UNITED STATES PATENT OFFICE

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AUTOMATIC TIMING CONTROL FOR
SCARFING APPARATUS

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4 Claims. (Cl. 266—23)

Our invention relates to a automatic timing
control for scarfing or desurfacing apparatus of
the character illustrated in United States Letters
Patent No. 2,516,418, granted March 2, 1943, to
A. M. Keller et al.

In the scarfing or desurfacing of billets and the
like, a series of oxygen torches or nozzles are em-
ployed to remove a surface layer of metal to re-
move defects and to otherwise thermally condi-
tion the billet for subsequent rolling. As disclosed
in the said Letters Patent, apparatus has been
provided for manipulating the torches and the
work to enable the complete overall surface treat-
ment of the billet or the like, and it is desired to
practice the scarfing operation as uniformly as
possible.

Although control means have been provided for
carrying out the necessary sequential steps in
completing the scarfing operations, the same have
not been entirely satisfactory. As illustrated in
said Letters Patent, a drum-type master con-
troller has been employed whereby the scarfing
steps are carried forward by progressively oper-
ated control circuits manually energized through
the operation of said controller. Such a control
is dependent upon the skill of the operator for
proper timing, and due to the inability to consist-
ently time the sequential steps, variations have
resulted which affect the quality of the scarfing
process.

It is a prime object of this invention to provide
an automatic timing control for the purposes
stated which will be capable of exact and accu-
rate timing sequence between the steps or opera-
tions essential to completely and uniformly scarf
the work.

Our invention contemplates a single master
switch controlling an automatic relay circuit
which may be readily adjusted and related to ac-
tuate the scarfing apparatus in an efficient and
uniform manner.

Additional objects and advantages will become
apparent from the following description taken in
connection with the accompanying drawing,
which drawing schematically illustrates the elec-
trical circuit employed in operative relation with
the scarfing apparatus, the latter being diagram-
matically illustrated both along and transversely
of the pass line of the work to simplify the show-
ing of the complete control circuit in a single
view.

Referring to the drawing, the scarfing appa-
ratus is mounted on a carriage, diagrammatically
indicated at X, which carriage is adapted to be
moved transversely of the pass line y—y of the
billet or work z upon suitable wheels 2 and track-
way 3 by means of an electric motor 4 and suit-
able gearing. In this manner, the scarfing device
may be positioned for scarfing or removed from
the mill operation as desired.

The scarfing device proper includes two banks
or series of nozzles or torches, one series A mounted
on a slide 6 being disposed to scarf the upper
and one side of the billet z, and the other series
B being mounted on a slide 8 for scarfing the bot-
tom and other side of said billet as the latter
passes between said series of nozzles or torches
while ignited. Slides or supports 6 and 8 are
movably mounted for compound motion toward
and away from the pass line of the work so as to
properly adjust and position the torches or nozzle
A and B in relation to the surface of the billet
z, the travel of said slides being effected by means
of movable horizontal fluid pressure cylinders 10
and 12 having their pistons connected with the
slides, and fixed vertical fluid pressure cylinders
7 and 9 having their pistons connected to said
horizontal cylinders 10 and 12 respectively.

Controlled means are provided for moving the
work or billet, which means are diagrammatically
indicated at the right hand side of the drawing
and illustrated as being viewed in side elevation
with respect to the showing of the cross-section
of the billet and the torches or nozzles hereina-
fore described. Said means includes a roller table
supporting the billet adjacent the scarfing station
in which one or more rollers 8 are geared to an
electric motor drive 6. A self-retracting pinch
roll 10 is mounted above the roller 8 and is mov-
able by a fluid pressure cylinder 11 into contact
with the billet when it is desired to move the car-
dier for scarfing.

During the initiation of the scarfing opera-
tion and throughout the cycle thereof, the fore-
going apparatus is motivated automatically in
proper sequence so as to obtain the uniform and
efficient scarfing of the billet. Our invention
has to do with the automatic control of the en-
tire operation as hereinafter set forth in connec-
tion with the description of the control appar-
atus and the functioning thereof.

Preliminary to the scarfing operation, the
carriage X is moved into position through the
actuation of a reversing control 13 in the
the circuit 14 of the carriage motor 4. The controller
being normally connected with a power source
15 by conduits 16, 17 and 18, 19, 20 and 21, the
latter conduit 21 containing a normally closed
contact 6 of a relay C, which relay is connected
in series with the normally open master control
switch or push button 12 and the power source 15 through conduits 16 and 23, 28.

To initiate the scarfing cycle, the operator closes master switch 12, thereby energizing relay C, opening contact 12 thereof to interrupt the carriage motor conduit 21 and thereby prevent movement of the carriage X. Normally closed contact 12 of relay C also opens to interrupt the circuit through conduits 21, 24 to the reversing controller 28 in circuit with the table roller motor 9, thereby preventing operation of the table roller 8.

Relay C also has two normally open contacts which close as the relay is energized, contact 25 energizing a second relay D through conduits 21, 24, 26, 27, and 28, and contact 26 energizing a motor 29 and a clutch coil 30 therefor, driving an automatic resetting timing relay T, which for example may employ a series of cam-actuated contacts as illustrated. The power for said motor and clutch is supplied from a separate source 30 in circuit with contact 26.

Relay D is energized, its normally closed contact 31 opens and normally open contact 32 respectively, moving valve 33 to the position shown in the drawing, whereby fluid is discharged from the inner ends of the cylinders 5 and 6 and high pressure fluid is admitted by said valve from the table supply line 34 through a valve 35 to the outer ends of said cylinders to move their pistons and slides 5 and 6 inward, thereby engaging the torches A and B with the billet z. Solenoids 31 and 32 are connected by a common conduit 36, solenoid 31 being connected through contact 37 in conduit 36 with conduit 37 and solenoid 32 through contact 38 in conduits 38, 39 with conduit 28.

As the torches A and B are moved into engagement with the billet, they are self-ignited and begin preheating the billet preliminary to scarfing, said ignition and the preheating gases being supplied by mechanism provided in the mounting of the torches, not shown, and the preheating of the billet continues until the cutting oxygen is turned on, as hereinafter described, thereby defining a fixed and uniform preheat time for each operation of the scarfing apparatus. Contact 37 also energizes solenoids 41a and 41b and the actuating fluid valves 41a and 41b to adjust the vertical position of the torches A and B, respectively, upon the billet, said solenoids being in circuit with conduits 17 and 36. Valve 41a controls the supply 42 of high pressure and supply 43 of low pressure fluid to cylinder 1a, and as actuated by contact 37 and solenoid 41a, said valve closes off the high pressure fluid and admits low pressure fluid from supply 43. Similarly, valve 41b controls an exhaust line 44 from cylinder 1b and a supply 45 of low pressure fluid thereto, the latter position of the valve being defined by contact 37 through solenoid 40.

Hence, by means of valves 33, 41a and 41b, the torch slides 5 and 6 are adjusted through the respective fluid cylinders to bring the torches A and B into contact with the billet z, the pressure thereof upon the latter being adjusted to just permit the torches to ride the billet without injury to the said torches. Each of the valves 41a and 41b and their respective low pressure supplies 43 and 45 is provided with a pressure control including a solenoid valve 46 in circuit with a pressure relief switch 47 whereby the pressure of the fluid to said valves 41a and 41b may be limited, said control devices being in circuit with conduits 38 and 17.

Relay D also closes a normally open third contact 42 in circuit with conduit 20 and a conduit 46, to activate solenoid 48 and its valve 49, admitting fluid under pressure from supply 51 to pinch roll cylinder 11, causing the pinch roll 10 to engage the billet z.

The actuation of the foregoing takes place during a predetermined time interval, following which the timer T initiates the remaining operation of the scarfing cycle. Contact 17 of the said timer next closes to energize relay E, closing a single normally open contact 52 which energizes solenoid 53 connected to valve 54, thereby subjecting the cylinders 5 and 6 to low pressure fluid from supply 55, insuring sufficient pressure reduction upon the torches A and B to permit the billet z to be moved, said solenoid being energized in circuit with conduit 39 and with conduit 38 through a conduit 44. Likewise, contact 54 energizes a solenoid 56 through conduits 17 and 36, 54, moving valve 57 to open water sprays 58 surrounding the billet z immediately rearwardly of the plane of the torches A and B, said said water sprays being fed from a pressure supply line 59 for removal of slag as the scarfing progresses.

Contact 54 of the timer T next closes, energizing relay F having two normally open contacts 58 and 59. Contact 58 closes and energizes solenoid 60 opening valve 61 to admit cutting oxygen to the torches A and B, said solenoid being in circuit with conduits 58, 38, 17 and 19. Contact 59 closes and energizes conduit 24 to complete the circuit to the controller 22 and roller table motor 9, whereupon the billet z is moved through the scarfing torches A and B.

After a predetermined timing interval, contact 6 of timer T closes to energize relay G. Normally closed contact 62 of said relay opens to break the circuit 63, 64 to the pinch roll valve solenoid 40, permitting self-retracting pinch roll 10 to raise from contact with the billet z, and normally closed contact 63 opens to break the circuit 64, 65 to the roll table motor 9, preventing another billet from entering the torches A and B while the latter are still closed.

Contact 6 of the timer T is in circuit with the motor 59, and normally closed and remains closed until contacts 6 and 62 close to start the relays and apparatus which the latter control, whereupon contact 6 opens. The scarfing continues until the operator opens the master control switch 12, whereupon clutch 40 opens to stop the scarfing operation. The operator gauges the time to stop the scarfing by observing the travel of the billet through the torches.

Upon opening switch 12, relay C is deenergized and the other relays are deenergized substantially instantaneously therewith, shutting off the oxygen supply to the torches, permitting the carriage motor 4 and roll table motor 9 to be operated from their controllers, the torch slides 5 and 6 are retracted by the reverse operation of their respective fluid cylinders, and the water sprays 58 are turned off. The automatic resetting timer T resets and is in readiness for the next scarfing operation, the time interval for returning the entire apparatus and control to normal being dependent only upon the speed of the relays and control devices.

By properly timing the intervals between the successively actuated relays, it is possible to provide a highly accurate control based upon the time interval necessary to initiate the scarfing...
operation without over or undersize treatment, and without waste of the scarfing gases. In addition, when the scarfing apparatus is positioned in a continuous mill, the same may be located in spaced relation to a subsequent torch stand to accommodate with the length of billet being treated, and thereby create a fixed interval for the operation of timer contact so that the table roller and pinch roll may be stopped as soon as the billet reaches the roll stand.

It should be noted that the timing of relay F to act subsequent to relays D and E insures the relief of clamping pressure upon the torch slides and so that when relay F starts the cutting oxygen, the torches will freely ride the billet without injury. A further and important advantage of the present control switch, operated from a single master switch, is the ability to immediately return the apparatus to normal in the event of trouble being encountered while scarfing, or at the completion of the scarfing cycle, by the simple expedient of opening said master switch. Changes and modifications are contemplated within the scope of the following claims.

We claim:
1. Apparatus for continuously scarfing billets and the like, movable scarfing torches and electrically operable means controlling movement of the same in relation to the billet, electrically operable means for moving the billet in relation to the torches, electrically operable means controlling the supply of cutting oxygen to the torches, and means controlling the movement of the torches, a control circuit including a timing device interconnected and automatically actuating all of said electrically operable means in predetermined timed sequence while said circuit is energized, and a single pole switch in series with said power supply and control circuit for instantaneous interrupt of said circuit, whereby the timing device is reset, the flow of oxygen is shut off, and the torches are retracted from the work.

2. Apparatus for continuously scarfing billets and the like, movable torches and electrically operable means controlling movement of the same in relation to the billet, electrically operable means for moving the billet in relation to the torches, electrically operable means controlling the supply of cutting oxygen to the torches, a source of electrical power, a control circuit including a plurality of relays and a timing device interconnected and actuating all of said electrically operable means in predetermined timed sequence while said circuit is energized, means for automatically resetting the timing device upon interrupting said circuit, and a single pole switch in series with said power source and control circuit for instantaneous interrupt of said circuit, whereby the operation of all of said means may be arrested simultaneously.

3. Apparatus for scarfing billets or the like comprising a plurality of scarfing torches, means for moving the torches in relation to the billet, means for moving the billet in relation to the scarfing torches including adjustable pressure means for regulating the engagement of the torches with the billet, means for supplying cutting oxygen to the torches, a control circuit, a single control switch for controlling the flow of current to said circuit, a timing relay in said circuit, means actuated by the closing of said switch for starting the timing relay in operation, a second means actuated by the closing of said switch for moving the torches into contact with the billet to preheat it, means operable by said timing relay after a predetermined time interval to supply cutting oxygen to the torches and move the billet in relation to the scarfing torches, means operable by said timing relay after a second predetermined time interval to stop the movement of the billet, and means operable by the opening of said switch at any time during the scarfing cycle for resetting the timing relay, shutting off the oxygen flow to the torches, and retracting the torches from the billet.

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Certificate of Correction


GEORGE C. EHEMANN, JR., ET AL.

It is hereby certified that an error appears in the printed specification of the above numbered patent requiring correction as follows: Column 5, lines 61 and 62, claim 2, strike out the words "the operation of all of said means may be arrested simultaneously" and insert instead "the timing device is reset, the flow of oxygen is shut off, and the torches are retracted from the work"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 21st day of October, A. D. 1947.

[Seal]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.
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[SEAL]

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Assistant Commissioner of Patents.