

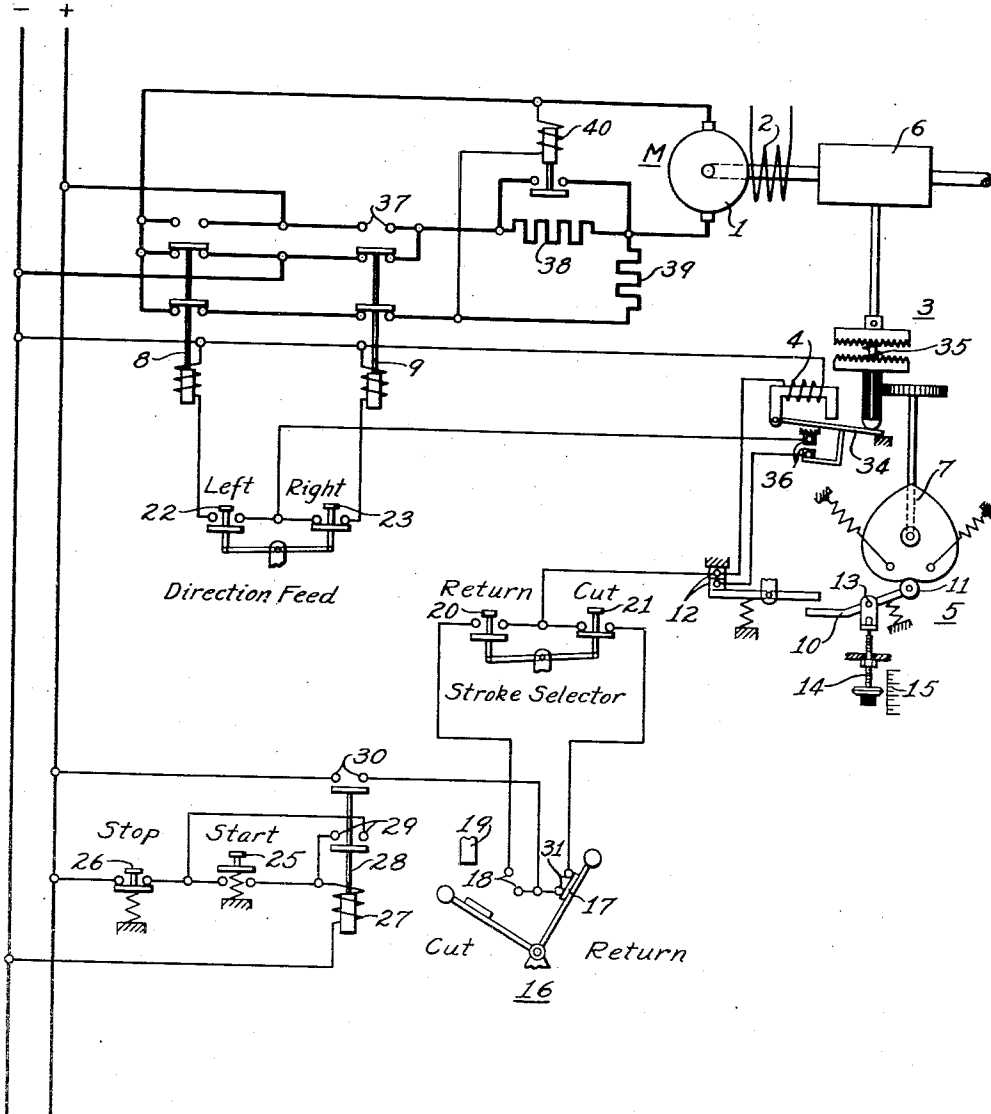
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GEARED LIMIT SWITCH

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GEARED LIMIT SWITCH

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My invention relates to a control system for effecting a predetermined amount of rotation of a feed motor in either of two directions, and is particularly suitable for reciprocable machine tool systems such as planer control systems and the like.

Motor operated incremental feed is used quite extensively on planers, plate planers, travelling head planers, planer millers, drawcut and push-cut shapers, etc. The measuring means used to obtain the feed may be a dashpot relay, a geared limit switch or any similar device. This system of control has already been covered by my earlier filed Patent No. 2,100,745, issued November 30, 1937.

Briefly, this method of control employs the use of a limit switch geared directly to the feed motor through a magnetic clutch. The limit switch is reset by a spring when the clutch is deenergized. A dial is provided calibrated in fractions of an inch for setting the amount of feed, the gearing is usually designed, for example, so that one-quarter revolution of the motor is equal to one sixty-fourth of an inch feed or 16 motor revolutions equal one inch of feed.

One outstanding objection to the above scheme such as shown in my prior patent, is that there is no means of protection against failure of the magnetic clutch. Should the magnetic clutch for any reason such as the failure of the coil or some piece of apparatus in series with the coil fail to engage, the feed motor would run continuously. This would cause the tool to feed an excessive amount causing damage to the work, the machine and very likely injury to the operator. In such instances, the tool is very apt to snap into several pieces which may be projected towards the face of the operator. I have found it very necessary that some means to increase the safety and reliability of the limit switch should be provided.

An object of my invention is to provide a safety device which will prevent feeding motion by the feed motor unless the timing mechanism (or geared limit switch) is intact to interrupt the energizing circuit of the motor after a predetermined feeding motion of the motor.

A more specific object of my invention is to provide a geared limit switch for interrupting a feed motor after a predetermined number of revolutions, a movable contact member on the armature or operating member of an electro-magnetic clutch for interrupting the feed motor energizing circuit in the event that the clutch

which couples the feed motor to the geared limit switch is not engaged.

Other objects and advantages will become more apparent from a study of the following specification when considered in conjunction with the accompanying drawing, in which:

The single figure is a schematic showing of the control system embodying the principles of my invention.

Referring more particularly to the figure, M denotes a feed motor having an armature 1, which motor is excited by a suitable field winding 2 from a source of constant potential (not shown). Geared to armature 1 is an electro-magnetic clutch 3 having an operating coil 4 which when energized effects engagement of said clutch. The purpose of the clutch is to couple or uncouple a measuring means or geared limit switch 5 from the feed motor through suitable reduction gearing indicated by numeral 6, which measuring means per se is old in the art and is described in my earlier filed patent previously mentioned. It may be briefly described as comprising a spring biased heart-shaped cam 7, which is rotated either clockwise or counter-clockwise, depending upon whether reversing contactor 8 or reversing contactor 9 is energized and having a spring biased pivoted arm 10, the roller 11 on one end which moves along the periphery of cam 7 and which is adopted after predetermined movement of the cam to open spring biased contact members 12, so as to effect deenergization of clutch coil 4, hence uncoupling thereof and to effect interruption of contact members 12 so as to effect deenergization of the reversing contactor (8 or 9), thereby interrupting the feed circuit of the motor. For simplicity, means for predetermining the necessary angular rotation of cam 7 for effecting opening of contact members 12 is represented as a vertically movable pivot 13, which is moved by an adjustable screw 14 alongside a calibrated scale 15. However, since the specific measuring means described above forms no part of my invention, more detailed explanation thereof is not deemed necessary since such can be found in the previously mentioned patent.

Since my invention is particularly suitable in a control system for effecting reciprocating motion between a cutting tool, such as a planer, and a work piece, it is shown as being associated with such device. However, such planer control systems are quite common, and have been described in my previous patents, such as my earlier filed patent mentioned above, and it is felt that

for the sake of simplicity, it will be necessary merely to show the limit switch 16 thereof which is moved counter-clockwise at the end of the return stroke by the reciprocating work piece (or in some cases the reciprocating cutting tool, that is, when the work piece is stationary), so as to close contact members 17 thereof and which limit switch is moved clockwise at the end of the cut stroke so as to close contact members 18 thereof. A portion of the reciprocating member 10 is denoted generally by numeral 19 and which alternately effects counter-clockwise and clockwise movement of the limit switch 16. Feed motion is sometimes desirable only at the end of the cut stroke and sometimes is desirable only at the end of the return stroke.

"End of stroke" selector push buttons 20 and 21 are provided for effecting feed at the end of the return and at the end of the cut stroke; respectively. It will be evident that either of these switches may be closed to secure feed at the end of either of the strokes. In addition, a pair of "direction of feed" selector push button switches 22 and 23 are provided for effecting either left or right lateral feed movement by said feed motor, that is, either rotation in one direction or in an opposite direction of said feed motors.

The operation of the control system is as follows: When the feed is to start push button 25 is depressed. A circuit will be completed from one terminal of the direct-current source indicated by + through the stop push button 26, the start push button 25 and the relay coil 27 of relay 28 which effects operation of relay 28 and closing of contact members 29 which complete a holding circuit around the start push button and sets up a circuit to either of the directional contactor coils. The limit switch 16 is shown in the position corresponding to the end of the return stroke. At the end of the return stroke a motor energizing circuit will be established which may be traced from the + terminal through contact members 30, contact members 17, the push button 21, one of the contact members 12, clutch operating coil 4 to the — terminal. Energization of the clutch operating coil 4 will attract the armature or operating member 34 thereof which effects engagement of clutch 4 against the bias of the spring 35 and at the same time effects closing of contact members 36, the latter effecting completion of a motor energizing circuit through the "right" push button 23 of the "direction of feed" switch and the operating coil of the "left" feed contactor 9. This will effect completion of a circuit from the + terminal, through contact members 37, resistor 38 and armature 1 to the — terminal, also through a parallel circuit including resistor 39 and coil 40 which will effect short circuiting of resistor 38 shortly after energization. It will be apparent that had the "right" push button of the direction of feed switch been depressed, the "right" contactor 8 would have been operated which would have effected completion of the same circuit, except that the direction of energizing current would have been reversed so as to drive motor M in an opposite direction, which is well known in the art.

The outstanding feature of my invention centers about a pair of contact members 36, one of which is movable and rigidly secured to armature 34 and the other of which is stationary, as shown. It will be apparent that contact members 36 close whenever the coil 4 is energized to effect engagement of clutch 3. If during feed-

ing of the platen (or tool) by the motor 1, the clutch operating coil 4 should burn out effecting disengagement of clutch 3, then armature 34 would drop out and effect opening of contact members 36, thus effecting interruption of the motor energizing circuit which will cause the feed motor to stop. The feed motor obviously will not be able to restart so long as clutch operating coil 4 is not operative. In other words, the motor feed circuit can be completed only when the clutch is engaged and is not completed while the clutch is disengaged. Therefore, there can be no feeding motion of the feed motor unless the timing mechanism or geared limit switch is intact and ready to interrupt the circuit after a predetermined number of revolutions. In this way, there can be no overfeeding by the feed motor, which overfeeding might be destructive to the work piece or injurious to the operator.

I am, of course, aware that others, particularly after having had the benefit of the teachings of my invention, may devise other devices embodying my inventions, and I, therefore, do not wish to be limited to the specific showings made in the drawings, and the descriptive disclosure hereinbefore made, but wish to be limited only by the scope of the appended claims and such prior art that may be pertinent.

I claim as my invention:

1. In a control system for effecting relative reciprocating movement between a machine tool element and a work piece element, in combination, a feed motor for effecting lateral incremental feed motions of one of said relatively movable elements at the end of its reciprocating movement, an energizing source of electrical potential for said motor, a limit switch operable in response to relative motion between the tool element and work piece, means operable by said limit switch for effecting lateral feed motion of said motor, a circuit interrupting means including an electromagnetically operated clutch normally engaged while being driven by said motor and being responsive to a predetermined number of rotations of said motor to interrupt said motor energizing circuit and stop the motor, and means responsive to the operation of said clutch to effect interruption of said motor energizing circuit in the event of failure of the clutch to engage during feeding movement of the motor.

2. A control system as set forth in claim 1 in which said clutch includes an operating member which directly effects interruption of said motor energizing circuit in event of failure of the clutch to engage when the motor is operating.

3. A control system as set forth in claim 1 in which said clutch includes an electromagnet having an armature which acts as an operating member for said clutch, a pair of contacts, one of which is carried by said armature for effecting interruption of said motor energizing circuit in the event said clutch fails to engage during rotation of said motor.

4. In a control system for effecting relative reciprocating movement between a machine tool element and a work piece element, in combination, a feed motor for effecting lateral incremental feed motions of one of said relatively movable elements at the end of its reciprocating movement, an energizing source of electrical potential for said motor, a limit switch operable in response to relative motion between the tool element and work piece, and a reversing contactor operable by said limit switch for selectively effecting feed motion of said motor in one direc-

tion or an opposite direction, circuit interrupting means including an electromagnetically operated clutch normally engaged while being driven by said motor and being responsive to a predetermined number of rotations of said motor to interrupt said motor energizing circuit and stop the motor, and means responsive to the operation of said clutch to effect interruption of said motor energizing circuit in the event of failure of the clutch to engage during feeding movement of the motor.

5. A control system as set forth in claim 4 in which said clutch includes an operating member which directly operates said circuit interrupting means in the event of failure of the clutch to engage when the motor is operating.

6. A control system as set forth in claim 5 in which said clutch includes an electromagnet having an armature which acts as an operating member for said clutch, a pair of contacts, one of which is carried by said armature for effecting interruption of said motor energizing circuit in the event said clutch fails to engage during rotation of said motor.

7. In a control system for effecting relative reciprocating movement between a machine tool element and a work piece element, in combination, a feed motor for effecting lateral incremental feed motions of one of said relatively movable elements at the end of its reciprocating movement, an energizing source of electrical potential for said motor, a limit switch operable in response to relative motion between the tool element and work piece, a pair of switches each of which is effective to interrupt said energizing source of electrical potential, transmission means driven by said motor and including a clutch and a revolution counting mechanism for operating one of said switches in response to a predetermined number of revolutions of said motor, and means actuated by the disengaging movement of

said clutch for operating the other of said switches to effect interruption of said energizing source.

8. A control system as set forth in claim 7 in which said clutch includes an electromagnetic operator having an armature and in which said last mentioned means includes a contact member rigidly secured to said armature and a co-operating stationary contact member.

9. A control system for effecting a lateral feeding movement of a reciprocable machine tool element at recurrent intervals comprising, in combination, a feed motor for effecting said lateral feed movement, transmission means driven by said motor including a clutch and a revolution counter, a circuit interrupter which is operable in response to a predetermined number of revolutions of said motor as measured by said revolution counter for effecting deenergization and stoppage of said motor, a second circuit interrupter which is directly operated by one of the elements of said clutch for effecting deenergization of said motor whenever said clutch is disengaged.

10. A control system as set forth in claim 9 in which said clutch is electromagnetically operated, including an armature which serves as an operating member and in which one of the contact members of said second circuit interrupter is rigidly secured to said armature.

11. In a system for controlling movement of an element, a drive for imparting movement to the element, means for measuring the movement of said element and for stopping said drive after movement of said element a predetermined distance, a clutch connecting said measuring means to said drive for rendering said measuring means operative, and means operative upon failure of said clutch for stopping said drive prior to operation of said measuring means.

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