An apparatus for accumulating the time spent by individual workers on a job comprising a source of periodic electric timing pulses and worker assigned time accumulator units connected in circuit with the source of periodic timing pulses. Each of the time accumulator units includes an electrical counter for counting the periodic timing pulses and a normally closed switch requiring a separable actuator to open the switch. A worker when not on a job will insert a worker assigned separable actuating device in the normally closed switch to open the switch and stop the counter from counting the periodic timing pulses. When the worker goes on a job, the separable actuator is removed from the normally closed switch to permit the switch to close and the counter to resume counting the periodic timing pulses while the worker is on the job. Plural time accumulator units may be connected in parallel circuits to receive the electric pulses from the source of periodic electric timing pulses in accordance with the requirements for workers on a job, there being one time accumulator unit for each worker on the job within the capabilities of the apparatus. The apparatus includes a box-like housing having a display panel, the front face of which has a plurality of similar display areas, each display area having a worker's identification, an indicator for the worker's accumulated time on a job and an aperture through which the worker inserts a separable actuator to open the normally closed switch located behind the display panel of the particular worker's time accumulator unit.

12 Claims, 5 Drawing Figures
This invention relates to apparatus for accumulating the time spent on a job by one or more workers.

The apparatus disclosed herein is to be used in conjunction with the Cost Accumulator and Method for Cost Accumulating disclosed in the co-pending patent application Ser. No. 2,693, filed Jan. 14, 1970 in the names of Charles F. Strandberg, Jr. and Robert C. Strandberg and assigned to the same assignees as the present application.

In the cost accumulator disclosed in the aforesaid co-pending patent application each worker on a job is assigned a rate programmed resistance plug the resistance value of which is calibrated in accordance with a particular worker's pay scale.

The cost accumulator comprises an electric oscillator whose frequency is a function of the resistance value of a resistance-capacitance timing circuit which includes parallel connected jacks into which the worker's rate programmed plugs are inserted when the workers are on a job and from which the plugs are removed when the workers go off a job. The frequency of the electrical oscillator is varied as the workers, one or more at various times, plug-in and withdraw their rate programmed plugs from the cost accumulator. Means provided within the cost accumulator for producing electrical pulses corresponding in frequency to the output frequency of the electrical oscillator, and additional means is provided for counting the pulses and giving an indication of the number of pulses counted. Since the oscillator frequency varies as a function of the composite pay rate of all the workers on a job at a given instant, the accumulated count over a period of time can be made to be an indication of the accumulated cost of the job as the job progresses.

It is an object of the present invention to provide a time accumulator which will accumulate the time which individual workers (one or more) spend on a given job using the same rate programmed plugs provided for use with the aforementioned cost accumulator to control the time accumulator to start and stop the accumulation of time the worker spends on a job. By requiring the same worker-assigned plug actuator to stop the time accumulator as is required to set into the cost accumulator a worker's pay rate, the two machines can be made to complement each other.

It is another object of this invention to provide a time accumulator which is controlled by a worker-assigned plug adapted to be plugged in and out of the time accumulator to start the accumulation of time when the worker assigned plug is withdrawn and to stop the accumulation of time when the plug is reinserted into the time accumulator.

It is another object of this invention to provide a system for substantially simultaneously counting labor cost on a job and accumulating individual worker's time on the same job, comprising an electrical cost accumulator, an electrical time accumulator and a rate programmed plug assigned to each worker on the job, each plug including an electrical resistance element set to a predetermined value corresponding to a worker's pay scale, the cost accumulator and the time accumulator both being controlled by the rate programmed plugs, in diverse ways, said time accumulator having plural means of actuated by the insertion of one of the worker's rate programmed plugs into a receptacle in said time accumulator for stopping the time accumulating function of said time accumulator for the particular worker, and actuated by the withdrawal of the rate programmed plug from said receptacle to start the time accumulating function of the time accumulator, said cost accumulator having plural receptacles for receiving at a given time one or more of said rate programmed plugs as the workers remove their assigned plugs from the time accumulator, said cost accumulator having means controlled by the rate programmed plugs to vary the accumulation of labor costs as a function of the composite rate of all the rate programmed plugs which are plugged into said cost accumulator at a given instant.

FIG. 1 is a perspective view of the time accumulator of this invention looking toward the display face thereof with one worker's plug in a jack and another plug about to be inserted into a jack, and with a cost accumulator mounted on top of the time accumulator;

FIG. 2 is a fragmentary front elevational view on an enlarged scale showing one display area of the display face of the invention;

FIG. 3 is an enlarged side elevational view of one of the plugs shown in FIG. 1;

FIG. 4 is a schematic wiring diagram of the invention showing two similar individual worker's time accumulator units with circuits for adding other similar individual workers' time accumulator units broken away; and

FIG. 5 is a schematic circuit diagram of one of the rate programmed plugs.

Referring now to the drawings in detail and particularly to FIG. 1 the time accumulator is designated by the reference number 90 and includes a box-like housing 11, one wall of which is a display panel 12. The display panel 12 has an exterior display face which includes a plurality of similar display areas A, B, C within the boundaries of the display face. One of the display areas is better shown by means of an enlarged view in FIG. 2. Within a display area are located a channel shaped receptacle 13 for receiving a worker's name tag, an indicator lamp 14 for indicating when energized that a worker is on the job, a viewing window 15 for viewing the numeral indicators 16 of an electrical counter, a counter reset dial 17, a plug receiving jack 18, and a time card receiving slot 19. FIG. 1 shows one of the assigned worker's plugs 20 positioned in one of the jacks 18 in the display area B and a second worker's plug in line with, but removed from, the jack 18 in the display area A. While FIG. 1 shows only three display areas on the face of the cost accumulator it is to be understood that as many display areas and associated components may be provided as necessary to accommodate the anticipated number of workers on a job within, of course, practical limits of available space. The display areas are all similar and include similar component associated therewith. While the display areas are shown arranged in a single transverse row of the display panel in FIG. 1, it should be recognized that the display areas can be variously arranged in multiple rows and columns to cover the face of the display panel depending on the number of display areas required to accommodate the workers on the job.

FIG. 4 is an electrical schematic diagram showing the components of the invention required to accumulate and indicate the time accumulated by two workers on a job. While only the components necessary for two workers are shown in FIG. 4, similar components for any desired number of workers within practical limits can be readily added as will be subsequently explained.

The time accumulator includes a synchronous timing motor 28 which is energized continuously via power leads 25 and 26 from an A-C power source connected to the terminal strip 27 as shown in the lower left of FIG. 4. The synchronous motor speed is preferably chosen to be 100 revolutions per hour, or one revolution every 36 seconds. A rotary cam 29 attached to the shaft 29' of the motor normally open switch 31 momentarily during each revolution by engaging the pivoted lever arm 30 and forcing the lever arm clockwise to depress the outwardly biased switch actuator button 32. The normally open switch 31 and associated synchronous motor driven cam 29 provide a means for producing a periodic timing pulse representative of a predetermined increment of time. The periodic switch 31 is connected on one side to power lead 26 via conductor 36 and power branch conductor 37 and is con-
conected on its other side to circuit conductor 38. The circuit conductor 36, the power branch conductor 37 and another power branch conductor 39 connected to power line 25 serve as d-c links to the circuit conductor unit 30 connected. Each time accumulator unit includes an electrical counter 33, and a normally closed telephone jack type switch 34 connected in series across the circuit conductor 38 and the power line branch conductor 39. Each time accumulator unit also includes an electrical indicator means 35 which preferably includes a panel lamp 14, and a series resistor 43, connected on one side through conductor 36 to the power branch line 37 and on the opposite side through conductor 41, the normally closed switch 34, and conductor 42 to the power branch line 39.

The telephone jack type switch 34 preferably includes a single-throw set of contacts a and a double-throw set of contacts a,b,c. The movable contacts b and d of the two sets of contacts are interconnected by an insulated rod 44 so as to be actuated simultaneously when a worker assigned separable actuating device such as the rate programmed plug 20 is inserted in the jack receptacle ring 18'. A V-shaped bend projecting downwardly from the free end of the movable contact d is positioned with respect to the axis of the receptacle ring 18' so as to be engaged by the end 21 of the plug 20 and displaced outwardly from the axis of the receptacle ring 18'. As shown in FIG. 4 the switch 34 in unit A is closed, while the switch 34 in unit B is held open by a plug 20B inserted in the jack 18. The contacts a and c of the switch 34 are fixed contacts, alternately engaged by the movable contact b in the closed and open positions of the switch respectively. The contact b is connected through conductor 41 to one side of the counter solenoid coil 33' and through conductor 40 connecting the other side of the counter coil 31' to the circuit conductor 38. Normally when no plug is inserted in the jack 18 the movable contacts b and d are resiliently biased to engage the fixed contacts c and e respectively. The V-shaped bend (which will be referred to as a detent) on the contact d will engage the annular groove 20B in the plug shank 22 when the plug is fully inserted in the receptacle 18' and frictionally hold the plug in place. Contact c is connected through conductor 42 to the power line branch conductor 39. Movable contact d and the metal jack ring 18' are both connected to ground, and the fixed contact e is connected via conductor 46 to a terminal on the bus bar 27 which may be connected through appropriate wiring to a remote lamp 47.

If the rate plug 20B is not inserted in the jack 18, the condition of switch 34 will be as shown in unit A (FIG. 4) and the panel lamp 14 will be continuously energized from the A-C source through the normally closed contacts b,c of the switch 34. Through these same contacts b,c the counter coil 33' will be momentarily energized each time the periodic switch 31 is actuated by the cam 29 attached to the shaft of the synchronous motor 28. An optional remote lamp terminal 47 will be grounded through the contacts d and e of the switch 34. The remote lamp may serve to show which employees are working.

If the rate plug 20B is inserted in the jack 18 (the condition shown in unit B, FIG. 4) both sets b,c and d,e of normally closed contacts in switch 34 will open and no power will be delivered to the panel lamp 14 and the counter coil 33'. Since the metal jack ring 18' and the movable contact d are grounded at all times both the body 22 and tip 21 of the plug are grounded while in the jack 18 thereby eliminating any electrical hazard.

The operation of the time accumulator will be apparent from the foregoing description. As long as the time accumulator is connected to A-C power through leads 25 and 26 the synchronous motor 28 will be energized, and will rotate cam 29 at a uniform speed to repeatedly open and close switch 31. Since the time accumulator 30 is connected through the periodic switch 31 to power branch conductor 37 electrical pulses will be available to any number of accumulator units connected in closed circuit from the circuit conductor 38 to the other power branch conductor 39. Each accumulator unit including a counter coil 33' in circuit with normally closed contacts b,c of the switch 34, will be energized to count the pulses appearing on the circuit conductor unit 30 connected. As long as a rate plug 20 is not inserted in the jack 18, and the panel lamps 14 being connected directly from the power branch conductor 37 through the closed contacts b,c of the switch 34 to the other power branch conductor 39 will be energized. As previously explained the normally closed condition of switch 34 is the condition when the rate plug is not inserted in the jack 18 and is the condition when the worker is on the job, the rate plug 20 having been removed from the jack 18. When the worker goes off the job he reinserts the plug 20 in the jack 18, the switch 34 is opened, the panel light 14 goes off and the counter 33 ceases to count.

Whenever a job is completed or at the end of a payroll period a job supervisor can reset the time accumulator units to zero by means of the counter reset dial 17. The counters 33 should be reset only with the plugs 20 for each worker plugged in. The counters 33 indicate hours to the one-hundredth of an hour.

The time accumulator panel 12 may optionally be furnished with slots 19 to hold time cards on which the daily ascending balance of time worked can be entered.

The separable actuator 20 is sometimes referred to as a plug, rate plug, or rate programmed plug, is shown in detail in FIGS. 3 and 5. It may be the same plug 24 as is disclosed and described in co-pending application Ser. No. 2,693 previously referred to, and must be similar to the rate programmed plug 24 disclosed in the aforesaid pending application if it is to be used in conjunction with the cost accumulator disclosed in the aforesaid application. FIG. 5 shows schematically the electrical circuit arrangement of one of the plugs 20 which includes a calibrated resistance means connected in circuit between the conductive shank body 22 of the plug 20 on one side and the conductive tip 21 on the other side. The calibrated resistance means includes a potentiometer 50 and fixed resistor 51 connected in series. The resistance means is selected and calibrated to be a function of the pay rate of the worker to whom the plug is assigned. The tip 21 and the body portion 22 of the plug shank are electrically separated by an insulator portion which may be in the groove 23.

Again referring to FIG. 1, a cost accumulator which is described in detail in the aforesaid application Ser. No. 2,693 is shown positioned on top of the time accumulator housing. While the cost accumulator does not have to be mounted on top of the time accumulator the two devices should be located in close proximity if they are to be used in conjunction with another so that when a worker pulls his plug 20 from the time accumulator he can immediately insert his plug in one of the jacks J of the cost accumulator. Or, when the worker pulls his plug from the cost accumulator he can immediately insert his plug in his assigned time accumulator unit in the time accumulator. The rate programmed plug 20 when inserted in one of the cost accumulator jack J provides an input of the worker's pay rate into the cost accumulator.

While the time accumulator particularly described in this specification has been described as part of a system including a cost accumulator and a rate programmed plug which serves both the time accumulator and the cost accumulator, it is not intended that the use of the time accumulator be limited to such a system. The time accumulator may readily be used as a separate time accumulating device, requiring only a separable actuator for controlling the switch 34.

What is claimed is:

1. Apparatus for accumulating the time a worker is on a job comprising (a) an electric power source, (b) means for producing a periodic electric timing pulse representative of a predetermined increment of time, (c) an electrical counter means in circuit with the periodic pulse generating means for counting said periodic pulses, (d) normally closed switch means in circuit with said periodic pulse producing means and said counter means for connecting and disconnecting said
periodic pulse producing means and said counter to said electric power source, said normally closed switch means requiring a separable actuating device to open said switch and (e) a worker assigned separable actuating device which is normally applied by the worker to open said normally closed switch means when the worker stops working, and is withdrawn by the worker from said normally closed switch means when the worker goes on a job to permit said normally closed switch means to close and said counter to count the periodic pulses produced by said periodic pulse producing means during the time said separable actuating device is withdrawn.

2. The apparatus set forth in claim 1 together with an electric indicator means connected in circuit with said power source and said normally closed switch to be energized when said normally closed switch is closed and said counter is counting for indicating when a worker is on the job.

3. The apparatus set forth in claim 1 wherein said periodic timing pulse producing means comprises a periodic switch, and motor actuated means for opening and closing said periodic switch in a continuous manner.

4. The apparatus set forth in claim 1 wherein there are plural electrically actuated counters and plural normally closed switch means, there being one counter and one normally closed switch means in multiple parallel branches and each of said branches being serially connected with said periodic timing pulse producing means and said electric power source.

5. The apparatus set forth in claim 4 wherein there are plural electric indicator means for indicating which workers are on the job there being at least one indicator means for each normally closed switch means.

6. The apparatus set forth in claim 4 together with a box-like housing having one wall which is a display panel with front and rear faces, the front face of said display panel comprising a plurality of similar display areas within the confines of said display face, and there being mounted behind each display area within said housing, one of said plurality of counters, and one of said normally closed switches, each display area having means for viewing the counter mounted behind said display area and access means within the display area extending through said display panel for receiving said separable actuating device for opening said normally closed switch.

7. The apparatus set forth in claim 6 wherein there are plural electric indicator means corresponding in number to the number of said display areas, there being one electric-indicator means mounted within each of said display areas, each of said indicator means being connected in circuit with said power source and with the normally closed switch behind a corresponding display area to be energized when the normally closed switch behind a corresponding display area is closed for indicating when a worker assigned separable actuating device for said corresponding normally closed switch is withdrawn and said worker is presumed to be on the job.

8. The apparatus set forth in claim 7 together with a plurality of remote electrical indicator means which are located remotely from said housing there being at least one remote indicator for each of the electrical indicator means mounted in said housing, for presenting a remote indication corresponding with the indication of a particular indicator means in said housing.

9. The apparatus set forth in claim 1 wherein said normally closed switch means includes a receptacle for receiving said worker assigned separable actuating device, and means positioned within the receptacle for engaging said separable actuating device for opening said normally closed switch when said separable actuating device is inserted into said receptacle.

10. The apparatus set forth in claim 9 wherein the receptacle of said normally closed switch means includes means for grounding said separable actuating device.

11. Apparatus for accumulating the time a worker is on a job comprising (a) an electric power source, (b) means for producing a periodic electric timing pulse representative of a predetermined increment of time, (c) an electrical counter means in circuit with said periodic pulse producing means for counting said periodic pulses, (d) normally closed switch means in circuit with said periodic pulse producing means and said counter means for connecting and disconnecting said periodic pulse producing means and said counter to said electric power source, said normally closed switch means requiring a separable actuating device to open said switch and (e) a worker assigned separable actuating device which is normally applied by the worker to open said normally closed switch means when the worker stops working, and is withdrawn by the worker from said normally closed switch means when the worker goes on a job to permit said normally closed switch means to close and said counter to count the periodic pulses produced by said periodic pulse producing means during the time said separable actuating device is withdrawn, said normally closed switch means including a receptacle for receiving said worker assigned separable actuating device, and means positioned within the receptacle for engaging said separable actuating device for opening said normally closed switch when said separable actuating device is inserted into said receptacle, said separable actuating device being a plug-type plug including a handle portion and a shank projecting from said handle portion, and said receptacle having a complementally shaped opening for receiving said shank, said shank having a body portion and a tip end portion and an annular groove adjacent said tip end portion, and means positioned within said receptacle for engaging said separable actuating device having a resiliently biased projection for engaging said groove and frictionally holding said separable actuating device in said receptacle.

12. Apparatus for accumulating the time a worker is on a job comprising (a) an electric power source, (b) means for producing a periodic electric timing pulse representative of a predetermined increment of time, (c) an electrical counter means in circuit with said periodic pulse producing means for counting said periodic pulses, (d) normally closed switch means in circuit with said periodic pulse producing means and said counter means for connecting and disconnecting said periodic pulse producing means and said counter means for counting and disconnecting said periodic pulse producing means and said counter to said electric power source, said normally closed switch means requiring a separable actuating device to open said switch and (e) a worker assigned separable actuating device which is normally applied by the worker to open said normally closed switch means when the worker stops working, and is withdrawn by the worker from said normally closed switch means when the worker goes on a job to permit said normally closed switch means to close and said counter to count the periodic pulses produced by said periodic pulse producing means during the time said separable actuating device is withdrawn, said normally closed switch means including a receptacle for receiving said worker assigned separable actuating device, and means positioned within the receptacle for engaging said separable actuating device for opening said normally closed switch when said separable actuating device is inserted into said receptacle, said separable actuating device being a phone-type plug including a handle portion and a shank projecting from said handle portion, said receptacle having a complementally shaped opening for receiving said shank, said shank having a body portion and a tip end portion and an annular groove adjacent said tip end portion, and means positioned within said receptacle for engaging said separable actuating device having a resiliently biased projection for engaging said groove and frictionally holding said separable actuating device in said receptacle, said body portion of said shank and said tip being of electrically conductive material and being separated by an insulated portion, the handle portion of said plug being hollow and enclosing a calibrated electrical resistance means, and means connecting one side of said resistance means to said tip portion and means connecting the other side of said resistance means to said body portion.