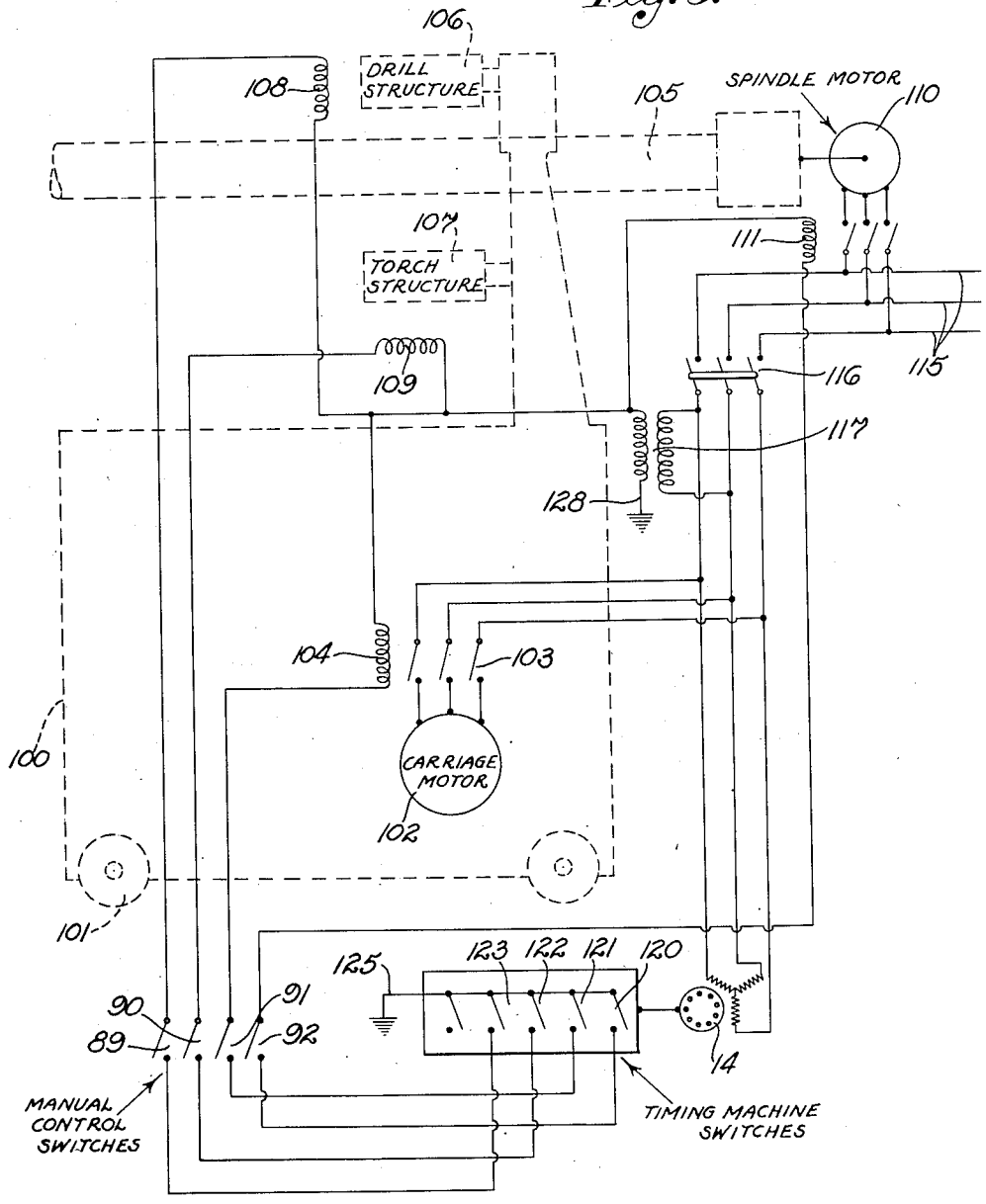
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Original Filed Feb. 4, 1930 2 Sheets-Sheet 2

Fig. 3.



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1,993,957

TIMING MACHINE

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Original application February 4, 1930, Serial No. 425,838, now Patent No. 1,912,362, dated June 6, 1933. Divided and this application March 6, 1933, Serial No. 659,662

14 Claims. (Cl. 200—30)

My invention relates to a timing machine for controlling the sequence of a plurality of operations. The present application is a division of my application entitled Method and apparatus for cutting slots in pipe, filed Feb. 4, 1930, Serial No. 425,838, patented June 6, 1933, #1,912,362.

It is often desirable to be able to control the sequence of a number of operations performed by suitable operating means. Thus, in my application supra I have disclosed a pipe slotting machine including a plurality of such operating means composed of a carriage advancing means, a spindle control means, and means for controlling the operation of drills, torches, etc. The present invention controls the sequence of operations, and provides a structure whereby the sequence may be changed at will.

In using such a pipe slotting machine it is necessary to cut slots of different length and of different spacing. It thus becomes desirable to quickly change the sequence of operations from one job to the next. In the present invention I utilize a cam structure so arranged as to control the sequence of operations for each job. It is thus necessary only to replace this cam structure with another structure to change the operation of the machine from one job to another.

The switch structure operated by this cam structure is also an important feature of the invention, as is also the particular construction of the cam assembly itself.

Another feature of the invention is the retracting means operating to withdraw the switch means from contact with the cam assembly as this assembly is being replaced.

Another feature of the invention is that it permits the operator to visually ascertain the particular operation effected by the timing machine at any particular instant.

The objects of this invention include the provision of a timing machine having certain or all of the features mentioned above, as well as features which will be hereinafter made evident to those skilled in the art.

Referring to the drawings:

Fig. 1 is a vertical sectional view with elements partially broken away to illustrate the mechanism of my timing machine.

Fig. 2 is a top view, partially in section, of the structure shown in Fig. 1.

Fig. 3 is a wiring diagram illustrating one use of the timing machine.

Referring particularly to Figs. 1 and 2, the timing machine of the invention includes an enclosure 10 including a bottom wall 11, four side walls 12 and a removable top wall or cover 13, this cover being preferably hinged to one of the side walls. An electric motor or other drive means 14 is mounted in one end of this enclosure and includes a shaft 15 extending into a gear box 16, this gear box being formed below an intermediate wall 17 and to the left of an upright wall 18.

The shaft 15 carries a worm 20 meshing with a worm gear 21 secured to a shaft 22 suitably journalled. This shaft carries a worm 23 which is in turn meshed with a worm gear 24 secured to a vertical shaft 25. This shaft 25 is journalled in a collar 26 depending from the intermediate wall 17 and extends upward through the intermediate wall 17 to support a change gear 30 detachably connected thereto through the action of a nut 31.

Also mounted in the intermediate wall 17, and preferably fixed with relation thereto, is a shaft 33 rotatably mounting a cam assembly 35. The lower end of this cam assembly includes a gear 36 meshing with the change gear 30, the gear 36 being removable with the cam assembly 35. It is thus apparent that this cam assembly may be initially positioned in a finite number of angular positions depending upon the number of teeth in the gear 36.

The cam assembly 35 is in the form of a unitary drum 38 having a plurality of annular channels 39 cut into the periphery thereof, each channel including peripheral edges 40. Mounted in each of the annular channels 39 is one or more cams 42 in the form of arcuate members substantially corresponding in shape to the curvature of the channels 39, as best shown in Fig. 2. It will thus be clear that each of these cams can be positioned in any desired portion of its corresponding annular channel 39. Means is provided for clamping these cams in a desired position. In the preferred embodiment, this clamping means includes a tapered set screw 44 threaded into each end of the cam 42, these ends being split. Thus, as the tapered set screw 44 is screwed inward the cam expands into tight engagement with the walls of the annular channel in which it is positioned. The cams 42 extend outward beyond the periphery of the drum 38, and the set screws are so proportioned as to lie substantially flush with the outer surface of the cam when in clamped position.

Each of the cams 42 is adapted to be engaged by a follower 50 which may be in the form of a round headed member, as shown. This follower is attached to or made integral with a hook

member 51 which is in turn secured to a switch arm 52. Each of these switch arms is clamped between a metallic plate 53 and a cover member 54, this plate being in turn secured to a bracket 55 formed of insulating material and suitably secured to the intermediate wall 17 as by bolts 56. Also clamped between the plate 53 and the cover member 54 is a plurality of contact arms 57, one contact arm being positioned adjacent each switch arm 52. The free end of the contact arm 57 extends into and is retained by the hook member 51 to permit only limited movement of this contact arm. Each contact arm carries a contact member 58 adapted to engage a corresponding contact 59 adjustably mounted on the insulated bracket 55.

This structure comprises a switch means which is operated by the cam assembly and which includes a plurality of switches which are opened and closed in a sequence depending upon the particular cam assembly 35 utilized. The switch arms 52 are formed of a spring material so as to resiliently force the follower 50 into engagement with the peripheral edges 40 of the annular channel 39 corresponding thereto during the time that this follower is not in engagement with one of the cams 42. The contact member 58 is separated from the contact 59 at this time. As a cam 42 moves into engagement with the follower 50 it forces this follower leftward and moves the contact member 58 into engagement with the contact 59 to close a circuit controlling one of the operations to be performed.

It is very desirable that the operator should know which particular operation is being performed at a particular instant of time. For this reason I provide a port 60 in the upper wall or cover 13 of the enclosing structure, this port being disposed opposite an upper face 61 of the particular cam assembly being used. This upper face carries appropriate indicia visible through the port 60, such, for instance, as one or more lines 62 suitably scribed thereon.

In removing the cam structure 35 it is desirable to be able to simultaneously move the switch means from engagement with the cam assembly. In accomplishing this end I utilize a retracting member in the form of a shaft 70 which is vertically slidable in a bore 71 formed in a boss 72 of the intermediate wall 17. A spring 73 is positioned in the lower end of this bore and resiliently forces the shaft 70 upward.

This shaft extends adjacent all of the switch arms 52 and provides a flat side 75 facing these switch arms. When in this position, this flat side does not contact these arms, but when the shaft 70 is turned in the bore 71 this shaft acts as a cam to move the switch arms leftward so as to close all of the switches and move the followers 50 from engagement with any portion of the cam assembly 35.

It is desirable to suitably lock this shaft or retracting member during the time that the timing machine is in operation so as to prevent any possibility of engagement with the switch arms 52. In the preferred embodiment of the invention this lock means includes a plate 80 secured to the upper end of the shaft 70 as by a cap screw 81. This plate is so mounted as to extend into an annular notch 83 in the upper corner of the cam assembly when the shaft 70 is in a depressed position. This plate 80 includes an annular surface 84 which is curved to correspond to the inner wall of the notch 83, thus preventing any turning of the shaft 70 when this shaft is in a depressed position. The top wall or cover 13 forms a convenient means of lowering the shaft 70 so as to move the plate 80 into the annular notch 83, it being clear that the shaft is thus lowered only when this cover 13 is closed.

This lock means has another very desirable advantage in that it prevents removal of the cam means until the shaft 70 is turned sufficiently to move the plate 80 from the annular notch 83. At this time the followers 50 are moved into retracted position so that this lock means prevents removal of the cam structure until the shaft or retracting member has moved the switch arms leftward.

Also mounted in the enclosure 10 is a plurality of manually operable switches 89, 90, 91, and 92 which are preferably utilized for manually controlling the individual operations. One manner of connecting these manual switches and the timing switches together is illustrated in Fig. 3, wherein I indicate in dotted lines a carriage 100 providing wheels 101, this carriage being suitably driven along a track by means of a carriage motor 102. The carriage motor is suitably controlled by a magnetic switch 103 controlled by the energization of a winding 104 in a well known manner. This type of machine is adapted to process a length of pipe 105, and, as disclosed in my application supra, it is often desirable to be able to drill openings in this pipe and thereafter send a cutting jet of oxygen therethrough. If the carriage 100 is moved during the time that the oxygen jet moves through the previously formed opening this jet will cut a slot in the pipe 105. Such a drill means is diagrammatically indicated by the dotted lines 106, while a torch structure for forming the cutting jet is diagrammatically illustrated by dotted lines 107, these structures being individually controlled by energization of windings 108 and 109. So also it is desirable to be able to rotate this pipe, and for this purpose I provide a spindle motor 110 which is energized by the magnetic switch including a control winding 111.

In Fig. 3 I have illustrated the incoming line by the numeral 115, the spindle motor being connected thereto through the switch previously mentioned. A main switch 116 controls the energization of a transformer 117. The carriage motor 102 is connected to the line through the switch 103, while the timing machine motor 14 may be permanently connected to the switch 116, as illustrated. The timing machine switches are diagrammatically indicated by the numerals 120, 121, 122, and 123, one terminal of each of these switches being connected together through the plate 53 and being grounded as indicated by the numeral 125. The remaining terminal of the switch 120 is connected through the manual control switch 92 to the winding 111 controlling the spindle motor and thence to one terminal of the secondary winding of the transformer 117, the other terminal of this secondary winding being grounded as indicated by the numeral 128. Thus, if the manual control switch 92 is closed the operation of the spindle motor will be dependent upon the closing of the switch 120 by the timing machine.

The switch 121 is connected through the manual control switch 91 to the winding 104 controlling the switch 103, this winding being then connected to the transformer, as previously indicated. Thus, when the manual control switch 91 is closed the operation of the carriage motor is dependent upon the opening and closing of the timing switch 121.

Similarly, the switch 122 is connected through the manual control switch 90 to the winding 109 controlling the torch structure, while the switch 123 is connected through the manual control switch 89 to the winding 108 controlling the drill structure. Thus, if the manual control switches 89 and 90 are closed the operation of the drill structure and torch structure will be dependent upon the operation of the timing machine switches 123 and 122.

When the cam structure is withdrawn from the timing machine it will be clear that all of the timing machine switches are necessarily closed due to the action of the retracting member or shaft 70. Thus, if manual operation is desired it is only necessary for the operator to withdraw the cam structure and thereafter individually actuate the manual control switches.

It should be understood that the invention is not limited to the particular use shown in Fig. 3, this use being illustrated only for descriptive purposes. The timing machine finds utility in various arts where it is desired to control a plurality of operations, whether this control is an electrical control or whether the followers 50 are directly connected to other control means.

I claim as my invention:

1. In combination in a timing machine for controlling the sequence of a plurality of operations: a rotatable drum including a plurality of annular channels formed around the periphery thereof; a follower movably mounted to lie opposite each of said annular channels; an arcuate member in each channel and movable therealong around said channel, each arcuate member including a cam face engaging one of said followers corresponding thereto; means for clamping said arcuate member in a desired position in its corresponding channel; and means controlling said operations in response to the movement of said followers.

2. A combination as defined in claim 1 including means normally holding each of said followers against the peripheral edges of its corresponding annular channel until the arcuate member therein moves said follower outward.

3. In combination in a timing machine for controlling the sequence of a plurality of operations: a plurality of timing switches, each switch controlling one of said operations; a rotatable drum providing a plurality of annular channels formed therein, each of said channels corresponding to one of said timing switches; and a cam adjustably and removably positioned in each of said annular channels to be moved relative to the periphery of said annular channel, said cam operatively engaging the timing switch associated with the annular channel in which said cam is positioned.

4. A combination as defined in claim 3 including a shaft on which said drum is removably mounted, and including means for simultaneously moving said timing switches and said cams apart to permit removal of said drum without engagement with said timing switches.

5. In combination in a timing machine for controlling the sequence of a plurality of operations: a plurality of switch arms; a plurality of contacts adapted to be respectively engaged by said switch arms; removable cam means operating said switch arms in predetermined sequence to engage said contacts; a retracting member extending adjacent each of said switch arms and providing a flat side facing said switch arms and adapted when turned to move said switch arms away from said cam means to permit removal of said cam means without engaging said switch arms.

6. In combination in a timing machine for controlling the sequence of a plurality of operations: a plurality of switch arms; a plurality of contacts adapted to be respectively engaged by said switch arms; removable cam means operating said switch arms in predetermined sequence to engage said contacts; a retracting member extending adjacent each of said switch arms and engageable therewith to move said switch arms from engagement with said cam means as said cam means is being removed; and means cooperating with said cam means and said retracting member to prevent movement of said retracting member into engaging relation with said switch arms when said cam means is in place.

7. In combination in a timing machine for controlling the sequence of a plurality of operations: a plurality of switch arms; a plurality of contacts adapted to be respectively engaged by said switch arms; removable cam means operating said switch arms in predetermined sequence to engage said contacts; a retracting member extending adjacent each of said switch arms and engageable therewith to move said switch arms from engagement with said cam means as said cam means is being removed; and lock means cooperating with said cam means and said retracting member to prevent removal of said cam means until said retracting member has moved said switch arms from engagement with said cam means.

8. A combination as defined in claim 7 in which said retracting member is pivotally mounted and moves said switch arms when turned, and in which said lock means includes a member operatively connected to said retracting member and extending into the path of withdrawal of said cam means to prevent removal thereof until said member is turned, this movement of said member turning said retracting member to move said switch arms into retracted position.

9. A combination as defined in claim 7 in which said cam means includes an annular notch therein, and in which said lock means extends therein, and including means movably mounting said lock means to move said lock means from said annular notch after which said retracting member can be moved into engagement with said switch arms.

10. In combination in a timing machine for controlling the sequence of a plurality of operations: a plurality of switch arms; a plurality of contacts adapted to be respectively engaged by said switch arms; removable cam means operating said switch arms in predetermined sequence to engage said contacts; a retracting member extending adjacent each of said switch arms and engageable therewith to move said switch arms from engagement with said cam means as said cam means is being removed; an enclosing structure around said cam means and said switch arms and including a removable wall; and means operated by said removable wall for preventing movement of said retracting member into engagement with said switch arms when said removable wall is closed.

11. In combination in a timing machine for controlling the sequence of a plurality of operations: a plurality of switch arms; a plurality of contacts adapted to be respectively engaged by said switch arms; removable cam means operat-

ing said switch arms in predetermined sequence to engage said contacts; a retracting member extending adjacent each of said switch arms and engageable therewith to move said switch arms from engagement with said cam means as said cam means is being removed; an enclosing structure around said cam means and said switch arms and including a removable wall operatively engaging said retracting member when in a closed position; and lock means holding said retracting means in a position disengaged from said switch arms when said removable wall is in closed position and engaging said retracting member.

12. In combination in a timing machine for controlling the sequence of a plurality of operations: an enclosure including a port through the walls thereof; a cam assembly removably positioned in said enclosure and providing a surface facing said port whereby a portion of said cam assembly moves adjacent said port when said cam assembly is moved; means for moving said cam assembly; a plurality of timing switches each controlling one of said operations and operated by said cam assembly to be opened and closed in a predetermined sequence; and indicia on said surface of said cam assembly and visible through said port as said cam assembly moves for indicating to the operator which operation is being performed at any instant of time.

13. A combination as defined in claim 12 in which said means for moving said cam assembly includes a prime mover and means for operatively connecting said cam assembly to said prime mover in a finite number of relative positions whereby said sequence of operations can be started at a desired point.

14. In combination in a timing machine for controlling the sequence of a plurality of operations; an enclosure including a port formed through the walls thereof; a shaft in said enclosure; a cam assembly on said shaft but withdrawable therefrom, said cam assembly providing a surface facing said port and movable therepast when said cam assembly is rotated; a rotatable gear in said enclosure; a gear on said cam assembly meshing with said rotatable gear when said cam assembly is in place; means for rotating said rotatable gear to rotate said cam assembly; means operated by said cam assembly for controlling said operations; and indicia on said surface of said cam assembly and visible through said port as said cam assembly rotates for indicating to the operator which operation is being performed at any instant of time.

CLARENCE J. COBERLY.