Nov. 21, 1961 W. F. CLARKE 3,010,058

MOTOR CONTROL AND INDICATOR FOR BLANK CUTTING MACHINES

Filed Dec. 12, 1956 2 Sheets-Sheet 1

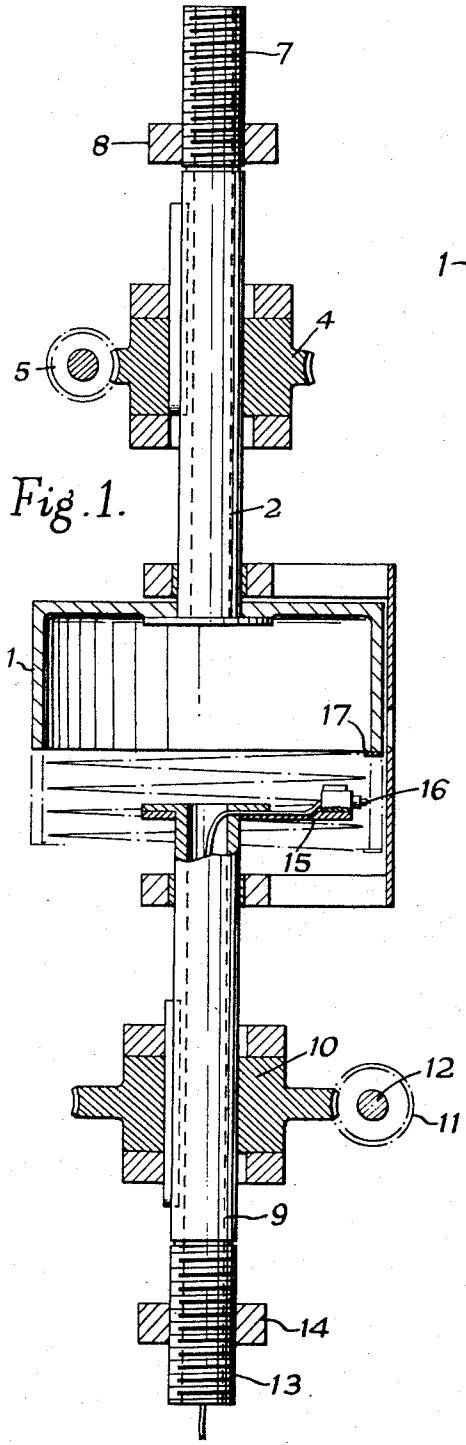
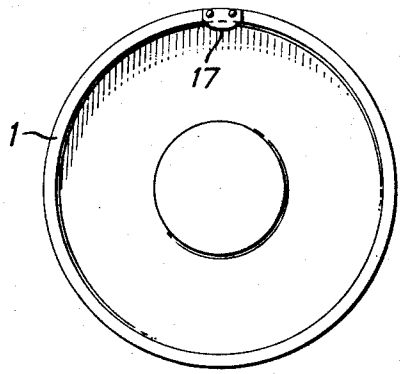


Fig. 1.

Fig. 3.



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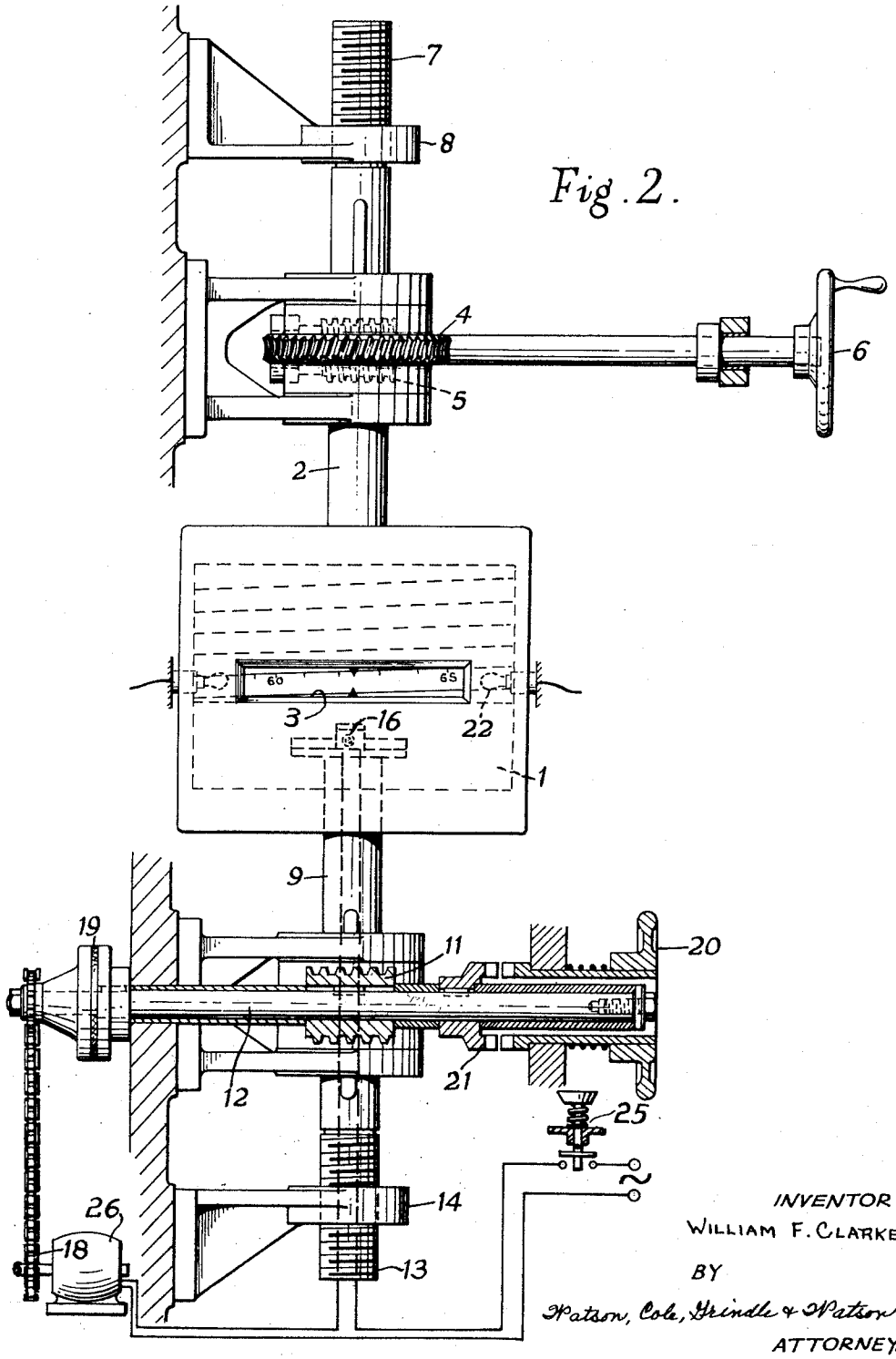


Fig. 2.

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United States Patent Office 3,010,058 Patented Nov. 21, 1961

3,010,058

MOTOR CONTROL AND INDICATOR FOR BLANK CUTTING MACHINES

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Filed Dec. 12, 1956, Ser. No. 627,786
Claims priority, application Great Britain Dec. 20, 1955
5 Claims. (Cl. 318—14)

This invention concerns an indicator for machines in which blanks are cut from a continuous web.

In the manufacture of blanks for large cartons, for example, those made from corrugated board, a continuous web is made up or manipulated in the machine and at the delivery end of the machine there is a transverse cutting device whereby blanks of a certain length can be cut from the continuous web. There is also usually a slitting device for dividing a wide web into narrower webs before the transverse cutter operates but this does not concern the present invention. When continuous webs are made in this way, it is necessary for efficient working that the machine shall run continuously for long periods but the quantities of blanks required for any given size are usually not sufficient to run the machine for such long periods and means are provided whereby the blank length can be altered while the machine is running.

For this purpose it is known to provide such a machine with an indicator showing the length being cut and this indicator is arranged so that it can be set to a different length when it is desired to alter the length of the cut. When the time comes to make the change a switch is closed which operates a motor to alter the gear ratio of the cutter drive. It will be appreciated that as the web is travelling at a uniform speed, the length of the blank will depend on the number of revolutions per minute that the cutter is making and further, the cutting mechanism, which is of a cyclically variable speed type, is so adjusted that at the instant of cut the knives are travelling substantially at the speed of the web.

In some indicators at present in use there is a graduated arc of about 90° in extent and over this is movable an arm having a pointer which shows a desired blank length. There is another arm which under normal conditions, that is, when the machine is cutting blanks of a desired length, is in alignment with the first arm. The first arm carries a micro-switch and the second arm has an abutment which can trip the switch under certain conditions. If then the machine is running and cutting blanks of a certain length and it is desired to change the length, the first arm is moved round the graduated quadrant to the division showing the new length. This operation is done some time before the run of blanks of the first said length comes to its end. When sufficient blanks of the first length have been cut the operator presses a switch and the second arm moves round the quadrant until it trips the switch. The movement is effected by gearing from an electric motor which at the same time alters the gear ratio of the cutter drive and adjusts its variable speed drive to ensure that the knives of the cutter are moving at web speed when the new cut is effected. The cutter is usually driven through a gear of the type in which a belt extends between two sets of adjustable cones which are moved in and out respectively to change the gear ratio. Other indicators operating in a somewhat similar manner have the arms movable over a complete circle.

It is found that with the existing indicating devices the distance through which an arm moves for the two arms to coincide after a new blank length has been predetermined and the motor altering the gear ratio has been set into motion, is too short for accurate calibration to small limits in the setting of the cutter to the desired blank length and the subsequent stopping of the motor which has effected this.

A typical machine of the class to which such indicators are fitted is shown in U.S. patent to Swift, 2,059,412, granted November 3, 1936. In FIGURE 3 of the Swift drawing a pair of cutting rollers 1 and 2 are shown. These are geared together and driven from a mainshaft 39 through a variable speed transmission 42 which can be altered by a motor 47. Thus as the variable speed transmission is altered the cutters 1 and 2 will have their speed in revolutions per minute changed thus altering the blank length, as the web runs at a uniform speed. In order that the cut shall be properly made without injury to the material, it is usual to give the cutters a variable cyclic motion so that at the time of cutting the blades are traveling at web speed, or as near as may be. For this purpose Swift drives the cutters through a differential crank motion, that is, a motion where one shaft is eccentric to another and the shafts are coupled by a pin and slot mechanism. Actually Swift shows two such mechanisms in tandem but this is merely to obtain a wide range of variable motion and makes no difference in principle. In FIGURE 1 of Swift a gear wheel 12 has a slot in it in which a roller 17 travels and the ratio of the highest to lowest speed during one revolution depends on the distance between the axes of shafts 13 and 19 and this distance can be altered by moving a support 20, in which the shaft 19 is journaled. For this purpose, as can be most easily seen from FIGURE 2 of the patent, the support 20 has slides 27 which can be traversed by a motor 32. The two pin and slot devices are clearly shown in this figure. The machine is also provided with a pointer 50 which cooperates with a rotatable dial 48 which is driven by the motor 47 which adjusts the revolutions per minute of the cutters. The pointer thus indicates the instant blank length. The motor 47 is controlled by push buttons 52 and 53 while the motor 32 is controlled by push buttons 54 and 55, see FIGURE 4. The above brief reference to the Swift patent gives a clear idea of the class of machine for which indicators are required, though the indicator forming the subject of the present application is of a pre-set type, developed since the date of the patent. It will be appreciated, of course, that the indicator of the present application is applicable to any web cutting machine having control devices equivalent to those described by Swift, namely, a device for altering the cutter revolution speed and another for altering the peripheral speed of the cutter to suit it to the web speed at the time of cutting.

According to the present invention, there is provided an indicator for machines of the kind referred to wherein a graduated drum is rotated and moved axially at the same time in order to set the indicator for the desired length of blank and the gear changing motor is arranged to operate a rotatable arm carrying a micro-switch and movable axially so that the switch moves through a helical path until it comes into contact with an end of the drum, whereupon the micro-switch is tripped and the gear-changing motor is stopped.

The drum is rotated through hand-driven gearing in order to set it to the desired blank length.

With the type of gear referred to above (often known as a Reeves' gear) comprising a belt and two pairs of adjustable cones, adjustment has a tendency to alter the ratio to which the gear is set if the belt is re-tensioned, as is sometimes necessary. In order to overcome this difficulty, a friction clutch is provided in the drive to the rotatable arm of the indicator, with means for releasing it so that the arm and indicator drum can be brought into engagement for a given gear setting and the belt adjusted as necessary, whereafter the friction clutch is again locked. The indicator arm is driven through this

clutch so that after re-setting as just described the indicator will be accurate for the newly-adjusted belt tension.

The invention will be further described with reference to the accompanying drawing in which:

FIGURE 1 is a sectional elevation of the indicator; and

FIGURE 2 is a side elevation of FIGURE 1, also partly in section; and

FIGURE 3 is a detail of FIGURE 1.

Referring to FIGURE 1, a hollow drum **1** is fixed to a shaft **2** and is graduated on a spiral line as shown in FIGURE 2. A window **3**, FIGURE 2, is provided having pointers which show the blank length which the machine will cut with the drum in the position shown. A worm-wheel **4** is fixed to the shaft **2** and is rotatable by a worm **5**, which is driven by a hand-wheel **6**. The shaft **2** is threaded at **7** and a fixed nut **8** engages the thread. The thread is preferably a multiple-start thread. Thus, when the hand-wheel **6** is rotated, the drum will rotate and move up or down in the helical path, this path being arranged to coincide with the helical graduation on the drum.

Another shaft **9** is provided and arranged co-axially with the shaft **2**. This shaft is provided with a worm-wheel **10** driven by a worm **11** fixed to a spindle **12** which is rotated as described later. The shaft **9** is provided with a thread **13** which is of the same pitch as the thread **7** and engages a fixed nut **14**. An arm **15** is fixed to the shaft **9** at the end opposite to the threaded end and at the end of the arm is a micro-switch **16** which is normally closed. The drum **1** is provided with a switch tripping device **17** consisting of a flat cam plate fixed to the open end of the drum.

The operation of the device is as follows: Assuming the machine is running and cutting blanks of a given length and it is desired to change the length, the hand-wheel **6** is rotated until the desired length is shown by the helical graduation on the drum **1** against the pointers shown in FIGURE 2. When the operator decides that it is time to start cutting blanks of the new length, he presses and holds down a switch **25** which starts a motor **26** which alters the ratio of the gear driving the cutter of the machine. The spindle **12** is also driven by this motor through a chain **18**, FIGURE 2 which drives a friction clutch **19**, one element of which is fixed to the spindle **12**, so that the worm **11** rotates and causes the arm **15** to travel through a helical path. Eventually the switch **16** will come into contact with the cam plate **17** and the tripping of the switch will stop the motor, leaving the cutter set to cut the right length and the indicator with the switch **16** still in contact with the cam plate **17**.

It will be understood that the accuracy of the cut depends very much on the accuracy of the gear which drives the cutter and as this gear is of the type comprising a belt movable between two pairs of adjustable cones, it is at times necessary to re-tension the belt. Such adjustment must necessarily affect the gear ratio somewhat so that the indicator would not then be showing the length correctly. Means is therefore provided whereby the drive to the spindle **12** can be disconnected from the gear driving the cutter so that after a belt has been re-tensioned, the indicator can be accurately set to agree with the ratio to which the gear is set. For this purpose there is provided a hand-wheel **20** which can be clutched or unclutched with a half-clutch **21** fixed to the spindle **12**. The friction clutch **19** is first unclamped so that the motor drive to the spindle **12** is disengaged and then the hand-wheel **20** is clutched to the spindle **12** and rotated to drive the shaft **9** and the arm **15** until the switch is in contact with the trip **17**, the drum **1** being already set to show the length of blanks to be made. After this adjustment, it will be seen that the indicator shows the correct blank length; the switch arm is in contact with the trip; and therefore the motor would be stopped (if it were running) and the gear set to cut the given length.

When, therefore, the indicator device is again to be used, it will have been accurately adjusted to agree with the drive to the cutter, and after the adjustment described, the clutch **19** is again locked and everything is in order for using the indicator in the re-setting of the cutter for a fresh length of blank as above described.

In this process of adjusting the indicator to suit the gear, it is not always possible to see if the switch is exactly in contact with the trip and therefore indicator lamps shown diagrammatically at **22**, FIGURE 2, are provided which light up at the instant of contact between the switch and the cam plate **17**.

What I claim as my invention and desire to secure by Letters Patent is:

1. A motor control and indicator comprising an electric motor having a starting switch, a pair of aligned shafts, a driving connection between said motor and a first one of said shafts for imparting simultaneous rotary and reciprocatory movement thereto, a manually operable control member, a driving connection between said member and the second one of said shafts for imparting simultaneous rotary and reciprocatory movement thereto, said second one of said shafts having indicia thereon, a fixed pointer cooperating with said indicia to show the extent of rotary and reciprocatory movement of said second one of said shafts, a normally closed switch device in circuit with said motor and carried by one of said shafts laterally of the shaft axis, and a switch tripping device carried by the other of said shafts laterally of the shaft axis, the positions of said switch device and switch tripping device being such that each device traverses essentially the same spiral path on movement of the respective shafts, whereby upon displacement of one of said devices to a selected position away from the other of said devices, said switch device is closed to permit energization of said motor by said starting switch to drive first one of said shafts until said switch device again contacts said switch tripping device to open the motor circuit.

2. A motor control and indicator as claimed in claim 1 and including manually operable means for positioning said first one of said shafts independently of said motor to effect initial calibration of said indicia and pointer with respect to the motor position.

3. A motor control and indicator comprising an electric motor, a pair of aligned shafts, a driving connection between said motor and a first one of said shafts for imparting simultaneous rotary and reciprocatory movement thereto, a manually operable control member, a driving connection between said member and the second one of said shafts for imparting simultaneous rotary and reciprocatory movement thereto, said second one of said shafts having indicia thereon, a fixed pointer cooperating with said indicia to show the extent of rotary and reciprocatory movement of said second one of said shafts, a switch device in circuit with said motor and carried by one of said shafts laterally of the shaft axis, and a switch tripping device carried by the other of said shafts laterally of the shaft axis, said devices being positioned to traverse conforming spiral paths upon movement of the respective shafts.

4. A blank length control mechanism and blank length indicator for a machine which cuts a web traveling at constant speed into separate blanks, said mechanism comprising a graduated cylinder supported for simultaneous rotary and axial movement and having a switch tripping device attached thereto so as to follow a helical path on movement of said cylinder, a fixed pointer adjacent the cylinder graduations, manually operable means for imparting simultaneous rotary and axial movement to said cylinder to set a graduation against said fixed pointer to indicate a given blank length, a motor and a manual starting switch therefor, said motor operating to change the blank length being cut, a shaft coaxial with the aforesaid

cylinder and supported for rotary and axial movement, a driving connection between said motor and said shaft, said driving connection including devices imparting simultaneous rotary and axial movement to said shaft, an arm projecting laterally from said shaft, and a switch carried by the free end of said arm in such position that the switch moves through a helical path conforming substantially to said first named helical path when the said motor is running, the switch carried on said arm being in the motor circuit so that when the switch engages said switch tripping device the motor is stopped.

5. A motor control and indicator as claimed in claim 1 comprising signal devices for indicating when said switch is in contact with said switch tripping device.

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