

July 28, 1953

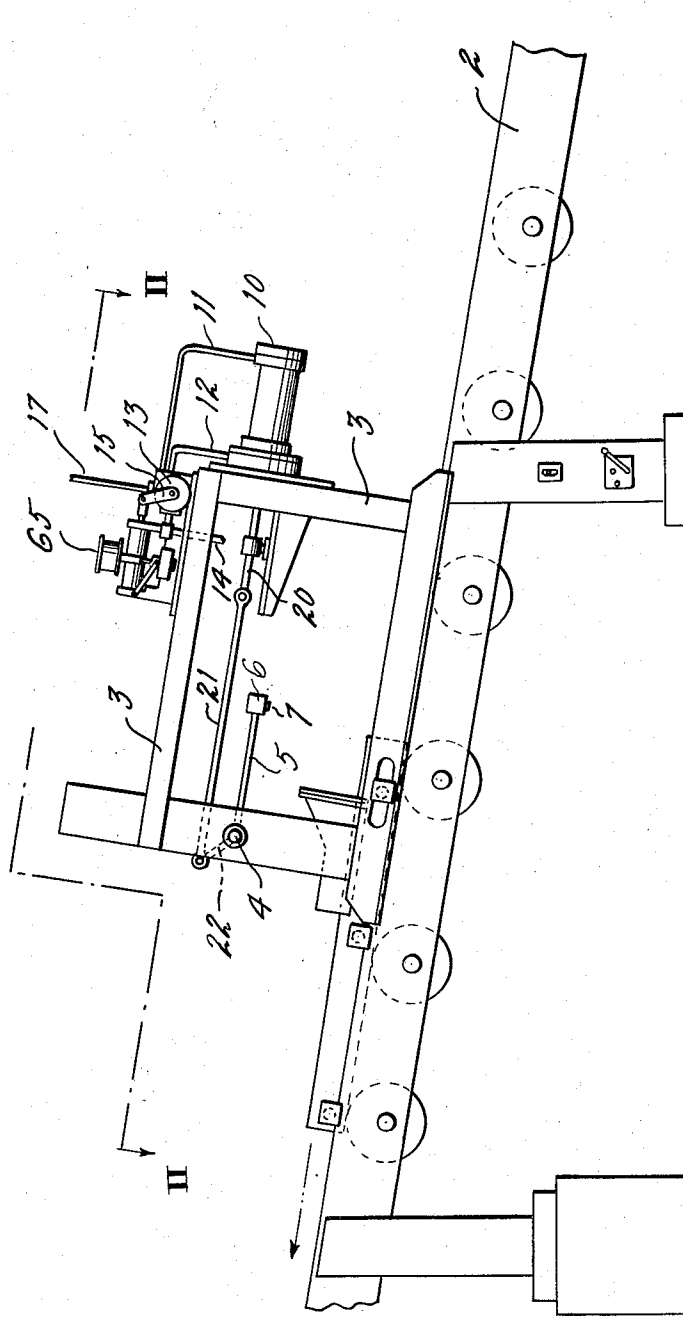
H. E. MULLER, SR

2,646,746

CONTROL SYSTEM FOR BILLET MARKING

Filed April 1, 1947

3 Sheets-Sheet 1



Inventor

Herman E. Muller Sr.

89 Donald G. Dalton

His Attorney

July 28, 1953

H. E. MULLER, SR

2,646,746

CONTROL SYSTEM FOR BILLET MARKING

Filed April 1, 1947

3 Sheets-Sheet 2

Fig. 2.

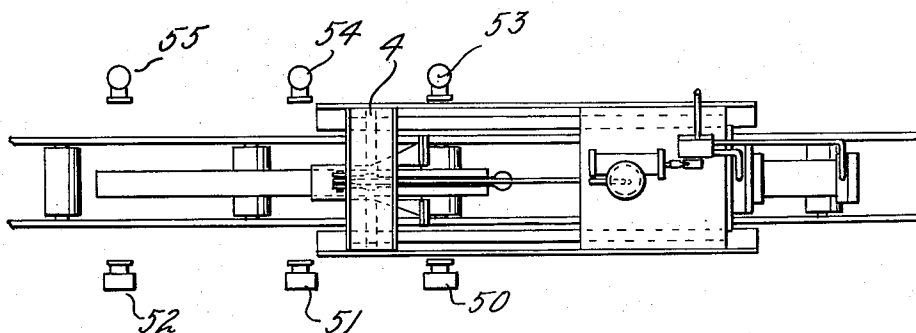
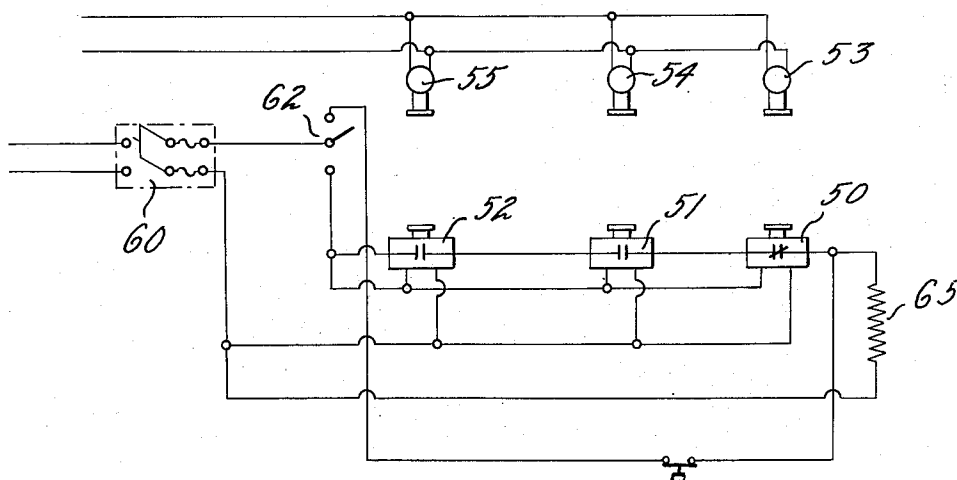


Fig. 3.



Inventor
Herman E. Muller Sr.
By Donald E. Dalton
His Attorney

July 28, 1953

H. E. MULLER, SR

2,646,746

CONTROL SYSTEM FOR BILLET MARKING

Filed April 1, 1947

3 Sheets-Sheet 3

Fig. 4.

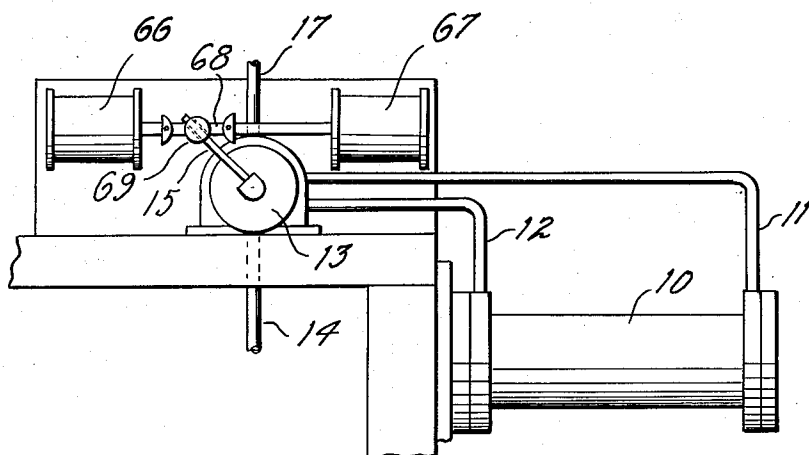
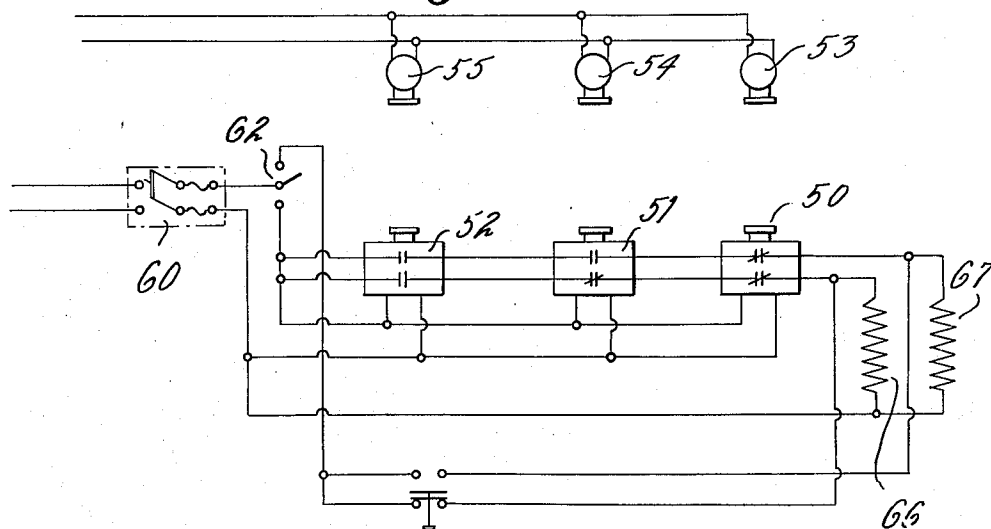


Fig. 5.



Inventor
Herman E. Muller Sr.
By *Donald L. Dalton*
His Attorney

UNITED STATES PATENT OFFICE

2,646,746

CONTROL SYSTEM FOR BILLET MARKING

Herman E. Muller, Sr., Swissvale, Pa., assignor
to United States Steel Corporation, a corporation
of New Jersey

Application April 1, 1947, Serial No. 738,763

2 Claims. (Cl. 101-4)

1

2

This invention relates to control systems, and more particularly to control systems for apparatus for performing a predetermined operation on a work object which is moved along a conveyor, although not limited thereto.

According to an illustrative embodiment, the apparatus of the present invention may be utilized in combination with a billet stamping apparatus, the same being illustrated in the drawings and described more fully hereinafter.

In some steel mills it is the practice to stamp the end of heavy metal billets with the number of the heat of steel from which they were made. Ordinarily the stamping of the end of the billet is accomplished as it moves along a conveyor. In the past this has been accomplished by an operation which is either manual, or manually initiated. In some cases it has been found expedient to move the billets endwise along a conveyor and to mount over the conveyor a pivoted arm on which the heat numbers are detachably mounted, the said arm being actuated by an adjacently disposed fluid cylinder through the medium of a control switch, itself susceptible to manual operation. More recently the manually operated switch has been superseded by photoelectric controls. It has heretofore been proposed to so mount photoelectric or light-sensitive cells, and their light sources, that the advancing end of the billet will interrupt the light to the first cell, but the solenoid will not be actuated until the advancing end of the billet interrupts the light to the second cell, at which time the trailing end of the billet is immediately below the operative point of the swinging arm carrying the billet stamp; and it is at this point that the fluid cylinder is actuated to swing the arm in its lowermost position and thereby move the said billet stamp against the trailing end of the ingot with the requisite force.

While no difficulty or danger is to be experienced were the light rays to the first of these photoelectric cells accidentally interrupted, it has been found that the accidental interruption of light rays to the second photoelectric cell while any portion of the advancing billet is interrupting the light rays to the first cell will result in the accidental and possibly dangerous downward movement of the heavy swinging arm with its heavy billet stamp.

It is accordingly among the objects of the present invention to provide a control system which may be used in various operations such as the motivation of the billet stamping apparatus referred to, and by means of which the desired control of the apparatus is insured against im-

Another object is the attainment of the foregoing by the use of instrumentalities which are simple and inexpensive to manufacture and install, and ones which are at the same time quite durable in service.

The invention, then, comprises the features hereinafter described and as particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative of several of the number of ways in which the principles of the invention may be employed.

In said drawings:

Figure 1 is a side elevation of a conventional inclined conveyor of the type adapted to endwise or longitudinally move a succession of heavy steel billets, the said conveyor being provided with a superposed billet stamping apparatus;

Figure 2 is a plan of the showing of Figure 1 but on a reduced scale, and showing in addition certain photoelectric cells and light sources which will be described more fully hereinafter;

Figure 3 is a simple and conventional electric circuit which may be utilized to operate the instrumentalities of the control system of the present invention;

Figure 4 is a fragmentary enlarged elevation of a modified solenoid system; and

Figure 5 is a simplified electric circuit which may be utilized to operate the instrumentalities embodying the modified solenoid system of Figure 4.

Referring more particularly to the drawings, the numeral 2 generally designates an inclined conveyor comprising a plurality of suitably driven conveyor rolls which are constructed and arranged to successively feed elongate metal billets, or other workpieces, in endwise fashion.

As shown most clearly in Figures 1 and 2, a frame 3 is mounted atop the inclined conveyor and carries an elevated and transversely extending rotatable shaft 4. Secured to this rotatable shaft 4 is one end of an arm 5, the other of which carries a heavy marking head 6. Suitable numbers, or other marking media 7, are detachably carried by the head 6, the same being so constructed and arranged as to permit of marking one end of a metallic billet when the pivotally mounted arm 5 is moved with sufficient force through a downward arc.

The frame 3 carries a double-acting air cylinder 10, the outer and inner ends of which communicate with air conduits 11 and 12, respectively. These air conduits 11 and 12 connect through a valve 13 with an air supply pipe 14. An

operating lever 15 is operable to alternately connect the air conduits 11 and 12 with the air supply pipe 14 and an air exhaust pipe 17.

The piston of the double-acting air cylinder 10 is provided with the usual piston rod 20, and to the latter there is pivotally connected an elongate rod 21 which extends over the arm 5. The extended end of the elongate rod 21 is pivotally connected to one end of a link 22, the other end of the said link being secured to the rotatable shaft 4.

Referring to Figures 2 and 3 of the drawings, as the elongate metal billets are moved along the inclined conveyor 2 and pass under the frame 3, they travel through a field across which there is focussed a series of three substantially spaced photoelectric or other light-sensitive units, as shown at 50, 51 and 52. The distance between the first and third of these light-sensitive units is approximately the same as the length of the metal billets (or other workpieces) which are to be marked by the marking media 7 carried by the marking head 6 on the outer end of the pivotally mounted arm 5, the reason for which will appear shortly hereinafter.

Each of the light-sensitive units 50, 51 and 52 is actuated by a light source, as at 53, 54 and 55, respectively, which is positioned immediately opposite on the other side of the conveyor and at such points as will enable the light rays emanating therefrom to be intercepted by the metal billets during their forward movement along the inclined conveyor 2.

In their own circuit the light-sensitive units 50, 51 and 52 are connected in parallel, whereas the contactors of the relays they operate are connected in series and operate a solenoid unit 65, which comprises a spring-loaded single-acting cylinder. Referring back to Figure 1, this solenoid unit 65 actuates the operating lever 15 of the control valve 13. That is, when the solenoid 65 is energized it will swing the lever 15 of the control valve 13 in the direction opposite to that shown in Figure 1, with the result that the piston (not shown) within the air cylinder 10 is caused to move to the right, causing the piston rod 20 and its pivotally connected elongate rod 21 to move in the same direction, with the end result that the pivotally mounted arm 5 and its marking head 6 are caused to swing downwardly. In this manner, then, the numbers or other marking media 7 are caused to make contact with the trailing end of a metal billet which is advancing along the inclined conveyor 2 and through a suitable guide, such as the conventional bell illustrated in Figure 1. When the solenoid unit 65 is deenergized the spring within its single-acting cylinder causes the lever 15 of the control valve to return to its initial position, as in Figure 1. Thus, the working cycle of the control valve 13 is simply a matter of alternately deenergizing or energizing the solenoid unit 65 which is performed through the opening or closing of the contactors of the relays of the light-sensitive units 50, 51 and 52.

As to the manner of opening or closing the contactors of the relays of the hereinbefore described light-sensitive units 50, 51 and 52, the said units are, like their respective light sources 53, 54 and 55, connected in parallel, whereas the contactors of the photoelectric relays which the said units control (and which in turn control the solenoid unit 65) are in series. With the main switch 60 in closed position and the operating arm of the switch 62 in its downward or "automatic" position, the current flows to all of the photoelectric

units directly, except to the solenoid unit 65, for the reason that the contactors of the relays of the light-sensitive units 51 and 52 are normally "open," while the contactors of the relay of the light-sensitive unit 50 are normally "closed," all as shown in Figure 3.

If any interruption of the light rays emanating from the light sources 53, 54 and 55 causes a reaction on the contactors of the relays of the light-sensitive units, it will have no effect on the solenoid unit 65 if one of the contactors is still "open" because they are all connected in series.

As the metal billet moves along the inclined conveyor 2, its leading end interrupts the light rays emanating from the light source 53, thereby opening the contactors of the relay of the light-sensitive unit 50. In progressing forwardly the billet then interrupts the light rays emanating from the light source 54, with the result that the contactors of the relay of the light-sensitive unit 51 are closed. In progressing further along the inclined conveyor 2 the leading end of the billet intercepts the light rays emanating from the light source 55, thereby closing the contactors of the relay of the light-sensitive or photoelectric unit 52. Up until now the operating circuits of the photoelectric unit 51 and the photoelectric unit 52 are closed, but the operating circuit for the photoelectric unit 50 is open. Accordingly, there is no energization of the solenoid unit 65, and this is for the reason that the billet is not as yet in position to be marked. However, in a very short interval of time the trailing end of the billet passes from between the light source 53 and the photoelectric unit 50 with the result that the circuit of the latter (which was up until now open) is closed. The solenoid 65 is energized with the result that the arm 5 is swung downwardly in the manner hereinbefore described, thus causing the trailing end of the billet to be marked by the numbers or other indicating media 7 carried in the marking head 6. The movement of the lever 15 of the control valve 13 in the opposite direction to that illustrated in Figure 1 causes the said valve to permit compressed air to enter the air cylinder 10 through the air conduit 12. The pivotally mounted arm 5 remains in a down position until the trailing end of the billet passes the light rays emanating from the light sources 54 and 55, at which time there is broken the circuits of the photoelectric units 51 and 52, thus deenergizing the solenoid 65 and permitting the spring within the spring-loaded single-acting air cylinder 10 to operate the valve 13 to reverse the flow of air and permit same to flow through the air conduit 11, thus returning the arm 5 to its inoperative position.

According to the teachings of the present invention the photoelectric unit 52 and its light source 55 constitute a safety measure as it prohibits the operation of the pivotally mounted arm 5 unless the circuits of both the photoelectric units 51 and 52 are simultaneously broken, as is the case when a billet passes. The purpose of this is to prevent accidental operation of the pivotally mounted arm 5 due to a dropped tool or passing hand of the operator which might break the light beam.

Referring to Figures 4 and 5 of the drawings, there is illustrated a modified form of the invention which contemplates the use of two opposed solenoids 66 and 67 in lieu of the single solenoid 65 of Figures 1 through 3. According to this permissive embodiment one of the solenoids (i. e. 67) operates the hammer, while the other (i. e. 66) actuates the return of the hammer to its inop-

erative position. This modification may be practiced by simply disposing the solenoids 66 and 67 in the opposed positions shown in Figure 4 with their thruster shafts in alignment and connected together through a link 68 which is provided with a pivotal connection 69 for receiving the outer end of the operating lever 15 of the control valve 13.

If desired, suitable manual controls may be added and operated after moving the arm of the selector switch 52 into a vertical position with respect to the showings of Figures 3 and 5.

While I have shown and described certain specific embodiments of the present invention, it will be readily understood by those skilled in the art that I do not wish to be limited exactly thereto, since various modifications may be made without departing from the scope of the invention as defined in the appended claims.

I claim:

1. In combination with a conveyor and apparatus for marking the rearward ends of a series of billets being successively fed along the conveyor, said apparatus having a marking device in an initial operating position out of the path of travel of the billets, means for actuating the marking device to mark a billet and means for resetting the marking device to initial position; a series of three light sensitive elements positioned along the conveyor, a light source positioned opposite each of said elements and directed across the conveyor toward its associated element at a height adapted to energize the same when a billet is not interposed therebetween, said elements being spaced along the path of travel of billets on the conveyor, the spacing between the first and last of the elements being equal approximately to the length of a billet, whereby each of said elements are deenergized in sequence by the lead end of a billet passing along the conveyor and are reenergized in the same sequence by the passing of the trailing end of the billet, a solenoid mechanically connected to the means for actuating the marking device and controlling the operation thereof, a first relay operable by the first of said series of light sensitive elements along the path of travel of the billets and having a pair of normally closed contacts opened by deenergization of said first element, a second relay operable by

the second of said light sensitive elements and having a pair of normally open contacts closed by deenergization of said second element and a third relay operable by the third of said light sensitive elements and having a set of normally open contacts closed by deenergization of said third element, said solenoid and aforementioned contacts of said first, second and third relays being connected in series circuit to a suitable power source whereby the circuit to said solenoid is completed and the marking device is actuated only when the second and third light sensitive elements are in the deenergized state and the first light sensitive element is energized.

2. The combination of claim 1 which includes a solenoid mechanically connected to the means for resetting the marking device to initial position and controlling the operation thereof, a first relay operable by the first of said series of light sensitive elements along the path of travel of the billets and having a pair of normally closed contacts opened by deenergization of said first element, a second relay operable by the second of said light sensitive elements and having a pair of normally closed contacts opened by deenergization of said second element and a third relay operable by the third of said light sensitive elements and having a pair of normally open contacts closed by deenergization of said third element, said solenoid and aforementioned contacts of said first, second and third relays being connected in series circuit to a suitable power source whereby the circuit to the solenoid is completed and the resetting means of the apparatus operated only when the third light sensitive element is deenergized and the first and second light sensitive elements are energized.

HERMAN E. MULLER, Sr.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,995,881	Cockrell et al.	Mar. 26, 1935
2,099,230	Rix	Nov. 16, 1937
2,171,362	Gulliksen	Aug. 29, 1939
2,339,204	Stockbarger et al. ...	Jan. 11, 1944
2,348,566	Papzian	May 9, 1944
2,400,489	Dana et al.	May 21, 1946