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REMOTE CONTROL APPARATUS FOR A STAMPING MECHANISM

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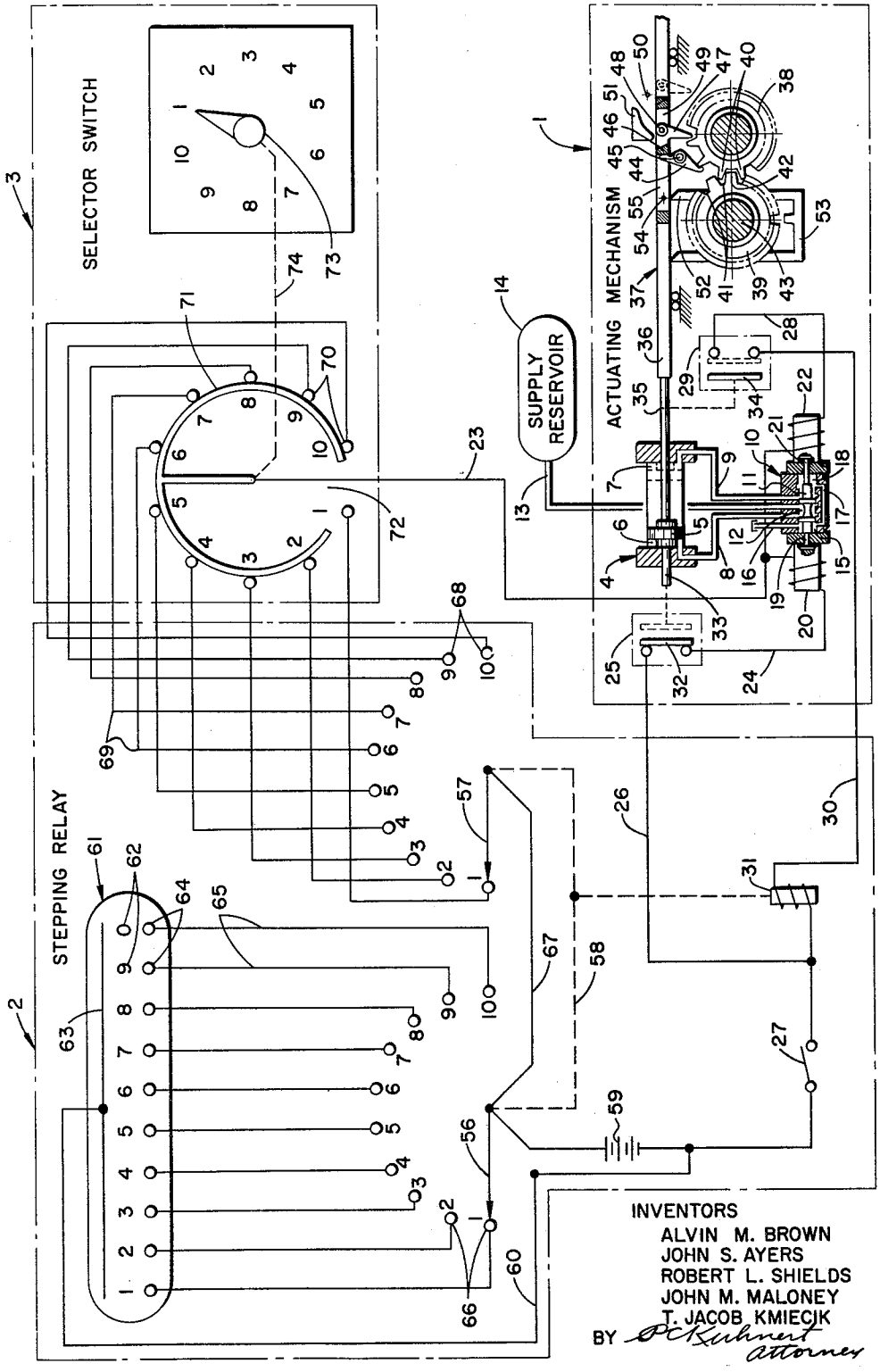

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REMOTE CONTROL APPARATUS FOR A STAMPING MECHANISM

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This invention relates to control apparatus and more in particular to control apparatus for the preselection and automatic arrangement of a stamping mechanism located in an area remote from the control station.

The principal object of this invention is to provide a control apparatus by means of which a selection of a particular combination of characters on a set of stamping dies may be established prior to the automatic operation of resetting the stamping dies.

Another object is to provide a control apparatus of the above type which may be operated at a station which is remote from both the area of the die arranging operation and from the stamping operation.

Another object is to provide a control apparatus of the above type which includes a separate rotary means for arranging each individual rotary stamping die in a selected position by a stepping action which makes available an accurate knowledge of the positions of all the dies at a remote station at all times.

A further object is to provide a control apparatus of the above type which includes rotary means adapted to make individual direct meshing engagements with the respective rotary stamping dies and provide thereby a positive driving action for the operation of arranging said dies.

Still another object is to provide in a control apparatus of the above type a reliable ratchet mechanism which will unerringly advance the characters on each rotatable stamping die in a rapid stepping action until the particular characters preselected at the remote station are presented in the stamping face.

Other objects and advantages will appear in the following specification when taken in connection with the accompanying drawing wherein the single figure is a diagrammatic view showing schematically the electrical circuit and associated fluid pressure system for operating a single rotary stamping die, the actuating mechanism being shown mainly in diagrammatic vertical section.

As indicated by broken lines in the drawing, the remote control apparatus embodying this invention comprises an actuating mechanism 1, the operation of which is controlled by a stepping relay 2, whose operation is determined by the position of a selector switch 3.

The actuating mechanism 1 comprises a fluid pressure operated actuating cylinder 4 which is of the double acting type, having a piston 5 which divides said cylinder into opposite chambers 6 and 7. These chambers 6 and 7 are connected by way of pipes 8 and 9, respectively, to a double magnet valve 10, which also constitutes a part of the actuating mechanism 1.

The magnet valve 10 comprises a casing having a spool valve 11 slidably mounted therein so as to define a central, annular chamber 12 which is always open through a pipe 13 to a supply reservoir 14 charged with fluid under pressure. At the left-hand side of the spool valve 11, as viewed in the drawing, is a chamber 15 which is always open to atmosphere by way of a passage 16 and continually connected by way of a passage 17 in the casing to a chamber 18 at the right-hand side of spool valve 11. The left-hand side of the spool valve 11, as viewed in the drawing, is connected by means of a stem

19 to the armature of a solenoid 20, which, when energized, actuates said valve to the position shown in which the supply reservoir 14 is connected to chamber 6 in the cylinder 4 by way of pipe 13, chamber 12 and pipe 8, and, the opposite chamber 7 in the cylinder 4 is opened to atmosphere by way of pipe 9, chamber 18, passage 17, chamber 15 and passage 16. The right-hand side of the spool valve 11 is connected by means of a stem 21 to the armature of a solenoid 22 so that, when solenoid 22 is energized, supply reservoir 14 is connected to chamber 7 in the cylinder 4 by way of pipe 13, chamber 12 and pipe 9, and, the opposite chamber 6 in the cylinder 4 is opened to atmosphere through pipe 8, chamber 15 and atmospheric passage 16.

The inner terminals of both solenoids 20 and 22 are connected to an electrical conductor 23 which leads to the collector side of the selector switch 3. The outer terminal of solenoid 20 is connected by a conductor 24 to one contact of a trip switch indicated by a dash line at 25, the other contact of which is connected by a conductor 26 to one terminal of a toggle switch 27. The outer terminal of the solenoid 22 is connected by a conductor 28 to one terminal of a trip switch indicated at 29, the other terminal of which is connected by a conductor 30 to one side of a stepping coil 31, the other side of which is connected to conductor 26. Both switches have a delayed opening action so that a short period of time must elapse before either one reopens after being closed to maintain the circuit until piston 5 has almost completed its travel in a particular direction. The trip switch 25 is arranged to be closed by a bridging contact 32 carried on a stem 33 on the left-hand side of piston 5 when said piston is at the left-hand end of its travel, as viewed in the drawing, which is its normal position. The trip switch 29 is arranged to be closed by a bridging contact 34 carried on a stem 35 on the right-hand end of piston 5 when said piston is at the right-hand end of its travel.

With the trip switch 25 closed as shown in the drawing and conductor 23 energized a circuit may be established which will energize the solenoid 20 and thereby actuate the spool valve 11 through the medium of stem 19 toward its left-hand position in which it is shown. In this position of spool valve 11, chamber 6 will be supplied with fluid under pressure and chamber 7 will be vented to atmosphere by the routes described above. In response to pressure of fluid in chamber 6, piston 5 will shift toward its right-hand position. In the right-hand position of piston 5, trip switch 29 will be closed, thereby establishing a circuit that will energize solenoid 22. The solenoid 22 will then actuate spool valve 11 through the medium of the stem 21 to its right-hand position, in which position chamber 7 will be supplied with fluid under pressure and chamber 6 will be vented to atmosphere by the routes previously described. Pressure of fluid in chamber 7 will return the piston 5 to the position in which it is shown, whereupon the same cycle of reciprocation will be repeated. Thus, so long as conductor 23 remains energized, piston 5 will be conditioned at the end of each stroke for movement in the opposite direction by closing either trip switch 25 or trip switch 29 according to the direction of travel.

The reciprocating motion of piston 5 may be transferred by an extension of stem 35 to an operating bar 36 of a ratchet mechanism 37 which constitutes a part of the actuating mechanism 1. This operating bar 36 is adapted to rotate a ratchet wheel 38 through the angular distance equal to the displacement of one tooth for each reciprocating cycle of the bar. The ratchet wheel 38 is arranged to mesh directly with a rotary die 39, such as that shown and described in our copending patent application for improvements in a Stamping Mechanism, U.S. Serial No. 737,041, filed May 22, 1958. Teeth 40 on the ratchet

wheel 38 are spaced apart so as to fit into notches 41 between a plurality of characters 42, preferably numerals 1 to 9, inclusive, and 0, and revolve them about a shaft 43 until the proper one is in the contact area of the stamping face. There is a detent 44 for each ratchet wheel 38 rockably mounted on a fixed pin 45 anchored in the casing of the ratchet mechanism 37 and is normally held in position to prevent rotation of the ratchet wheel 38 in a counterclockwise direction, as viewed in the drawing, by a cross rib portion 46 of the associated bar 36, which is one of a plurality of such bars slidably mounted in the casing of the mechanism. In the normal position shown in the drawing, the cross bar 46 bears against an upper projection of the detent 44 and holds the same against rotation in a crosswise direction. A driving pawl 47 is rockably suspended on each of a series of pins 48 fixed on bars 36 and disposed in a cavity 49 so that it is free to rock clockwise as it is carried to the right until it engages a stop pin 50 fixed in the casing. A guide 51 is formed in the casing for returning each of the pawls 47 to its operative position as the bar 36 moves toward its normal position at the left as viewed in the drawing. As the die 39 is brought into the position for being reset, the stems 52 of a keeper bar 53 will contact the frame of the mechanism 1, and move the keeper bar 53 downward out of locking engagement with a notch 41 in the die 39.

It will now be seen that as the operating bar 36 is shifted horizontally by the piston 5 first to the right and then to the left, the associated die 39 will rotate clockwise through an angle equal to the space between two adjacent notches 41. As the bar 36 is shifted to the right, the pawl 47 will contact the front side of the adjacent tooth 40 to the right to be advanced next and will be rocked thereby in a clockwise direction as it passes over said tooth to its right-hand position. At the same time a pin 54, carried in a cavity 55 in the bar 36, will contact an upright arm of the detent 44 which projects into said cavity so as to rock the detent clockwise about the pin 45 and out of the path of travel of the teeth 40. As the bar 36 is shifted back to the left, the pawl 47 will engage the next tooth 40 after the one just previously advanced, and move it to the left while rotating the ratchet wheel 38 counterclockwise. After the wheel 38 has started to rotate counterclockwise, the pin 54 will move away from the detent 44, allowing the detent to drop into the following space between two teeth 40. When the detent drops into position and engages the left-hand or front side of a tooth 40, the wheel 38 will have rotated a distance equivalent to the distance between two teeth 40. This distance will be enough to move the next character 42 into the stamping area. The pawl 47 will now be in contact both with the back of the advanced tooth 40 and the rib portion 46 separating the cavities 49 and 55. Thus the wheel 38 will be prevented from rotating counterclockwise by the detent 44 and clockwise by the pawl 47. This reciprocating action of the piston 5 and the attached bar 36 may be continued until the desired character 42 is rotated into the stamping area as determined by the operation of the stepping relay 2 under the control of the selector switch 3.

It will be noted that when the pawl 47 engages a tooth 40 while the pawl 47 is being shifted toward the left that not only is it prevented from rotating counterclockwise by the rib portion 46 but, after the left-hand end of pawl 47 passes beneath the bottom edge of the guide 51, the pawl 47 cannot rotate clockwise to permit a second tooth 40 to advance on the same return stroke of the bar 36. There is thus, a double precaution by reason of detent 44 and pawl 47 against overtravel of the ratchet wheel 38.

The stepping relay 2 shown diagrammatically in the drawing may be of the conventional type having two contact arms 56 and 57 joined together on a common shaft indicated by a dash line 58 for operation in a stepping action produced in the usual manner by the stepping coil 31. The stepping coil 31 is connected at one side to the trip switch 29 by the conductor 30, while the other side

is connected to one side of the toggle switch 27 by a branch of the conductor 26. The other side of the switch 27 is connected to the negative side of an electric current source 59 by a conductor 60 which also leads to one side of a position indicator light 61. This indicator light 61 may be composed of a series of illuminating elements 62 formed in the configurations of the numerals 1 to 9, inclusive, and 0, a particular one of which is lighted at each stepping position of the contact arm 56. The elements 62 may be translucent and superimposed one upon the other so that only the illuminated one will appear in the indicating frame, which consequently will have to be only large enough to encompass one numeral. The illuminating elements 62 have a common connection 63 to the conductor 60 while each of the other terminals 64 is connected by its individual conductor 65 to its particular one of the series of contacts 66 arranged in a semi-circle for engagement by the outer end of the pivoted contact arm 56, which, together with the contact arm 57, is connected at its pivoted end to the positive side of the electric source 59 by a conductor 67. A series of contacts 68 are arranged in a similar manner for engagement by the contact arm 57, each of which is connected by its individual conductor 69 to its particular contact 70 in the selector switch 3.

The ten contacts 70 of the selector switch 3 are arranged in a circle for engagement by a rotatable collector ring 71 connected to the conductor 23. This collector ring 71 has a segment broken out, leaving a gap 72 in the ring 71 so that only nine contacts 70 can be engaged by the ring 71 at any one time. As will appear more fully later, the contact 70 that is left open determines the position in which the control apparatus and the stamping die 39 will come to rest. The position of the gap 72 may be selected by a rotatable index knob 73 positively connected by means of a shaft, indicated by the dash lines at 74, to the collector ring 71. The numerals 1 to 10, inclusive, arranged in a circle about the index knob 73 indicate the positions of the die 39, of which one may be selected to which the die will be rotated in the next indexing operation.

It is desirable that the position of the stamping die 39 corresponds to the position of the stepping relay 2. That is, the numeral on the character 42 in the stamping area of the die 39 is the same as the number on the contacts 66 and 68 in the associated stepping relays. As shown in the drawing, the selected numeral is 1. With the index knob 73 pointing to the numeral 1, the gap 72 in the connected collector ring 71 is located at #1 of its contacts 70. Since the contact arm 57 of the stepping relay 2 is also at #1 of its contacts 68, thereby connecting the source 59 to #1 of contacts 70 through conductors 67 and 69, the circuit from the stepping relay 2 to the solenoids 20 and 22 of the magnet valve 10 is open as shown in the drawing. Consequently no stepping action will take place at this time when the toggle switch 27 is closed. Since the circuit for the indicator light 61 is independent of the switch 27, and the contact arm 56 engages #1 of its contacts 66, the numeral 1 will be illuminated in the frame of the indicating light 61, showing that the numeral 1 is in stamping position on the die 39. It should be understood that in the normal position of the piston 5 the trip switch 25 is closed and the trip switch 29 is open as shown in the drawing.

Let it be assumed that the knob 73 of the selector switch 3 is turned to position #2. The gap 72 in the collector ring 71 will likewise be turned thereby to #2 of contacts 70, at the same time connecting #1 of contacts 70 to collector ring 71. Now, when the toggle switch 27 is closed, a circuit is established leading from the positive side of the source 59 through conductor 67 to the contact arm 57 and #1 of contacts 68, thence through #1 of conductors 69 to #1 of contacts 70 in selector switch 3, conductor 23, solenoid 20, conductor 24, closed switch 25, conductor 26, switch 27, and conductor 60 to the negative side of the source 59. With the solenoid 20 thus ener-

gized, spool valve 11 is drawn to its left-hand position shown in the drawing, in which fluid under pressure is supplied from reservoir 14 to chamber 6 in the actuating cylinder 4 and fluid under pressure in chamber 7 is vented to atmosphere, as previously described in connection with the operation of the magnet valve 10. In response to pressure of fluid in chamber 6, the operating bar 36 is actuated toward the right by piston 5 and stem 35, releasing the detent 44 by means of the pin 54 and carrying the pawl 47 over the next tooth 40 to be advanced. As the piston 5 reaches the end of its stroke in the right-hand direction, the trip switch 25 is opened by delayed action and the trip switch 29 is closed by a suitable lost-motion connection (not shown). The solenoid 22 is then energized by a circuit completed from the conductor 23 by way of switch 29, conductor 30, stepping coil 31, conductor 26, switch 27, and conductor 60 to the negative side of the source 59. Spool valve 11 will then be actuated to its right-hand position, in which fluid under pressure in chamber 6 will be vented to atmosphere and chamber 7 will be supplied with fluid under pressure from supply reservoir 14. In response to fluid pressure in chamber 7, piston 5 will actuate the operating bar 36 toward the left in a return stroke, advancing the wheel 38 by one tooth 40 and thereby advancing one character 42 on the die 39. In this case, the character 42 advanced into stamping position will bear the numeral 2. At the end of the return stroke of the bar 36 the detent 44 and pawl 47 will assume the positions in which they are shown in the drawing. As previously noted, clockwise rocking of the detent 44 and pawl 47 is prevented by the rib 46 and guide 51, respectively, and counterclockwise rocking of same by the wheel 38 and rib 46, respectively.

Now, when the solenoid 22 was energized, the stepping coil 31 was also energized since it is connected in series with solenoid 22. This energization will cause the relay 2 to prepare to advance the contact arms 56 and 57 through one step. When the piston 5 nears the end of its stroke, the stepping coil 31 will be deenergized by the interruption of the energizing circuit at the opening of the switch 29 as the piston 5 nears the end of its return stroke. Deenergization of the stepping coil 31 will cause the contact arms 56 and 57 to advance to #2 positions of engagement with contacts 66 and 68, respectively. Thus, advancing arm 56 from #1 to #2 position to change the indicating light 61 to #2 of the elements 62 will be substantially concurrent with the advancing of the character bearing the numeral 2 into stamping position. Advancing the contact arm 57 to engagement with #2 of the contacts 68 will at the same time connect #2 of conductors 69 to #2 of the contacts 70 in the selector switch 3. However, since the gap 72 is now at #2 position, the conductor 23 will not be energized and therefore, actuating mechanism 1 will remain positioned as shown in the drawing.

If the index knob 73 is turned to the numeral 6, for example, the stepping procedure just described will be repeated five times until the stepping relay contact arm 57 reaches position #6 in which the energizing circuit through the selector switch 3, is open at the gap 72 which is positioned at #6 of contacts 70. Briefly, solenoid 20 will be energized, piston 5 will actuate the operating bar 36 to the right, picking up another tooth 40 on the gear wheel 38 and closing trip switch 29, whereupon solenoid 22 will be energized, piston 5 will actuate the operating bar 36 to the left, advancing one tooth 40 on the gear wheel 38, and thereby one character 42 on the die 39. The stepping coil 31 will be energized at the end of the piston stroke to the right and will be deenergized near the end of the piston stroke to the left, thereby advancing the relay one step to a new position for energizing a new cycling circuit to the selector switch 3. At the end of the return stroke of the piston 5 toward the left, the trip switch 25 will be closed again for the start of another reciprocating cycle until the stepping relay 2 connects with a conductor 69 leading to the gap 72 in the selector switch 3. At this time the cycling will cease and the selected numeral will be in stamping position on the die 39.

It will be seen, therefore, that the marking die is rotated in one direction only in increments each of which is sufficient to bring the next character on the die into marking position. The manually operable selector switch is set to bring a selected character into marking position. The operating mechanism for rotating the marking die includes the indexing gear or ratchet wheel 38 and driving pawl 3 with its associated operating bar 36, piston and cylinder. This actuating means is controlled by electromagnetic valve 18 and the circuit for such valve which includes the manual selector switch, the trip switches 25 and 29, and the stepping relay, the arrangement being such that the stepping relay is advanced by the operation of the actuating mechanism to open the circuit to the electromagnetic control valve 18 and thereby prevent further operation of the actuating mechanism until the manual selector switch has again been operated. The actuating means for turning the marking die therefore operates continuously when the electromagnetic valve circuit is closed to advance the indexing wheel and the marking die in increments, and to also advance the stepping relay until the stepping relay opens the circuit. The operation stops when the circuit is thus opened.

It should be understood that the unit that has been shown and described above is rarely, if ever, used singly, but is used in a set of a plurality such as six, or more, which may be controlled at a console where the selector switch 3 and indicator light 61 for each circuit is mounted in a position corresponding to the relative positions of the associated die in the stamping head. With the toggle switch 27 open, the knobs 73 of these switches may be set in the same order as the desired number to be stamped. This number may be retained in readiness for the die arranging operation until the set of dies 39 rotatably mounted in a suitable frame (not shown) is carried into meshing engagement with the respectively matching ratchet wheels 38. With the closing of the toggle switch 27, the operation for arranging the dies 39 in the preselected order on the array of the selector switches 3 is set in motion and carried out to completion, which is reached when each stepping relay has effected a reciprocating cycle of the actuating mechanism for each step until each relay registers with the respective gap 72 in the respective selector switch 3.

Having now described our invention what we claim as new and desire to secure by Letters Patent is:

1. In a control apparatus for a stamping mechanism having a rotatable annular die with a plurality of characters spaced evenly around the periphery thereof, a ratchet mechanism comprising a gear wheel for operatively engaging a rotary die for advancing the characters thereon one step at a time, a reciprocating bar for actuating said gear wheel, a pawl pivotally mounted on said reciprocating bar for advancing said wheel, said pawl having a driving arm arranged to pass over a tooth on said wheel during movement of said bar in a priming direction and to make driving engagement with the same tooth upon return movement of said bar, a stationary pin, a stop carried on said bar, said pawl having another arm arranged to rock freely in a release direction during the initial part of the priming stroke and to rock said pawl toward its operative position near the end of said priming stroke by collision with said stationary pin and to be prevented from pivoting past its operative position in the direction opposite to release direction by said stop, a stationary guide for directing said pawl toward its driving position during the latter part of the return stroke of said reciprocating bar and preventing said pawl from rocking in a direction to permit overtravel of said wheel in an advancing direction, and power means for reciprocating said bar.

2. In a control apparatus for a stamping mechanism

having a rotatable annular die with a plurality of characters spaced evenly around the periphery thereof, a ratchet mechanism comprising a gear wheel for operatively engaging said die to advance the characters thereon one at a time, a reciprocating bar for actuating said gear wheel, a pawl pivotally mounted on said reciprocating bar for connecting said bar to said wheel, said pawl having a driving arm arranged to pass over the tooth to be advanced next on said wheel during movement of said bar in the priming direction and to make driving engagement with the same tooth upon return movement of said bar, a stationary pin, a stop carried on said bar, said pawl having another integral arm arranged to rock freely in a release direction during the initial part of the priming stroke and to rock said pawl toward its operative position near the end of the priming stroke by collision with said stationary pin and to be prevented from pivoting past its operative position in the opposite direction by said stop, a detent pivotally mounted in a stationary position between said bar and said wheel held by said stop on said bar in a normal position for preventing rotation of said wheel in an advancing direction and rockable out of said normal position during the latter stage of the priming stroke of the bar to permit advancement of another tooth, the detent normally engaging the leading surface of an advanced tooth and the pawl normally engaging the back surface of the tooth just advanced after the aforesaid tooth.

3. In a marking machine having a rotary marking die with characters about its periphery and rotatable through equal angular increments to bring a selected character into marking position, a manually operable multiple contact selector switch having a number of contacts equal to the number of positions to which the marking die is movable and having a movable arm selectively movable only by manual operation into any one of said contacts and which remains in the selected position until

manually moved therefrom for selecting the character on said die to be brought into marking position, operating means for rotating the marking die intermittently in one direction only in equal angular increments sufficient to bring a different character of the marking die into marking position with each increment, electromagnetic means and a circuit therefor connected with the selector switch for controlling the operation of the operating means so long as said circuit is energized, and means actuated by the operating means for opening said circuit when the character selected by the manual selector switch has been rotated to marking position.

4. A marking machine as defined in claim 3 wherein the operating means comprises a pawl mechanism which is reciprocated and an indexing gear engaged by the pawl with each cycle of reciprocation to rotate said indexing gear through one increment of movement, said indexing gear being engaged with the marking die to move the marking die, fluid pressure means for reciprocating the pawl mechanism, the electromagnetic means comprising an electromagnetically operated valve for controlling said fluid pressure means, the circuit for the electromagnetic valve including trip switch means actuated by the travel of the pawl mechanism for effecting the operation of the electromagnetic valve means.

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