Feb. 28, 1967 J. A. SANDRICK ETAL 3,307,197

COUNTER-TIMER-PRINTER DEVICE WITH READOUT MECHANISM

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FIG. 2.

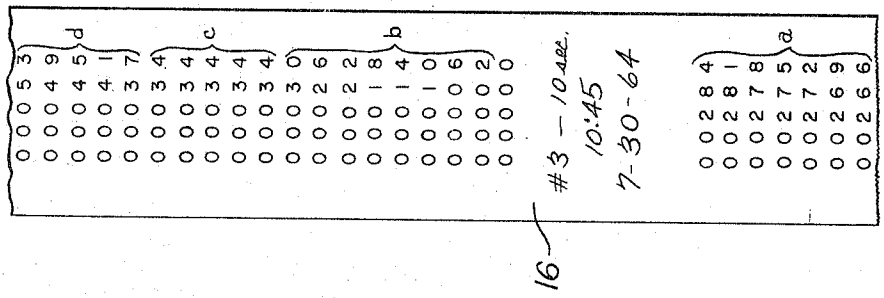


FIG. 1.

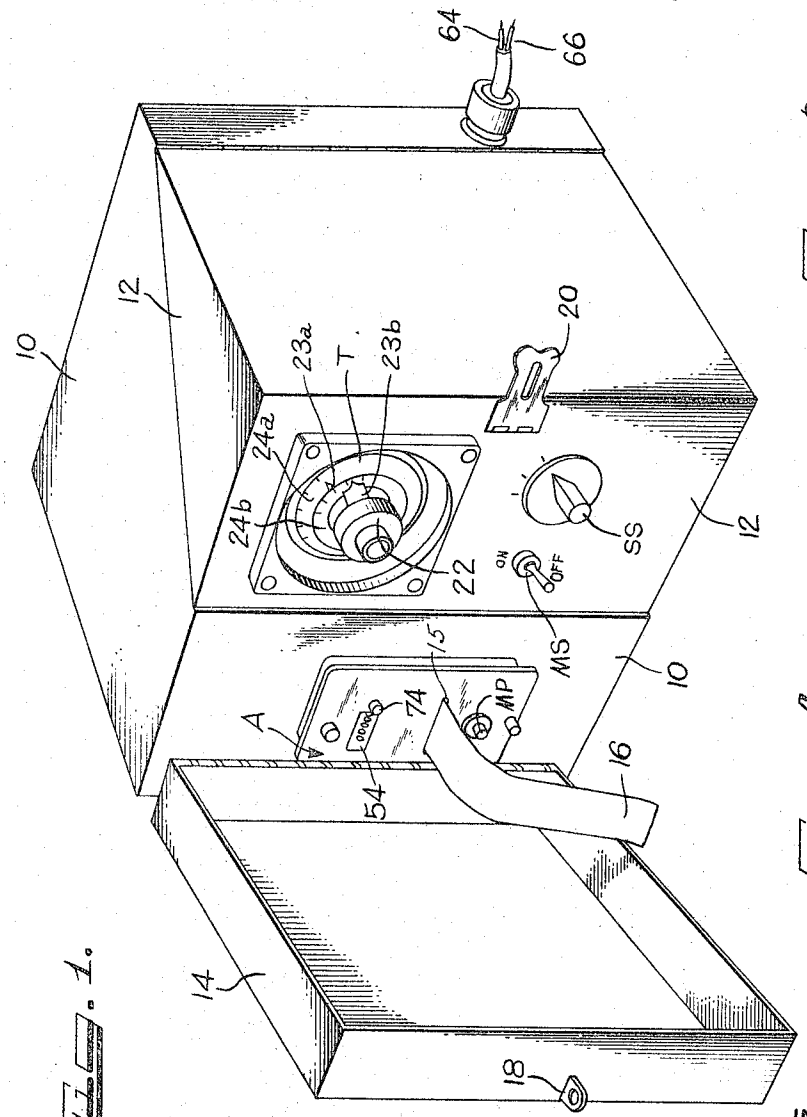


FIG. 3.

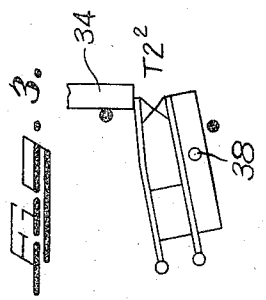
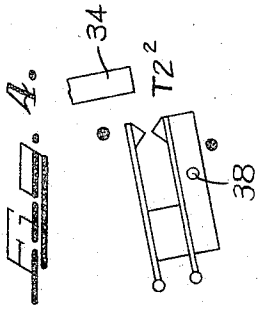


FIG. 4.



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Fig. 5.

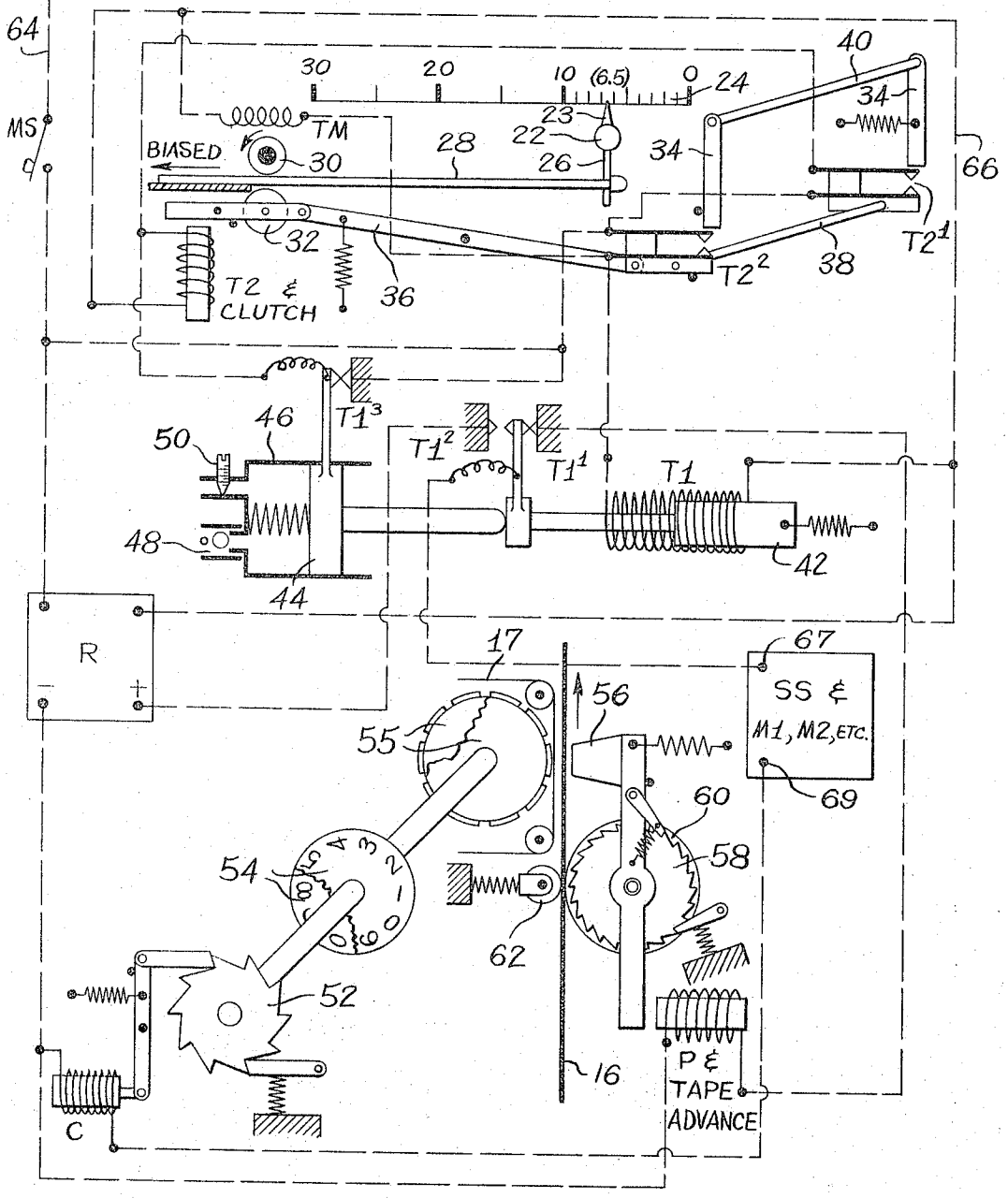


Fig. 6.

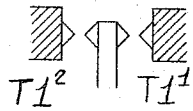
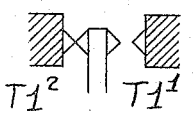


Fig. 7.



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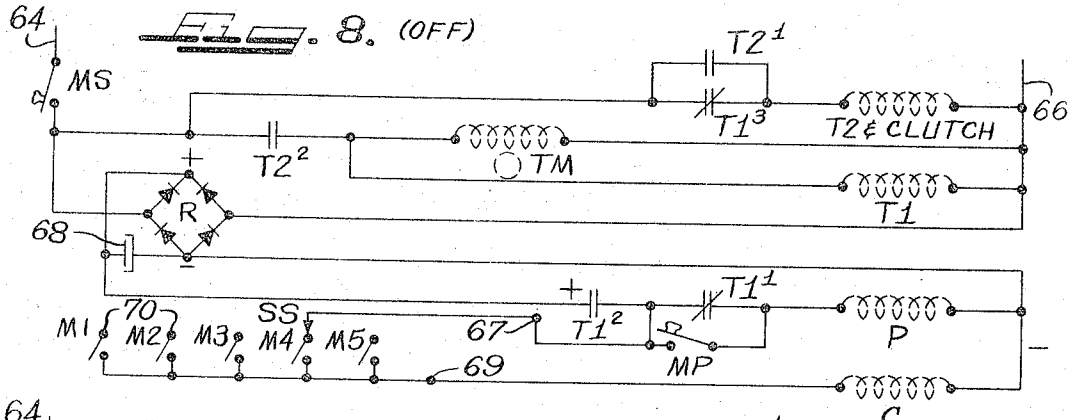


FIG. 8. (OFF)

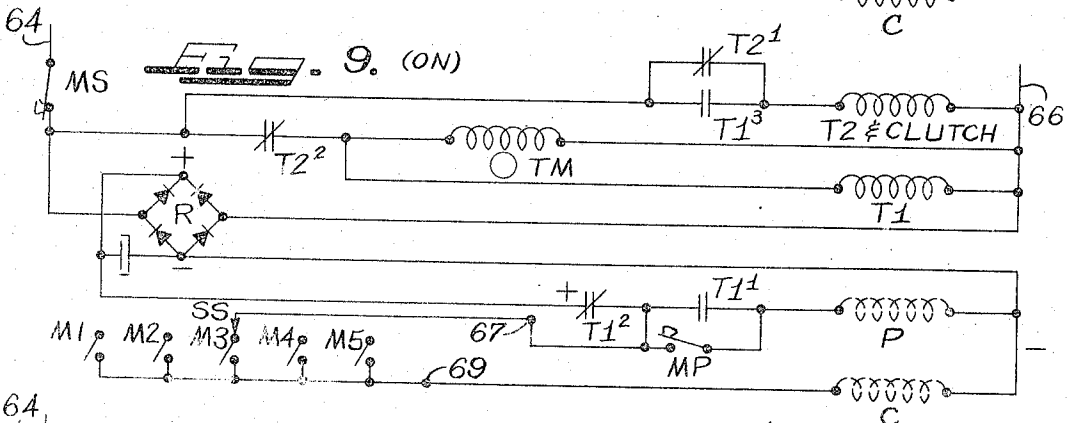


FIG. 9. (ON)

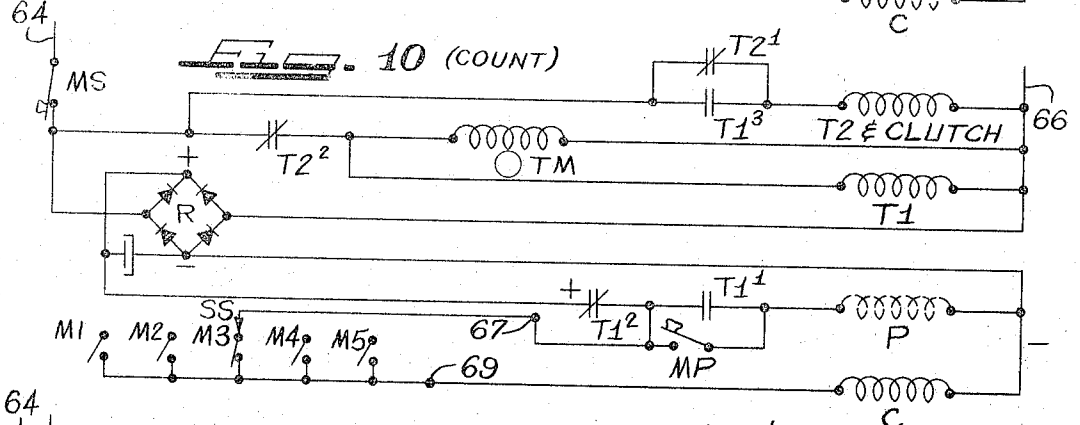


FIG. 10 (COUNT)

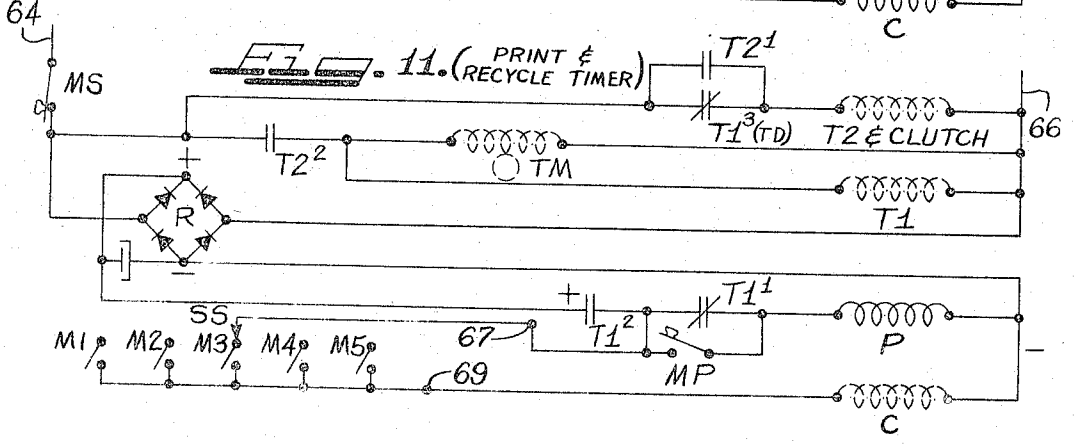


FIG. 11. (PRINT & RECYCLE TIMER)

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COUNTER-TIMER-PRINTER DEVICE WITH READOUT MECHANISM

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2 Claims. (Cl. 346—14)

This invention relates to a counter-timer-printer device having mechanism to read out counted totals of events such as machine operations during selected time periods occurring successively, the expiration of each time period actuating the printer for a readout tape.

One object of the invention is to provide a device of the kind referred to particularly adapted as a production monitor.

Another object is to provide a counter-timer-printer which is compact, simple to install, requires only one electrical connection to plug it into any 110 volt A.C. outlet, which can monitor any one of any desired number of machines, or an individual machine, for a completely printed record of production per day or any other desired time period, and which can be installed either at the machine or at a point remote therefrom such as the office of a production manager or time study analyst.

Still another object is to provide a unitary device which simplifies connection to one or more machines, the production of which are to be monitored, the requirement for each machine being a limit switch or any other type of pulse generator mounted thereon to pulsate the counter of the device, the pulse generator responding to any cyclically movable part or the like of the machine.

A further object is to provide a device of the character referred to which produces a printed record for time study of machines and the like by showing operations per time period and thereby the number of work pieces machined or produced by the machine, for any down time of the machine or for times the operator is not on the job and similar situations which result in a change of pace of operations, omission of operations or other events which are desirable of recordation.

Still a further object is to provide a readout mechanism having a counter and a printer, a timer being provided which can be preset for counting during predetermined, pre-settable time periods, the printer operating at the expiration of each time period and the timer being automatically reset at the end of each timing period.

An additional object is to provide a cricuit arrangement for a timer having a clutch-actuating coil operable to reset the timer, the counter and printer having electromagnetic coils for actuating the same and a relay arrangement being provided for the automatic resetting of the timer and proper actuation of the counter and printer at the times required.

A further additional object is to provide relay actuated means for preventing counting during the time that the printer is in operation but insuring the count as soon as the printing operation is completed.

With these and other objects in view, our invention consists in the construction, arrangement and combination of the various parts of our counter-timer-printer device, whereby the objects above contemplated are attained, as hereinafter more fully set forth, pointed out in our claims and illustrated in detail on the accompanying drawings, wherein:

FIG. 1 is a perspective view of a counter-timer-printer device embodying our invention;

FIG. 2 illustrates a portion of a readout tape showing

an example of the printing operation resulting from operations of the counter and timer;

FIGS. 3 and 4 show different operations of a certain relay switch of the device which is shown in normal position in FIG. 5;

FIG. 5 is a diagrammatic view of the counter-timer-printer and readout mechanisms to show the operation thereof and includes an electric circuit for the electrical components of the device, the circuit being "OFF";

FIGS. 6 and 7 are views of a portion of FIG. 5 showing a certain relay switch in different positions of operation;

FIG. 8 is an electro-diagrammatic view of the device showing the circuit simplified for ease of electrical tracing as compared to that shown in FIG. 5, the circuit being "OFF";

FIG. 9 is a similar electrical diagram showing the positions of the components when the current is "ON";

FIG. 10 is a similar electrical diagram showing the positions of the components when a "COUNT" operation is initiated; and

FIG. 11 is a similar electrical diagram showing the positions of the components when a "PRINT" operation is initiated.

On the accompanying drawings we have used the reference numeral **10** to indicate a housing for a counter-timer-printer, the timer comprising a unit indicated generally at T and the counter-printer and readout mechanism comprising another unit indicated generally at A. The housing **10** has a hinged section **12** which can be opened for access to the mechanism within the housing and a hinged cover **14** for the exposed portions of the timer and counter-printer and readout mechanism and for a main switch MS and a selector switch SS. A readout tape is shown at **16** issuing from the mechanism A. A hasp **18–20** is provided for a padlock to lock the cover **14** closed when unauthorized admission to the mechanism is undesirable.

Referring to FIG. 5 the timer T comprises a timer motor TM and electro-magnetic coils acting as timer relays and identified T1 and T2. The coil T2 also actuates a clutch as will hereinafter appear. Timer relay switches $T1^1$, $T1^2$, $T1^3$, $T2^1$ and $T2^2$ are actuated by the respective coils T1 and T2.

Setting and actuating mechanism for the timer T comprises a setting knob **22** which can be manipulated to set a pointer **23** at selected graduations along a scale **24**. The setting knob **22** sets a stop **26** for a traveller **28** which is biased toward the left so that a head on its right-hand end is normally stopped by the stop **26**. The timer motor TM has a counterclockwise rotating rotor **30** for driving the traveller **28** in the right-hand direction whenever a clutch roller **32** is engaged therewith by reason of energization of the coil T2. The traveller will thereupon move in a right-hand direction until it engages a latch **34** for releasing the switch $T2^2$ as will hereinafter appear. We find a Microflex reset timer suitable for our purpose as it has a vernier type dual setting dial arrangement with coarse and fine reading scales 24^a and 24^b as shown in FIG. 1 and pointers 23^a and 23^b readable thereagainst. The dial combination illustrated can be set for time periods as small as nine seconds.

Upward movement of the clutch roller **32** results through a pivoted lever **36** in downward movement of the left-hand end of the switch $T2^2$ about a pivot axis such as a shaft **38**. The normally open switch $T2^2$ is thereupon closed as shown in FIG. 3. The switch $T2^1$ is actuated simultaneously with the switch $T2^2$ by both being connected to the shaft **38**. Subsequently when the latch **34** is swung toward the right as in FIG. 4, by reason of the traveller **28** timing out, the switch $T2^2$ is unlatched

and assumes the open position shown in this figure. The switch $T2^1$ is also actuated in a similar manner by reason of a similar latch **34a**, the latches **34** and **34a** being interconnected as shown at **40**.

The timer coil **T1**, when energized, actuates the switches $T1^1$ and $T1^2$ through an armature **42** as illustrated in FIGS. 5, 6 and 7. As long as the coil is de-energized, the switch $T1^1$ is closed and the switch $T1^2$ is open as shown in FIG. 5. When the coil is energized, $T1^1$ opens as in FIG. 6 before $T1^2$ closes. FIG. 7 shows the final position of the switches $T1^2$ closed and $T1^1$ open.

The armature **42** of the coil **T1** also actuates the switch $T1^3$ which is provided with a pneumatic time delay mechanism such as a piston **44** in a cylinder **46**, a check valve **48** being provided to permit rapid movement in the left-hand direction and a needle valve **50** being provided to permit only slow movement in the right-hand direction to thereby provide a time delay period for closure of the switch $T1^3$ upon de-energization of the coil **T1**. The needle valve may be adjusted to secure the desired time delay period.

FIG. 5 also shows a main switch MS. It also shows a rectifier R, a selector switch SS and certain associated machine switches **M1**, **M2**, etc., in block diagram, FIGS. 8 to 11 showing them in accordance with the necessary electric circuitry, the latter having terminals **65** and **67**.

FIG. 5 also shows the counter mechanism and the printer mechanism for readout purposes, the counter mechanism comprising a count coil C for actuating a ratchet wheel **52** to effect rotation of counter dials **54** which in turn rotate type rollers **55** in a well known manner. The printer comprises a print coil P for actuating an anvil **56** to cause a printed impression on the tape **16**. Energization of the print coil P also effects tape advance as by means of a ratchet **58** for rotating a drive roller **60**, the tape being backed by an idler roller **62**. A suitable unit for this purpose is a Sodeco impulse totalizing counter.

Current supply wires **64** and **66** are shown for supplying a suitable current to operate our counter-timer-printer device such as the usual 110 volt A.C. current. Referring to FIG. 8, the electrical symbol for the rectifier R is illustrated and a caapcitor **68** is shown for smoothing out the pulsating D.C. current. The output supply wires of the rectifier are indicated + and — in the usual manner. A "manual print" switch MP is shown shunting the contacts $T1^1$ and the selector switch SS is illustrated as a plurality of contacts **70** to be selectively engaged by a contact blade **72** to select which one of a plurality of machine switches (such as M3 in FIG. 9) is to actuate the the counter-timer-printer device.

When the main switch MS is open as in FIG. 8 (OFF), no current is flowing through any of the circuits and accordingly all five of the coils shown are de-energized which is indicated by showing them in dotted lines.

To start a monitor operation, the selector switch SS is adjusted to the desired machine such as M3 as shown in FIG. 9 (ON) and the main switch MS is then closed whereupon the first circuit that is established is through the closed contacts $T1^3$ and the coil T2 (see FIG. 8), and the rectifier R is energized. The energization of T2 closes the switches $T2^1$ and $T2^2$ as in FIG. 9, $T2^1$ serving as a holding switch for T2, and $T2^2$ serving to energize the timer motor TM and the coil T1. Energization of the coil T1 opens the switch $T1^1$ so it is ready to be closed when T1 is later de-energized, and closes the switch $T1^2$ so as to enable a count operation when one of the machine switches closes. Energization of the coil T1 also opens the switch $T1^3$ for subsequent de-energization of the coil T2 upon opening of the switch $T2^1$. The time period for which the timer T is set is now running and any operations that are counted before a printing operation effect rotation of the counter dials **54**.

FIG. 10 (PRINT) shows the operation upon closure of the machine switch M3 which would be installed at machine No. 3. This energizes the count coil C through a circuit from the + side of the direct current supply through the switch $T1^2$ which is closed to enable the count, the selector switch SS, the machine switch M3 and the coil C back to the — side of the circuit. If the machine operates four cycles during the timing period, the counter dials **54** will show this and the print rollers **55**, upon the printing operation occurring, will print the numbers showing on the dials. The printing means includes the usual inked ribbon **17** (FIG. 5).

FIG. 11 (PRINT and RECYCLE TIMER) illustrates the printing operation as well as the automatic recycling of the timer. When the time period times out, the latches **34** and **34a** will be actuated mechanically by the traveller **28** to open the switches $T2^1$ and $T2^2$. The opening of $T2^1$ de-energizes the coil T2 (since the switch $T1^3$ has not yet reclosed because of the time delay indicated "TD") and this renders the clutch inoperable by electro-magnetically releasing the clutch roller **32** so that the bias of the traveller **28** will return the traveller to the stopped position shown in FIG. 5. This also resets the switches $T2^1$ and $T2^2$ as in FIG. 5. Opening of the switch $T2^2$ de-energizes the timing motor TM and the timer coil T1. De-energization of the coil T1 opens the switch $T1^2$ before the switch $T1^1$ closes thereby eliminating any possibility of counting while printing inasmuch as a "PRINT" operation is sometimes coincident with a "COUNT" operation. De-energization of the coil T1 also causes reclosing of the switch $T1^3$ after the time delay period determined by the setting of the pneumatic timer **44–46–48–50** has expired which time delay period is sufficient to permit the traveller **28** to return to stopped position even though the knob **22** is adjusted to the full length of the scale **24**. Thereupon re-energization of the coil T2 closes the switches $T2^1$ and $T2^2$ and reengages the clutch roller **32** with the traveller **28**, the circuit thereupon being re-established for restarting the timing period as in FIG. 9. The switches M1, M2, M3, etc., are so designed and so set with respect to the cycling element of the machine which operates them that they stay closed long enough to effect a count operation after the print operation recloses the switch $T1^2$.

As long as the main switch MS remains closed, the counting will continue (provided, of course, the selector switch is set to some machine switch, and whether or not that machine is operating), the printer will operate to produce the readout tape **16** and the timer T will recycle. Referring to the tape **16** shown in FIG. 2, for instance, a group *a* of indicia indicates the printed totals for a machine that had been cycling three times each time period for which the timer was set. Next the operator made a note on the tape that he was selecting machine No. 3 and setting the timer for ten second periods at 10:45 on July 30, 1964. He zeroed the counter dials **54**, the usual zeroing button **74**, FIG. 1 being provided for that purpose, and then started monitoring machine No. 3. Two cycles occurred in the first time period and after that four cycles each time period occurred indicated in the group *b*. Then for forty seconds no cycles occurred (group *c*) following which group *d* indicates four cycles every ten seconds of machine operation.

Thus, we have provided a production monitor device which is particularly adaptable for monitoring a number of machines from a remote central point. For example, estimated production may call for 2,000 pieces per hour or a total of 16,000 pieces per day; but machine operator and tooling have been improved so that the machine can produce 3,000 pieces per hour or 24,000 per day. However, the operator, in lagging through the day, may turn in a production of only 16,500 pieces. Now if the time study analyst monitors the machine and selects a ten minute printed count of this machine for a full days production, he would have before him an actual record at the end of the day as to the number of pieces produced per

minute. He would also have a record of the number of pieces going into inventory.

Developing this example further, if the rate is 2,000 pieces per hour, the machine would have to produce 33 pieces per minute, or 330 pieces for the first ten minutes. Now, let us suppose the operator starts at 8:00 a.m.; at 8:10 the monitor would print 330 pieces; at 8:30, the monitor would print 990 pieces, and so on, for every ten minutes of the day.

Now let us assume the operator works continuously in the morning; and in the afternoon slows down for some reason. The monitor would indicate such a condition. If the machie is capable of producing 3,000 pieces per hour, the monitor would print 500 pieces for every ten minutes; or at 12:00 Noon, 10,000 pieces. If at 4:30 p.m., the count is 16,500 pieces, this indicates a let-down in the afternoon.

In checking the printed tape, the time study analyst will be able to tell at what time or times the machine has stopped production because the monitor will reprint the same count number every ten minutes, or will show a let-down in production per minute; that is, less than fifty pieces per minute. An account must be made for the missing 7,500 pieces of production or a little more than two and a half hours of lost time.

Our device is also beneficial to attain maximum tool life or minimum tool breakage. It does a job that no time study analyst could ever accomplish; without it that is, an operator's own actual printed record. When used in conjunction with a computer, it can be an mportant function for immediate stock control. It also has unlimited fields as to recording linear measurement, liquid flow measure, weight, and the like by substituting suitable impulse generators responsive thereto in place of limit switches responsive to cyclical movement of a machine element.

From the foregoing specification it will be obvious that we have provided a counter-timer-printer suitable for production monitoring and capable of producing a visual readout record of permanent character and of considerable use to time study analysis, production managers inventory, clerks and the like. Its operation is simple and versatile and permits the individual monitoring of a number of machines by providing a monitoring unit for each, or the monitoring of a number of machines from one monitoring unit having a selector switch for selecting the desired machine to be monitored. The device accomplishes the objects contemplated and obviously certain changes may be made in the construction and arrangement of the parts of our counter-timer-printer without departing from the real spirit and purpose of our invention. It is, accordingly, our invention to cover by our claims any

modified forms of structure or use of mechanical equivalents which may reasonably be included within their scope.

We claim as our invention:

1. In a counter-time-printer device, a recycling timer having means to set the same for a predetermined time period, a counter-printer having counting dials, printing rollers driven thereby, a readout tape and printing means, a first electrically operated means to actuate said counting dials and printing rollers including an impulse generator responsive to machine cycles, a second electrically operated means to actuate said printing means in response to expiration of the time period for which said timer is set, an electrically actuated clutch which automatically disengages upon expiration of the time period for which said timer is set to effect the recycling of said timer, a switch which is effective when closed to energize the circuit for said timer, said electrically actuated clutch being effective to close said switch, a latch to normally hold said switch in closed position, and means to release said latch in response to expiration of the time period.

2. In a counter-time-printer device, a timer having means to set the same for a predetermined time period, said timer including an electric timing motor and a clutch, a counter-printer having counting dials, printing rollers driven thereby, a readout tape and printing means, a first electrically operated means to actuate said counting dials and printing rollers including an impulse generator responsive to machine cycles, a second electrically operated means to actuate said printing means comprising an actuating element and drive means therefor comprising said electric timing motor and said clutch operable in response to expiration of the time period for which said timer is set to energize said second electrically operated means and de-energize said electric timing motor and said clutch, means to recycle said timer which is effective to return an actuating element thereof from zero setting to the timer setting, a switch to re-energize the timer after such return and means to delay the closing of said switch to permit full return before re-energization.

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