May 26, 1959 E. W. MACOY ET AL 2,888,626

JOG LIMIT DEVICE

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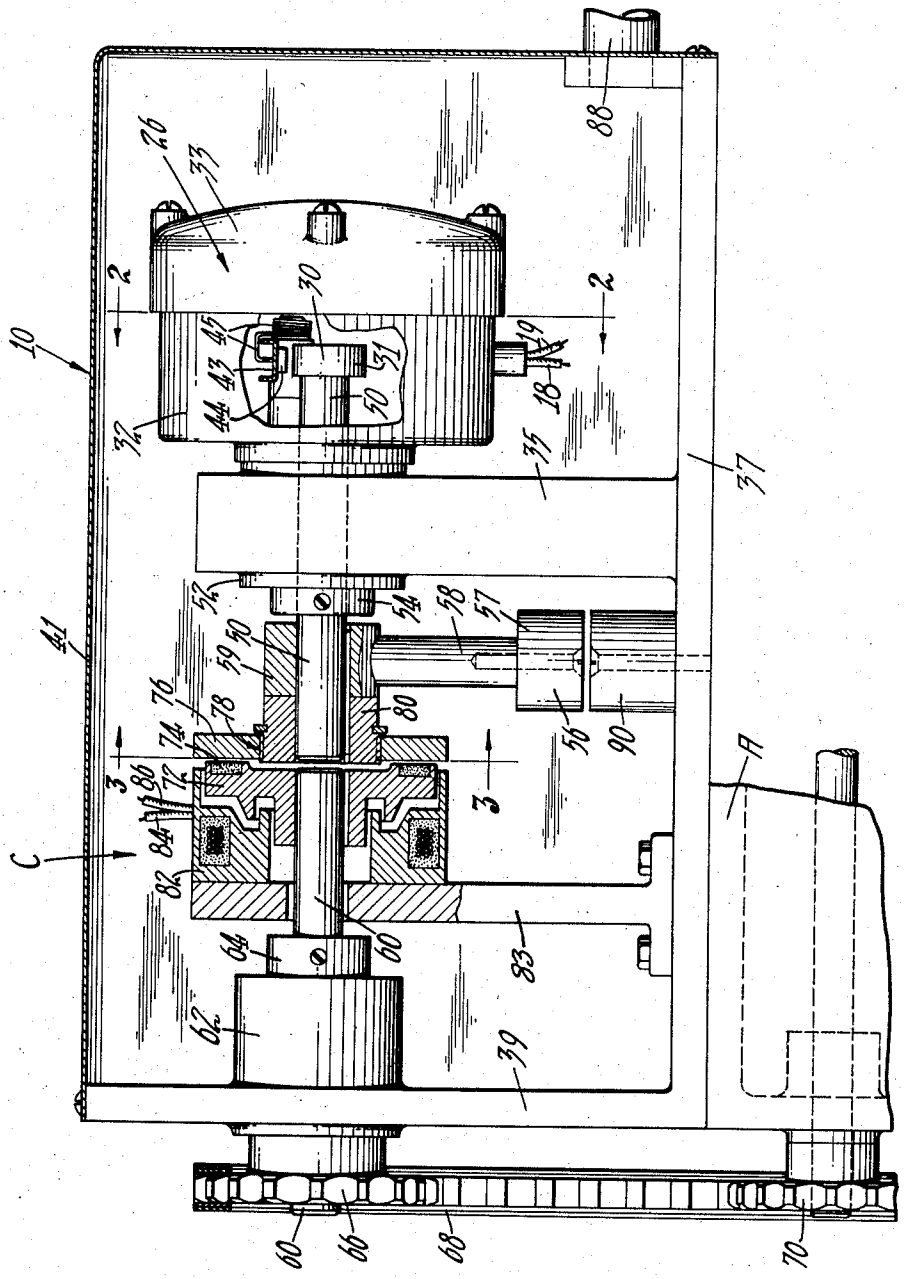


FIG. 1

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FIG. 2

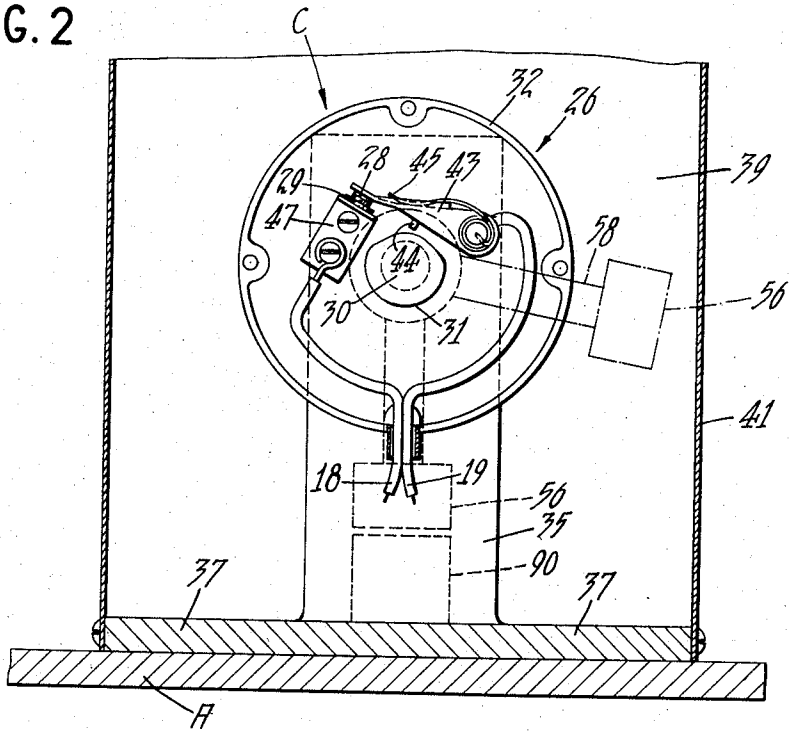


FIG. 3

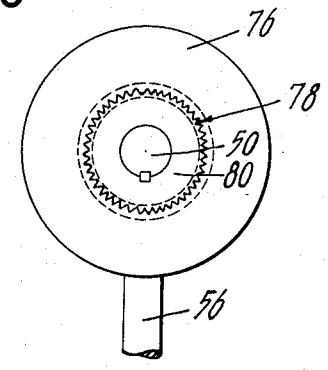
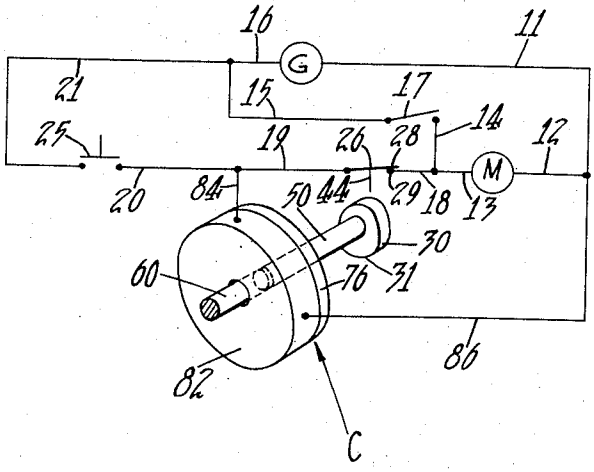


FIG. 4



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United States Patent Office 2,888,626 Patented May 26, 1959

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JOG LIMIT DEVICE

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Application March 22, 1955, Serial No. 495,946

3 Claims. (Cl. 318—470)

The present invention relates to machine control devices, and has particular reference to an electromagnetically controlled timing device for automatically limiting the jogging movements of certain types of automatic machines such as lithographic presses and coating machines.

In order to properly service or adjust many machines it is necessary that they be repeatedly turned over under their own power through a series of uniform jogging cycles, each of which comprises a predetermined portion of a complete operating cycle. This is particularly true in the case of printing or coating machines where a controlled jogging action is necessary to enable an operator to successively expose predetermined portions of the cylinder surfaces in order to facilitate cleaning or other treating operations.

The devices heretofore used to control these jogging cycles have been unnecessarily complicated in construction. Some of these devices are primarily electrical in design and comprise elaborate combinations of relays. This type has been extremely expensive to construct and maintain. Other types have been more mechanical in design, and have embodied numerous moving parts such as levers and meshing gears which have had a tendency to get out of order rather easily. The present invention, on the other hand, provides a device which is extremely simple and rugged in construction. Its main operating parts comprise a simple rotary timing switch and a commercially available, inexpensive electromagnetic clutch which couples the switch to a moving part of the machine being jogged. It is reliable in operation and exceptionally durable, since it contains few moving parts. Moreover, those parts which do move travel only short distances and are engaged and disengaged without severe shock.

An object of the present invention, therefore, is the provision of an inexpensive jog limit device of superior construction and performance.

Another object is the provision in such a device of magnetic means which insure the rapid resetting of the switch to a predetermined position after each jogging cycle.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a side elevation of the jog limit device of the instant invention, parts being shown in section and parts broken away;

Figs. 2 and 3 are vertical sections taken substantially along the lines 2—2 and 3—3 respectively in Fig. 1, and

Fig. 4 is a schematic wiring diagram of the electrical circuits used in conjunction with the apparatus of the instant invention.

As a preferred and exemplary embodiment of the instant invention, the drawings disclose a jog limit device,

generally designated by the numeral 10, which is adapted to control the jogging cycles of an automatic machine A (fragments of which are shown in Figs. 1 and 2) such as a printing press, a lithographic press, a coating machine, or any other machine which must be operated through an accurately controlled step-by-step movement for any reason.

In normal operation, the drive motor M (see Fig. 4) of the machine A is supplied with electrical energy from any suitable source such as a D.C. generator G through an operating circuit which includes wires 11, 12, 13, 14, 15, 16 and a control switch 17.

When the machine A is to be jogged under its own power, the control switch 17 is opened and a jogging circuit is utilized to run the machine. This jogging circuit includes wires 11, 12, 13, 18, 19, 20, 21 and 16; a manually operated, normally open jogging switch 25 which when closed initiates the jogging cycle of the machine; and a rotary timing switch 26 comprising a pair of normally closed contacts 28, 29 (see also Fig. 2) and a rotary edge cam 30 provided with a high portion 31 which automatically operates to open the contacts 28, 29 to stop the motion of the machine A at the completion of each jogging cycle.

The timing switch 26 constitutes an important element of the jog limit device 10 and includes a cup-shaped switch housing 32 and a cover 33 (Figs. 1 and 2). The switch housing 32 is mounted on a stanchion 35 which may be welded or otherwise secured to a base plate 37 which, together with an end wall 39 and a sheet metal protective cover 41, forms a housing for the principal parts of the jog limit device 10 and may be suitably mounted on the frame of the machine A.

The switch contact 28 is movable and is mounted at the end of a pivoted arm 43 (Fig. 2) which is normally urged in a counterclockwise direction (as viewed in Fig. 2) by a spring 45 to hold the contact 28 in engagement with the contact 29. The contact 29 is mounted on a stationary lug terminal 47. The arm 43 is formed with a depending lug 44 which is adapted to engage and ride on the high portion 31 of the cam 30. The cam 30 is preferably made symmetrical with respect to the lug 44 so that the jog limit device can operate in either direction in the event the machine A is reversible.

As can readily be seen from Fig. 4, the jogging movement of machine A begins with the manual closing of the jogging switch 25, and continues until the contacts 28, 29 are automatically opened by the rotary cam 30. In order to effect this opening of the contacts at the completion of a predetermined jogging cycle, it is necessary that the rotation of the cam 30 be initiated by the closing of the switch 25. In order to provide for this, the cam 30 is mounted on the end of a rotatable shaft 50 which extends through the stanchion 35 and is suitably journaled in a bearing 52 mounted therein. The shaft 50 is held against longitudinal movement by a collar 54 disposed against one side of the bearing 52 and by a second collar (not shown) which is disposed within the switch housing 32. A gravity pendulum or counterweight 56 comprising a bob 57, a rod 58 and a hub 59 is secured to the shaft 50 in order to maintain the cam 30 in its initial position with its high portion 31 out of contact with the lug 44.

A second rotatable shaft 60 is disposed in longitudinal alignment with the shaft 50, and is journaled in a bearing 62 mounted in the end wall 39. This shaft is held against outward movement by a collar 64 and has a sprocket 66 secured to its outer end. The sprocket 66 is driven from a moving part of the machine A in any suitable manner. In the instant drawings, this is effected by means of a drive chain 68 which operates around the sprocket 66 and around a second sprocket 70 which forms a part of the

machine A and is driven from the motor M. Thus, when the motor M is started by the closing of the jog switch **25**, the shaft **60** immediately begins to rotate.

In order to transmit this rotary motion to the cam **30**, an electromagnetic clutch C is provided to couple the rotating shaft **60** to the shaft **50**. Thus the shaft **60** becomes the drive shaft of the combination and the shaft **50** becomes the driven shaft. The electromagnetic clutch C includes a magnetizable rotor **72** which is keyed to shaft **60** and provided with a friction face **74**, and an armature disc **76** which is slidingly mounted, as by a multiple spline fitting **78** (see Fig. 3) on a hub **80** keyed to the shaft **50**. Magnetic flux is supplied to the rotor **72** by a stationary field coil **82** which is secured to a stanchion **83** and closely surrounds the rotor. The close spacing between the coil **82** and the rotor **72** enables magnetic flux to jump from the coil to the rotor when the coil is energized. The coil **82** is connected in parallel across the switch contacts **28**, **29** and motor M (see Fig. 4) by means of lead wires **84**, **86** which, together with the switch lead wires **18**, **19**, enter the jog limit device housing through a conduit **88** (see Fig. 1).

When the jog switch **25** is closed, electric current is supplied simultaneously to the machine motor M and to the electromagnetic clutch C. As a result, the machine A starts its jogging cycle and at the same time the armature disc **76** is attracted to the rotor **72**, thus coupling the drive shaft **60** to the driven shaft **50** and starting the rotation of the cam **30**. The machine A continues to operate until the rotation of the cam **30** brings its high portion **31** against the lug **44** of the movable arm **43**, thus opening the contacts **28**, **29** and stopping the motor M. The electromagnetic clutch C remains energized until the switch **25** is opened, at which time the pendulum **56**, which has been moved to the raised position shown in dot and dash lines in Fig. 2 by the rotation of the shaft **50**, swings downwardly to its plumb position as shown by the dotted lines in Fig. 2, thus returning the cam **30** to its starting position and resetting the device for another jogging cycle.

Under some circumstances, it may be found desirable to create a magnetic field to attract the pendulum **56** to ensure its return to exactly the same position after each jogging cycle, and to quickly dampen any oscillations of the pendulum which may result from its free swing from its raised position. To effect this, a permanent magnet **90** is secured to the base plate **37** in closely spaced vertical alignment beneath the plumb position of the pendulum bob **57** which should of course be made of a magnetizable material. It is obvious that the same result can be had by making the pendulum bob **57** a magnet and replacing the magnet **90** with a magnetizable block, or by making both members magnets. In this latter construction, the mutual magnetic attraction would be at a maximum.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

We claim:

1. A jog limit device for controlling the jogging cycle of a machine operating under its own power, comprising in combination an electric jogging circuit including means for driving said machine, a normally open jogging switch in said circuit, a normally closed timing switch in said circuit, said switches being connected in series with said driving means, a rotary drive shaft driven from said machine in a predetermined rotary direction, a rotary driven shaft disposed in axial alignment with said drive shaft and normally uncoupled therefrom, an electromagnetic clutch positioned at the adjacent ends of said shafts and operable when energized to couple said shafts to rotate said driven shaft in said predetermined direction, said clutch being connected into said jogging circuit in series with said jogging switch and in parallel with said timing switch and said driving means so that energization of said clutch is controlled by said jogging switch and is completely independent of said timing switch, cam means mounted on said driven shaft and rotatable from an initial position through an arc of less than 180 degrees into position for opening said switch to break said circuit to stop said machine, and a pendulum secured to said driven shaft for maintaining said cam means in its initial position, said pendulum being rotatable with said driven shaft and operable to rotate said shaft in a rotary direction opposite to said predetermined rotary direction to return said cam means towards its initial position when said electromagnetic clutch is deenergized by the opening of said jogging switch.

2. A jog limit device for controlling the jogging cycle of a machine driven by a motor, comprising in combination, an electric jogging circuit for said machine, said circuit including a normally closed timing switch and said motor, a drive shaft rotatable from said motor, a driven shaft normally uncoupled from said drive shaft, an electromagnetic clutch for coupling said driven shaft to said drive shaft, manually controllable switch means for simultaneously energizing said electromagnetic clutch and said jogging circuit, cam means carried by and rotatable with said driven shaft for opening said timing switch to stop said machine after said machine has operated through a predetermined jogging cycle, a magnetizable pendulum secured to said driven shaft and disposed in substantially plumb position when said cam is in its initial position, and magnetic means disposed adjacent said pendulum in its plumb position to provide a magnetic field to hasten and ensure the return of said pendulum to its plumb position and said cam to its initial position.

3. A jog limit device for controlling the jogging cycle of a machine operating under its own power, comprising in combination an electric jogging circuit including means for driving said machine, a normally open jogging switch in said circuit, a normally closed timing switch in said circuit, said switches being connected in series with said driving means, a rotary drive shaft driven from said machine in a predetermined rotary direction, a rotary driven shaft disposed in axial alignment with said drive shaft and normally uncoupled therefrom, an electromagnetic clutch positioned at the adjacent ends of said shafts and operable when energized to couple said shafts to rotate said driven shaft in said predetermined direction, said clutch being connected into said jogging circuit in series with said jogging switch and in parallel with said timing switch and said driving means so that energization of said clutch is controlled by said jogging switch and is completely independent of said timing switch, cam means mounted on said driven shaft and rotatable from an initial position through an arc of less than 180 degrees into position for opening said switch to break said circuit to stop said machine, a magnetizable pendulum secured to said driven shaft and normally disposed in a substantially plumb position for maintaining said cam means in its initial position, and magnetic means disposed adjacent said pendulum in its plumb position to provide a magnetic field to hasten and ensure the return of said pendulum to its plumb position and said cam to its initial position.

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