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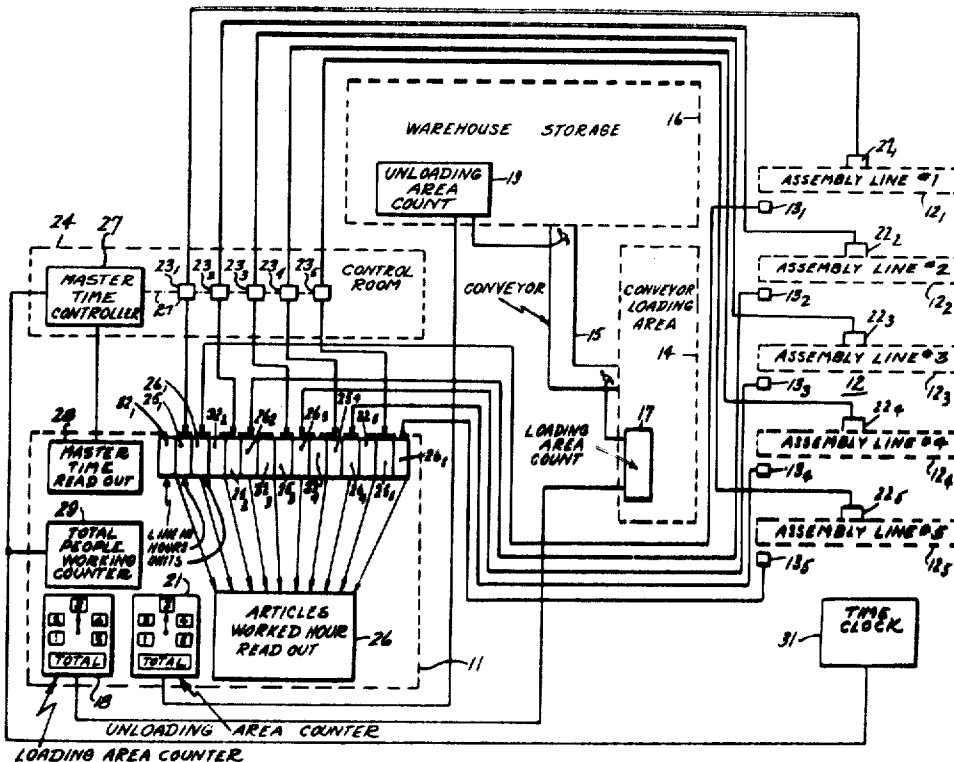
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[54] ARTICLE/TIME RECORDING SYSTEM
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198/40, 235/92 PD, 235/92 K, 328/59, 340/183
[51] Int. Cl. G06g 7/52,
G06f 15/24
[50] Field of Search 235/92,
151, 151.1, 179; 198/40; 340/172.5, 182, 183;
328/59, 60

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ABSTRACT: This specification describes an article/time/persons working recording system for manufacturing facilities which provides a central, continuously up-dated running account of all people hours worked in the manufacturing facility in a given interval of time, the number of people working and the number of articles produced. Additionally, if desired the recording system can identify the number of people working at a particular assembly line or other work stations together with the total number of hours being worked at that station or assembly line and the number of articles being produced by the assembly line in the given interval of time. With this information, an accurate and readily obtained up-to-date figure for the number of articles produced per work hour and/or the number of articles produced per person for the entire facility and/or any given assembly line, is instantaneously available for accounting purposes for anytime during or after a work day.



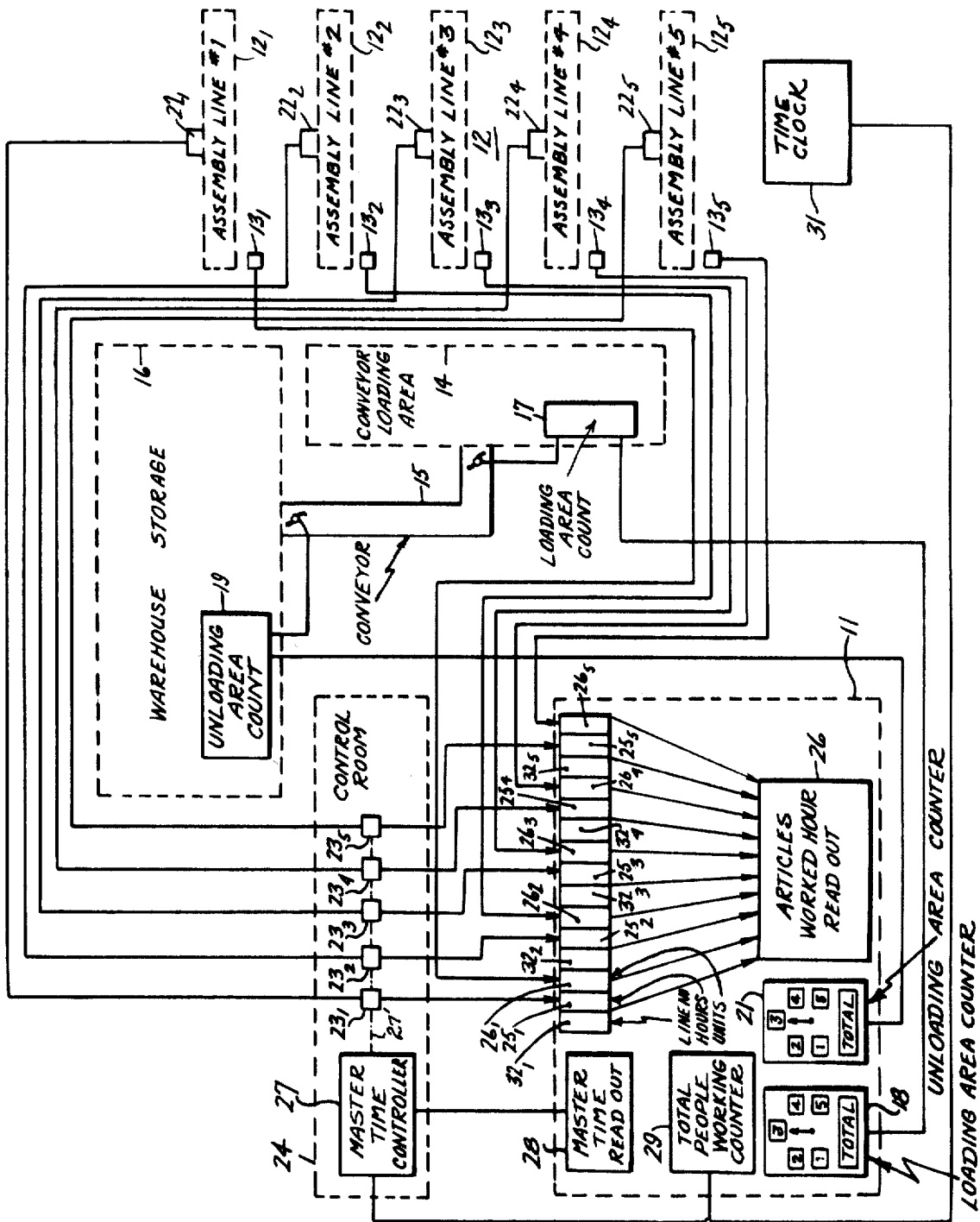
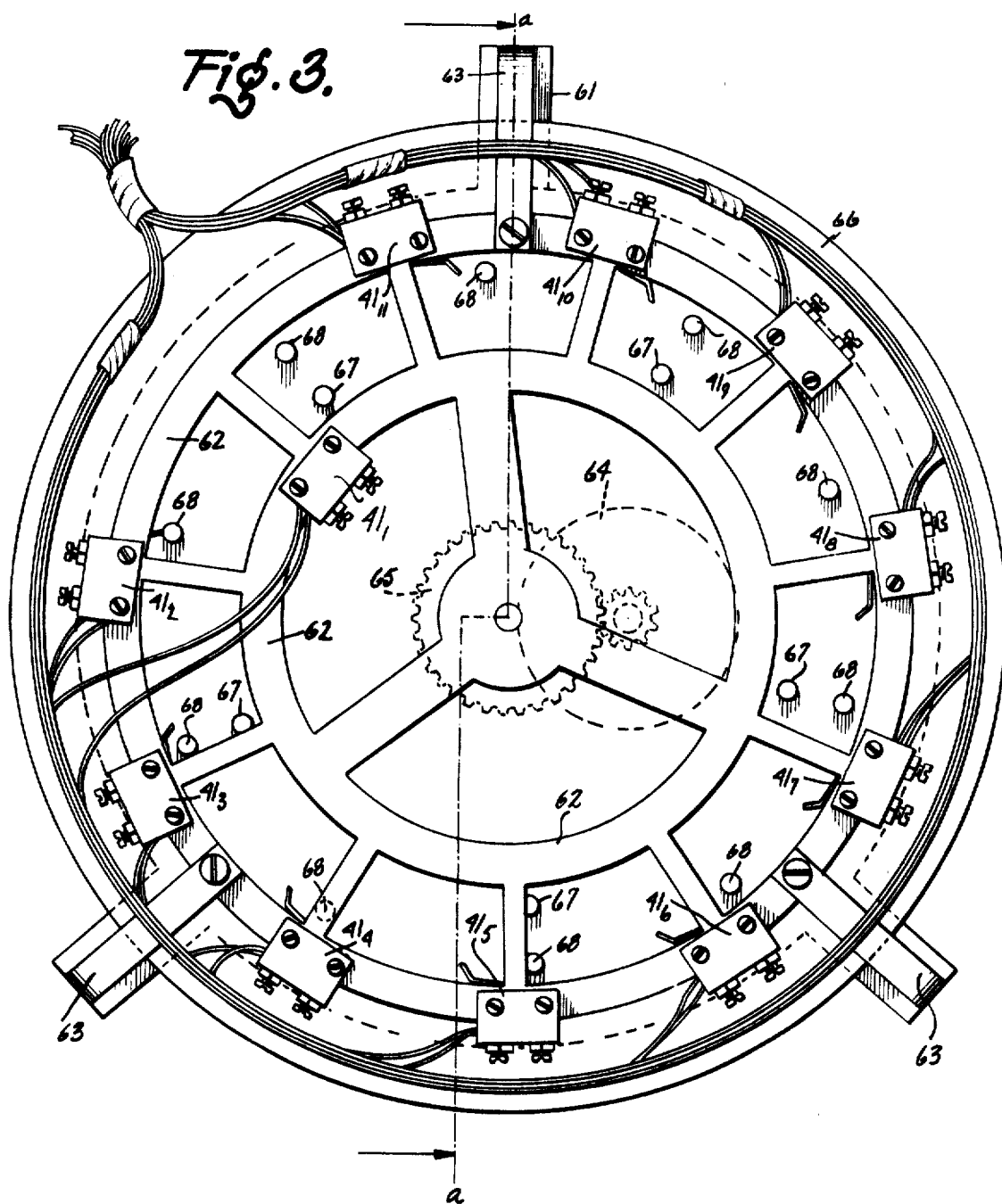


Fig. 1.

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Fig. 3A.

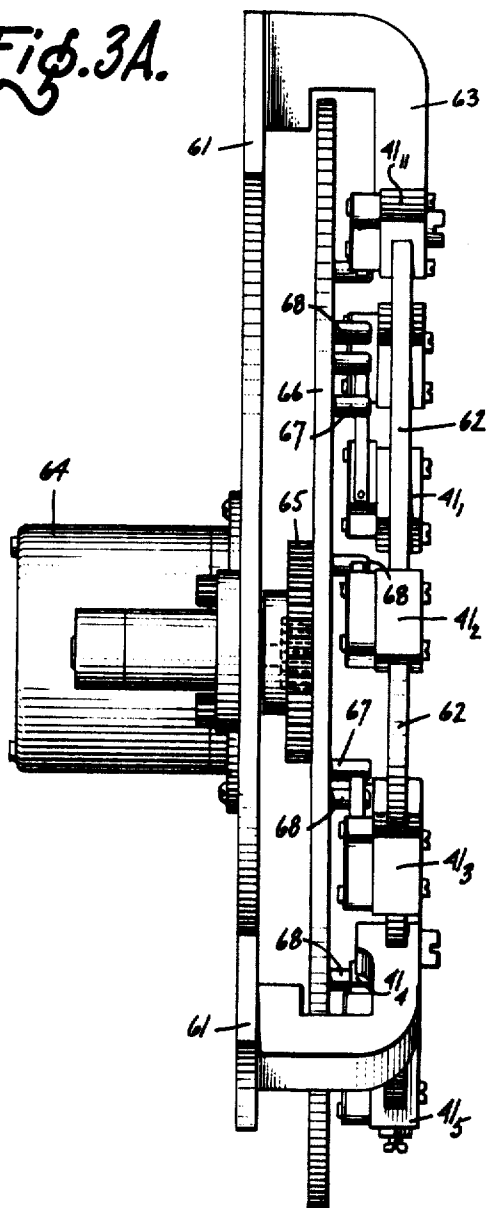
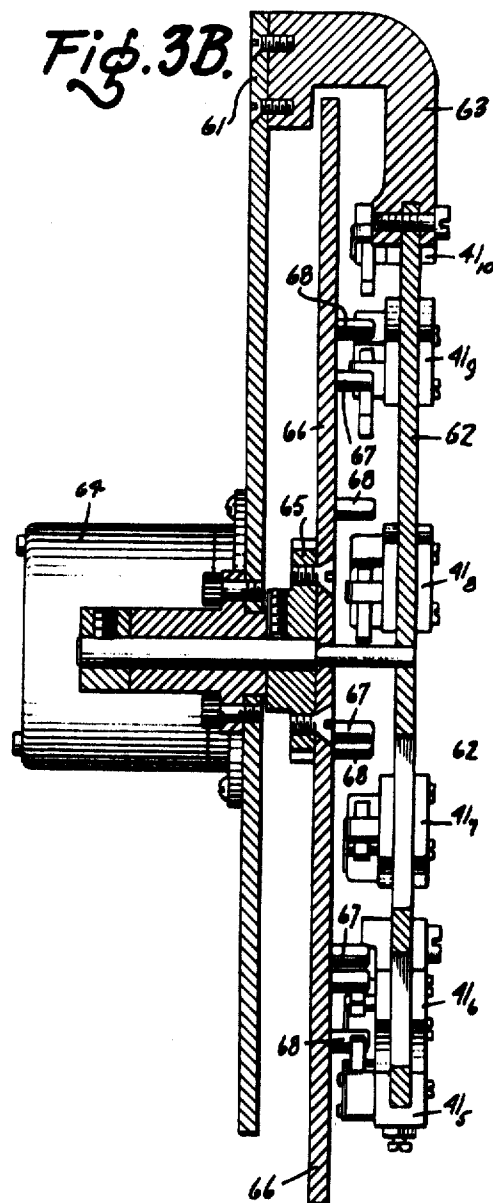
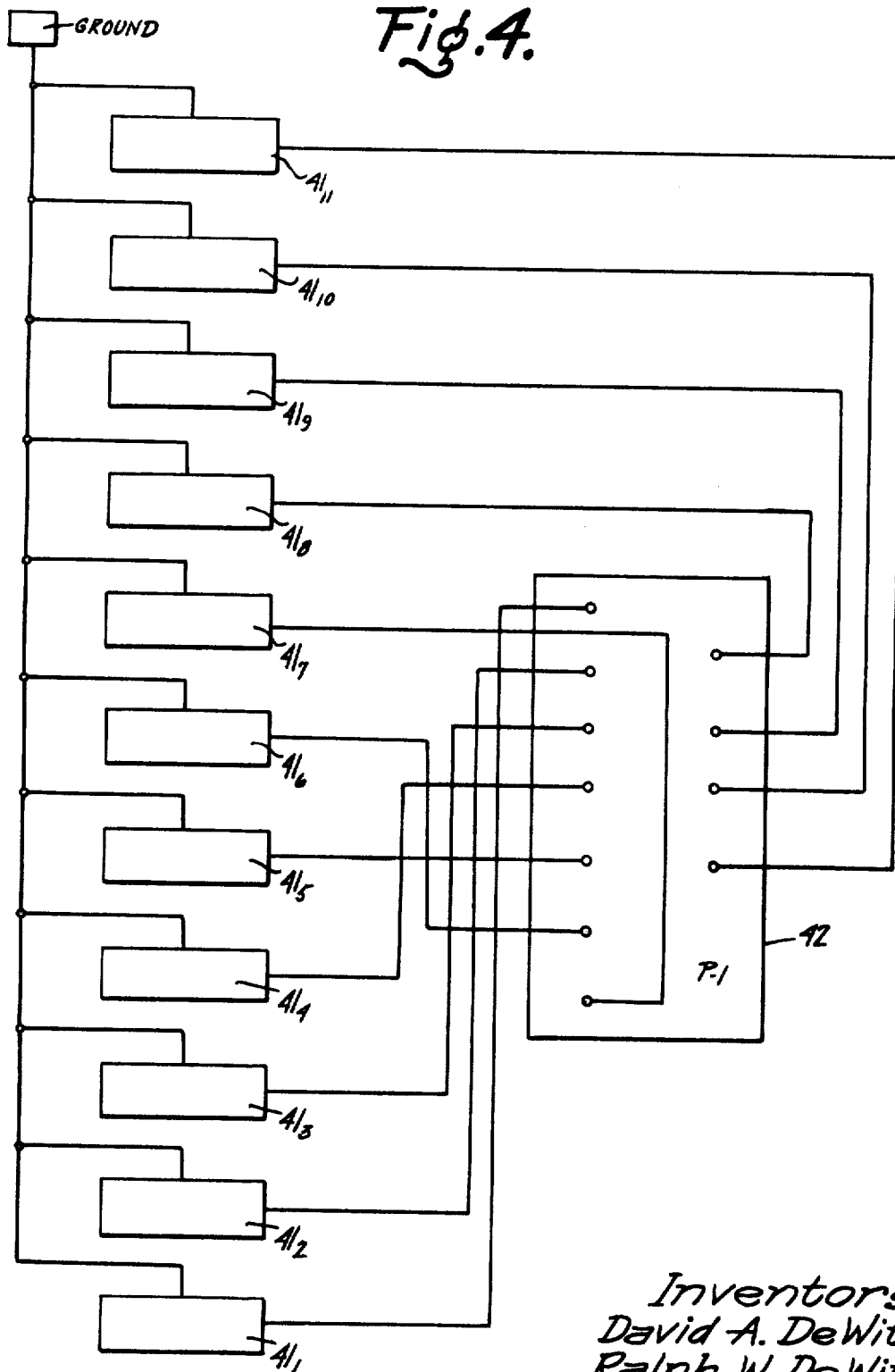


Fig. 3B.



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Fig. 4.

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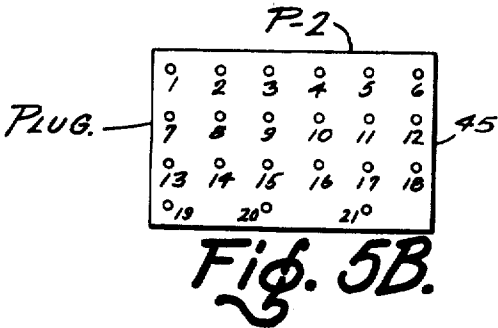
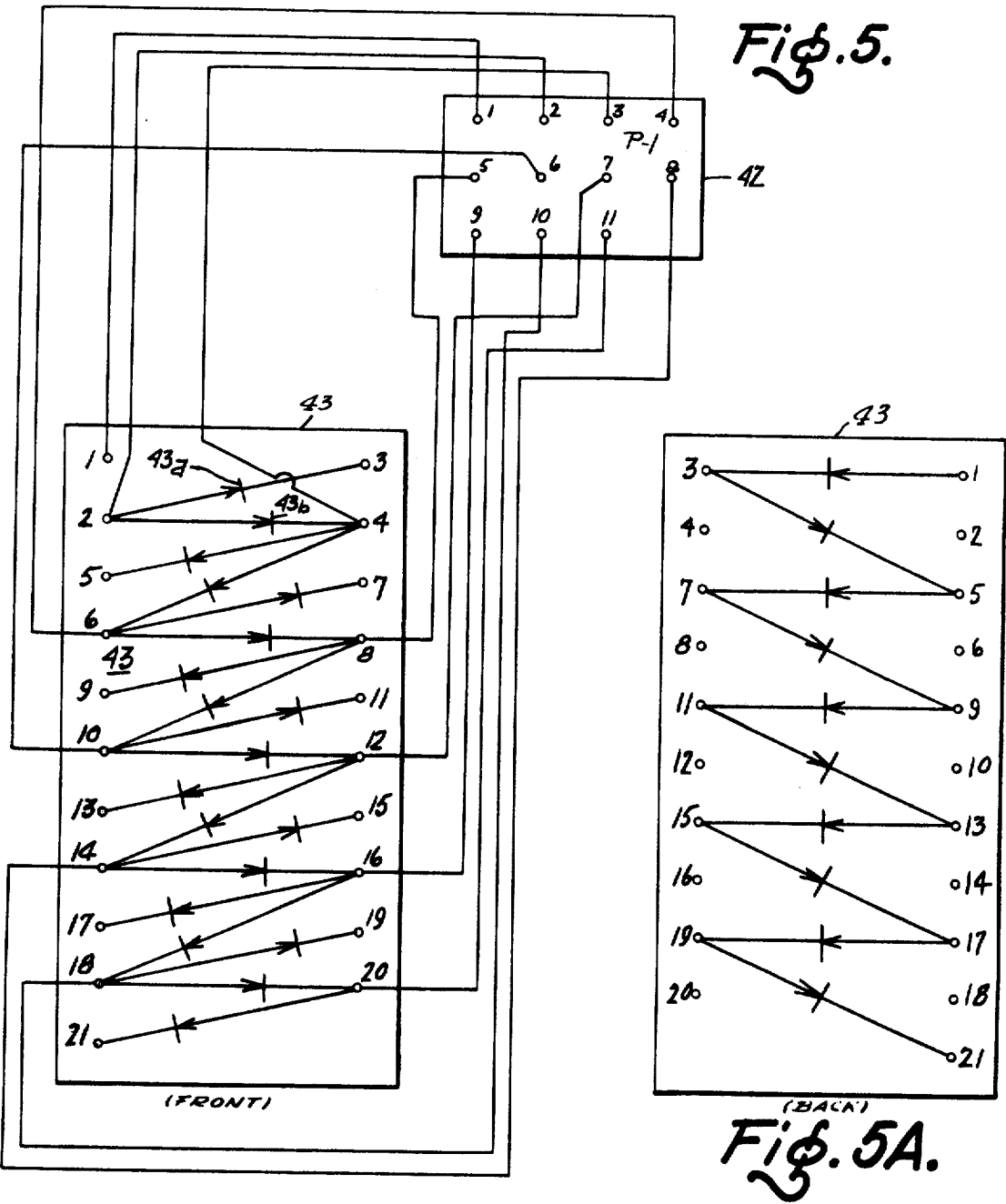


Fig. 6.

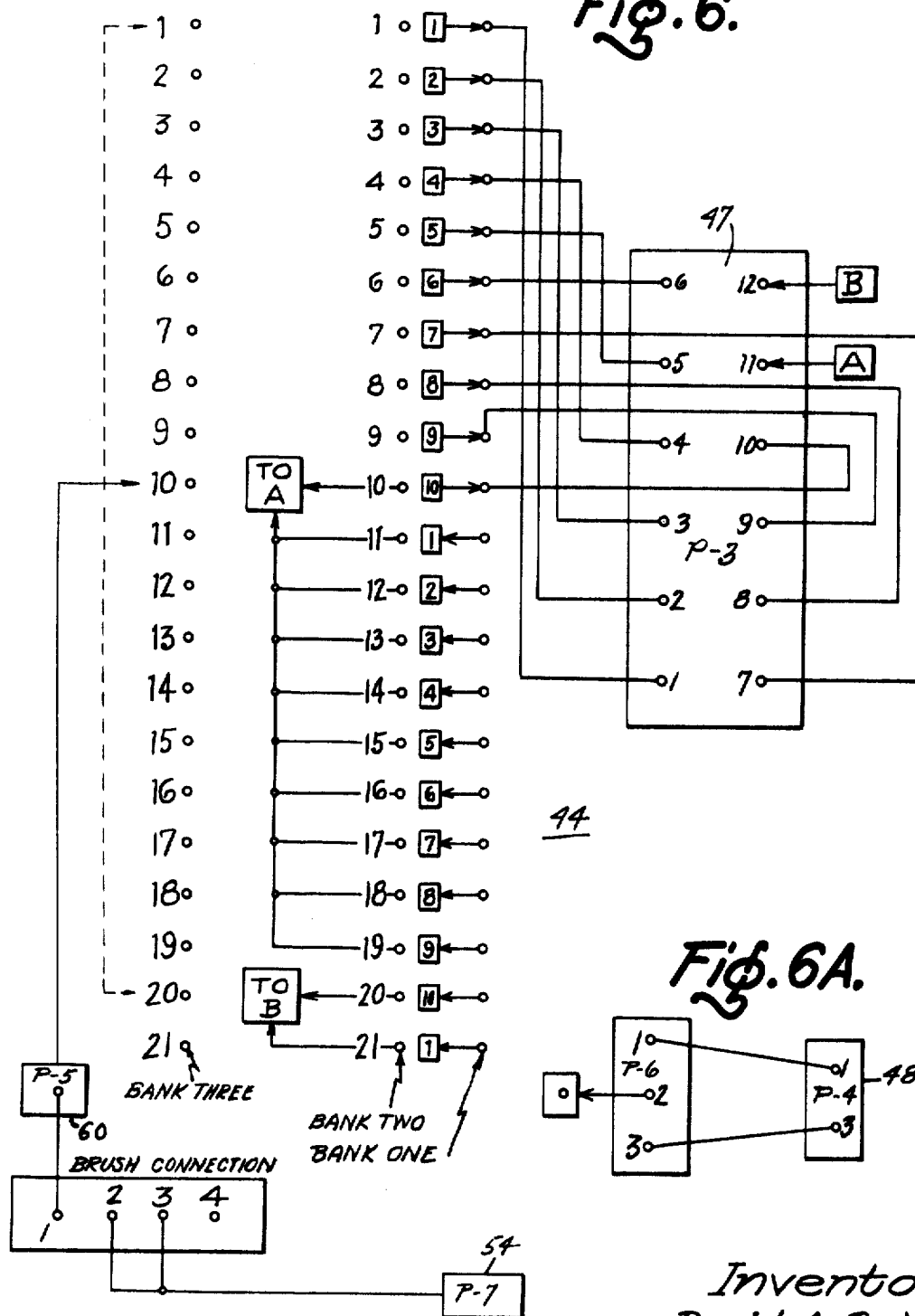
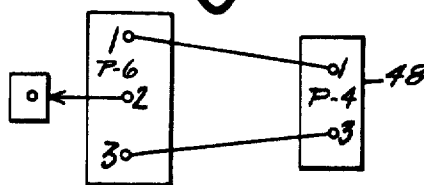


Fig. 6B.

Fig. 6A.



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Fig. 8.

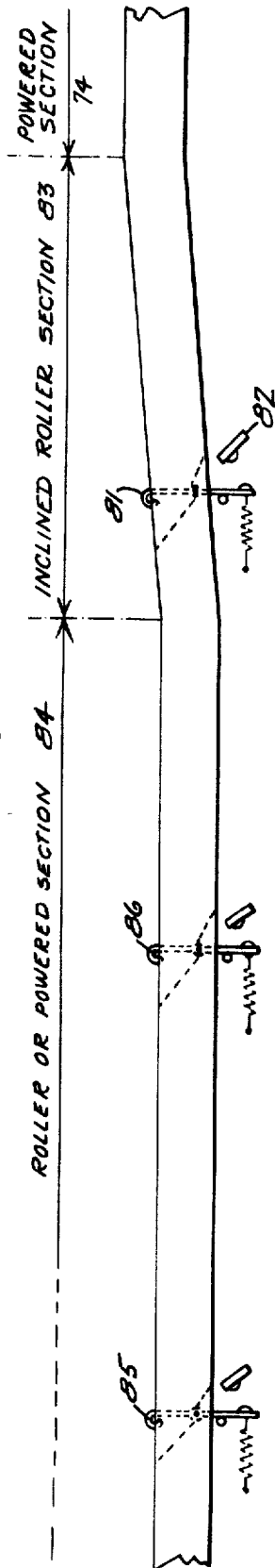
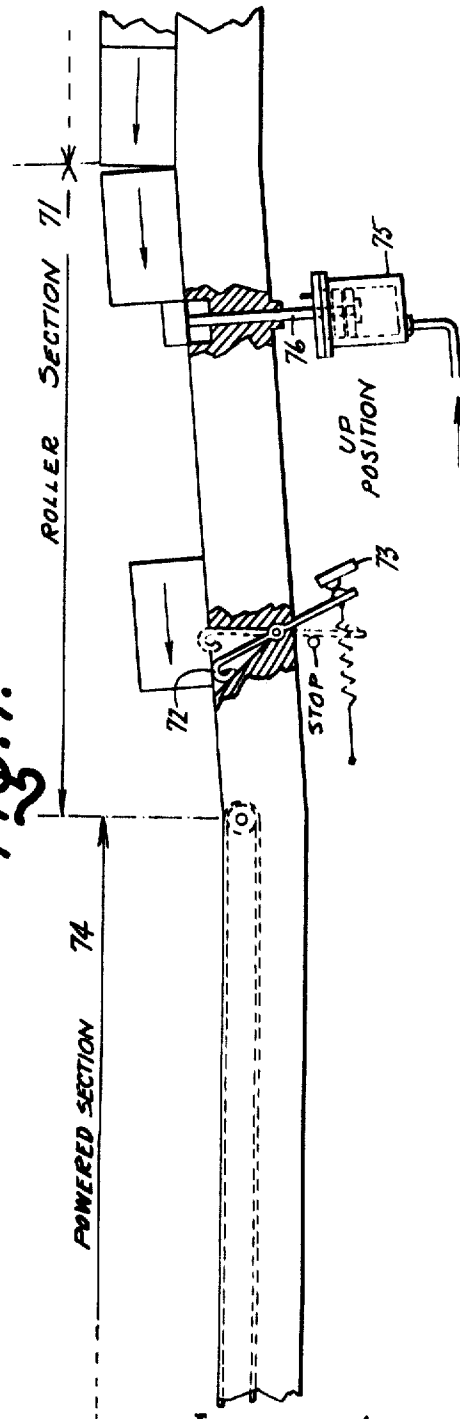


Fig. 7.



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ARTICLE/TIME RECORDING SYSTEM

BACKGROUND OF INVENTION

1. Field of Invention

This invention relates to an article per unit of time worked recording system.

More particularly, the invention relates to a system for obtaining a central, continuously updated, running account of all people-hours worked in a manufacturing facility in a given interval of time, the number of people working and the number of articles produced whereby an accurate and readily obtained up-to-date figure for the number of articles produced per worked hour and/or the number of articles produced per person, is instantaneously available for accounting purposes at any time during the workday as well as at the end of the workday.

2. Description of Prior Art

Heretofore, manufacturing facilities have had no convenient and reliable means for rapidly assimilating important data relating to the operation of the facility and its efficiency at any given instant during the workday. This is particularly true of larger manufacturing facilities having manufacturing operations carried out at a number of unit assembly line areas or work stations in different location. It has generally been the practice to wait to the end of each day's production to accumulate such data manually by a clerk, etc. However, in many operations which are highly competitive and border on being marginal in return, to wait for a full day's results in order to determine whether or not a given operation is running efficiently, may very well turn out to be catastrophic. What is needed in this kind of operation, is some system which makes available at a central location, continuously updated, accurate data bearing on the efficiency of the manufacturing facility on a substantially instantaneous demand basis at any time during or after a workday. To satisfy this need the present invention was developed.

SUMMARY OF INVENTION

It is therefore a primary object of the present invention to provide a new and improved article/time/persons working recording system for manufacturing facilities which provides a central, continuously updated running account of all people-hours worked in the facility in a given interval of time, the number of people working and the number of articles produced whereby an accurate and readily obtained up-to-date figure for the number of articles produced per worked hour and/or the number of articles produced per person, is instantaneously available for accounting purposes at any time during or after a workday.

The system automatically accumulates hours worked by individuals or groups from the time they are started on a job until they are removed. Start and stop may be at random but accumulated time and totals always reads on a counter up to the actual time that the reading is taken to the nearest one-hundredth of an hour. The control which collects time for the entire facility may emanate from a time clock which would begin to record at the end of the initial starting time (which may extend over a 10-minute interval) and continue to record until the stopping time at noon, or at the end of a workday. People punching in late or leaving early are detected and compensated for. The counter shows accumulated hours for all persons working in the facility during any given time interval regardless of when they punched in or out, and another master counter indicates the total number of persons punched in and working in the facility at any given time. The total number punched in are broken down into groups and accounted for by an arrangement which monitors each group and the sum of people working as individuals or groups must equal the total punched in. When this is true, then the total of accumulated hours recorded for each group will also equal the total hours indicated as being worked.

In addition to the above features, where the individual or group is generating a manufactured article as a work product, the number of pieces of the article can also be registered as part of the same system. Consequently, where production standards of either individual or group type are set up, an immediate and exact comparison with the "standard" may be made at any time during the workday up to the exact moment that it is made, by simply dividing the number of pieces or units completed up to the point in time where the comparison is made by the total accumulated hours worked by a particular person or group. Comparing the sum of the time for all groups with the total time being paid makes possible constant and exact cost checking which otherwise is difficult, if not impossible, to obtain without much complicated paperwork, and then only at the end of a work period or day because everything changes during the workday at the time computations and collection of such information is being made. The system can be made to read out directly in pieces per hour or dollars per thousand as a further addition to the equipment thereby eliminating the need for any mental computation and thereby provide an instantaneous comparison of actual cost with the "standard" cost.

From the above set forth brief summary of the characteristics of the new and improved article/time/person recording system, it will be appreciated that:

1. The system keeps an accurate count of every employee punching into or out of work in the facility on a time clock which may be of conventional construction if desired.

2. The system keeps an accurate count of everyone employed on any work station, assembly line, packing area or any other type of operation utilized by the firm.

3. The system makes available at any time the total amount of accumulated worker time for those employees on any desired operation. This information is in direct readout form, accurate to any desired decimal amount of the total accumulation of worked time, on any operation, by any number of employees, and is available at any desired time of readout. The important feature to note is that the readout is accumulated constantly and is instantaneously available at any time during the workday.

4. The system also records all of the items or parts produced, in any unit amount desired, that are or are not a direct result of the previously mentioned operations. In cases where the items produced are a direct result of those operations, it can be readily appreciated that a figure of units per worked hours is available by simply dividing the total number of units produced by the total number of worked hours used in producing those units. Here again, the figure is available either manually through mental division computation, or electrically through a direct acting computation device of an electromechanical or electronic nature. This figure also is available on an instantaneous basis at any desired readout time during the workday.

5. The system can completely record all of the items passing over a conveyor system for transporting the completed articles from an assembly area to an unloading or storage area. This can be done item by item again reading out in any units desired. Another important feature is that the items to be transported by the conveyor can be placed on the conveyor at random without any coded markings necessary on the item, other than to indicate that an item has been counted, and the system can be set so as to not only count the randomly placed items unit by unit, but also sort them by item into a separate count of each type of item being transported.

6. The system supplies information on how many people are working at any instant since they have been recorded by the time clock. It will also provide information as to the total time accumulated up to a given point of readout to any decimal amount desired, and the total number of people and amount of time worked by the same people on any given operation. This supplies an instantaneous check of time and people to be paid against time worked or people working respectively on the several operations being conducted in the facility.

7. The system will also supply information as to the unit pieces per worked hour or per person on an instantaneous demand basis. These figures are extremely important in any firm employing standard cost control measures. It will aid in obtaining accurate and adequate standards for a given manufacturing facility using standard units per worked unit of time. This helps in controlling production and evaluating the advantages or disadvantages of different production techniques on and "on the spot" instantaneous basis after introducing new procedures or changing old techniques.

8. The system also aids in recording all of the units of an item produced and supplies a triple check on this figure which is important in obtaining accurate inventory control.

In practicing the invention an article/time recording system for a manufacturing facility is provided which comprises central people-hours-worked counting and readout means for deriving a count of the total number of people-hours worked and fractional parts thereof in a given time interval. Central articles completed counting and readout means are also provided for deriving a count of the number of articles completed in the same given time interval in the facility. At least one people-hours-worked-count registering means is coupled to and controls at least partially the central people-hours-worked counting and readout means, and, at least one articles completed count registering means is coupled to and controls at least partially the central articles completed per people-hours worked by the facility can be readily determined at any given time during the workday.

In the preferred arrangement, automatic means responsive to the central people-hours-worked counting and readout means and to the central articles completed counting and readout means, are provided for dividing the number of articles completed in a given time interval by the number of people-hours worked to provide a continuously up-dated indication of the number of unit articles completed per people-hours worked by the facility in the given time interval.

Preferably, there are a plurality of unit people-hours-worked-count registering means and a plurality of unit articles completed count registering means for deriving people-hours worked at different work stations located throughout the manufacturing facility, and for deriving a count of the number of articles completed in the same given time interval at the plurality of different work stations, respectively. The plurality of unit people-hours-worked-count registering means and the plurality of unit articles completed count registering means are all coupled to the central people-hours-worked counting and readout means for controlling proportionate parts of the total people-hours-worked count accumulated by that means, and the plurality of different unit articles completed count registering means are coupled to and control the central articles completed counting and readout means to provide a proportionate part of the total articles completed count accumulated by that counter.

The central people-hours-worked counting and readout means comprises readout counter means, and people-time count signal digitizing means for generating a series of pulsed waveform electric signals wherein each electric signal pulse is representative of a finite time period worked by one person and the unit people-hours-worked-count registering means serves selectively to apply desired numbers of the electric signal pulses from the people-time count-digitizing means to the readout counter means.

The system also further includes a master time controller and readout means for deriving a count of the total time being worked by the total number of people working in the facility, and is controlled by a master time clock means which records the time and number of all time recorded people working in the facility. The master time clock means preferably includes means for punching-in and punching-out workers at particular authorized times so as to add to or subtract from the total number of people working in the facility at any given time, and ancillary bypass punch-in and punch-out means for punching in and punching out workers at other than the particular authorized times at the discretion of a supervisor.

The system further includes people recording and readout means for recording the total number of people working in the facility in any given time with the people recording and readout means being connected to and controlled by the master time clock means.

A packing area counting and readout means is also provided for deriving a count of the completed articles being processed through a packing area located at the end of any particular work station, and packing area count registering means are coupled to and control the packing area counting and readout means.

The article/time recoding system also further includes loading area counting and readout means for deriving a count of the completed articles being processed through a loading area supplied from a predetermined number of packing areas in the facility for deriving a count of the completed articles being processed through the loading area. Loading area count registering means are coupled to and control the loading area counting and readout means and preferably include a loading area count registering trigger mounted on a conveyor mechanism for moving completed articles out of the loading area. The count registering trigger is actuated by a completed article passing over the conveyor mechanism for registering one unit count in the loading area counting readout means for each completed article transported by the conveyor mechanism out of the loading area. The conveyor mechanism preferably includes a power driven portion which normally in its inactive condition engages a completed article subsequent to the completed article being loaded upon the conveyor mechanism. The mechanism is arranged such that the count registering trigger in addition to registering a unit count for each completed article loaded upon the conveyor mechanism, also actuates the power driven portion of the conveyor to cause the conveyor to withdraw the completed article off the count registering trigger and onto the power driven portion a sufficient distance to assure return of the trigger to its normally inactive position while simultaneously recording one unit count and loading the power driven portion of the conveyor with one completed article. It is preferred that the loading area counting and readout means also include a plurality of different characteristic article counters for deriving a count of each of the different type of articles completed in the manufacturing facility and processed through the loading area. Type of article selector means are also provided which comprise a part of the loading area count registering means for selectively activating a desired one of the plurality of different characteristic article counters in accordance with the type of article being processed through the loading area.

The article/time recording system also preferably includes a conveyor mechanism which has at its discharge unloading end at least one overdelivery sensing and inactivating control means for sensing a buildup of unloaded articles being delivered to the unloading end of the conveyor above a predetermined number and for inactivating the power driven portion of the conveyor in response to this buildup. A manually operable control means is also provided for inactivating the power driven portion of the conveyor at the option of an operator-unloader working at the discharge-unloading end of the conveyor.

Unloading area counting and readout means are also provided for deriving a count of the completed articles being transported to the unloading area from the manufacturing facility, and unloading area count registering means located in the unloading area are coupled to and control the unloading area counting and readout means. The unloading area count registering means preferably comprises an unloading article sensing trigger mounted on the discharge-unloading end of the conveyor mechanism for registering one unit count for each article transported over the conveyor from the loading area into the unloading area. If desired, the unloading area may comprise a warehouse, a vehicle for transporting the finished articles away from the manufacturing facility, etc.

BRIEF DESCRIPTION OF DRAWINGS

Other objects, features and many of the attendant advantages of this invention will be appreciated more readily as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein like parts in each of the several figures are identified by the same reference character, and wherein:

FIG. 1 is an overall functional block diagram of an article/time/persons working recording system for a manufacturing facility constructed in accordance with the invention;

FIG. 2 is a more detailed, functional block diagram illustrating the construction of a people-hour count signal-digitizing portion of a people-hours worked registering, counting and readout subsystem for use in the article/time recording system shown in FIG. 1 of the drawings;

FIG. 3, 3A and 3B are respective plan, side and sectional views of a synchronously driven, timing wheel subassembly comprising a part of the people-time count signal-digitizing circuit shown in FIG. 2;

FIG. 4 of the drawings is an electrical wiring diagram illustrating the manner in which the microswitches mounted on the timing wheel shown in FIG. 3 are electrically connected in the signal digitizing circuit shown in FIG. 2;

FIGS. 5, 5A and 5B are wiring diagrams illustrating how an isolating bank of diodes is connected into the signal-digitizing circuit shown in FIG. 2;

FIGS. 6, 6A and 6B are wiring diagrams showing how a conventional commercially available stepping switch which comprises a part of the signal-digitizing circuit of FIG. 2, is connected into the system;

FIG. 7 is a sectional view of an unpowered, gravity operated roller loading section of a conveyor mechanism for use in the loading area of a manufacturing facility, and shows the construction of a count recording and power conveyor actuating trigger device used on the loading section; and

FIG. 8 is a sectional view of a discharge-unloading end of a conveyor mechanism illustrating a count trigger arrangement and load limiting power inactivating switch arrangement for controlling operation of the conveyor in the unloading area and simultaneously obtaining a count of all articles processed through the unloading area.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Overall Article/Time Recording System—People-Time Counting and Readout

FIG. 1 of the drawings illustrates the overall article/time/people recording system comprising the invention as applied to a manufacturing facility having some five assembly lines where each assembly line produces an individual type of product that is then packed into suitable containers at the end of the line and transferred out to a warehouse storage area to await distribution. It is to be expressly understood that the system is in no way restricted to the particular manufacturing facility herein described, but may be applied to any manufacturing facility wherein it is desired to utilize the system. For example, should it be desired the system could be used in connection with only a single assembly line supplying a single warehouse storage area. However, it is believed that the multiple assembly line manufacturing facility poses the more general problem, and hence, it has been chosen as the background with which to describe the present invention.

The article/time recording system installation illustrated in FIG. 1 utilizes a readout information station room shown at 11 where the several counters and meters used in monitoring the people-hours worked, and the number of articles produced by all of the time recorded people working on a plurality of assembly lines shown at 12₁, 12₂, 12₃, etc. are located. The articles produced on each of the assembly lines 12 are packed in a suitable packing area and simultaneously counted by packing

area counters shown at 13₁, 13₂, 13₃, etc. The packed articles are then supplied to a conveyor loading area shown at 14 where they are loaded onto a conveyor shown at 15 for transportation to an unloading or warehouse area shown at 16. The conveyor loading area 14 also includes a loading area count registering device 17 which supplies a count of the articles passing through the conveyor loading area to a loading area counter 18 located in the readout information station. Similarly, an unloading area count registering device 19 supplies a count of the articles coming into the unloading area or warehouse storage area 16 to an unloading area counter 21 likewise located in the readout information station 11.

In producing the completed articles packed at the end of each assembly line 12, the scheduled production (as determined by a line supervisor) requires that the assembly line to have a certain number of workers or people applied to the work for a certain amount of time. In order to obtain an accurate record of the required amount of worker-time or people-time needed to produce the articles, a line people-hours count registering device shown at 22₁, 22₂, 22₃, etc. is provided for each assembly line and is under the control of the line supervisor. The output for each of the line people-hours count registering devices 22, which is electrical in nature, is supplied to a plurality of line time controllers and people-time count signal-digitizing means 23₁, 23₂, 23₃, etc. located in a control room 24. The outputs from the line time controllers and digitizers 23 are supplied to a plurality of counters 25₁, 25₂, etc. located in the readout information station 11 which together with the people-time count digitizers 23 comprise the central people-hours-worked counting and readout means. The counters 25 are conventional, commercially available direct current counters of the type manufactured and sold by a number of United States manufacturers. For example, the 24-volt direct current counter-type No. 19835—006 manufactured and sold by the Veeder Root manufacturing company is satisfactory for this component. Counters of this type generally comprise decade counters which provide a visual indication of the count accumulated in the counters.

The electrical output signals derived from all the line people-hours count signal-digitizing devices 23₁, 23₂, 23₃, etc. also are supplied to an hours-worked per article computing and readout machine shown at 26 and located in the readout information station 11, in parallel with the counters 25. Alternatively, for less elaborate installations, it is possible to omit the articles per worked hour computing and readout machine 26 and perform the necessary division mentally from the reading of the counters 25 and the reading of a plurality of articles completed counters 26₁, 26₂, 26₃, etc. to which are supplied the output count signals derived from all of the packing area count registering devices 13. The articles completed counters 26 may be similar in construction to the counters 25.

The construction and operation of the line time controllers and digitizers 23 will be described more fully hereinafter in connection with FIGS. 2 through 6 of the drawings as will be the line people-hours count registering devices 22. Similarly, the construction and operation of the packing area count registering devices 13, the loading area count registering device 17, the construction of the conveyor 15, the unloading area count registering device 19, the loading area counter 18 and the unloading area counter 21 likewise will be described more fully hereinafter in a more detailed manner. The articles per worked hour readout machine 26 may comprise an on line, general purpose digital computer for use in inventory control or the like which generally can be found in more expensive and elaborate manufacturing installations.

In addition to the above several subsystems, the article/time recording system further includes a master time controller 27 located in control room 24 and a master time readout counter 28 located in the readout information station 11. The master time controller 27 is similar in construction and operation to the line time controllers and digitizers 23 and will be described more fully hereinafter in connection with FIGS. 2 through 6. Similarly, the master time readout counter 28 is similar to the

counters 25 and 26 with the exception that it is capable of accumulating a much greater count than are the counters 25 and 26. Also included in the readout information station 11 is a total people working counter 29 which preferably is a reversible counter of conventional construction. The total people working counter 29 and the master time controller 27 are connected to and controlled by the output from a time clock 31 that is located in an area where people going to and coming from the assembly lines 12 are required to punch in and punch out when going to and from their work stations at the beginning and the end of each workday, and during the noon lunch period.

The time clock 31 may comprise a conventional, commercially available time clock such as the Simplex time recorder model No. 63 JD 8 manufactured and sold by the Simplex Time Recording Company. However, it is preferred that the time clock 31 comprise a specially designed time clock which is described more fully in our copending U.S. application Ser. No. 705,262 entitled "Control Circuit For Time Clock and Master Counter" filed Jan. 31, 1968—(concurrently with this application)—David A. and Ralph W. DeWitt, Inventors. The specially designed time clock and control circuit described in our above-identified copending U.S. application includes not only a means for punching-in and punching-out workers at particular authorized times such as the morning starting time, the noon lunch break, and the normal evening quitting time, so as to add to or subtract from the total number of people shown as being punched in and working in the facility at any given time; but it also includes ancillary bypass punch-in and punch-out means which are key operated for punching-in and punching-out workers at other than the particular authorized times at the discretion of a supervisor. The time clock circuit disclosed serves to develop a number of electric output signal pulses which correspond to the punching-in or punching-out of workers coming to and leaving the manufacturing facility. These electric signal pulses are supplied to the total people working counter 29 which is a reversible counter and provides an instantly available count of all time recorded people working in the facility at any given time. These electric signal pulses also are supplied to the master time controller 27 for controlling the master time readout count accumulated by counter 28.

In operation, the article/time recording system shown in FIG. 1 functions in the following manner. At a predetermined time before actual work is begun a warning signal is triggered by the time clock 31. At this time, a device wired into the time clock actuates and places the clock in a "punch-in" mode of operation in a known manner. During this period, the workers to be assigned to the assembly lines may punch their time cards, and proceed to their various work assignments. At the exact time that work is to begin, a second signal is sounded which is again controlled by the time clock 31. At this time, the master time controller enables all of the line time controllers 23₁, 23₂, etc. through a connection 27' that includes suitable relay actuated contacts in series with the power supply to the line time controllers, with the relay actuated contacts being actuated by the master time clock control circuit. Also, the special device in the time clock actuated the clock mechanism so as to put the clock in a "no-punch" mode. That is, after this time no further punching by the simple process of inserting a time card into the clock, is possible, and from this point on workers arriving to punch in will be considered late for work. Since most manufacturing firms place their workers on the assembly lines before the work signal, it is quite difficult, along with all the other tasks that a supervisor has to do during normal work operations, to place a late person on an assembly line immediately. Since the worker must then stand and wait, with this system the worker now waits without being punched in and therefore he must wait on his "own" time and not the company's. Thereafter, when the supervisor has a place on an assembly line for the late worker, he can then bypass the "no-punch" circuit with a key supplied to the supervisor for this purpose, allow the worker to punch his time

card, and then place the worker at a particular place on an assembly line where he is to be assigned.

Each time a worker punches in on the time clock 31 he is entered into the article/time recording system, whether it be during a regular "punch-in" period or with the "punch-in" bypass key, the counter 29 in the readout room 11 advances by one count. Thus, the counter 29 can supply at any time the total number of people working in the facility at any given time, and hence the people to be paid at this time. Concurrently with the actuation of the total working counter 29, a stepping switch on the master time controller 27 (to be described more fully hereinafter) is advanced by one count. At the time of the start work signal, all of the time of those people punched into the clock starts to record on the master time readout 28. This provides the readout of the total time of all of the time recorded people working in the facility on the various assembly lines 12. As workers are allowed to punch in by a supervisor through the use of his key operated "bypass" of the no-punch of the time clock, these workers times likewise will start to be added to the total time being accumulated by the master time readout counter 28.

At the noon lunch break normally occurring around 12 p.m., the time clock 31 automatically changes to a punch-out mode during which period workers can punch out automatically by inserting a time card into the clock in a normal manner and thereby allow the workers to punch out for their noon luncheon break. After a short interval of time, it is preferable that the time clock again revert to a no-punch mode of operation until the end of the noon luncheon break, normally occurring around 12:30 p.m. At this time, the time clock 31 again automatically goes into a punch-in mode during which time workers can again punch-in their time card by merely inserting the time cards into the time clock. Thereafter, the time clock again reverts to its no-punch mode until the end of the work period when the punching out process is again repeated. Each time that a worker punches out, whether it is during the prescribed "punch-out" period at noon or at the end of the workday, or whether it is a key operated bypass form of punch-out with the assistance of the supervisor, the reversible total people working counter 29 will count down by one count for each worker punching-out, and similarly, one worker will be subtracted from the total number of workers times being registered in the master time controller 27 so as to show on the master time readout 28. For a more detailed description of the construction and operation of the time clock 31, and particularly the means for punching-in and punching-out workers at particular authorized times so as to add to or subtract from the total number of people working in the facility at any given time recorded on the total people working counter 29, as well as the ancillary, key operated, bypass punch-in and punch-out means for punching-in and punching-out workers at other than the particular authorized times at the discretion of a supervisor, reference is made to our above-identified copending U.S. application, Ser. No. 705,262.

After punching-in at the time clock 31, a worker is placed on one of the five assembly lines 12, and at this time, a supervisor adds one count to his line people-hours-count-registering device 22₁, 22₂, etc. which preferably also includes a readout light located in the assembly line area to indicate to the supervisor the total number of people working on that particular assembly line. The line people-hours-count-registering device actually is a pair of electric switches with one switch representing a plus (+) and the other is representing a minus (−) for adding to or subtracting from the number of workers indicated by the readout light. Upon a worker being added, the plus (+) switch is pressed by the supervisor and will add one count to the number indicated by the readout light in the assembly area, and simultaneously will add one count to the number being readout by the line time controllers and digitizers 23 located in the control room 24 as will be described more fully hereinafter in connection with FIG. 2 through 6. Similarly, if a worker is removed from the assembly

line, the supervisor merely actuates the minus (−) switch so as to subtract one count from the number indicated on the assembly line readout light, and simultaneously subtract one count from the people-time count of the line time controllers and digitizers 23. If it is desired to change a worker from one assembly line to another assembly line, the minus (−) control on the assembly line that he is leaving is depressed, and the plus (+) control switch on the line that he is entering is actuated.

From the foregoing description, it will be appreciated that whenever a plus (+) or minus (−) switch in the line people-hours count registering devices 22, is actuated, two simultaneous events take place. The number recorded in the readout light located in the assembly line area is changed by adding or subtracting one digit due to a stepping switch on the line time controllers and digitizers 23 located in the control room 24 being stepped up or stepped down, respectively. The stepping up or down of the stepping switch also changes the people-hours count being recorded on the counters 25 located in the readout information station 11. In addition, preferred installations will include readout counters shown at 32₁, 32₂, 32₃, etc. located in the readout information station 11 for a purpose to be disclosed more fully hereinafter. Thus, if these counters are provided, a third event will occur upon the line people-hours count-registering device 22 being actuated which results in changing the number indicated by the readout counters 32 located in the information station. Whenever the stepping switch on one of the line time controllers and digitizers 23 is stepped up or down, that person's time on the line begins to be either added or stops being recorded, respectively to the total hours-worked time being recorded on the counters 25 located in the readout information station 11. Hence, it will be appreciated that at any time when a person is added or subtracted from an assembly line, his time instantaneously begins to be added to the total on the line he is assigned to, and ceases to be recorded on the line at which he was previously working.

Completed Article Counting And Readout

The next important feature provided by the article/time recording system of the invention is the exact tallying of all articles being produced on each assembly line 12. This tallying of the articles produced throughout the manufacturing facility, is accomplished in three places; namely, in the packing area for each assembly line with the packing area count registering devices 13, in the loading area 14 with the loading area count registering device 17, and in the unloading area or warehouse 16 with the unloading area count registering device 19. The construction and operation of each of the devices 13, 17, and 19 will be described more fully hereinafter; however, it is important to note that the article counts derived by these devices are supplied to counters in the readout information room for producing a readily available centrally located tally of all of the items produced and subsequently handled in the manufacturing facility.

The count recorded by the packing area count registering devices 13 is supplied to respective central articles completed counting and readout counters 26₁, 26₂, 26₃, etc. located in the readout information room 11. The loading area count derived by the loading area count registering device 17 is supplied to the loading area counter 18, and the unloading area count derived by the unloading area count registering device 19 is supplied to an unloading area counter 21 with both counters 18 and 21 being substantially identical and located side by side in the readout information station 11. It should be noted at this point that the loading area counter 18 and the unloading area counter 21 located in the readout information room may readily keep track of all the packed articles moving from the loading area into the unloading area by the conveyor 15. This also supplies a cross-check against the counts obtained on the packing area counters 26 from all of the unit assembly line readouts. This is achieved by designing counters 18 and

21 to include separate assembly line unit counters 1—5 for providing a count of each separate type of article produced by the respective assembly lines, as well as a total count of all articles passing through the loading and unloading areas.

In operation, the article tallying portion of the article/time recording system functions in the following manner. At the beginning of the workday, or at the beginning of some other similar period of work time, all of the unit meters are set at zero, and at the end of the period, all of the articles produced during the period are placed in the warehouse storage area. With these operating conditions satisfied, the sum total on each assembly line counter 26 should equal the total, for each item respectively, of the unit meters 1—5 on the panels of the loading area counter 18 and the unloading area counter 21. Also, the total of all of the assembly line readouts 26 together should equal the totals shown on both the loading area counter 18 and the unloading area counter 21. Should it prove desirable, it is also possible to have a pieces produced per hour meter for each assembly line which can be made visual to the workers on that line so that they can see how well or how poorly they are producing as compared to a predetermined standard. This can serve to keep up incentive and work interest. It is also possible by means of suitably designed operational amplifiers to convert the pieces per hour into a dollars and cents cost, and read this particular value off on a suitable electrical meter with an altered unit measuring scale.

From the foregoing description of the overall article/time recording system, it will be appreciated therefore that the system is capable of keeping an accurate count of every employee punching into or out of work on a standard commercial time clock. The system when properly operated by the line supervisors and packing station operators keeps an accurate count of the total number of employees on any assembly line, packing station, or any other type of operation utilized by the manufacturing firm. It makes available at any time, the total amount of accumulated worker time by those employees on any of the above operations. It provides a direct readout accurate to any desired decimal amount, of the total accumulation of work time, on any operation by any number of employees at any desired time of readout. In other words, the readout is accumulated constantly and is instantaneously available. The system also records all of the items or parts produced, in any unit amount desired, that are or are not a direct result of the manufacturing operations. In any case where the items produced are a direct result of those operations, a cost control figure of units per worked hour is readily available by simply dividing the total number of units produced by the total number of worked hours required to produce those units. This figure is available either manually through division on the part of an operator assigned to the readout information station, or it may be obtained electrically through direct acting computation devices. Here again, this figure is available on an instantaneous basis at any desired readout time. The system can completely record all of the items passing out of the manufacturing areas over a conveyor system into a storage area. This can be done item by item again reading out in any unit desired. Another important feature (to be discussed more fully hereinafter in connection with FIGS. 2 to 6) is that the articles placed on the conveyor, can be placed at random without any special markings necessary on the items, and the system can be so set as to not only count these items at random by units, but also sort them by type of item into any combination desired. The system will provide information as to how many people are being recorded for pay purposes at any instant since they are being recorded by the time clock. It will also tell one the total time being paid for at any instant to any decimal figure desired. It will record the total number of people and the amount of time being worked by these same people on any particular operation. This provides an instantaneous check of the time and people being paid for, for comparison to particular job standards for the jobs at which these people are working, and the time spent on the job. The system will aid in obtaining good standard costs using standard units per worked-

unit of time and will also help in controlling production and evaluating the advantages or disadvantages of different production techniques on an "on the spot" instantaneous basis. It provides a record of all of the units of a particular article produced, and supplies the manufacturer with a triple check on this figure which is quite important in obtaining accurate inventory records.

Line Time Controllers and People Time Count Signal Digitizing Means

FIG. 2 of the drawings illustrates in greater detail the construction of the line time controller and people time count signal digitizing circuit for generating a series of pulsed waveform electric signals wherein each electric signal pulse is representative of a finite time period worked by one person on an assembly line. It will be understood from a consideration of FIG. 1 of the drawings, that there is one such line time controller and digitizer unit for each assembly line area, and further, that the master time controller 27 will be built in a substantially similar fashion, but must be designed to accommodate a greater number of workers times since it is totalizing the time for the entire manufacturing facility. The particular line time controller and digitizer shown in FIG. 2 and described in greater detail in connection with FIGS. 3 through 6, is designed to accommodate an assembly line having from 1 to 21 persons working on it. However, the principles here disclosed are in no way restricted to these particular numbers, and may be applied to the design of any desired type of control and digitizer to accommodate either greater or smaller numbers of persons. It is anticipated that in the design of the master time controller, such modifications are required in order to accommodate the total number of people working on all of the lines. The principles applied to the design of the individual assembly line time controllers and digitizers, however, may be applied in constructing the master time controller.

Each of the line time controllers and digitizers is comprised by an electromechanical timing wheel shown in FIGS. 3, 3A and 3B, and to be described more fully hereinafter, which operates to actuate a plurality of microswitches mounted around its periphery at unique time intervals. These microswitches are shown as microswitch section at 41 in the electrical wiring diagram of FIG. 2. The output from the timing wheel microswitch section 41 is supplied through a multiprong connector 42 to a bank of isolating diodes 43 which serve to interconnect the fixed contacts of a stepping switch 44 through a connector plug 45 to selected ones of the plurality of timing microswitches in the microswitch section 41. The diode bank 43 serves to isolate all save particular ones of the outputs of the several microswitches in the microswitch section 41 from the fixed contacts of the stepping switch in order that the fixed contacts of the stepping switch 44 have applied thereto characteristic numbers of electric signal pulses. The interconnection of the diode bank 43 through the intermediary of the connecting plugs 42 and 45 to the respective timing microswitches 41 and stepping switches 44 is best illustrated in FIG. 4 through 6 of the drawings.

Referring to FIG. 4 of the drawings, it will be seen that in the particular embodiment of the invention described, the timing wheel microswitch section 41 is comprised by eleven microswitches 41₁, 41₂, 41₃, etc. mounted around the periphery of a timing wheel in the manner shown in FIGS. 3, 3A and 3B. These microswitches may be conventional, commercially available alternating current microswitches such as are manufactured and sold by the Micro Switch Corporation, model No. V3L-5-V8, or some similar microswitch structure. One side of all of these switches is connected to the respective output terminals 1 through 11 of an output connector plug 42. As shown in FIG. 5, connector plug 42 has its terminals connected in the manner shown to certain ones of the terminals 1 through 21 located on one side of a wiring board 43 to which the respective isolating diodes 43A, 43B, etc. that make up the

bank of isolating diodes 43, are connected. FIG. 5A of the drawings illustrates the back side of the diode board, and FIG. 5B illustrates the terminal connections of the plug 45 that connects the output of the diode bank 43 to the stepping switch 44.

FIG. 6 of the drawings illustrates the manner of interconnecting the connector plug 45 to the fixed contacts of the stepping switch 44 which may be of the type manufactured and sold by Telecommunications Ltd. under the trademark "Bothway Selector" type U-3314-E. Each prong of the plug 45 is connected to a respective terminal of bank 3 of the stepping switch shown in FIG. 6. In banks 2, contacts 1-9 are open-circuited, contacts 10-19 are connected to prong A of plug 47, and contacts 20 and 21 are connected to prong B. The prongs A and B when energized by wiper contact 2 of the stepping switch light a "period" on the left or right side 2 respectively of the numbers on the number lights 57 and 58. The lighted period on the left of the numbers 0-9 indicates that the number is preceded by a "1", hence equal to 10-19, and the lighted period on the right indicates a "2" in the first digit, and hence equal to 20 and 21. This is a cost saving feature, and if desired, A and B could be employed to light up digit numbers 1 and 2 provided for this purpose. Bank 1 of the stepping switch is wired in the following manner. Contacts 1, 11 and 21 are in series with prong 1 of plug 47. Contacts 2 and 12, 3 and 13, 4 and 14, 5 and 15, 6 and 16, 7 and 17, 8 and 18, 9 and 19 and 10 and 20 are all connected to prongs 2-10 of plug 47, respectively. These connections are depicted by the boxes to the left of the contacts of bank 1. Each box is numbered and employs arrows to indicate connections to and from correspondingly numbered contacts with like numbers being connected to each other in a series circuit arrangement.

FIG. 6A of the drawings illustrates the wiring connection to the stepping coil for the stepping switch 44. It will be seen from FIG. 6A and FIG. 2 that opposite terminals of the stepping coil are connected through a suitable two prong connector 48 back to a pair of add (plus) and subtract (minus) microswitches 49 and 51, respectively, which comprise the line people-hours count-registering devices 22 located in each assembly line area 12. The middle or third input terminal to the stepping coil is connected back to a 24-volt of direct current power 52 which is excited from a conventional 110-volt, 60 cycles AC power source.

As is shown in FIG. 2, the output from the 24-volt DC power source is supplied through a 12-volt DC to DC converter 53 of conventional construction, and hence through a single prong connector plug 54 to one of the brush terminal connections of the stepping switch 44 in the manner shown in FIG. 6B of the drawings. The remaining input terminal of the brush connections for stepping switch 44 are connected back through a single prong plug connector 60 (p-5), and through a people-hours counter 25 to the opposite side of the 24-volt DC source 52. By connection in this manner, the brushes of the stepping switch 44 will be excited with only a 12-volt DC potential instead of the 24-volt DC potential that is used to excite the stepping coils by means of the interconnection shown in FIG. 6A and the add or subtract switches 49 or 51, so as to prolong their operating life.

Referring back to FIG. 2 of the drawings, it will be seen that the add and subtract microswitches 49 and 51 that comprise the line people-hours count-registering device 22 are excited from the 24-volt direct current power source 52 through an add switch counter 55 and a subtract switch counter 56, respectively. The add and subtract switch counters 55 and 56 comprise the line unit counting and readout devices 32 located in the readout information station for providing to this central monitoring point a permanent record count of the number of people working on any given assembly line at a given time. This number is obtained by subtracting the subtract count shown on counter 56 from the add count shown on counter 55. The counters 55 and 56 as well as the people-hours counter 25 all comprise conventional, commercially available direct current counters of the type manufactured

and sold by the Veeder Root manufacturing company, and identified as the type 19835-006 counter. It is also desirable to include a separate "downtime" people-hours counter 25 in some installations where it is necessary to keep separate records of "standard" work time and "downtime" of the assembly lines or other working station whose time is being accumulated. For this purpose, either the "standard" people hours counter 25, or the "downtime" people-hours counter 25a is selectively activated by a relay 25b controlled from a selector switch 25c located at the assembly line area. The switch 25c is controlled by a line supervisor to indicate that the people-time being counted is applied either to standard work or is being wasted in downtime. At this point, it should be noted that the people-time should not be construed as limiting the disclosure to the count of man-hours worked, but should be considered generically as applying to machine-hours, plane-hours, etc. where the system might be employed to measure the unit-hours of operation of any device or mechanism, or combinations thereof. It should be noted at this point, that although the brushes of the stepping switch 44 are excited with only a 12-volt direct current potential, the readout of the stepping switch utilizes the 24-volt DC potential due to the manner which the people-hour counter 25 is connected to the readout terminals. If desired, the add and subtract counters 55 and 56 could be replaced with a more expensive, reversible counter, however for purposes of economy the arrangement described is preferred.

In addition to the count tabulated by the counters 55 and 56, the output count indicating signals derived from the stepping switch 44 through the connector plug 47 is supplied back to a number indicating lighting board 57 located in the assembly line area 22 and is also supplied back to a second number indicating lighting board 58 located in the readout information station. The inclusion of these number indicating lighting boards 57 and 58 provides to the supervisor in the assembly line area 22 a readily perceived indication of the number of people which the article/time recording system had indicated are working in his area. In addition, it provides a cross-check on the count being accumulated by the counters 55 and 56 to the person in the readout information station for monitoring purposes.

FIGS. 3, 3A and 3B of the drawings illustrate the construction of the timing wheels and the manner in which the several microswitches 41₁, 41₂, 41₃, etc. are mounted around the periphery of this assembly. The main body of the device is a frame comprised by a backing member 61 which is connected to a front web 62 by a plurality of brackets 63. A conventional, commercially available synchronous electric motor 64 (such as the Hurst—Model No. GAIRP=synchronous motor) is mounted on the backing member 61 along with a suitable reduction gear assembly 65. The front web 62 is used to support the microswitching elements 41₁, 41₂, 41₃, etc. In the center of the front web there is a bearing for a main shaft which rotatably supports a circular plate or rotating member 66 containing two circumferentially spaced series or rows of actuating pins 67 and 68. The inner set of five actuating pins are circumferentially arranged to engage and actuate the single microswitch 41₁ located on the inner portion of the web 62. The outer row of 10 circumferentially arranged actuating pins 68 are arranged to contact and actuate the remaining microswitches 41₂ through 41₁₁. The rotating member 66 is driven by the synchronous motor 64 which is a one revolution per minute synchronous motor geared down through the gearing assembly 65 to rotate the rotating member 66 at a speed of one-third revolutions per minute.

In the following discussion, the concentric series of pins and switches will be referred to as rows of pins and switches. Each switch consists of an actuator arm and three contacts (normally open, normally closed and common). When any pin in a row comes in contact with the actuator arm, the switch makes and breaks a circuit. The switches are so spaced on the supporting web in a manner such that no two switches are actuated at the same time. In the particular embodiment of the in-

vention disclosed, there are 11 such switches, with one switch being located in the first row and 10 switches in the second row. The output of all the switches are arranged so that when the rotating member 66 completes one revolution, the microswitch in the first row produces five electric signal pulses, and each microswitch in the second row produces 10 electric signal pulses. This is due to the fact that in the first row there are five actuating pins and one switch and in the second row there are 10 pins and 10 switches. Thus, with the rotating member 66 turning at a speed of one-third revolutions per minute, this results in five switches for each 3 minutes or 100 switches in 1 hour for the switch in the first row. This is analogous to one persons registered time in hundreds of an hour per switch. In the second row there are 10 switches and 10 pins. Thus, there are 10 switches produced by each microswitch in the second row in every 3 minutes or 200 switches for each switch in 1 hour. This is analogous to two persons recorded time in hundreds of an hour.

From the foregoing description, it will be seen that each switch in the first row represents one persons recorded time and each switch in the second row represents two persons recorded time. Since the impulses from these switches do not overlap, then the combination of the outputs of all the switches would equal the recorded time of 21 people. Thus, by using appropriate various combinations of the output from these switches, any number of recorded peoples time from 1 to 21 can be obtained. By wiring the output of these switches through the diode bank 43, any desired number of switch outputs can be isolated. The wiring of the diode bank is shown in greater detail in FIG. 5 of the drawings. As will be appreciated, the output from this diode bank can be taken at any one of 21 different junctions which is representative of 21 different switch combinations required for recording the time of from 1 to 21 people.

This timing wheel switching arrangement may also be expanded to record any number of peoples times. About the only limit is the size of the rotating member and the frame and also the placement of the switches. Since each switch must be actuated at a unique instant of time, the angle at which each switch is placed becomes critical as the number of switches increases. Another limiting factor is the time and distance of travel needed for mechanical actuation of the switch arm itself. A solution to these problems would be to provide some form of nonconducting disc using a conducting disc below it and a concentric series of holes (instead of pins) and a circumferentially arranged series of brushes for establishing the desired electrical pulse producing circuits. Another arrangement would be to employ a series of concentric photoelectric cells using a perforated disc between the cells and a light source. Thus, the photocells would be activated each time that the light beam from the light source was uninterrupted. By these or other similar arrangements, the capacity of the timing wheel can be greatly increased to accommodate large numbers of people.

In operation, the line time controllers and digitizing circuits shown in FIGS. 2 through 6 of the drawings operates in the following manner. At the time that a worker is assigned to a particular assembly line and goes into the assembly line area, a supervisor for the assembly line actuates the add switch 49. Actuation of add switch 49 causes the stepping coil of stepping switch 44 to step the brushes of the stepping switch up one count. This results in connecting the output of the output of the microswitch 41₁, that produces 100 electric signal pulses per hour to be supplied to the people-hours counter 25. Concurrently, the number indicating lights 57 and 58 to are energized show that one person has been added to the assembly line. When the next worker arrives, the supervisor again actuates the add switch 49 to cause the stepping switch 44 to be stepped to its number 2 contact. The number 2 contact would be connected to the output of one of the microswitches such as 41₂ in the outer row that produces 200 electric signal pulses per hour and is representative of the worked time of two workers. Similarly, when the third worker arrives the stepping

switch will connect both the microswitch 41₁ and the microswitch 41₂ to the people-hours counter 45 to provide it with 300 electric signal pulses per hour. This process is continued until the assembly line is entirely staffed. Should it prove necessary to remove one of the workers, all the supervisor needs to do is to actuate the subtract switch 51. This will then cause the stepping switch to be stepped down one unit count and this fact will be recorded on the subtract switch counter 56 as well as on the number indicating lights 57 and 58. It will be appreciated therefore that the line time controllers and digitizers in effect convert the unit count to be added or subtracted signal derived from the switches 49 and 51 in the assembly line area into a series of digitized electric signal pulses representative of people-hours measured in one/one hundredths of an hour.

Packing Area Counting and Readout Device

At the end of each assembly line, as the completed article leaves the assembly line, it is generally packed into a container usually in some predetermined quantity such as one per box, one half dozen per box, one dozen per box, etc. When each container is closed, a special piece of "control tape" is placed on it in a predetermined location on the container. In order for the packer to obtain this "control tape" a conventional, commercially available electromechanical dispensing and counting apparatus is employed. This apparatus may be any one of a number of commercially available dispensing and preset count, counting mechanisms wherein the preset count is one. Actuation of the tape dispenser to issue one piece of 'control tape' causes the counter registering device to register one count in the unit counters 26₁, 26₂, 26₃, etc. located in the readout information room. If desired, the count may also be recorded on a suitable indicating dial located in the packing area.

In addition to registering a count for each piece of 'control tape' issued, the dispenser activates a visual or audible signal which is locked "on," and is not turned "off" until the packer places the container in a specified area (such as a loading platform or on the loading section of a conveyor), and then presses a second control switch which will deenergize the visual or audible alarm. This second control switch preferably also is used to control the dispenser which is designed so that it is locked out and cannot dispense another piece of control tape until such time that the second control switch is actuated thereby indicating that the packer has placed the container in the specified area. This is a safety feature which diminishes the possibility of a packer placing two pieces of control tape on one package, and thereby botching up the count of the number of articles coming off the assembly line. It also makes it mandatory for the packer to place each container in the specified area. The count provided by the packing area counting and readout means then gives a running and instantaneous count of the number of articles produced by each assembly line. This figure coupled with the total worked time on each line as indicated by the meter 25 for that particular line, will then supply the instantaneous pieces per unit per person-hour rate which can be compared against a standard. The desirability of having this figure on an instantaneous demand basis has been pointed out above.

Loading Area Count and Readout

As is illustrated in FIG. 1 of the drawings, the next article count to be obtained following the packing area count, is that derived in the conveyor loading area 14 by the loading area count registering device 17. This count is obtained automatically by an operator loading the conveyor 15. A standard roller or belt-type electromechanical powered conveyor is used in conjunction with a gravity operated loading area portion employing a special circuit such as that shown in FIG. 7 of the drawings. Referring to FIG. 7, each container of completed articles is loaded by placing the container on an inclined, unpowered, roller (loading) section of the conveyor shown generally at 71. Thereafter, the container will roll down until it encounters the activation arm or trigger arm 72 of a microswitch 73 for deriving a count of the articles loaded on

the conveyor. The trigger arm 72 is placed in the center of the conveyor and is pivotally mounted with a spring return so that it always returns to a normal inactive position where it will be contacted by the next container passing over the loading section of the conveyor. The unpowered, gravity operated loading portion of the conveyor is placed immediately adjacent to a powered section 74 in a manner such that a container traveling down the gravity operated portion will slide onto and engage at least a part of the powered portion of the conveyor while simultaneously depressing the trigger arm 72.

The powered conveyor portion shown generally at 74 is designed so that it runs only when the switch arm 72 is depressed. Therefore, as a container moves past and depresses the switch arm 72, the powered section of the conveyor is activated so as to withdraw the container off of the count registering trigger 72, and onto the power driven portion of the conveyor a sufficient distance to assure return of the trigger 72 to its normally inactive position thereby recording one count while simultaneously loading the power driven portion of the conveyor with one completed article. Upon this occurrence, the powered portion of the conveyor will again stop due to the trigger 72 no longer being depressed. It will be seen therefore that as each container is placed on the loading position 71 of the conveyor, the powered section 74 inches forward only enough to accept each container that passes the trigger arm 72. Concurrently with this action, activation of the switch 73 by the trigger arm 72 operates to record one count in the loading area counter 18 located in the readout station 11. If desired, a similar counter may be activated in the loading area to indicate to the loading operator that the container has been properly counted and recorded.

Another safety factor which is built into the article/time recording system is to protect against two or more containers being counted as one by the trigger arm 72. This is possible because if, for example, two containers are placed on the loading portion 71 of the conveyor back to back, trigger arm 72 will be depressed and power section 74 activated. As the first container moves into the powered section, the second container (being back to back against the first) does not allow the trigger arm 72 to return to its normally inactive position, which is required in order to record a count for the second container. Consequently, the loading area counter would record only one unit count instead of two. To prevent this occurrence, a count assuring, cylinder actuated, stop shown at 75 and having a stopping arm 76 is provided. The cylinder actuated stop 75, 76 is activated by the switch 73 so that the stopping arm 76 is raised to prevent containers moving down the loading section 71 in back-to-back fashion. Therefore, during the time that a container is on the trigger arm 72, no other container may enter the area (at a predetermined distance) in front of the arm 72 without being stopped by the extended stop arm 76 of cylinder 75. Since in most manufacturing firms, the length of the containers will vary widely, a number of such stops are required at various positions in the unpowered section 71, the activation of which is determined by a selector switch to be described more fully hereinafter.

Referring again to FIG. 1 of the drawings, it will be seen that the loading area counter 18 located in the readout information station 11 has on its face a plurality of dials indicated as numbers 1 through 5 together with a total dial. Each of these dials 1 through 5 comprises a separate meter which may be selectively activated by a selector switch arm, the setting of which is determined by the setting of an identical counter located in the loading area 14. This setting adjustment is made by the loading operator in accordance with the type of article being loaded. Hence, it will be appreciated that each meter 1 through 5 will represent the total number of a given type of article or container being loaded. The fact the 5 meters are used is purely for explanatory purposes since there may be any number of meters to correspond to the number of different items being produced by the assembly lines being serviced. With this arrangement, if the loading operator decides to load containers of item number 3 for example, he sets the selector

switch to the unit meter representing item number 3. Thereafter, each time that the trigger arm 72 and switch 73 are actuated in the loading area, one unit count will be added to the count accumulated on the unit meter 3. Also, one count is added to the total units out of the loading area meter shown in the lower portion of the counter 18. It will be seen therefore that as each different item is loaded onto the conveyor, the selector switch is changed to record the total number of each different type of article or container being loaded, and that the lower totaling meter will provide a total count of all of the articles or containers being processed through the loading area.

It should also be noted at this point that the selector switch arm for the loading area counters also activates the previously mentioned differently positioned stopping arms 76 for accommodating different length containers of completed articles. It will be seen therefore that as each different item is loaded onto the loading portion 71 of the conveyor, the selector switch is actuated by the loader-operator so as to count and record separately the total number of this particular type of container being loaded, and that the selector switch also selects which particular stopping arm 76 will be actuated so as to accommodate the particular size container for the type of article being loaded.

Unloading Area Counting and Readout

Another control feature made available by the article/time recording system of the invention is the provision of an unloading area counting and readout means for deriving a count of the completed articles being transported to an unloading area from the manufacturing facility. As is best seen in FIG. 1 of the drawings, this unloading area is located at the discharge-unloading end of conveyor 15 and comprises an unloading area count registering device 19. The count registering device 19 may comprise any form of electric switch for producing one electric signal pulse for each container or article coming into the unloading area. However, preferably the device 19 comprises a counter similar to the loading area counter 18 described previously for accommodating different types of articles being processed through the unloading area. It is also preferable that the device 19 comprise an automatically triggered counter mechanism such as the trigger actuated switching arrangement 72, 73 shown in FIG. 7. This arrangement may be mounted on an unpowered, gravity operated discharge-unloading portion of the conveyor mechanism for automatically recording one count for each container supplied to the unloading portion of the conveyor. If a multitype counter 21 is used as the unloading area counter in the readout information station 11, a similar multitype counter will be employed as the unloading area count registering device 19. With such an arrangement, all that the unloader-operator has to do is to change the position of the selector switch to identify the particular type of article being unloaded, and the count for such article will be registered on his own and on the unloading area counter 21 in the readout information station 11. Concurrently, a totaled count of all containers passing through the unloading area will be registered on the total count appearing in the lower portion of the counter 21.

FIG. 8 of the drawings illustrates in sectional view the discharge unloading portion of the conveyor 15 wherein the count registering trigger arm is shown at 81 for actuating a microswitch 82 that records the count of a container passing through the unpowered, gravity operated roller section 83 supplied from the powered section 74 of the conveyor. Thereafter, a container passing through the unloading-discharge portion of the conveyor rolls onto a section 84 which may be either gravity operated or a powered section. This section includes at least one overdelivery sensing and inactivating control means for sensing a buildup of unloaded containers being delivered to the discharge-unloading portion above a predetermined number, and for inactivating the power driven portion 74 of the conveyor mechanism in response to this buildup. This overdelivery sensing and inactivating control is comprised by a series of limit switches 85

and 86 which control the power operated section 74 of the conveyor. This protective feature is provided in order to enable an operator-unloader to remove the containers from the section 84 without fear of the containers being put on by the loading area operator so fast that they pile up in the unloading area. The limit switches 85 and 86 are spaced farther apart in distance than the longest container to be processed. Therefore, if the containers start to pile up at the unloading-discharge end of the conveyor, then either one, or both of the limit switches 85 and 86 will be depressed so as to deenergize the powered section 74. Whether one or two of the limit switches 85 or 86 is employed is determined by the degree of buildup that will be tolerated before the limiting action is introduced. Upon the powered section 74 being thus deenergized by either or both of the limit switches 85 and 86, the stop 76 at the loading end will automatically be raised by cylinder 75 so that no further containers may be loaded onto the conveyor until the limit switches 85 and 86 are again cleared.

As stated previously, in the readout information station 11 there is located all of the counters and meters employed in the article/time recording system. This enables one man in the readout information station to keep track of all of the information necessary to obtain the desired cost accounting information in controlling the operations of the manufacturing facility. By reading the loading area counters 18 and the unloading area counter 21 it is possible for him to keep track of all of the containers moving from one area of the plant to another. It also provides a check against the counts that are obtained from the unit line readouts 26 on a continuously updated substantially instantaneous basis. Under normal operations, at the beginning of any one work day or other work period of time, all the unit meters are set to zero and all the containers made during that period are placed in the storage area at the end of the period. Under these conditions, the sum total on each unit line readout 26 should equal the total for each item respectively of the unit meters on the loading area and unloading area counters 18 and 21, respectively. Also the total of all the unit line readout 26 should equal the total counts shown on both the loading area counter 18 and unloading area counter 21.

From the foregoing description, it will be appreciated that the present invention provides a new and improved article/time/persons working recording system for manufacturing facilities which provide a central, continuously updated running account of all people-hours worked in the facility in a given interval of time, the number of people working and the number of articles produced whereby an accurate and readily obtained up-to-date figure for the numbers of articles produced per worked hour and/or the number of articles produced per person, is instantaneously available for accounting purposes at any time during the work day or at the end of the day.

Having described one embodiment of a new and improved article/time/persons working recording system constructed in accordance with the invention, it is believed obvious that other modifications and variations of the invention are possible in the light of the above teachings. It is therefore to be understood that changes may be made in the particular embodiment of the invention described which are within the full intended scope of the invention as defined by the appended claims.

What we claim is:

1. An article/time recording system for a manufacturing facility comprising central people-hours-worked counting and readout means for deriving a count of the number of people-hours including any fractional parts thereof applied at predetermined work units within the facility in a given time interval, central articles completed counting and readout means for deriving a count of the number of articles completed in the same given time interval in the facility, at least one unit people-hours-worked-count registering means coupled to and controlling a corresponding part of the central people-hours-worked counting and readout means, and at least one articles

completed count registering means coupled to and controlling a corresponding part of the central articles completed registering and readout means whereby the number of unit articles completed and people-hours worked by the facility is readily determined at any given time during the work day.

2. An article/time recording system according to claim 1 further including automatic means cooperating with the central people-hours-worked counting and readout means and with the central articles completed counting and readout means for dividing the number of articles completed in a given time interval by the number of people-hours-worked to provide a continuously updated indication of the number of unit articles completed per people-hours-worked by the facility in the given time interval.

3. An article/time recording system according to claim 1 wherein there are a plurality of unit people-hours-worked-count registering means located at different work stations throughout the facility and all units are coupled to and control a corresponding part of the total people-hours-worked-count accumulated by the central people-hours-worked counting and readout means.

4. An article/time recording system according to claim 1 wherein there are a plurality of unit articles completed count registering means for deriving a count of the number of articles completed in a given time interval at a plurality of different work stations throughout the facility and all units are coupled to and control corresponding part of the total articles completed count accumulated by the central articles completed counting and readout means.

5. An article/time recording system according to claim 1 wherein the central people-hours-worked counting and readout means comprises counter means providing readout, and people-time-count-signal digitizing means for producing pulsed waveform electric signals wherein each electric signal pulse is representative of a finite time period worked by one person, and said unit people-hours-worked-count registering means serves selectively to apply representative numbers of the electric signal pulses from the people-time-count-digitizing means to the readout counter means.

6. An article/time recording system according to claim 3 wherein there are a plurality of unit articles completed count registering means for deriving a count of the number of articles completed in a given time interval at a plurality of different work stations throughout the facility and all units are coupled to and control a corresponding part of the total articles completed count accumulated by the central articles completed counting and readout means.

7. An article/time recording system according to claim 6 wherein the central people-hours-worked counting and readout means comprises readout counter means, and people-time-count signal digitizing means for generating a series of pulsed waveform electric signals wherein each electric signal pulse is representative of a finite time period worked by one person, and said unit people-hours-worked-count registering means serves selectively to apply desired numbers of the electric signal pulses from the people-time-count digitizing means to the readout counter means.

8. An article/time recording system according to claim 7 further including automatic means responsive to the people-time-count-signal digitizing means and to the central articles completed-count for dividing the number of articles completed in a given time interval by the number of people hours worked to provide a continuously updated indication of the number of unit articles completed per people hours worked by the facility in the given time interval.

9. An article/time recording system according to claim 5 further including automatic means responsive to the people-time-count-signal digitizing means and responsive to the central articles complete count for dividing the number of articles completed in a given time interval by the number of people-hours worked to provide a readily accessible indication of the number of articles completed per people-hours-worked by the facility in the given time interval.

10. An article/time recording system according to claim 5 wherein the people-time-count-signal digitizing means comprises a rotated member driven at a predetermined number of revolutions per minute and having a plurality of actuating elements secured thereto, a source of electric potential, a plurality of electric switch means connected to the source of electric potential and fixedly mounted with respect to the rotating member and arranged around its periphery and actuated by the actuating elements for developing a predetermined total number of electric signal pulses for a given number of revolutions of the rotating member, and stepping switch means having fixed and moveable contacts with the fixed contacts being selectively connected to the plurality of electric switch means for obtaining a desired number of electric signal pulses from the outputs of the plurality of electric switch means in accordance with the setting of the moveable contacts of the stepping switch, the setting of the moveable contacts being controlled by the people-hours-worked registering means.

11. An article/time recording system according to claim 10 further including a bank of isolating diodes operatively interconnecting the fixed contacts of the stepping switch means to the plurality of electric switch means mounted around the periphery of the rotating member for isolating all save selected ones of the outputs of the several electric switch means from the fixed contacts of the stepping switch means in order that fixed contacts of the stepping switch means have applied thereto characteristic numbers of electric signal pulses within a predetermined range and the setting of the stepping switch determines the number of electric signal pulses supplied at its output.

12. An article/time recording system according to claim 11 wherein the rotated member is driven at a speed of one-third r.p.m. and has an inner row of five actuating elements that coact with a single electric switch means and an outer row of 10 actuating elements that coact with 10 electric switch means whereby the single inner switch means operates to develop 100 pulses per hour with each pulse representing one-one hundredth of an hour and each outer electric switch means operates to develop 200 pulses per hour with each pulse representing one-one hundredth of an hour and with the total number of pulses produced representing the time in one-one hundredths of an hour of a system usable in controlling operation of up to 21 persons.

13. An article/time recording system according to claim 11 wherein there are a plurality of unit people-hours-worked-count registering means located at different work stations throughout the facility and all units are coupled to and control a corresponding part of the total people-hours-worked count accumulated by the central people-hours-worked counting and readout means and wherein there are a plurality of unit articles completed-count registering means for deriving a count of the number of articles completed in a given time interval at a plurality of different work stations throughout the facility and all units are coupled to and control a corresponding part of the total articles-completed-count accumulated by the central articles completed counting and readout means and further including automatic means responsive to the people-time-count-signal digitizing means and to the central articles completed count for dividing the number of articles completed in a given time interval by the number of people-hours-worked to provide a continuously updated indication of the number of unit articles completed per people-hours-worked by the facility in the given time interval.

14. An article/time recording system according to claim 11 wherein there are a plurality of unit people-hours-worked-count registering means located at different work stations throughout the facility and all units are coupled to and control a corresponding part of the total people-hours-worked count accumulated by the central people-hours-worked counting and readout means and wherein there are a plurality of unit articles-completed-count registering means for deriving a count of the number of articles completed in a given time interval at a plurality of different work stations throughout the facility

and all units are coupled to and control a corresponding part of the total articles-completed-count accumulated by the central articles completed counting and readout means whereby a continuously updated and current indication of the number of unit articles-completed and people-hours-worked by the facility in the given time interval can be obtained.

15. An article/time recording system according to claim 13 further including a master time controller and readout means for deriving a count of the total time being worked by the total number of people working in the facility, said master time controller and readout means being controlled by master time clock means which records the time and number of all time recorded people working in the facility.

16. An article/time recording system according to claim 15 wherein the master time clock means includes means for punching-in and punching-out workers at particular authorized times so as to add to or subtract from the total number of people working in the facility at any given time, and ancillary bypass punch-in and punch-out means for punching-in and punching-out workers at other than the particular authorized times at the discretion of a supervisor.

17. An article/time recording system according to claim 16 wherein the articles completed count registering means comprises packing area counting and readout means for deriving a count of the completed articles being processed through a packing area located at the end of a work station, and packing area count registering means coupled to and controlling the packing area counting and readout means, and wherein the packing area count registering means comprises a control tape dispensing means for dispensing an identifying piece of tape for securing to the completed article to indicate that the completed article has been processed through the packing area, and wherein each time a piece of control tape is dispensed, a completed article processed unit count is registered, and the control tape dispensing means operates automatically to dispense one piece of control tape at a time, and is controlled by a lockout control means that must be activated to enable the tape dispensing means to dispense another piece of control tape following a prior dispensing operation.

18. An article/time recording system according to claim 17 further including loading area counting and readout means for deriving a count of the completed articles being processed through a loading area, loading area count registering means coupled to and controlling the loading area counting and readout means, a conveyor mechanism for moving completed articles out of the loading area, and loading area count registering trigger means mounted on the conveyor mechanism and actuated by a completed article passing over the conveyor mechanism for registering one unit count in the loading area counting and readout means for each completed article transported by the conveyor mechanism out of the loading area.

19. An article/time recording system according to claim 18 further including a plurality of different characteristic article counters comprising a part of the loading area counting and readout means for deriving a count of each different type of article completed in the manufacturing facility, and type of article selector means comprising a part of the loading area count registering means for selectively activating a desired one of the plurality of different characteristic article counters in accordance with the type of article being processed through the loading area.

20. An article/time recording system according to claim 19 wherein the conveyor mechanism includes a power-driven portion that normally in its inactive condition engages a completed article subsequent to the completed article being loaded upon the conveyor mechanism and wherein the count-registering trigger means in addition to registering a unit count for each completed article loaded upon the conveyor mechanism also actuates the power-driven portion of the conveyor to cause the conveyor to convey the completed article thus counted to another location, and wherein there are a plurality of differently located count-assuring stop means for assuring an accurate count of articles loaded on the conveyor

and for accommodating different types of articles being loaded on the conveyor mechanism, and said type of article selector means further controls which particular type count-assuring stop means is rendered active for use in controlling the supply of articles to the power-driven portion of the conveyor mechanism.

21. An article/time recording system according to claim 19 wherein the conveyor mechanism also includes a gravity-operated portion that feeds the power-driven portion and upon which the completed articles are initially placed, the count-registering trigger means being supported on the gravity-operated portion at a distance from the power-driven portion designed to assure simultaneous engagement of the gravity-operated portion and actuation of the count-registering trigger means whereby the power-driven portion will be enabled upon each occurrence of a completed article being placed on the conveyor mechanism to withdraw the completed article off the count-registering trigger means and onto the power-driven portion a sufficient distance to assure return of the trigger means to its normally inactive position while simultaneously loading the power-driven portion of the conveyor with one completed article.

22. An article/time recording system according to claim 21 wherein the conveyor mechanism further includes at its discharge-unloading end a discharge-unloading portion to which the power-driven portion delivers articles stored thereon for unloading, and said discharge-unloading portion includes at least one overdelivery sensing and inactivating control means for sensing a buildup of unloaded articles being delivered to the discharge-unloading portion above a predetermined number and for inactivating the power-driven portion of the conveyor mechanism in response thereto, and further including manually operable control means for inactivating the power-driven portion of the conveyor mechanism at the option of an operator-unloader working at the discharge-unloading end of the conveyor mechanism.

23. An article/time recording system according to claim 22 further including unloading area counting and readout means for deriving a count of the completed articles being stored in the unloading area in which the discharge-unloading end of the conveyor mechanism is located and to which the articles are transported from the manufacturing facility by the conveyor mechanism and unloading area count registering means located in the unloading area and coupled to and controlling the unloading area counting and readout means.

24. An article/time recording system according to claim 23 wherein the unloading area count registering means comprises unloading article sensing trigger means mounted on a discharge-unloading portion of the conveyor mechanism for registering one unit count for each article transported over such discharge-unloading portion into the loading area.

25. An article/time recording system according to claim 24 wherein said unloading area counting and readout means includes a plurality of different characteristic article counters for deriving a count of each different type of article coming into the unloading area, and type of article selector means comprising a part of the unloading area count registering means for selectively activating a desired one of the plurality of different characteristic article counters in accordance with the type of article coming into the unloading area.

26. An article/time recording system according to claim 1 further including a master time controller and readout means for deriving a count of the total time being worked by the total number of people working in the facility, said master time controller and readout means being controlled by master time clock means which records the time and number of all time recorded people working in the facility and serving to synchronize operation of the central people-hours worked counting and readout means.

27. An article/time recording system according to claim 26 wherein the master time clock means includes means for punching-in and punching-out workers at particular authorized times so as to add to or subtract from the total

number of people working in the facility at any given time, and ancillary bypass punch-in and punch-out means for punching-in and punching-out workers at other than the particular authorized times at the discretion of a supervisor.

28. An article/time recording system according to claim 27 further including people recording and readout means for recording the total number of people working in the facility in a given time interval, the people recording and readout means being connected to and controlled by the master time clock means.

29. An article/time recording system according to claim 28 wherein the articles completed count registering means comprises packing area counting and readout means for deriving a count of the completed articles being processed through a packing area located at the end of a work station, and packing area count registering means coupled to and controlling the packing area counting and readout means and wherein the packing area count registering means comprises a control tape dispensing means for dispensing an identifying piece of tape for securing to the completed article to indicate that the completed article has been processed through the packing area, and wherein each time a piece of control tape is dispensed, a completed article processed unit count is registered, and the control tape dispensing means operates automatically to dispense one piece of control tape at a time, and is controlled by a lockout control means that must be activated to enable the tape dispensing means to dispense another piece of control tape following a prior dispensing operation.

30. An article/time recording system according to claim 26 further including people recording and readout means for recording the total number of people working in the facility in a given time interval, the people recording and readout means being connected to and controlled by the master time clock means.

31. An article/time recording system according to claim 26 wherein the articles completed count registering means comprises packing area counting and readout means for deriving a count of the completed articles being processed through a packing area located at the end of a work station, and packing area count registering means coupled to and controlling the packing area counting and readout means.

32. An article/time recording system according to claim 1 wherein the articles completed count registering means comprises packing area counting and readout means for deriving a count of the completed articles being processed through a packing area located at the end of a unit work station, and packing area count registering means coupled to and controlling the packing area counting and readout means.

33. An article/time recording system according to claim 32 wherein the packing area count registering means comprises a control tape dispensing means for dispensing an identifying piece of tape for securing to the completed article to indicate that the completed article has been processed through the packing area, and wherein each time a piece of control tape is dispensed, a completed article processed unit count is registered.

34. An article/time recording system according to claim 33 wherein the control tape dispensing means operates automatically to dispense one piece of control tape at a time, and is controlled by a lockout control means that must be activated to enable the tape dispensing means to dispense another piece of control tape following a prior dispensing operation.

35. An article/time recording system according to claim 1 further including loading area counting and readout means for deriving a count of the completed articles being processed through a loading area, loading area count registering means coupled to and controlling the loading area counting and readout means, a conveyor mechanism for moving completed articles out of the loading area, and loading area count registering trigger means mounted on the conveyor mechanism and actuated by a completed article passing over the conveyor mechanism for registering one unit count in the loading area counting and readout means for each completed article transported by the conveyor mechanism out of the loading area.

36. An article/time recording system according to claim 35 wherein the conveyor mechanism includes a power-driven portion that normally in its inactive condition engages a completed article subsequent to the completed article being loaded upon the conveyor mechanism and wherein the count registering trigger means in addition to registering a unit count for each completed article loaded upon the conveyor mechanism also actuates the power driven portion of the conveyor to cause the conveyor to convey the completed article thus counted to another location.

37. An article/time recording system according to claim 36 wherein the conveyor mechanism also includes a gravity operated portion that feeds the power-driven portion and upon which the completed articles are initially placed, the count-registering trigger means being supported on the gravity-operated portion at a distance from the power-driven portion designed to assure simultaneous engagement of the gravity-operated portion and actuation of the count registering trigger means whereby the power-driven portion will be enabled upon each occurrence of a completed article being placed on the conveyor mechanism to withdraw the completed article off the count-registering trigger means and onto the power-driven portion a sufficient distance to assure return of the trigger means to its normally inactive position while simultaneously loading the power-driven portion of the conveyor with one completed article.

38. An article/time recording system according to claim 37 further including a plurality of differently located count assuring stop means for assuring an accurate count of articles loaded on the conveyor and for accommodating completed articles of different size, and means for controlling which particular size count assuring stop means is rendered active for use in controlling the supply of articles to the power-driven portion of the conveyor mechanism.

39. An article/time recording system according to claim 37 wherein the conveyor mechanism further includes at its discharge unloading end a discharge-unloading portion to which the power-driven portion delivers articles stored thereon for unloading, and said discharge-unloading portion includes at least one overdelivery sensing and inactivating control means for sensing a buildup of unloaded articles being delivered to the discharge-unloading portion above a predetermined number and for inactivating the power driven-portion of the conveyor mechanism in response thereto.

40. An article/time recording system according to claim 39 further including manually operable control means for inactivating the power-driven portion of the conveyor mechanism at the option of an operator-unloader working at the discharge-unloading end of the conveyor mechanism.

41. An article/time recording system according to claim 40 further including unloading area counting and readout means for deriving a count of the completed articles being transported to the unloading area from the manufacturing facility, and unloading area count registering means located in the unloading area and coupled to and controlling the unloading area counting and readout means.

42. An article/time recording system according to claim 35 further including a plurality of different characteristic article counters comprising a part of the loading area counting and readout means for deriving a count of each different type of article completed in the manufacturing facility, and type of article selector means comprising a part of the loading area count registering means for selectively activating a desired one of the plurality of different characteristic article counters in accordance with the type of article being processed through the loading area.

43. An article/time recording system according to claim 42 wherein the conveyor mechanism includes a power-driven portion that normally in its inactive condition engages a completed article subsequent to the completed article being loaded upon the conveyor mechanism and wherein the count registering trigger means in addition to registering a unit count for each completed article loaded upon the conveyor mechanism also actuates the power-driven portion of the con-

veyor to cause the conveyor to convey the completed article thus counted to another location, and wherein there are a plurality of differently located count assuring stop means for assuring an accurate count of articles loaded on the conveyor and for accommodating different types of articles being loaded on the conveyor mechanism, and said type of article selector means further controls which particular count assuring stop means is rendered active for use in controlling the supply of articles to the driven portion of the conveyor mechanism.

44. An article/time recording system according to claim 42 wherein the conveyor mechanism further includes at its discharge-unloading end a discharge-unloading portion to which the power-driven portion delivers articles stored thereon for unloading, and said discharge-unloading portion includes at least one over delivery sensing and inactivating control means for sensing a buildup of unloaded articles being delivered to the discharge-unloading portion above a predetermined number and for inactivating the power-driven portion of the conveyor mechanism in response thereto and further including manually operable control means for inactivating the power-driven portion of the conveyor mechanism at the option of an operator-unloader working at the discharge-unloading end of the conveyor mechanism.

45. An article/time recording system according to claim 22 further including unloading area counting and readout means for deriving a count of the completed articles being transported to the unloading area from the manufacturing facility, and unloading area count registering means located in the unloading area and coupled to and controlling the unloading area counting and readout means.

46. An article/time recording system according to claim 45 wherein the unloading area count registering means comprises unloading article sensing trigger means mounted on a discharge-unloading portion of the conveyor mechanism for registering one unit count for each article transported over such discharge-unloading portion into the unloading area.

47. An article/time recording system according to claim 46 wherein said unloading area counting and readout means includes a plurality of different characteristic article counters for deriving a count of each different type of article coming into the unloading area, and type of article selector means comprising a part of the unloading area count registering means for selectively activating a desired one of the plurality of different characteristic article counters in accordance with the type of article coming into the unloading area.

48. An article/time recording system according to claim 1 further including unloading area counting and readout means for deriving a count of the completed articles being transported to the unloading area from the manufacturing facility, and unloading area count registering means located in the unloading area and coupled to and controlling the unloading area counting and readout means.

49. An article/time recording system according to claim 48 wherein the unloading area count registering means comprises unloading article sensing trigger means mounted on a discharge-unloading portion of the conveyor mechanism for registering one unit count for each article transported over such discharge-unloading portion into the unloading area.

50. A people-time-count-signal digitizing device for an article/time recording system generating electric signal pulses comprising a rotated member driven at a predetermined number of revolutions per minute and having a plurality of actuating elements secured thereto, a source of electric potential, a plurality of electric switch means connected to the source of electric potential and fixedly mounted with respect to the rotating member and arranged around its periphery and actuated by the actuating elements for developing a predetermined total number of electric signal pulses for a given number of revolutions of the rotating member, and stepping switch means having fixed and movable contacts with the fixed contacts being selectively connected to the plurality of electric switch means for obtaining a representative number of electric signal pulses from the outputs of the plurality of electric switch means in accordance with the setting of the movable contacts of the stepping switch, the setting of the movable contacts being controlled in accordance with the number of people working in a given time interval for which a people-time count is desired.

51. A people-time count-signal digitizing device according to claim 50 further including a bank of isolating diodes operatively interconnecting the fixed contacts of the stepping switch means to the plurality of electric switch means mounted around the periphery of the rotating member for isolating all save selected ones of the outputs of the several electric switch means from the fixed contacts of the stepping switch means in order that the fixed contacts of the stepping switch means have applied thereto characteristic numbers of electric signal pulses within a predetermined range and the setting of the movable contacts of the stepping switch determines the number of electric signal pulses supplied at the output of the stepping switch.

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