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C. A. MARSTON

2,048,192

COUNTING SYSTEM

Filed April 4, 1932

2 Sheets-Sheet 1

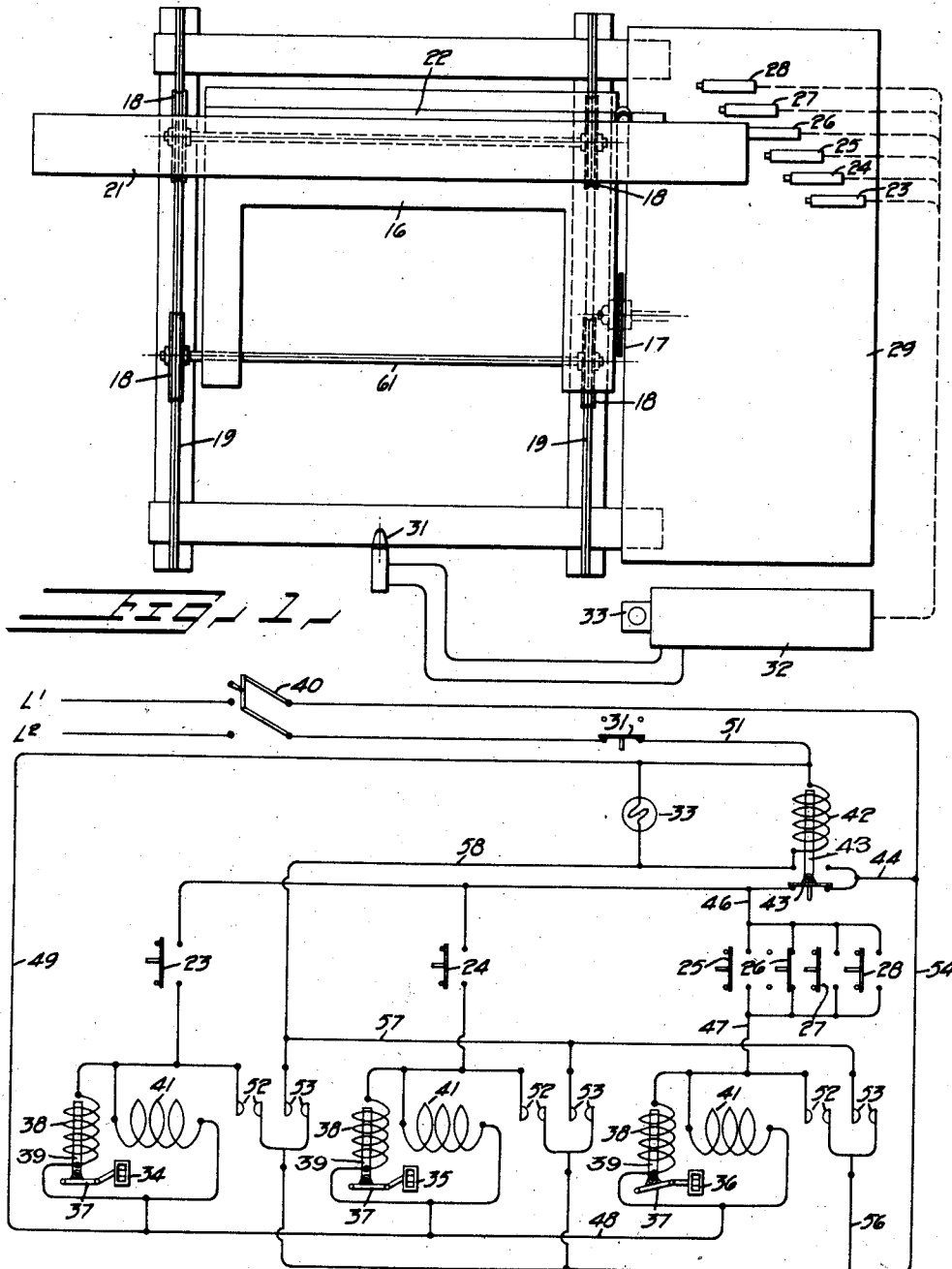


FIG. 2

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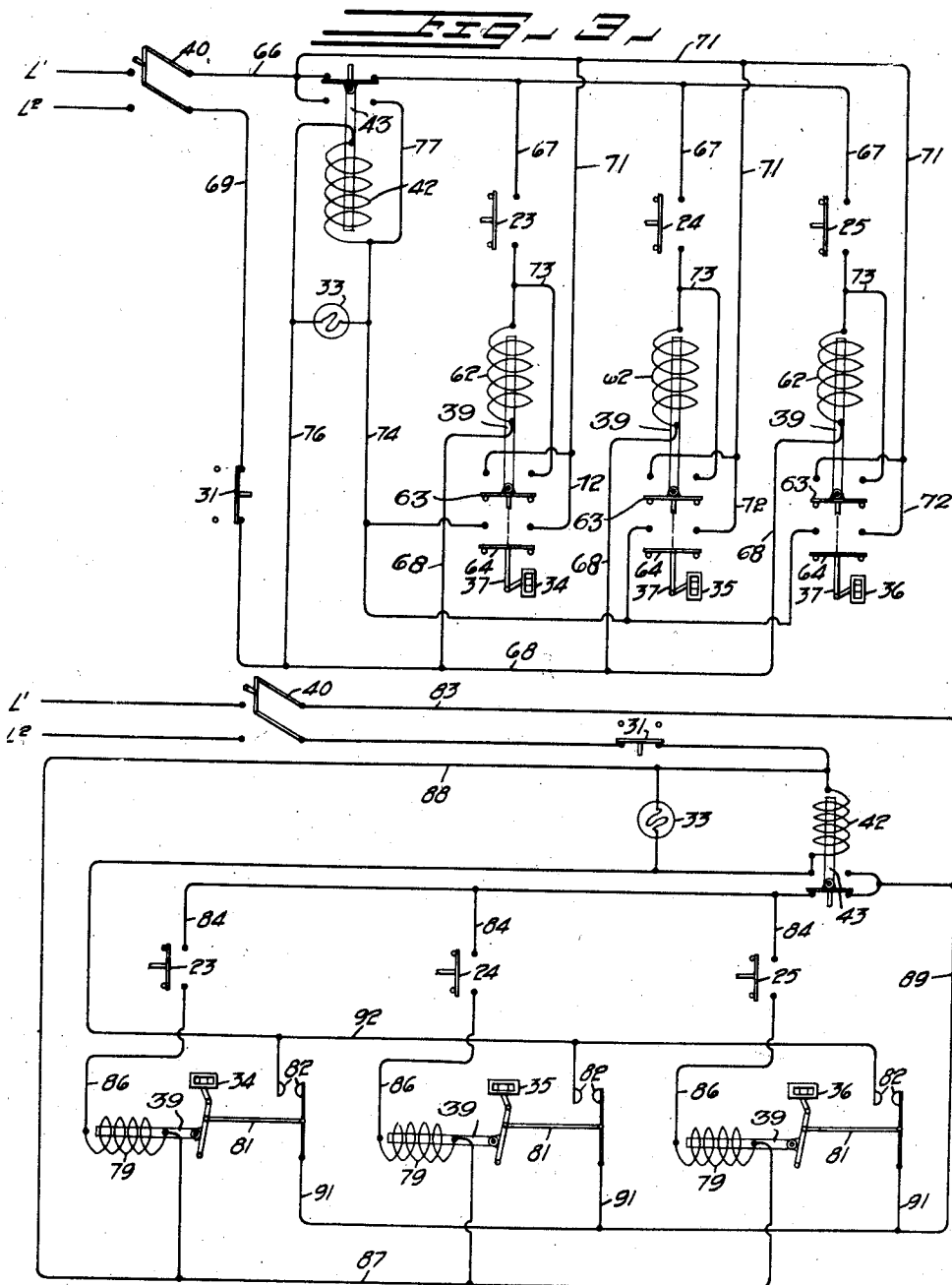


FIG. 4

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COUNTING SYSTEM

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5 Claims. (Cl. 235—92)

My invention relates to electric counting systems and more particularly it relates to a system for counting the number of times a particular operation has been performed by a certain machine. The principles of the invention will be described in connection with a cut-off saw machine, such as that employed in lumber mills, for cutting a board into lengths which are suitable for boxes, furniture, or various other articles of manufacture, but it is to be understood that the invention in its broadest aspects has a wide variety of other applications. In general, the system can be employed to advantage in any machine in which a definite cycle of steps is followed in performing the particular operation to be counted.

In a cut-off saw, for example, the board to be cut must be placed in a definite position in front of the saw blade and then moved into the saw blade for a definite distance to cut the piece off. Heretofore, counting devices were actuated at a particular step in the operation, as for example, each time the lumber carriage was moved to the end of its stroke. Unreliable or dishonest sawyers would frequently obtain a false count under this system by moving the empty carriage back and forth, and thus increase their wages by "cutting wind", as it were. Generally, pieces cut to a certain length are more readily usable than pieces cut to other lengths, and in prior counting systems no distinction was made between pieces of different lengths, with the result that the operator of a machine was given the same credit for cutting desirable lengths as he was given for cutting less desirable or odd lengths. This condition led to abuses by the operators, who, instead of exercising skill in the performance of their duties, made an endeavor to cut as many pieces as possible without regard to the best interests of the factory.

It is a general object of the present invention to provide a counting system which overcomes the disadvantages of prior systems and which renders the count more reliable as an indication of the work actually performed by the machine and its operator.

Accordingly, it is an object to devise a system of the character described in which idle movements of a machine are not recorded.

Another object is to provide a counting system in which a distinction is made between different classes of output resulting from substantially identical operations.

As applied to a cut-off saw, it is an object of the invention to provide counting means which

discriminate between the pieces cut to different lengths and which is unresponsive to idle movements of the lumber carriage.

Another object is to provide a counting system in which a plurality of operations are required in actuating the counting means and in which the counting means is rendered unresponsive to all operations except the proper one after the initial operation has been performed.

Another object is to provide a counting system in which means is provided which renders it necessary to perform more labor in obtaining a false count than is required to obtain the same count honestly, whereby the incentive to obtain a false count is entirely removed.

These and other objects and advantages are attained in the embodiments of my invention illustrated in the accompanying drawings, in which:

Figure 1 is a plan view, mostly diagrammatic, of a cut-off saw incorporating the principles of the invention and illustrating the general arrangement of the parts of the counting system.

Figure 2 is a circuit diagram illustrating one manner in which the electrical connections can be made in the counting system.

Figure 3 is a circuit diagram illustrating a modification.

Figure 4 is a circuit diagram of another modification.

Referring to the drawings and first to Figure 1 thereof, I have illustrated a cut-off saw having a carriage 16 and a rotatable buzz saw blade 17. The carriage 16 is mounted on wheels 18 which roll on tracks 19 to convey the carriage to and from the saw blade 17. A board or other length of lumber 21 is shown in position on the carriage 16 against a straight edge 22 or other suitable aligning means.

A plurality of accurately positioned stops 23 to 28, each incorporating an electric switch, are mounted on a relatively stationary table 29. The stops or switches 23 to 28 are positioned on the machine adjacent the end of the board which is to be cut off and serve to measure the length which is to be cut. Thus, when the end of the board 21 is made to abut against the stop 23, for example, a definite usable length of lumber will be cut off when the carriage 16 is afterwards moved to bring the board 21 into the path of the saw blade 17. In a like manner, other usable lengths will be cut off if the end of the board is brought into abutting engagement with any one of the other stops. A certain length will ordinarily be more readily usable than other

lengths, and a second length will be next desirable and so on, every length having some use, but the demand for the different lengths being different. The boards to be cut come in various
 5 lengths, so that each sawyer must determine to the best of his ability the most advantageous manner of sub-dividing the boards into shorter lengths. In doing this he should strive to obtain as many of the most desirable cuts as is
 10 possible, consistent with minimum waste.

In addition to measuring the piece to be cut off, the stops or switches 23 to 28 serve to initiate actuation of the counting devices. When the board is made to abut against one of the stops, the switch associated with this stop is actuated
 15 by the end of the board, thereby closing an electric circuit, to be described presently, for initiating actuation of the particular counter employed for counting the number of pieces of the length represented by that stop. Upon actuation of one
 20 of the switches 23 to 28 in this manner all of the counting devices are made unresponsive to a subsequent actuation of any of the switches until the piece has been cut off. In cutting off the
 25 piece, the carriage 16 is moved to bring the board against the saw blade 17 and a switch 31 disposed in the path of the carriage 16 is actuated at the end of the carriage movement. The actuation of switch 31 restores the counting apparatus and
 30 the circuit associated therewith to normal condition and the system is then in readiness for the next counting operation. The counting devices can be disposed in a suitable housing 32 and, if desired, a signal lamp 33 can be mounted on or
 35 near the housing in some conspicuous place.

Referring now to Figure 2, wherein I have shown one manner in which electrical connections can be made, there is illustrated a plurality of
 40 counting devices 34, 35, and 36, of any suitable construction but each having an actuating member 37 which is movable in a definite path to effect a counting operation. In the embodiment illustrated, the counting device 34 registers the
 45 number of pieces cut having a length determined by the switch stop 23, the counting device 35 registers the number of pieces having a length determined by the switch stop 24, and the counter 36 counts all of the pieces in the group of remaining lengths.

An electro-magnet 38 having an armature 39 is associated with each of the counters 34, 35 and 36. Whenever one of the electro-magnets 38 is energized and then de-energized, its associated counter effects a registering operation. A locking
 55 relay 41 can be connected in parallel with each of the electro-magnets 38 for completing a holding circuit for the associated electro-magnet 38. A main relay 42 is provided which serves as a circuit changer and which when energized renders all of the relays 38 unresponsive to subsequent
 60 actuation of the switches 23 to 28.

Assuming that the end of the board 21 is placed against the switch stop 26 as is shown in Figure 1, preparatory to the cutting off of a piece of board
 65 measured by the stop 26, the relay 38 associated with counter 36 will be energized over a circuit which can be traced from line L₁, through line switch 40, conductor 44, lower contacts and armature 43 of relay 42, conductor 46, switch 26,
 70 conductor 47, electro-magnet 38 and relay winding 41 in parallel, conductor 48, conductor 49, conductor 51, switch 31, line switch 40 to line L₂. Electro-magnet 38 is thereupon energized to move the actuating member 37 of counter 36 to the position shown in Figure 2. Simultaneously,

relay winding 41 is energized to close contacts 52 and contacts 53.

Closure of contacts 52 completes a holding circuit for electro-magnet 38 and relay winding 41 which can be traced from line L₁, conductor 54, conductor 56, contacts 52, windings 38 and 41 in
 5 parallel, conductors 48, 49 and 51, switch 31 to line L₂. Subsequent opening of switch 26, therefore, does not serve to effect de-energization of electro-magnet 38.

Closure of contacts 53 completes an energizing circuit for the main relay 42 and lamp 33, which can be traced from line L₁, conductor 54, conductor 56, contacts 53, conductors 57 and 58, relay winding 42 and lamp 33 in parallel, conductor
 15 51, switch 31 to line L₂. Lamp 33 thereupon lights up and the armature 43 of relay 42 opens the lower contacts and closes the upper contacts associated with relay 42.

Closing of the upper contacts of relay 42 serves
 20 to complete a holding circuit for this relay and the lamp 33 which can be traced from line L₁, conductor 44, upper contacts and armature 43 of relay 42, winding of relay 42, conductor 51, switch 31 to line L₂. Opening of the lower contacts of relay 42 disables the control circuit through switches 23 to 28, so that subsequent opening or closing of any one of these switches produces no effect on any of the counters 34 to
 25 36. Electro-magnet 38 of counter 36 is held energized over the circuit which extends through contact 52 and the associated actuating member 37 is thus held in the position shown in Figure 2. Relay 42 and lamp 33 are held energized over the circuit which extends through the upper con-
 35 tacts of relay 42.

To effect a complete counting operation and to restore the system to normal, the switch 31 is adapted to be actuated to open condition by movement of the carriage 16 to the position it as-
 40 sumes at the end of a sawing operation. Thus the switch 31 can be mounted as shown in Figure 1 in the path of the axle 61 of the forward wheels of the carriage or in the path of any other part of the carriage in such a location that it is
 45 actuated to open position when the carriage has been moved a distance which is sufficiently great to effect the cutting off of the end of the board 21. When the switch 31 is opened, the holding circuits of relays 42 and 41 are broken and electro-magnet 38 becomes de-energized, thereby releasing its armature 39 and allowing the actuating member 37 to be restored to its initial position under the force of any suitable biasing means. The piece cut off is thus counted on counter 36
 50 and the system is restored to normal condition.

In this manner the number of pieces cut in the group of lengths controlled by the switch stops 25 to 28 is registered in counter 36, while counters 34 and 35 register the number of pieces
 60 cut under the control of switch stops 23 and 24, respectively. Lamp 33 becomes illuminated whenever the relay 42 is energized and is extinguished when the relay 42 is de-energized, so that by watching the lamp at any particular
 65 saw, it can be readily determined whether the sawyer at that machine is attempting to obtain a false count. Movement of the empty carriage 16 back and forth against the switch 31 will not actuate any of the counters. Moreover, repeated actuation of switches 23 to 28, after an initial
 70 actuation of one of them, will not actuate the counters unless there is a succeeding operation of switch 31. It is to be understood that all of the other parts of the system can be made in-
 75

accessible to the operator of the machine, thereby precluding any unauthorized tampering in an effort to secure a false count.

The system illustrated in Figure 3 is somewhat similar to that shown in Figure 2, but a single electro-magnetic winding 62 is made to perform the functions of the windings 38 and 41 associated with each of the counters in Figure 2. The corresponding parts are indicated by the reference characters employed in Figure 1. A pair of movable switch elements 63 and 64, insulated from one another in any suitable manner, are actuated upon energization of the associated electro-magnet 62 and simultaneously the actuating member 37 is moved through one-half of its cycle of movement.

Assuming that the switch 23 has been closed by moving the end of the board thereagainst, an energizing circuit for the electro-magnet 62 is completed which can be traced from line L₁, line switch 40, conductor 66, upper contacts and armature 43 of the relay 42, conductor 67, switch 23, winding 62, conductor 68, switch 31, conductor 69 to line L₂. Thereupon switch 63 closes to complete a holding circuit for a winding 62 and switch 64 closes to complete an energizing circuit for relay 42, while simultaneously the actuating member of counter 34 is moved through one-half cycle of its movement.

The holding circuit for winding 62 can be traced from line L₁, conductor 66, conductor 71, conductor 72, switch 63, conductor 73, winding 62, conductor 68, switch 31, conductor 69 to line L₂. Winding 62, therefore, remains energized after the switch 23 is opened.

The energizing circuit for relay 42 can be traced from line L₁, conductors 66, 71 and 72, switch 64, conductor 74, through relay winding 42 and lamp 33 in parallel, conductor 76, switch 31, conductor 69 to line L₂. Lamp 33 thereupon lights up and the armature 43 is attracted to close the lower contacts and to open the upper contacts of relay 42. Upon opening of the upper contacts of relay 42, the energizing circuits of windings 62, through the switch stops 23, 24 and 25 are disabled, so that subsequent actuation of switches 23 to 25 produces no effect.

Closing of the lower contacts of relay 42 complete a holding circuit for this relay which can be traced from line L₁, conductor 66, lower contacts and armature 43 of relay 42, conductor 77, winding of relay 42 and lamp 33 in parallel, conductor 76, switch 31, conductor 69 to line L₂. The lamp 33 then remains energized, the switches 23 to 25 remain ineffective and the counter 34 remains partially actuated, until the carriage 16 is moved to cut off the end of the board. When the carriage 16 reaches the end of its stroke, the switch 31 of Figure 1 is opened, thereby restoring the system to normal condition, and in readiness to effect the next counting operation.

The system illustrated in Figure 4 is simplified still further in that the actuating electro-magnet 79 associated with each of the counters 34 to 36 is employed to close only a single set of contacts and the holding circuit for electro-magnet 79 is omitted. Thus, an arm 81 is actuated upon energization of one of the electro-magnets 79 to effect closure of a pair of wiping or sliding contacts 82 of any suitable construction. Assuming that the switch 24 is closed in Figure 4, an energizing circuit for the electro-magnet 79 associated with counter 35 is completed which can be traced from line L₁, line

switch 40, conductor 83, lower contacts and armature 43 of relay 42, conductor 84, switch 24, conductor 86, electro-magnet 79, conductor 87, conductor 88, switch 31 to line L₂. Electro-magnet 79 is thereupon energized actuating the counter 35 and closing contacts 82.

Closure of contacts 82 completes an energizing circuit for relay 42, which can be traced from line L₁, conductor 83, conductor 89, conductor 91, contacts 82, conductor 92, winding of relay 42 and lamp 33 in parallel, switch 31 to line L₂. Thereupon the armature 43 is attracted to open the lower contacts and close the upper contacts of relay 42. A holding circuit for relay 42 is completed through the upper contacts thereof which can be traced from line L₁, line switch 40, conductor 83, upper contacts and armature 43 of relay 42, winding of relay 42, through switch 31 to line L₂. Opening of the lower contacts of relay 42 disables the energizing circuits of all of the electromagnets 79, and the electro-magnet 79 associated with counter 35 is de-energized, permitting the contacts 82 to open. Subsequent actuation of the switches 23 to 25 produces no effect on any of the counters, since the energizing circuit for the counters remains open at the lower contact of relay 42 as long as relay 42 remains energized. To de-energize relay 42 and thus restore the system to normal, the carriage 16 must be moved to its rear position, thereby opening the switch 31.

In each of the embodiments illustrated in Figures 2, 3, and 4, one of the counters 34 to 36 is actuated, whenever the end of the board is placed against one of the switch stops preparatory to a cutting off operation. Until the switch 31 is opened, however, the circuits controlled by the switch stops are disabled, thereby precluding subsequent actuation of any of the counters without moving the carriage 16 to its rear position. In the embodiments illustrated in Figures 2 and 3 the actuated counter is only partially actuated in response to the placing of the board against one of the switch stops and the actuation of the counter is not completed until the carriage 16 has been carried to its rear position. In every case, however, two distinct steps in the operation of the machine are required to be performed during each counting operation and unless these steps are both performed, and performed in a definite order, the counters will be unresponsive.

I claim:

1. In an electrical counting system for separately counting the number of pieces of different sizes cut from a length of material by a cut-off saw, a plurality of counting devices, each of said counting devices serving to register the number of pieces cut of a definite size, an actuating member for each counting device movable in a definite cycle for effecting actuation of each of said counting devices, contacting means adapted to be operated by positioning of different lengths of material in operative position relative to the saw, electromagnetic means energized by operation of said contacting means to effect movement of one of said actuating members through a portion only of its cycle in response to the positioning of the length of material in operative position relative to the saw, the particular actuating member affected being the one associated with the counting device which counts the pieces of the size about to be cut when the length of material is thus positioned, means for de-energizing said electro-magnetic means to cause said actuating member to be moved to complete its cycle of its move-

ment in response to completion of a sawing operation, and means conditioned by operation of any one contacting means for precluding energization of the electro-magnetic means associated with all of the other actuating members during a sawing operation.

2. In a counting system for separately counting the number of units of different sizes successively operated upon by a work element, a plurality of counting devices each of which serves to register the number of units of a predetermined size which are operated upon by said work element, a movable actuating member for each of said devices, electro-magnetic means for effecting movement of one of said actuating members through a portion of its cycle in response to predetermined positioning of a unit of predetermined size with respect to said work element, said last means including electrical contacting means arranged to be operated by positioning units of predetermined size with respect to the work element, the particular actuating member affected being the one associated with the counting device which registers the units of that size about to be operated upon, and means for causing said actuating member to be moved to complete the cycle of its movement and to effect actuation of its associated counting device, upon the work element completing its operation upon a unit.

3. In a counting system for separately counting the number of units of different sizes operated upon by a machine having a definite cycle of operation, a plurality of counting devices each of which serves to register the number of units of a predetermined size which are operated upon by said machine, a movable actuating member for each of said devices, means for effecting movement of one of said actuating members through a portion of its cycle in response to a predetermined positioning of a unit of predetermined size with respect to said machine, at the commencement of a cycle of operation, said last means including electrical contacting means arranged to be operated by positioning units of predetermined size with respect to the work element, the particular actuating member affected being the one associated with the counting device which registers the units of predetermined size about to be operated upon, means for causing said actuating member to be moved to complete the cycle of its movement and to effect a registration in said counting device in response to said completion of its cycle of movement, and means released by completion of the cycle of operation of the machine for precluding actuation of all of the other actuating members only during the period that any

one of the actuating members remains partially actuated.

4. In combination with a machine having a definite cycle of operation for performing work upon articles of various sizes, a plurality of electrical contactors, there being a contactor corresponding to each size of article, each contactor being closed by introducing into the machine an article of its corresponding size, a plurality of counting devices, there being a counting device for each contactor, electro-magnetic actuating means for the counters, an electrical circuit connecting said contactors with said electro-magnetic means, whereby upon the closing of a contactor there is an actuation of a corresponding counting device, a master contactor adapted to be closed during a cycle of operation of the machine and to be automatically opened upon completion of said cycle, means effective responsive to closing of one of said first named contactors, together with closed condition of said main contactor, for rendering the remainder of the first mentioned contactors ineffective to cause a registration on their associated counting devices, and means responsive to opening of said main contactor for reconditioning the system for a subsequent counting operation.

5. In combination with a machine having a definite cycle of operation for performing work upon articles of various sizes, a plurality of electrical contactors, there being a contactor for each size of article, each contactor being closed upon introducing into the machine an article of its corresponding size, a plurality of counting devices, there being a counting device for each contactor, electro-magnetic means for the counters, each electro-magnetic means requiring electrical energization followed by de-energization of the same, to complete a count on its corresponding counting device, an electrical circuit connecting said contactors with said electro-magnetic means whereby upon closing of a contactor there is energization of the corresponding electro-magnetic means, means included in said circuit for retaining an electro-magnetic means energized following closing of its associated contactor and to shunt out the remainder of said electro-magnetic means, a master contactor adapted to be closed during a cycle of operation of the machine and to be automatically opened upon completion of said cycle, and means for effecting de-energization of an energized one of said electro-magnetic means and reconditioning of the system for a subsequent counting operation, responsive to opening of said master contactor.

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