UNITED STATES PATENT OFFICE

2,654,429

KNIFE CONTROL FOR PAPER-CUTTING MACHINES

William C. Rupp, Parma, Ohio, assignor to The Chandler & Price Company, Cleveland, Ohio, a corporation of Ohio

Application October 27, 1949, Serial No. 123,865

7 Claims. (Cl. 164—52)

1 This invention relates as indicated to a knife control for paper cutting machines and, more particularly, to a knife control for power operated paper cutting machines also having a power operated binder clamp adapted firmly to clamp a stack of sheets or the like upon the table of the cutter.

In my co-pending application Serial No. 60,341, filed November 16, 1948, I disclose an improved power operated binder clamp which is much more rapid and efficient in operation than the common hand clamp means. In my co-pending application Serial No. 112,655, filed August 27, 1949, I disclose certain improved driving mechanism for the reciprocating knife commonly employed in such machines. The present invention relates to novel control means interrelating the operation of the binder clamp with the knife actuating mechanism, and reference may be had to the two foregoing applications for a description of the other features of the machine in which I prefer to incorporate such newly improved control means. It will be understood, however, that such control means may be employed in paper cutting machines generally, including those illustrated and described in Tyler et al. Patent No. 1,967,900 and Rechert et al. Patent No. 2,205,735.

In such machines a flywheel driven by an electric motor may be connected through a clutch with a crank adapted to reciprocate the knife to cut a stack of sheets or the like. Generally, a bed or table is provided upon which the stack of sheets may be precisely positioned by means of adjustable gauges, and a vertically reciprocable knife is drawn down to make the cut and again elevated by means of such power driven crank. Means will also desirably be provided to prevent accidental actuation of the knife and to insure that the knife will return to fully elevated position after completion of a cut and remain there without repetition of the cycle. It is also highly important that the binder clamp be brought down into firm clamping engagement with the stack upon the table prior to bringing down the knife to cut or trim such stack. It is with such latter aspect that the present invention is concerned.

It is accordingly a primary object of my invention to provide knife control means for paper cutting machines and the like operative to permit operation of such knife only after the material to be cut has been firmly clamped.

A further object of my invention is to provide control means of the type indicated which will be positively actuated and equally effective without adjustment regardless of the thickness of the stack on the table.

Still another object is to provide means effective to prevent manual actuation of the knife drive means until the stack has thus been firmly clamped.

Other objects of this invention will become apparent as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

Fig. 1 is a front elevational view of a paper cutting machine embodying my invention;

Fig. 2 is a fragmentary sectional view through the binder clamp of such machine taken along the line 2—2 on Fig. 1; and

Fig. 3 is a front elevational view generally similar to Fig. 1 but illustrating a different embodiment of the invention.

Referring now more particularly to said drawing, my new control means may be incorporated in a paper cutting machine of generally conventional construction comprising a base frame 4 carrying a bed or table 3 upon which a stack of sheets may be positioned to be cut. A back gauge 5 may be adjusted forwardly or rearwardly of table 3 by means of hand wheel 4, the position of such gauge being indicated by a traveling steel tape in window 5 as described in Rechert et al. Patent No. 2,293,347. A knife bar 6 carrying knife 1 is mounted for generally vertical reciprocation in upper frame 8, a wooden knife stick 9 being inset in the upper surface of the table to avoid possible damage to the knife.

The knife bar 6 and knife 1 are adapted thus to be reciprocated by means of a connecting rod 10, crank 11 and crankshaft 12 driven through a clutch from a flywheel driven by an electric motor (not shown). Such clutch for engaging and disengaging the flywheel is adapted to be actuated by a hand lever 13 preferably of the safety type such as that requiring the same to be first moved to the right and then to the left as viewed in Fig. 1 to cause engagement of the clutch to reciprocate the knife bar. When one cycle of operation has been completed, the clutch will be automatically kicked out and the brake (also
not shown) applied, leaving the knife in elevated position.

Back gauge 3 may be shifted back and forth as desired by means of hand wheel 4 and locked in adjusted position by locking lever 14.

Referring now also to Fig. 2 of the drawing, the binder clamp there illustrated comprises the usual presser foot 15 extending transversely of table 2 and guided for vertical movement in conventional manner by the side frame members. Such presser foot is carried by a vertically extending screw 16 threadedly engaging nut 17 which is locked against rotation by means of set screw 18. Screw 16 may be driven by a reversible electric torque motor (not shown) through shaft 19 and speed reducing gears 20 and 21. Gear 21 is adapted to turn freely on upper end portion of shaft or spindle 22 constituting the upper extension of screw 16 and rests upon a collar 23 carried by such spindle. Collar 23 in turn normally rests upon the upper surface of bearing 24 and another collar 26 is secured to spindle 22 at a point normally slightly (about \( \frac{3}{4} \) inch) below lower end of such bearing.

A twin disc friction clutch of well-known conventional construction is carried by the upper end of spindle 22 for connecting gear 21 in driving connection with such spindle. Such clutch includes a plurality of interleaved driving plates within a casing 25, alternate plates being secured to spindle 22 and gear 21. Nut 27 may be adjusted to force steel back-up plate 28 against rubber compression member 29 to regulate the friction developed within such clutch. Consequently, the force with which the binder clamp pressure down upon the stack of sheets may be varied as desired.

Hand lever 13 is keyed to a rock shaft 30, oscillation of which is operative to control the knife drive mechanism in conventional fashion as above explained. A dog 31 is likewise keyed to shaft 30 and is adapted to engage the plunger or armature 32 of solenoid 33 when lever 13 is in clutch-disengaging and brake-applying position. A stop bracket 34 supports plunger 32, preventing movement of lever 13 to the left as viewed in Fig. 1 when such plunger is advanced. It will accordingly be apparent that it is physically impossible for the operator of the machine to actuate the knife until such solenoid plunger has been retracted.

A normally open limit switch 35 is mounted within upper gear housing 36 with a lower contact provided with a roller 37 adapted to engage the upper margin of the outer periphery of gear 21. As shown in Fig. 1, such switch is connected in an electric circuit with solenoid 33 so that when the switch is closed the solenoid will be energized to retract plunger 32 from the path of dog 31, permitting the latter to be rocked in a counterclockwise direction as viewed in Fig. 1.

After a stack of sheets has been properly positioned on table 2 against lower gauge 3, the operator first moves hand lever 13 to the right as viewed in Fig. 1, thereby operating micro-switch 38, completing a circuit energizing the electric motor (not shown) driving shaft 19. The spindle 22 is thereby revolved through the action of gear 21 and the clutch means carried by the upper end of spindle 22 to turn screw 16 to move presser foot 15 downwardly into clamping engagement with such stack. As above explained, the degree of pressure imposed upon the stack will depend upon the adjustment of nut 27. When presser foot 15 can no longer move downwardly, con-
explained. Instead of binder clamp screw 16, however, a double acting fluid pressure piston-cylinder assembly 42 is provided mounted vertically in head frame 8, an extension 43 of such piston engaging and supporting binder clamp presser shoe 15. The usual fluid pressure supply line 44 and 45 adapted to conduct such fluid (ordinarily hydraulic, although air pressure may be employed) to the upper and lower ends of said cylinder respectively. A branch line 46 leads to the lower end of fluid pressure cylinder 47, so that pressure in such line acts to retract plunger 48. Plunger 48 corresponds to armature 32, being interposed between dog 31 and stop 34, and normally held in extended position by action of compression spring 49. Thus, when fluid pressure is admitted to line 44 and relieved from line 45 by any suitable valving means, then presser shoe 15 will be brought down in clamping engagement upon the stack or table. Pressure is thereupon built up in line 46 sufficient to overcome spring 49 and retract plunger 48, whereupon lever 13 may now be shifted to operate the knife drive mechanism. When line 44 is connected to drain and line 45 to pressure the presser foot 15 will be elevated and spring 49 will again be effective to interpose stop plunger 48.

It will be appreciated that control means of the type above described are particularly advantageous where movement of the binder clamp is slower than movement of the knife. When a screw feed for the clamp is employed, the less the pitch, the less the power required to obtain a desired clamping pressure. Similarly, when employing hydraulic means, the slower the piston moves, the less the pressure of the pump required to supply the fluid under pressure. It is most important that the more rapidly traveling knife should not start its downward movement until the stack has actually been firmly clamped. Employment of relatively slow time-delay means of well-known type is not a satisfactory solution to the problem under these circumstances since the stack to be cut may be of varying thickness and the time-delay interval allowed would always have to be sufficient to permit the clamp to travel all the way to the table in order to be safe. With my novel arrangement the knife may be actuated promptly just as soon as the stack has been clamped, whatever may be the height of such stack. Furthermore, the knife may be brought down rapidly to obtain desired cutting characteristics without any danger of engaging the stack prematurely prior to proper clamping of the latter. These advantages I achieve by making operation of the knife drive mechanism dependent upon first obtaining clamping pressure on the stack.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

1. In a power driven paper cutting machine including a knife, a crankshaft adapted when rotated to reciprocate such knife, and a hand lever adapted to be rocked to actuate such crankshaft and knife; the combination of a binder clamp adapted to clamp a stack of sheets or the like upon the table of such machine comprising a vertically disposed spindle, a screw on the lower end of said spindle, a presser foot adapted to bear upon such stack threadedly engaging said screw for vertical reciprocation when said screw is rotated, a gear supported on the upper portion of said spindle for free rotation relative thereto, a disc-type friction clutch on said spindle interconnecting said presser foot and spindle in driving connection, a nut threaded on the upper end of said spindle adapted when tightened to increase the frictional resistance of said clutch, whereby the downward thrust of said presser foot upon such stack may be regulated, means operative to drive said gear, a rock shaft adapted to be rocked by such lever to actuate such crankshaft and knife, a dog secured to said shaft for oscillation therewith, a solenoid having an armature adapted when extended to engage said dog to prevent rocking of such lever to actuate such knife, a back-up stop adapted to support said armature against movement by said dog, an electric circuit controlling said solenoid, a normally open limit switch in said circuit located above said gear and adapted to be closed to energize said solenoid to retracted armature to permit rocking of such lever to actuate such knife when continued rotation of said screw after engagement of said presser foot with such stack operates to elevate said spindle, and means limiting such elevation of said spindle.

2. In a power driven paper cutting machine including a knife adapted to be reciprocated to make a cut, and a hand lever adapted to be rocked to actuate drive mechanism for reciprocating such knife; a binder clamp adapted to clamp a stack of sheets or the like upon the table of such machine comprising a vertically disposed spindle, a screw on the lower portion of said spindle, a presser foot adapted to bear upon such stack threadedly engaging said screw for vertical reciprocation when said screw and said screw are rotated, a gear carried by the upper portion of said spindle freely rotatable relative thereto, clutch means on such upper portion frictionally interconnecting said gear and spindle in driving connection, means adjustable to vary the degree of friction developed in such clutch thereby to regulate the downward thrust of said presser foot upon such stack, means operative to drive said gear, a back-up stop, means rigid with such lever and rockable therewith, a solenoid having an armature adapted when extended to be interposed between said last-named means and said back-up stop to prevent rocking of such lever to actuate such knife, an electric circuit controlling said solenoid, a normally open switch in said circuit positioned to be operated by lifting of said spindle, and means limiting the distance said spindle may be lifted, whereby, upon engagement of said presser foot with such stack, continued rotation of said screw will operate to lift said spindle to operate said switch to retract such armature, permitting manual operation of such lever to actuate such knife reciprocating mechanism.

3. In a power driven paper cutting machine including a knife adapted to be reciprocated to make a cut, and a hand lever adapted to be rocked to actuate drive mechanism for reciprocating such knife; a binder clamp adapted to clamp a stack of sheets or the like upon the table of such machine comprising a vertically disposed spindle, a screw on the lower portion of said spindle, a presser foot adapted to bear upon such stack threadedly engaging said screw for vertical reciprocation when said spindle and screw are rotated, means operative to drive said spindle,
stop means adapted to prevent reeking of such lever to actuate such knife drive mechanism, a
solenoid operative when energized to retract said stop means, an electric circuit controlling said
solenoid, a normally open switch in said circuit positioned to be operated by lifting of said
spindle, and means limiting the distance said spindle may thus be lifted, whereby, upon enga-
genement of said presser foot with such stack and firm clamping of the latter thereby, con-
tinued rotation of said screw will operate to lift said spindle to operate said switch to retract
said stop, permitting manual operation of such lever to actuate such knife reciprocating me-
chanism.

4. In a power driven paper cutting machine including a knife adapted to be reciprocated to
make a cut, and a hand lever adapted to be rocked to actuate drive mechanism for reciprocating
such knife; a binder clamp adapted to clamp a stack of sheets or the like upon the table of such
machine comprising a vertically disposed screw, a presser foot adapted to bear upon such stack
threadedly engaging said screw for vertical reciprocation relative thereto when said screw is
rotated, means operative to drive said screw, electrically controlled guard means normally oper-
ative to prevent rocking of such lever to actuate such knife drive mechanism, a switch
operative when actuated to release said guard means to permit such rocking of said lever, said
switch being positioned and arranged to be ac-
tuated by reciprocation of said screw, and means limiting the distance said screw may thus be
reciprocated, whereby, upon engagement of said presser foot with such stack and firm clamping
of the latter thereby, continued rotation of said screw will operate to lift the same to actuate
said switch to release said guard means, per-
mitting operation of such lever to actuate such
knife reciprocating mechanism.

5. In a power driven paper cutting machine including a knife adapted to be operated to make
a cut, and control means adapted to actuate drive mechanism for such knife; a binder clamp
adapted to clamp a stack of sheets or the like comprising a screw, a presser foot adapted to
bear against such stack threadedly engaging said screw for reciprocation relative thereto when
said screw is rotated, means operative to drive said screw, electrically controlled guard means
normally operative to prevent actuation of such drive mechanism for such knife, a switch ar-
ranged and disposed to be actuated by reciprocation of said screw and operative when thus
actuated to release said electrically controlled
guard means, and means limiting the distance
said screw may thus be reciprocated, whereby,
upon engagement of said presser foot with such
stack and firm clamping of the latter thereby,
further rotation of said screw will operate to
reciprocate the same to actuate said switch.

6. In a power driven paper cutting machine including a knife adapted to be operated to make
a cut, and manual control means adapted to
actuate drive mechanism for such knife; a binder
clamp adapted to clamp a stack of sheets or the
like comprising a screw, a presser foot adapted
to bear against such stack threadedly engaging
said screw for reciprocation relative thereto
when said screw is rotated, means operative to
drive said screw, guard means normally oper-
ative to prevent actuation of such control means
for such drive means for such knife, and means
responsive to lifting of said screw operative to
release said guard means, whereby, upon en-
gagement of said presser foot with such stack
and firm clamping of the latter thereby, further
rotation of said screw in the same direction will
serve to lift the same to release said guard means.

7. In a power driven paper cutting machine including a knife adapted to be driven to make
a cut, and drive mechanism for such knife; a
binder clamp adapted to clamp a stack of sheets
or the like including a presser foot, a screw
threadedly engaging said presser foot for re-
ciprocation of the latter, said screw being mount-
ced for limited axial shifting away from such
stack upon clamping engagement of said presser
foot with the work with consequent cessation of
such reciprocation of said presser foot, means
adapted to drive said screw to reciprocate said
presser foot at a slower rate than such knife
drive mechanism is adapted to drive such knife,
and means controlling initiation of movement
of such knife responsive to such axial shifting
of said screw when the work has thus been
clammed to set up such knife drive mechanism
for actuation.

WILLIAM C. RUPP.

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