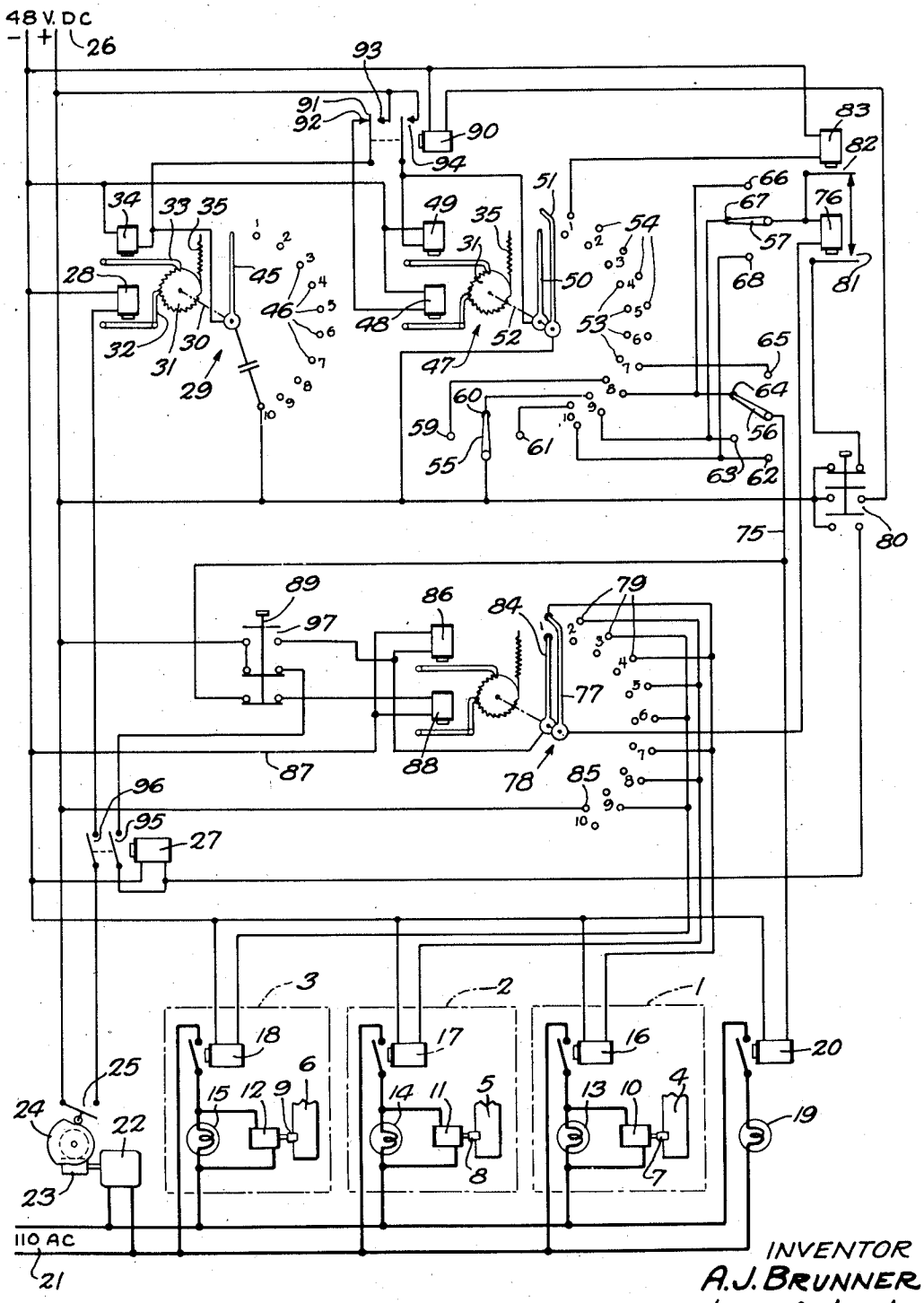
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TIMING APPARATUS

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INVENTOR
A. J. BRUNNER
BY Harry L. Duft
ATTORNEY

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TIMING APPARATUS

Anton J. Brunner, Congress Park, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

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This invention relates to timers and more particularly to a timing apparatus common to a plurality of signalling devices.

It is an object of the present invention to provide a simple and inexpensive apparatus for accurately timing operations.

In accordance with one embodiment of the invention, a central timing device is provided for transmitting signal impulses at selected intervals and a transfer mechanism operable under control of an impulse from the central timing device transfers signal impulses from the central timing device to a plurality of signal receiving stations or time interval indicating devices in automatic succession, whereby the plurality of signal receiving stations or interval indicating devices require only a single timing device.

A complete understanding of the invention may be had by reference to the accompanying drawing, wherein the single figure represents diagrammatically a timing apparatus illustrative of one embodiment of the invention.

In the drawing, three signal receiving stations 1, 2 and 3 are shown and these stations may comprise stations at which molding presses may be located for operation under control of an operator. Portions of the molding presses are indicated by the reference numerals 4, 5 and 6, which may be some portion of the press adapted to be locked by solenoid actuated plungers 7, 8 and 9, respectively.

In the embodiment of the invention disclosed herein, these plungers are operated under control of solenoids 10, 11 and 12 connected in parallel with electric lamps 13, 14 and 15, respectively. The lamps 13, 14 and 15 may be of any suitable color, for example, green, and the lighting of these lamps indicates that the cycle of operation of the molding presses has been completed due to the lapsing of a preselected length of time. The circuit to the solenoids 10, 11 and 12 and their associated lamps 13, 14 and 15 may be closed by the energization of relays 16, 17 and 18, respectively, connected in the separate circuits. In addition to the green lamps 13, 14 and 15 provided for each of the molding presses under control of a single operator, a warning lamp is provided in the form of an electric lamp 19, which may be colored red to distinguish it from the other lights. Current for energizing solenoids 10, 11 and 12 and supplying lighting current to the lamps 13, 14, 15 and 19 may be supplied through the contacts of the relays 16, 17, 18 and a relay 20, respectively, associated with the three green lamps and the lamp 19. The current supply for these lamps and the solenoids is supplied from a 110 volt A. C. source 21, which also supplies energizing current to a synchronous motor 22, which, through suitable gearing 23, drives a pulsing cam 24 at a selected rate, for example, one revolution per second, thereby to close a pair of pulsing contacts 25 once each second. The pulsing contacts 25 are connected in one side of a line leading to a 48 volt D. C. source 26 and, upon energization of a relay 27, will serve to transmit pulses to a driving electromagnet 28 of a telephone type stepper switch, designated generally by the numeral 29. The mechanical details of this switch may be of any suitable construction, wherein a brush supporting shaft 30, having a brush or brushes thereon, has fixed to it a driving ratchet 31 having associated therewith a pair of pawls 32 and 33. The pawl 32 is pivoted on the armature of the driving electromagnet 28 and the pawl 33 is attached to the armature of a release electromagnet 34. The ratchet 31 has a return spring 35 attached to it so that when the electromagnet 34 is energized, the spring 35 will return the ratchet 31 to normal position, as shown wherein brush 45 is not in engagement with any of its associated contacts 46.

The stepper switch 29 has a single brush 45 mounted upon its shaft 30 for sequentially engaging a series of ten contacts 46—46, and, together with a second stepper switch 47 and associated connections, comprises the signal transmitting portion of the apparatus. The stepper switch 47 has a driving electromagnet 48, a release electromagnet 49 similar to the electromagnets 28 and 34, respectively, but unlike the stepper switch 29, the switch 47 is provided with a pair of brushes 50 and 51 mounted upon its shaft 52 and adapted to simultaneously engage two series of ten contacts 53—53 and 54—54, respectively.

In the embodiment of the invention disclosed herein, the signal transmitting portion of the apparatus may be set to transmit signals to the receiving stations 1, 2 and 3 sequentially at intervals of 80, 90 and 100 seconds and it will then restore itself to normal position. The selection of the time interval at which signals will be transmitted to the receiving stations may be controlled by setting three switch arms 55, 56 and 57. The switch arm 55 may be set to engage any one of three contacts 59, 60 or 61, the switch arm 56 may be set to engage any one of four contacts 62, 63, 64 or 65, and the switch arm 57 may be set to engage any one of three contacts 66, 67 or 68. The switch arm 55 is connected directly

to the positive side of the 48 volt D. C. line 26 and the contacts 59, 60 and 61 are connected to the 8th, 9th and 10th contacts on the series of ten contacts 53 associated with stepper switch brush 50. Since the stepper switch brush 50 is connected directly to one side of the winding of the release electromagnet 49, the brush 50, upon contacting the contact 53, which has been connected to the positive side of the 48 volt line through switch arm 55, will supply current to energize the release electromagnet 49, which has the other side of its winding connected directly to the negative side of the 48 volt line 26, thus to restore the selector switch 47, as will be described more in detail in connection with the description of the operation of the apparatus. The contacts 62, 63, 64 and 65 associated with switch arm 56 are connected to the 10th, 9th, 8th and 7th of the series of contacts 54 and thus, when brush 51, which is connected to the positive side of the 48 volt line 26, contacts the contact in the series of contacts 54, which is connected at that time to the switch arm 56, current will be supplied to a line 75. The purpose of this supply of current to the line 75 will be described more in detail hereinafter.

The contacts 66, 67 and 68 are connected in parallel with the contacts 64, 63 and 62 to the 8th, 9th and 10th contacts 54 associated with brush 51. When the brush 51 engages one of the contacts 54, which has been connected to the switch arm 57, current will be supplied to energize a relay 76, which is connected in series with a brush 77 of a stepper switch, designated generally by the numeral 78, in the transfer portion of the apparatus. The brush 77 is adapted to sequentially contact a series of contacts 79—79 connected to one side of the winding of the relays 16, 17 and 18, the other side of the windings of which is connected to the negative side of the 48 volt line 26. Thus, when brush 51 encounters a contact 54 which is engaged by switch arm 57, current will be supplied from the positive side of the 48 volt line 26 through brush 51, switch arm 57, serially through the winding of relay 76, brush 77, one of the contacts 79, one of the relays 16, 17 or 18, depending upon the position of brush 77, and back to the negative side of the 48 volt line 26 to selectively energize one of the relays 16, 17 or 18 and to energize relay 76. When relay 76 is energized, it will lock up over a locking circuit extending from the positive side of the 48 volt line 26 through normally closed contacts of a start switch 80, through the armature of relay 76, and through a contact 81 of the relay 76 to normally closed contacts 82 of a relay 83. The normally closed contact of relay 83 is connected to the lead between the winding of the relay 76 and the switch arm 57, whereby, when the relay 76 is energized, it will lock up until relay 83 is operated. Relay 83 has one side of its winding connected to the negative side of the 48 volt line 26 and has the other side of its winding connected to the first contact of the series of contacts 54 associated with the brush 51.

The stepper switch 78, which forms a part of the transfer mechanism, is similar to the stepper switch 47, except whereas the brushes of the switch 47 return to a normal position where they are out of contact with any of the contacts 53 or 54, switch 78, in its return to normal position, engages its brush 77 and a brush 84 with the first contacts associated with them. Only one of the contacts associated with the brush 84, that is, contact 85, is an active contact and engagement of the contact 85 by the brush 84 will effect a resetting of the stepper switch 78 to the normal position, as shown, by completing a circuit from the positive side of the 48 volt line 26 through contact 85, brush 84, to one side of the winding of a release electromagnet 86, similar to the release electromagnets 34 and 49 and having the other side of its winding connected through a lead 84 to the negative side of the 48 volt line 26. A driving electromagnet 88 of the stepper switch 78 is also connected to the negative side of the 48 volt line 26 by means of the lead 87 and has the other side of its windings connected through normally closed contacts of a reset switch 89 to the lead 75.

In addition to the normally closed contacts which connect the contacts 81 of relay 76 to the positive side of the 48 volt line 26, the start switch 80 is provided with two pairs of normally open contacts. One of these sets of contacts serves to connect the positive side of the 48 volt line 26 with one side of the winding of a restoring relay 90, the other side of the winding of which is connected permanently to the negative side of the 48 volt line 26. Energization of the relay 90 serves to transfer an armature 91 from contact with a contact 92 and into engagement with a contact 93 and also serves to close a pair of contacts 94 to effect the restoration of the system to a normal condition, as will be described in connection with the operation of the apparatus.

The remaining pair of contacts of start switch 80, upon operation of the switch, will connect the positive side of the 48 volt line to one side of the winding of relay 27, the other side of the winding of which is permanently connected to the negative line of the 48 volt line. Upon energization, relay 27 will lock up over a circuit through its right hand make contacts 95 and a pair of normally closed contacts of reset switch 89 to the positive side of the 48 volt line. Energization of relay 27 will also serve to close a pair of contacts 96 to connect pulsing contacts 25 to one side of the winding of electromagnet 28, thereby to initiate operation of the apparatus.

The reset switch 89 has one set of contacts in addition to those previously described and this set of contacts, designated 97, upon closure, will serve to connect the positive side of the 26 volt line to release electromagnet 86 to energize it and restore the stepper switch 78 to its normal position.

In the operation of the apparatus, the switch arms 55, 56 and 57 may be set on their respective contacts to control the time cycle of the apparatus, that is, to control the time at which signals will be transmitted by the impulse transmitting portion of the apparatus to the transfer portion of the apparatus, and, as will be obvious, the length of time elapsing between the transmission of a signal to one of the signal-receiving stations will be three times as much as the time setting of the switch arms 55, 56 and 57 since the transfer portion of the apparatus will transfer the signals to the signal-receiving stations in sequence. As shown in the drawing, the apparatus is set to transmit a signal to each signal-receiving station and to unlock the molding press at that station every 4½ minutes. This is accomplished by so arranging the switch arms 55, 56 and 57 that the impulse transmitting portion of the apparatus will send out impulses to the transfer mechanism every 90 seconds. With the switch arms 55, 56 and 57 in the positions shown, operation of the start switch 80 will break the locking circuit to the relay 76, which had been previously com-

pleted, by breaking the circuit to the contacts 81. This operation is accomplished by the upper of the three sets of contacts of switch 80. The middle of the three sets of contacts at the start switch 80 will close a circuit to energize relay 90 and when relay 90 pulls up, it will transfer armature 91 from engagement with contact 92 to engagement with contact 93. When armature 91 leaves contact 92, the circuit path from brush 45 to driving electromagnet 48 will be broken and, therefore, no pulse may be transmitted to the electromagnet 48. When armature 91 engages contact 93, release electromagnet 34 will be energized over a circuit from the positive side of the 48 volt line 26 through the winding of the electromagnet and back to the negative side of the 48 volt line. Closure of the contacts 94 at relay 90 will close a circuit from a positive side of the 48 volt line through the winding of the release electromagnet 49 and back to the negative side of the line. Operation of the two release electromagnets 34 and 49 will permit the springs 35 associated with the ratchets 31 to return the shafts 30 and 52 to their normal position, thus to carry the brushes 45, 50 and 51 out of engagement with all of their associated contacts. The apparatus will thus be prepared to start a series of timing cycles and if it be assumed that the reset switch 89 had previously been operated, the brushes 77 and 84 of the stepper switch 78 would be on the first contact of their associated rows of contacts.

The third pair of contacts of the start switch 80 will supply current to energize relay 27 over a path from the positive side of the 48 volt line 26 through the closed contacts of switch 80 and through the winding of the relay 27 back to the negative side of the 48 volt line. As soon as relay 27 pulls up, it will lock up over a circuit from the positive side of the 48 volt line 26 through the middle contacts of reset switch 89, contacts 95 of relay 27, winding of the relay and back to the negative side of the 48 volt line. If it be assumed that the power is supplied to the 110 volt A. C. line 21, the synchronous motor 22 will be operating and the pulsing cam 24 will be closing once each second to transmit impulses at the rate of one per second to the driving electromagnet 28 of stepper switch 29. Therefore, upon release of start switch 80, stepper switch 29 will thus move its brush 45 successively into engagement with the contacts 46 at the rate of one step per second and this operation will continue until the brush 45 contacts the tenth contact 46 at which time current will be supplied from the positive side of the 48 volt D. C. line 26 through the tenth contact 46, brush 45 to the release electromagnet 34 and in parallel through armature 91 and contact 92 of relay 90, through the windings of the driving electromagnet 48 and then back to the negative side of the 48 volt line. In this manner, brush 45 will be restored to normal position out of engagement with any of the contacts 46 and one pulse will be transmitted to the driving electromagnet 48 to cause the stepping of brushes 50 and 51 into engagement with the first contact of their associated banks of contacts 53 and 54. As brush 51 engages its first contact 54, current will be supplied from the 48 volt line 26 through the brush in engagement with its first contact to energize relay 83, thus to break the locking circuit to relay 76 if necessary.

Since the brush 45 will step forward one contact each time a pulse is transmitted to the driving magnet 28, ten seconds will elapse in the interval between the transmission of pulses to the driving electromagnet 48 and thus the pair of brushes 50 and 51 will step one step each ten seconds. After the lapse of 80 seconds, brush 51 will engage its 8th contact 54 to connect the positive side of 48 volt D. C. line 26 through the brush and switch arm 56 to energize the electromagnet 86 and cause brushes 77 and 74 to step into engagement with the second contact of their associated banks of contacts. Simultaneously, current will be supplied over lead 75 to energize relay 20, which will close its contacts and cause electric lamp 19 to be lighted. Since the brushes 50 and 51 remain in contact with the 8th set of contacts on the bank of contacts for ten seconds, lamp 19 will be held lighted for ten seconds to give a warning to the operator in charge of the three molding presses 4, 5 and 6 that one of the presses will need attention within the next ten seconds. Accordingly, the operator may prepare to perform those operations necessary at the presses and since the brush 77 is in engagement with the second contact 79 and will remain in engagement therewith until driving electromagnet 88 is energized the second time, relay 17 will be connected to brush 77 and will be connected in series with relay 76. After ten seconds more have elapsed, making a total lapse of time of 90 seconds, brush 51 will engage the 9th contact 54 and will direct current from the positive side of the 48 volt line 26 through brush 51, switch arm 57, relay 76, brush 77, second contact 79 and relay 17, back to the negative side of the 48 volt line. This will cause relay 17 and relay 76 to be energized. When relay 76 is energized, it will lock up over the normally closed contacts 82 of relay 83 and contacts of starting switch 80 to hold relay 17 and relay 76 operated. When relay 76 operates, the closure of its contacts will effect the lighting of lamp 14 and the energization of solenoid 11 to release the plunger 8 and permit the operator to operate molding press 5.

Simultaneously with the engagement of the 9th contact 54 by brush 51, brush 50 will engage the 9th contact 53, thereby to complete a circuit from the positive side of the 48 volt line 26 through switch arm 55, 9th contact 54, brush 50 to energize release electromagnet 49, thus to restore stepper switch 47 to normal position as shown. The brush 51, in moving back to normal position, will pass over the first contact 54 but will not engage it for a sufficient length of time to energize the relay 83 and thus the locking circuit for relay 76 will not be broken during the return movement of the brush 51. Immediately upon the return of the brushes 50 and 51 to their normal position, a new cycle of operation of stepper switch 47 will be initiated and ten seconds after brush 51 engaged the 9th contact 54, a pulse will be transmitted by brush 45 to driving electromagnet 48, whereupon brushes 50 and 51 will be stepped into engagement with the first of their contacts. When brush 51 engages its first contact, relay 83 will be energized to break the locking circuit for relay 76, thus releasing not only relay 76 but also relay 17. The cycle of the stepper switch 47 will be repeated in the manner described hereinbefore until brush 51 engages its 8th contact, at which time another pulse will be transmitted to the driving electromagnet 88 of stepper switch 78 to step brushes 77 and 84 into engagement with their third contacts. When

brush 77 strikes the third contact 78, it will connect relay 18 in series with relay 76 preparatory to the operation of these two relays after ten seconds more elapse and lamp 19 will be lighted due to the energization of relay 20 in parallel with driving electromagnet 88. In this manner, 90 seconds will elapse between the operations of relay 20 and between the time at which relay 17 and relay 18 operate.

The cycles of the stepper switch 47 and the stepper switch 29 will be repeated automatically and the relays 16, 17 and 18 will be operated in sequence at 90 second intervals, making a total of 4½ minutes between operations of any single one of the relays. These cycles will continue until brush 77 is stepped off of its 9th contact 79 and when this occurs, brush 84 will engage contact 85 to operate release electromagnet 86 and restore brush 84 to engagement with its first contact in position to control the operation of relay 16 the next time brush 51 engages its 9th contact.

It will be understood that in the operation of the apparatus the cycles of the three molding presses, portions of which are shown at 4, 5 and 6, will be 4½ minutes and that the warning lamp 19 will be lighted ten seconds before the latching plunger of any one of the molding presses is released and that ten seconds after the lamp is lighted, one of the lamps 13, 14 or 15 will light to indicate to the operator which press needs to be reloaded. Any time it is desired to discontinue using the timing apparatus, switch 89 may be operated to break the locking circuit for relay 37 and restore stepper switch 78 to normal. The stepper switches 29 and 47 will remain in an off-normal position until the start switch 80 is operated to restore these switches to their normal position at the initiation of a series of timing cycles.

What is claimed is:

1. A timing apparatus comprising a pulse generator, a circuit, a contact making means actuated by generated pulses from the pulse generator for completing said circuit at selected intervals, a plurality of signal mechanisms, a signal device common to all of the signal mechanisms, a signal device common to all of the signal mechanisms, a signal device individual to each signal mechanism, a switching means for connecting the contact making means to the signal devices individual to the signal mechanisms, and means interconnecting the contact making means and switching means for periodically operating the switching means and the signal device common to all of the signal mechanisms.

2. In a timing apparatus, a first switching device settable to establish a circuit connection at selected intervals, a plurality of indicators, a second switching device for connecting the first swtiching device to the indicators in a predetermined cyclic order, and means under control of the first switching device for completing a circuit to operate the second switching device.

3. In a timing apparatus, a contact making device settable to complete circuits at selected intervals, a plurality of indicators, a stepper switch actuatable for connecting said indicators sequentially to the contact making device, and means interconnecting the contact making device and stepper switch for supplying actuating current to the stepper switch at the selected intervals.

4. In a timing apparatus, a contact making device settable to complete circuits at selected intervals, a plurality of indicators, a stepper switch actuatable for connecting said indicators sequentially to the contact making device, a signal device common to all of said indicators, and means interconnecting the contact making device and stepper switch for supplying actuating current to the stepper switch at the selected intervals and to the signal device common to the indicators.

5. A timing apparatus common to a plurality of signalling devices comprising a signal device common to said plurality of signal devices, a transferring stepper switch connected in parallel with said common signal device and operable step by step to prepare said plurality of signal devices for operation in a predetermined sequence, and a switching device settable to complete a circuit to actuate the common signal device and stepper switch at selected intervals.

6. In a timer, a plurality of time interval indicating means, a circuit, an impulsing device running at a predetermined speed to close said circuit at predetermined intervals, a second circuit, means responsive to a predetermined number of closures of said first-mentioned circuit for closing said second circuit at longer time intervals, means responsive to a predetermined number of closures of said second circuit for actuating the time interval indicating means, and transfer means actuated by said last mentioned means for selecting one of the plurality of time interval indicating means for actuation.

7. In a timer, a plurality of time interval indicating means, an impulsing device running at a predetermined speed to produce impulses at predetermined intervals, means responsive to a predetermined number of said impulses for producing an impulse at longer time intervals, means responsive to a predetermined number of said impulses of longer time intervals for actuating the time interval indicating means, transfer means actuated by said last mentioned means for selecting one of the plurality of time interval indicating means for actuation, and a warning signal device operable under control of the means responsive to longer time intervals a predetermined time prior to the operation of each time interval indicating means.

8. In a timer, a plurality of time interval indicating means, an impulsing device running at a predetermined speed to produce impulses at predetermined intervals, means responsive to a predetermined number of said impulses for producing an impulse at longer time intervals, means responsive to a predetermined number of said impulses of longer time intervals for actuating the time interval indicating means, transfer means actuated by said last-mentioned means for selecting one of the plurality of time interval indicating means for actuation, and means operable by said means for producing impulses at longer time intervals for initiating a new cycle of operation of said means for actuating the time interval indicating means.

9. In a timer for a plurality of processing devices, a plurality of signal devices, one associated with each processing device, a warning device common to said signal devices, an impulse generating device for generating impulses at a predetermined frequency, a circuit, means responsive to a predetermined number of said impulses for completing said circuit, a second circuit, means responsive to a predetermined number of operations of said first-mentioned means for completing said second circuit, means in said second circuit for rendering said warning device operative, and means under control of the sec-

ond mentioned means for rendering a signal device operative.

10. In a timer for a plurality of processing devices, a plurality of signal devices, one associated with each processing device, a warning device common to said signal devices, an impulse generating device for generating impulses at a predetermined frequency, a circuit, means responsive to a predetermined number of said impulses for completing said circuit, a second circuit, means responsive to a predetermined number of operations of said first mentioned means for completing said second circuit, a switch in said second circuit settable to select said predetermined number of impulses, means in said second circuit for rendering said warning device operative, and means under control of the second mentioned means for rendering a signal device operative.

11. In a timer for a plurality of processing devices, a plurality of signal devices, one associated with each processing device, a warning device common to said signal devices, an impulse generating device for generating impulses at a predetermined frequency, a circuit, means responsive to a predetermined number of said impulses for completing said circuit, a second circuit, means responsive to a predetermined number of operations of said first mentioned means for completing said second circuit, means in said second circuit for rendering said warning device operative, and a branch circuit forming a part of said second circuit for actuating a signal device.

ANTON J. BRUNNER.