

[54] **AUTOMATIC LEAD MAKING AND WIRING MACHINE**

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[58] Field of Search **29/203 R, 203 C, 29/203 D, 203 DT, 203 DTS, 203 MH, 203 MW, 203 S, 630**

[56] **References Cited**

UNITED STATES PATENTS

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[57]

ABSTRACT

The disclosure relates to an automatic lead making and wiring machine wherein a controlled device is utilized to select wire of predetermined size or color and feeds same into the machine wherein the wire is cut to a predetermined length. A wire is then sequentially fed to a plurality of operating units wherein the wire is stripped on one or both ends thereof, the amount of stripping being variable and depending upon the number of stripper units available. The wire is then automatically fed to a plurality of presses wherein terminals can be placed on one or both ends at the point of stripping, the control device further being capable of preselecting any one of a plurality of terminals to place on either or both ends of the stripped wire. The wire can then be marked if desired and the wires can then be positioned into a panel board or the like at predetermined terminal locations thereof. The result would be a completely wired panel board with wires therein having terminals thereon and being of predetermined wire size and predetermined wire color. As an alternative, the stripped and terminated wires need merely be placed on a conveyor or other such device at the termination of the operation.

2 Claims, 6 Drawing Figures

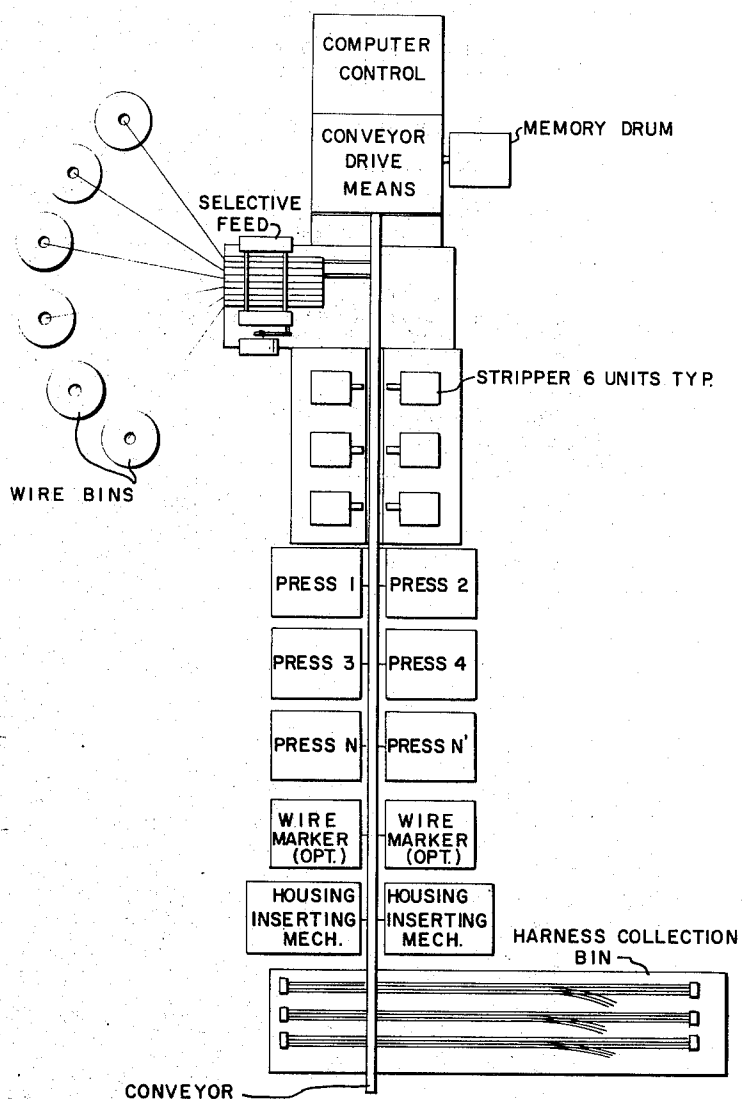
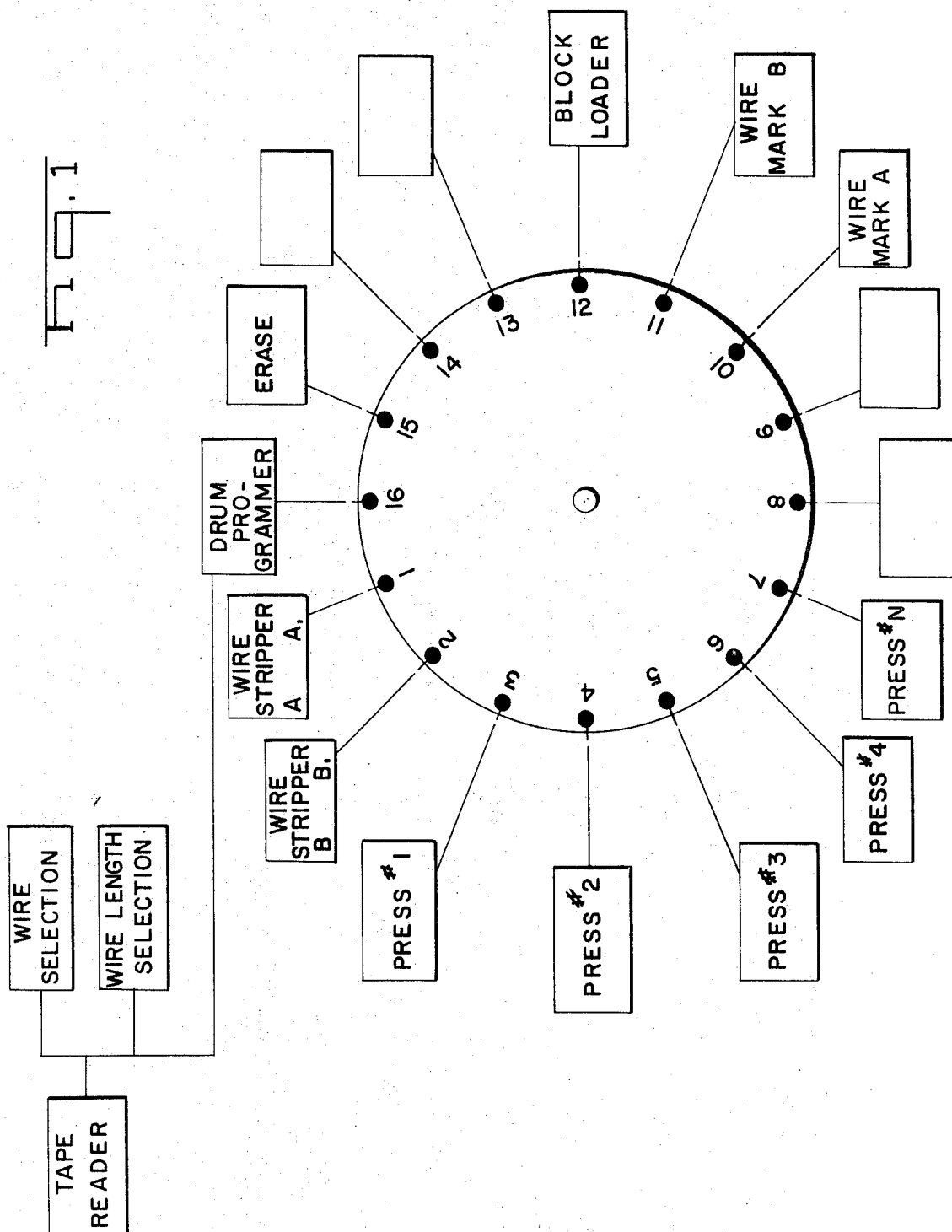
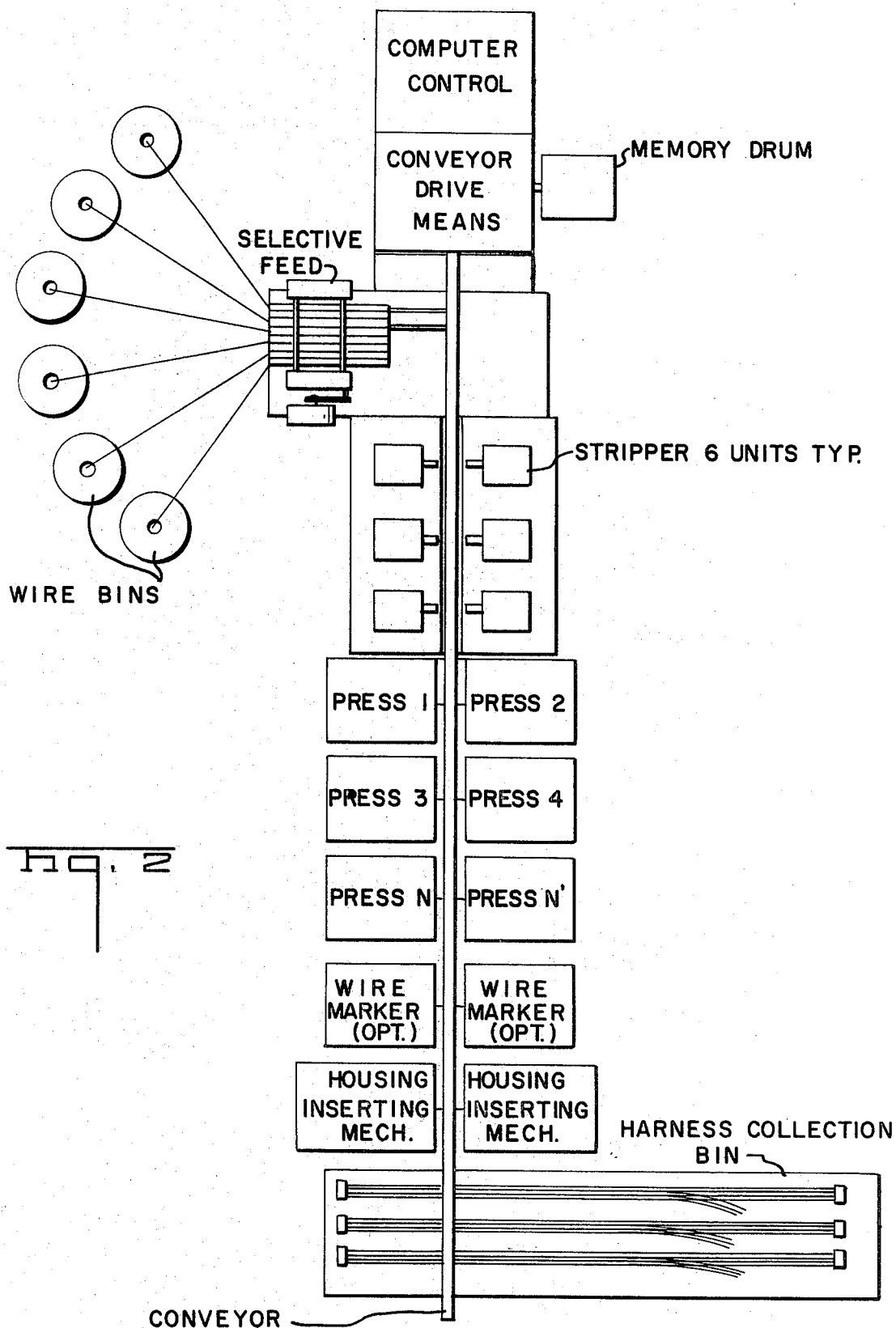
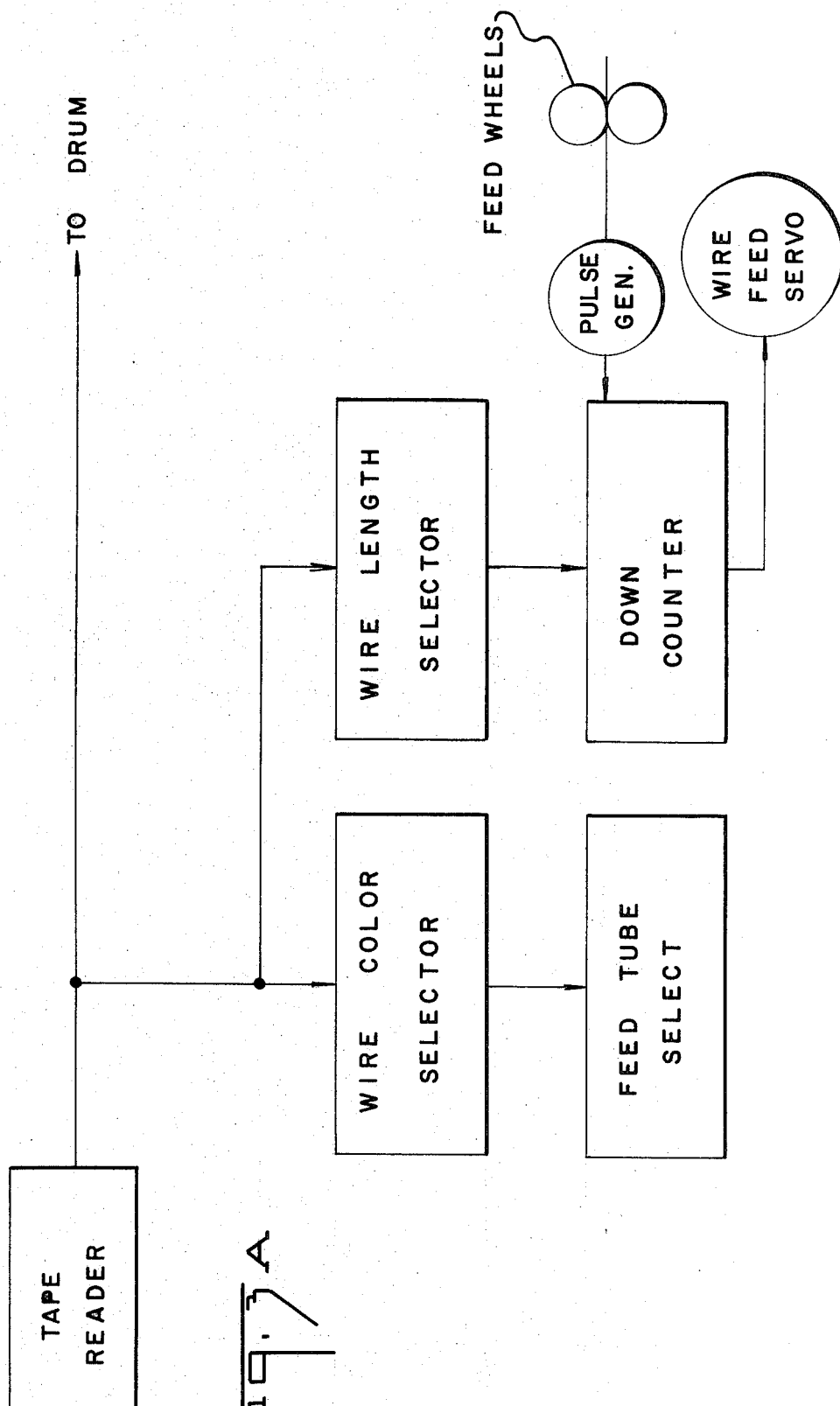
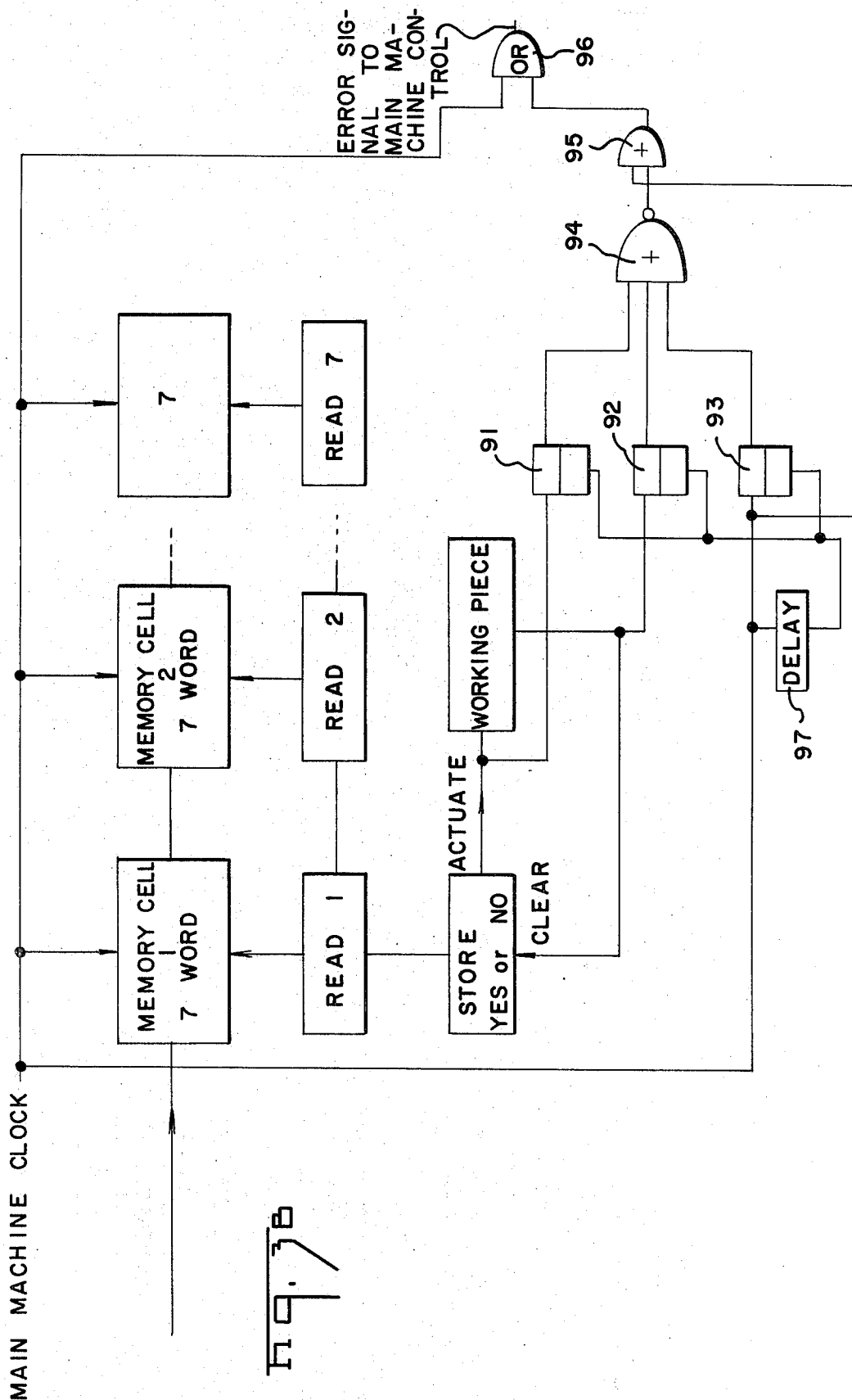


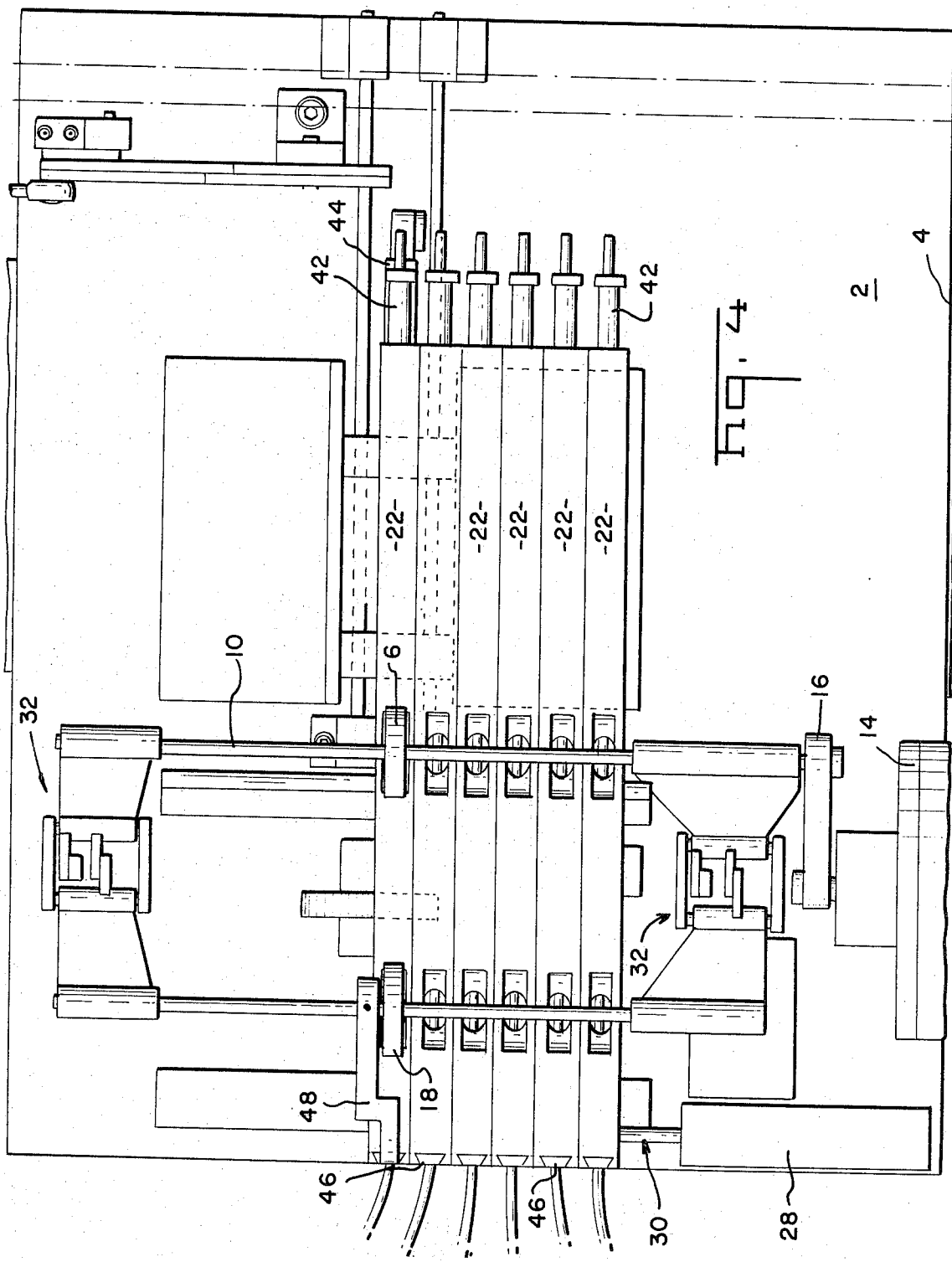
Fig. 1

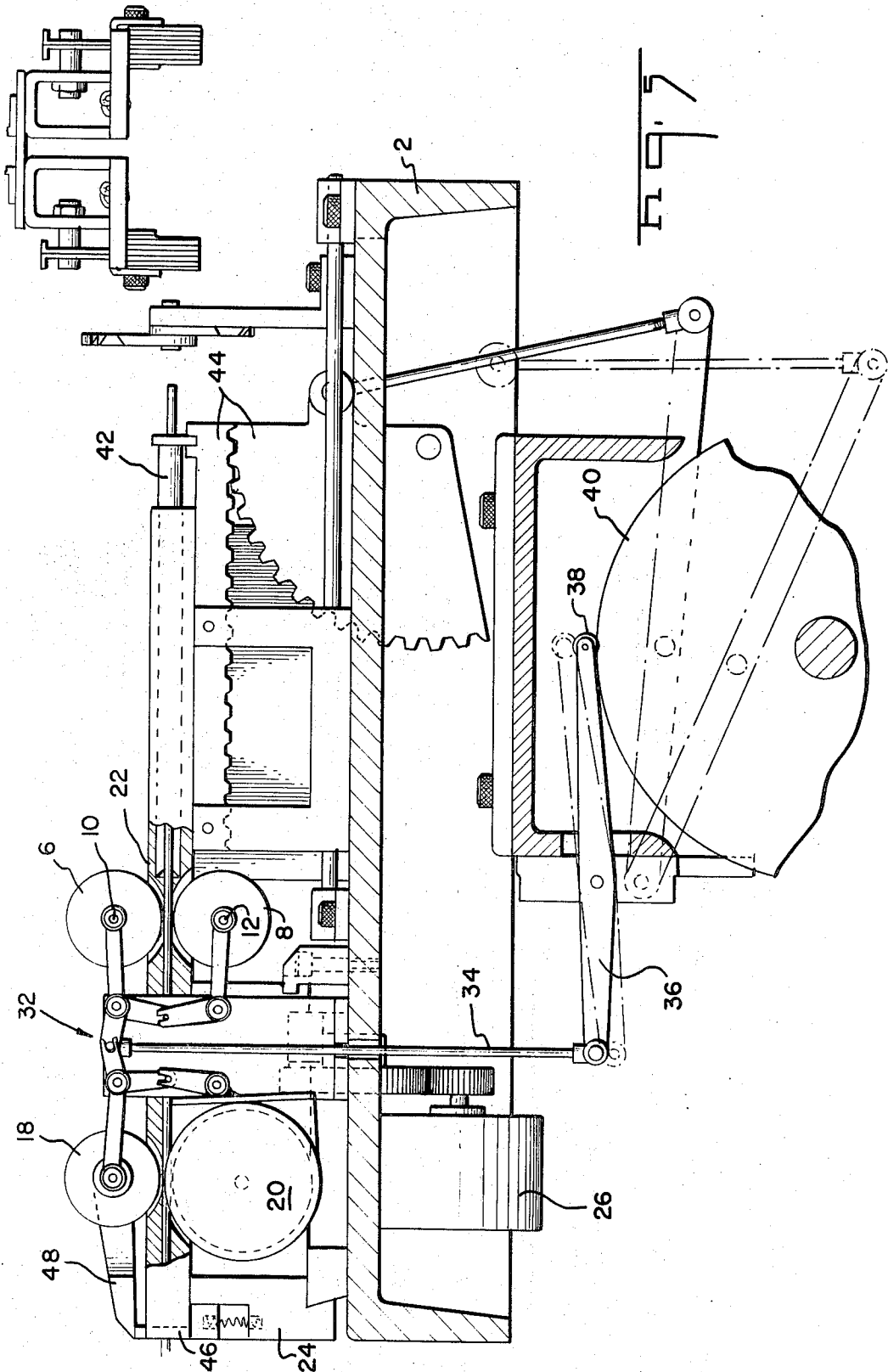












AUTOMATIC LEAD MAKING AND WIRING MACHINE

This invention relates to an automatic computer controlled wire selecting and feeding machine capable of determining wire length, color or the like and then, under the control of the computer, capable of stripping the wire on one or both ends thereof to predetermined depth and then placing one or two terminal thereon on one or both ends thereof of predetermined type to form a terminated wire of predetermined size and color. The machine then, under control of the computer, proceeds to insert the wire into a housing, plug board or the like in a predetermined location thereon to provide a completely wired terminal board completely under the control of the computer. The board can then be removed by way of a conveyor or the like. As an alternative, the wires themselves without being placed into a terminal board can be placed on the conveyor or a plurality of wires can be formed into a harness for use in varying devices.

The general concept of providing wire in a machine which can then be automatically positioned within a terminal board at a predetermined location thereof is well known in the art as exemplified by the patents to Kreinberg et al, U.S. Pat. No. 3,231,967, and Vickery U.S. Pat. No. 3,186,077. Machines of this type have found great use in the art. However, it is always desirable to provide machines which are capable of even more automated control and which are capable of operating at increased speeds and at lower cost relative to prior art devices.

In accordance with the present invention there is provided a machine capable of forming leads with terminations thereon of predetermined color, size and wire length and with predetermined terminations thereon, the leads then being automatically positioned within a panel board, housing or the like to form a completely wired device after beginning with the mere components in unassembled form. Briefly, the above is accomplished by providing a machine which is computer controlled and wherein information for each wire is stored on a memory drum or the like under control of a computer therein, in one embodiment the information being read out from the memory drum onto a shift register sequentially for each wire. The information in the shift registers is stored in a staggered type of relationship whereby all of the stations of the machine will simultaneously receive information during a clock period which is determined by an external clock source. This simultaneous information to each station is provided for operation simultaneously on a plurality of different wires at different stages of advancement in the machine. In this manner, a panel board can be completely wired with wires of predetermined color, length and termination completely under control of a computer and at speeds far in excess of those known to the prior art.

It is therefore an object of this invention to provide a lead making and wiring machine which is fully automatic.

It is a further object of this invention to provide a lead making and wiring machine which operates more rapidly to produce a final product from the raw parts than prior art devices.

It is a still further object of this invention to provide a lead making and wiring machine capable of providing

harnesses from raw wire more rapidly and economically than prior art devices.

It is a yet further object of this invention to provide a lead making and wiring machine capable of forming terminated wires and positioning the wires in plural selected positions of a connector block, all automatically.

The above objects and still further objects of the invention will become immediately apparent to those skilled in the art after consideration of the following specification and drawings of preferred embodiments of the invention which are provided by way of example and not by way of limitation, wherein:

FIG. 1 is a diagram to indicate one mode of machine operation;

FIG. 2 is a block diagram of the machine according to the present invention;

FIG. 3a and 3b are a circuit diagram of one embodiment of the control system for the present invention;

FIG. 4 is an end view of a wire feed and select mechanism in accordance with the present invention; and

FIG. 5 is a top view of the device of FIG. 4.

Information to provide the various operational steps can be provided in several ways. Two such methods are depicted with respect to FIGS. 1 and 2. Referring first to FIG. 1, information would be stored on, for example, a punched tape, the information being in blocks, the first block providing information, for example, as to which color of wire is to be selected. The next block of information on the tape will have instructions for wires 1 and 2 which information will be whether or not the first wire is to be stripped by stripper A and/or A1 and also the color and length of wire to be selected as wire number 2. This wire will be continued with each block containing additional information, i.e., information for the wire or wires being operated upon plus the new wire to be entered into the system. In the case of FIG. 1, there can be as many as sixteen different types of information per block, one for each position of the system. In this manner, all of the wires being processed will be processed simultaneously during each step of the operation or for each block of information being read out.

Referring now to FIG. 2, there is shown a second embodiment of storage of information wherein information is stored for each of the wires. That is, a block of information would include all of the required information for each step to be taken in processing a single wire. This would be done for each consecutive type of wire to be processed if different types of wire are to be processed. This information would be read out onto a drum, each successive readout for the drum corresponding to each successive wire being staggered around the drum by one station distance. Thereby, it would really be necessary to store all of the information for all the wires around the drum and read across the drum, thereby obtaining the information required for processing all of the wires being processed at that time simultaneously and performing the functions in the same manner as described above with respect to the embodiment of FIG. 1.

Referring now to FIGS. 3a and 3b, there is shown a third possibility of information readout wherein the information from the tape reader is provided in the same manner as disclosed above for FIG. 2, however the information with regard to the particular wire to be selected and its length is read out separately into the wire selector and cutter whereas the remaining information

is fed to and stored on a drum. In this manner, the particular wire and length can be chosen immediately without the requirement of storage, thereby decreasing the amount of equipment required. This is shown in FIG. 3a wherein the information is fed from the tape reader with that information relating to wire color selector and wire length selector being read out directly into the selection mechanisms whereas the rest of the information is fed onto a drum as shown in FIG. 3b, where it is positioned on the drum and then read out therefrom in the same manner described for the drum of FIG. 2.

Referring now more specifically to FIG. 2 there are shown the wire feed bins and wire length selector wherein wire of a particular color or gage, etc. is chosen and cut to predetermined length. A wire selector and cutter which is capable of performing this function is set forth in complete detail in application Ser. No. 532,014 of Kreinberg, now U.S. Pat. No. 3,458,787 as well as in the device set forth in FIGS. 4 and 5 discussed hereinbelow.

The wire which has now been selected and cut to proper length is held in jaws and moved along the conveyor to be presented to the subsequent stations for operation thereon in accordance with the instructions from the drum or other storage device as described above. This conveyor could be of the type disclosed in Howard application, Ser. No. 626,322 filed Mar. 27, 1967, now U.S. Pat. No. 3,479,717 which is incorporated herein by reference in its entirety. The wire is fed to a plurality of stripper units, one at a time, the stripper units being shown both in FIGS. 1 and 2. The stripping operation will take place on either one or both sides of the wire and at the particular stripper station selected. The stripper stations are shown in a plurality merely so that the length of the stripping can be varied as desired on both sides of the wire. The wire will then move along to the presses shown as 1 through N, a series of presses being positioned on each side of the wire, whereby either no terminal can be placed on one or both sides of the wire or any one of a predetermined number of preselected terminals can be positioned on the wire on one or both sides and crimped thereto, each press providing a different terminal. The wire then proceeds to an optional station or stations whereby markings can be placed on the wire indicative of some use, etc., as desired. The wire then is passed to the housing inserting mechanism where it is positioned in a predetermined location in a multiple connector block. The multiple position block is actually the one that is moved about and the wire itself is always positioned in the same location by the housing inserting mechanism. The multiple position connector is secured to a mechanism which is capable of moving it in an X-Y direction so that the particular wire which is being inserted can be inserted in the proper location therein. Accordingly, the housing inserting mechanism does not have to worry about positioning, this being taken care of by the positioning of the multiple position connector. A plurality of wires will be placed into the multiple position connector and, after all the wires have been positioned therein, the end result will be a completed and wired harness which can then be placed onto the harness collection bin with a new multiple position connector being inserted into the drive and the operation being repeated with the wires being selected, stripped, terminated, etc. to continually provided harnesses.

With reference to FIG. 3b, the information or memory cell and station 1 would be read out by the read 1 circuit into the store and this would then actuate the station corresponding thereto, in this case station number 1. If the working piece has been operated on satisfactorily, a signal will be sent back to the store to clear the store. Alternatively, if the working piece has not been operated upon satisfactorily, the clear signal will not be sent back and the store will not be cleared. The failure to clear the store would be the false signal which could also be detected at the next clock pulse time and could at that time, shut down the system.

It is necessary after each operation at each station to determine whether the stations are operating satisfactorily. It is highly undesirable to have the mechanism continue to operate after a jam-up due to faulty operation at one or more of the stations. The system therefore has an automatic self checking operation which will check each operation after completion and will automatically shut down the entire system if a fault is detected. Each station of the system has associated therewith a gating circuit composed of flip flops 91, 92 and 93, the flip flops being set by an actuate signal, a clear signal and a check signal respectively. The outputs of the flip flops are sent to a NAND gate 94 which provides an output only when the one of the flip flops is not set. The output of gate 94 is passed to AND gate 95 which is open only by a clock pulse and an output from gate 94 to provide an output to OR gate 96 to provide an error of fault indication. A similar arrangement is connected to each station, the system being stopped by breakdown at any station via OR gate 96. The flip flops are reset by the clock pulses after a small delay in delay element 97 which is of sufficient duration to allow the clock pulse to set flip flop 93 and allow gates 94, 95 and 96 to function. The input signals to the flip flops indicate that a readout has been provided by the memory, (the actuate signal of FIG. 3b), that the operation has been properly completed (the clear signal of FIG. 3b) and the clock pulse itself has been received. If error is detected, the system will be shut down by cutting off power, for example, or by shutting down the clock of the computer itself as is well known in the art.

FIGS. 4 and 5 set forth a wire feed and select mechanism which can be used in the present system.

The wire feed and select mechanism is mounted on a plate 2 which is in turn mounted on the main bed 4 of the conveyor mechanism. The feed consists of a pair of wheels 6 and 8 fixed on shafts 10 and 12 which are rotated for feeding by a motor 14 via belt 16. As it is being fed, the wire is measured by a second set of wheels 18 and 20 in the manner disclosed in the above mentioned Kreinberg patent. Positioned between wheels 6 and 8 and between wheels 18 and 20 are a plurality of wire guide tubes 22 having appropriate openings to allow the aforementioned wheels to communicate with the wires to be fed. Tubes 22 are fixed to a slidable member 24 which is guided for movement transversely to the feed wheels, thereby to position any one of the plurality of tubes between the feed wheels. This movement is accomplished by means of a rack and pinion mechanism driven by motor 26. This motion is controlled by means of a linear transducer 28 activated by a pin 30 connected to the slide 24. The transducer 28 controls motor 26.

When the guide tubes 22 are being moved to position the proper tube relative to the feed and measure

wheels, it is necessary to open the pairs of wheels to permit tube passage. This is accomplished by means of double toggle and bell crank linkage 32 which is operated by a rod 34 connected to one end of a lever 36 pivoted intermediate its ends to bed 4 and having a follower 38 on its opposite ends for engagement with a cam 40 on the main cam shaft of the conveyor mechanism.

Each guide tube 22 has an extension arm 42 telescopically connected for conveying the wire end to the conveyor jaws. This extension is actuated by a rack and pinion 44 connected through the necessary linkage to another cam on the main cam shaft.

Each tube also has a wire-gripping mechanism 46 for holding unused wires in their respective tubes until such time that the feed wheels are closed on the wire. At this time, tamper 48 on the same shaft as wheel 18, releases the gripping member so the wire may be fed.

Though the invention has been described with respect to a specific preferred embodiment thereof, many variations and modifications thereof will immediately become apparent to those skilled in the art. It is therefore the intention that the appended claims be interpreted as broadly as possible in view of the prior art to include all sorts of variations and modifications.

What is claimed is:

1. Apparatus for producing articles serially, said articles being manufactured from one of a plurality of starting blanks and being fundamentally similar and superficially dissimilar said apparatus comprising:

- a. a conveyor for said articles,
- b. a loading station for loading said articles onto said conveyer, loading means at said loading station for selecting a blank and loading the selected blank onto said conveyer,
- c. primary controller means for said loading means effective to select said blank,
- d. a plurality of working stations beside said con-

veyer, working means at said working stations for working a blank carried by said conveyer,

e. a plurality of secondary controller means, each of said secondary controller means being effective to control one of said working means,

f. a source of intelligence comprising a plurality of information blocks, each block defining the fundamental and superficial characteristics of one article,

g. primary reading means for reading each of said blocks,

h. means coupling said primary reading means and said primary controller means whereby information in one bundle concerning the blank for the defined article in said one bundle is transmitted to said primary controller means and the appropriate blank for said defined article is loaded onto said conveyer,

i. information storing means for storing the remaining information of said block for said defined article,

j. a plurality of secondary reading means, each of said secondary reading means being coupled to one of said secondary controller means,

k. means for presenting said remaining information of said one bundle retained in said storing means to each of said secondary reading means in synchronism with arrival of said one blank at each of said working stations whereby,

said one blank is operated on by selected ones of said working means as said blank is carried by said conveyer.

2. Apparatus as set forth in claim 1 wherein said blanks are wires and further including means responsive to said source of intelligence for selecting a predetermined wire and cutting said wire to predetermined length.

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