Jan. 22, 1935. S. KALKO 1,989,012

CYLINDER ROTARY CUT-OFF KNIFE

Filed July 24, 1934

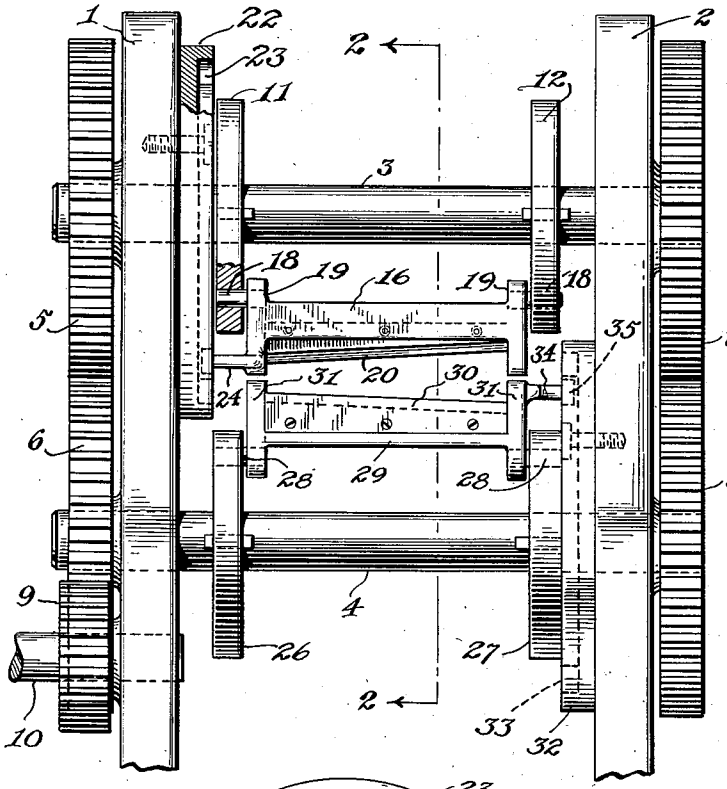


Fig. 1.

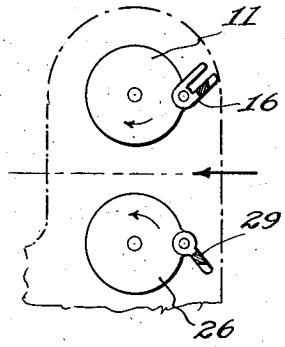


Fig. 5.

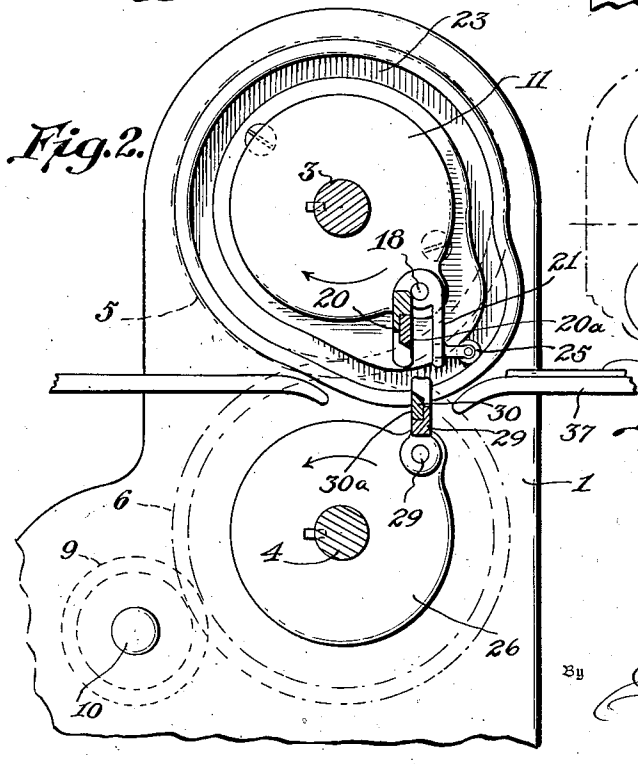


Fig. 2.

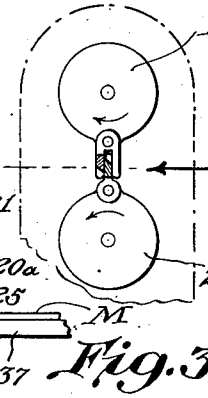


Fig. 3.

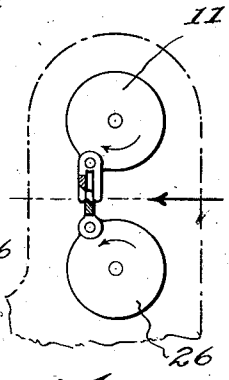


Fig. 4.

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UNITED STATES PATENT OFFICE

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CYLINDER ROTARY CUT-OFF KNIFE

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9 Claims. (Cl. 164—66)

This invention relates to shears, and more particularly to cylinder rotary cut-off knives of the type known as flying shears, in which the knives during their cutting stroke move with and in the direction of feed of the material being severed.

The severing of sheet material, such as metal, veneer or paper stock, into lengths is frequently accomplished by passing the material between a pair of cooperating knives disposed transversely of the material and mounted to rotate about parallel axes in a manner such as periodically, that is, during each cycle of their rotation, to bring the knives into engagement to sever the material. While this mode of cutting is continuous and rapid, requiring as it does no interruption of the feed of the material during cutting, it nevertheless is open to the objection that the knives frequently fail to effect a clean severance of the material, and this is especially true when the material is tough metal plate or bar stock. This objection arises from the fact that the rotary knives roll into engagement with each other, similarly to two cooperating gear teeth, and tend to deform and mutilate the material during its severance rather than to impart a straight shearing cut thereto. This rolling action also imposes a severe strain upon the knives in the cutting of heavy metal stock.

It is an object of my invention to overcome the foregoing objections by providing a cutting mechanism in which the knives, while partaking of a rotary motion so as to move with the material during the interval of cutting, are also mounted for pivotal movement so that the knives, notwithstanding their rotation, may be maintained at an unchanging angle to the plane of the material during their cutting stroke and to penetrate the material with a straight-line shearing action. A particular feature of the invention resides in the provision of means for controlling the pivotal movement of the knives so as to automatically guide them into alignment preliminarily to the cutting stroke and to maintain their operative faces in face-to-face sliding contact during severance of the material.

In the preferred form of the invention the longitudinal cutting edges of the knives are disposed at an inclination to the plane of the material so as to progressively sever the material from one side to its other, this being a characteristic feature of cutting machines of the reciprocating type.

Another object of the invention is to provide means for controlling the position of the knives so as to guide them into and out of shearing engagement. These control means according to the preferred form of the invention are mutually independent so that one knife, if desired, may follow a different pattern of movement from its companion knife, but the knives in any event being maintained in parallel, overlapped, cutting relationship during a prescribed period of their cycle of rotation. Preferably such control means comprise a pilot member arranged upon the knife carriers and arranged to slide within guide slots formed in stationary cam plates which latter advantageously may be supported upon the frame of the machine.

A further object of the invention is the provision of complementary members upon the knife carriers which move into interfitting engagement at the beginning of the cutting stroke and press the knives together and maintain them against spreading during severance of the material.

These and other objects and advantages of the invention will be apparent from the following detailed description of one preferred embodiment thereof, supplemented by the annexed sheet of drawings in which:

Figure 1 is a view in side elevation of one form of flying shear embodying the invention; Figure 2 is a cross-sectional view of the shear of Fig. 1 taken on the line 2—2 of that figure; and Figures 3, 4, and 5 are diagrammatic views of the shear showing the different relative positions assumed by the knives during a cycle of rotation.

The shear illustrated in the drawing is composed of a stationary frame having two upright side plates 1 and 2 in which are journaled parallel shafts 3 and 4 arranged in vertical alignment. Both shafts have their ends extended through the side plates, and fixed upon the outer ends of these shafts are pairs of intermeshing gears 5, 6, and 7, 8, driven by a pinion 9 upon a drive shaft 10 and operatively engaging the gear 6.

Keyed to the upper shaft 3 and located a short distance from the side plates 1 and 2 respectively is a pair of crank discs 11 and 12. Pins 18 project outwardly from the opposed faces of the crank discs 11 and 12 and are correspondingly located upon the crank discs at equal distances from the shaft 3. These pins are designed to provide a pivotal support for a knife carrier 16. The knife carrier extends transversely between crank discs 11 and 12 and is provided upon its ends with integral rocker arms 19 rotatably engaging the pins 18. A knife blade 20 is screwed to the knife carrier, the knife blade being seated within a recess formed in the knife carrier, as

shown in Fig. 2, so that its operative face 20a lies flush with a face of the knife carrier. A shoe 21 located upon each end of the knife carrier 16 overhangs and extends parallel to that face of the knife carrier which receives the knife. Bolted to the side plate 1 of the machine frame and encircling the shaft 3 is a cam plate 22 having formed in its exposed face a continuous cam slot 23. A pilot member 24 projects from one end of the knife carrier 16 and is provided with a roller 25 which enters the cam slot and rides therein during rotation of the shaft 3.

Keyed to the lower shaft 4 is a pair of crank discs 26 and 27 similar to the crank discs 11 and 12 and lying in common planes therewith. Pins 28 project from opposite faces of these crank discs and pivotally support a lower knife carrier 29. This knife carrier extends between the crank discs 26 and 27 and has associated therewith a knife blade 30 fastened within a recess in one face of the knife carrier so that its operative face 30a lies flush with the face of the knife carrier and, during cutting, in opposed relation to the knife blade 20. The ends of the carrier are integrally formed with rocker arms 31 which rotatably engage the pins 28. To the inner face of the side plate 2 of the machine frame and encircling the shaft 4 is bolted a cam plate 32 (Fig. 1) having an endless cam slot 33, similar to the cam slot 23 of cam plate 22, and projecting from the end of the knife carrier 30 adjacent the cam plate 32 is a pilot 34 having a roller 35 which fits within and is guided by the cam slot.

As shown in Fig. 1 the cutting edges of the knives 20 and 30 extend at an angle to each other and at an inclination to the plane of the material being operated on so as to cause the material to be cut progressively in a direction cross-wise of its length, as is common practice in the case of reciprocating cutting mechanisms.

During rotation of the shafts 3 and 4 the knife carriers 16 and 29 have a tendency to swing under the action of gravity upon the pairs of pins 18 and 28 by which they are pivotally attached to the crank discs 11, 12 and 26, 27 respectively. This movement, however, is positively controlled by the pilots 24 and 34 riding within the cam slots 23 and 33 respectively of the cam plates 22 and 32. The cam slots are designed so as to dictate the position of the knife carriers at all times. This insures that during rotation of the knives they will be brought into alignment, with the operative face of one knife disposed in a common plane with the operative face of the other knife.

The contour of the cam slot 23 of the cam plate 22 controlling the upper knife is shown in Fig. 2, and the cam slot 33 of cam plate 32 is a counterpart of the cam slot 23. The figure shows the position of the knives just in advance of the cutting stroke, the term "cutting stroke" being used for convenience to designate the movement of the knives during the interval they are actually engaged in severing the material. The sections of the cam slots engaged by the pilots 24 and 34 at this stage are suitably fashioned so as to maintain the knife carriers in a common shear plane that is substantially perpendicular to the path of travel of the material M. The material M, it will be understood, is continuously fed between the knives from the work support 37 at approximately the same speed as the knives so that knives during their severing stroke do not unduly impede the passage of the material.

Further rotation of the knife carriers in the direction of the arrows causes the knives to slide upon each other severing the material M until they reach the position shown in Fig. 3, which represents their maximum extent of overlap and indicates their positions at the end of the cutting stroke. During this cutting stroke the shoes 21 upon the ends of the knife carrier 16 initially engage the back of the lower knife carrier and urge the two operative faces of the knives together, and then, during further movement of the knives, serve to maintain the knives against separation, such as sometimes occurs in the cutting of metal stock. Continued rotation of the knife carriers causes the upper and lower knives to attain the relative positions shown in Fig. 4 at which time both knives have receded sufficiently far to be at the point of separation although still sweeping in the general direction of the feed of the material. The knives continue to rotate in the direction of the arrows, maintaining their vertical alignment, until the shoes 21 release the knife carrier 16, at which time the pilots 24 and 34 encounter the circular sections of the cam slots and both knife carriers are folded inwardly toward the shafts 3 and 4, as illustrated in Fig. 5. The knife carriers are then carried around in a circular path until they are again swung into alignment, as shown in Fig. 2, by the pilots as the latter ride into the eccentric portions of the cam slots.

The cam slots may take any suitable conformation in order to vary the relative positions of the knives at different points in their cycles of rotation. Nor need the knives necessarily be maintained perpendicular to the material during cutting, since under some circumstances it may be found desirable to impart a bevel cut to the material in which case the cam slots may be designed to guide the knives into engagement along a shear plane disposed at an angle to the plane of the material. An important function of the slots is to guide the knives into alignment just prior to their penetration of the material. The knives normally will be maintained in substantial alignment during the cutting stroke by the pilots 24 and 34 riding within cam slots 23 and 33, and the shoes 21 will serve principally to prevent lateral separation of the knives. Nevertheless, as the cam slots become worn and play develops between the rollers 25 and 35 and the slots, the shoes will operate additionally to correct any resulting misalignment of the knives and maintain the operative faces of the knives in sliding engagement. Furthermore the shoes serve to assume the stress which otherwise would be thrown upon the pilots during cutting.

It is not necessary that the knives rotate in the directions indicated by the arrows in Figures 2 to 5, inclusive, but under certain circumstances by reversing the revolution of the drive shaft 10 the knives may be rotated in opposite directions to those shown in the figures. In such cases, of course, the material will be fed to the machine in a direction opposite to that indicated by the arrows.

It will be apparent from the above description that the shear embodying the principle of the invention is so designed that the knives effect a straight shear-cut during the continuous feeding of the material, thus overcoming any tendency of the knives to distort the material during its severance.

I claim:

1. A cutting mechanism comprising a pair of cooperating knives mounted for rotation about parallel axes and periodically rotatable into en-

gagement with each other to perform a cutting stroke, said knives being mounted for pivotal movement and means for independently controlling the pivotal movement of each knife whereby each knife may follow a pattern of movement different from the other.

2. A cutting mechanism comprising a pair of cooperating knives mounted for rotation about parallel axes and periodically rotatable into engagement with each other to perform a cutting stroke, each knife being mounted for pivotal movement and a cam for independently controlling the pivotal movement of said knives, to maintain them in alignment during the cutting stroke.

3. A cutting mechanism comprising a pair of cooperating knives mounted for rotation about parallel axes, means for rotating said knives to periodically bring them into engagement with each other to perform a cutting stroke, said knives being mounted for pivotal movement, and cam means so constructed and arranged for causing pivotal movement of the knives so as to lock them into alignment in advance of the cutting stroke.

4. A cutting mechanism comprising a lower knife mounted for rotation and also for pivotal movement, a companion upper knife, means for rotating the lower knife to periodically bring it into engagement with the upper knife to perform a cutting stroke upon a piece of material introduced between the knives, a cam, and a pilot member engageable with the cam for controlling the pivotal movement of the lower knife and maintaining it in engagement with the upper knife and in fixed predetermined angular relation to the material throughout the cutting stroke.

5. A cutting mechanism comprising a knife carrier mounted for rotation, a companion lower knife, means for rotating the upper knife to periodically bring it into engagement with the lower knife to perform a cutting stroke upon a piece of material introduced between the knives, the upper knife being mounted for pivotal movement, a pilot member arranged upon the upper knife carrier and a stationarily mounted cam engageable by the pilot member for controlling the pivotal movement of the upper knife and maintain it in fixed predetermined angular relation to the material during its cutting stroke.

6. A cutting mechanism comprising a pair of cooperating knives, a knife carrier for each of the knives, means for rotating the knife carriers about parallel axes to bring the knives periodically into engagement to perform a cutting stroke, and means for swinging the knives into and out of alignment during their rotation, said last-named means comprising stationarily mounted cams and a pilot member upon each of the knife carriers engageable with a cam during rotation of the carriers for controlling the position of the carriers.

7. A cutting mechanism comprising a pair of cooperating knives, a knife carrier for supporting each of said knives, said knife carriers being both pivotally and rotatably mounted, means for rotating the knife carriers about parallel axes to bring said knives periodically into engagement to perform a cutting stroke, independent cams concentrically mounted with respect to the axes of rotation of said knives and adjacent the ends of the knife carriers, and pilots upon the knife carriers engaging the cams for controlling the pivotal movement of said knife carriers to bring the knives into alignment in advance of the cutting stroke.

8. A cutting mechanism comprising a pair of cooperating knives, a knife carrier for each of said knives, said knife carriers being both pivotally and rotatably mounted, means for rotating said knife carriers about parallel axes to bring said knives periodically into engagement to perform a cutting stroke, cams for independently pivoting said carriers to bring the knives into and out of alignment during their rotation, and means to prevent spreading of the knives during their cutting stroke.

9. A cutting mechanism comprising a machine frame, a pair of parallel shafts journaled in said machine frame and geared together for simultaneous rotation, means to drive the shafts, a pair of cranks rigidly connected to each shaft, a knife carrier supported between each pair of cranks and having a knife mounted thereon, the knife carriers being so arranged that upon rotation of the shafts the knives are periodically brought into engagement to perform a cutting stroke, means pivotally supporting the knife carriers upon the cranks, cams stationarily supported upon opposite sides of the machine frame, and pilot members extending from the knife carriers and engaging the cams for controlling the position of the knife carriers during their rotation.

STEPHEN KALKO.

CERTIFICATE OF CORRECTION.

Patent No. 1,989,012. January 22, 1935.

STEPHEN KALKO.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 13, claim 2, for "said knives" read each knife; and line 22, claim 3, for "lock" read rock; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of March, A. D. 1935.

Leslie Frazer

(Seal) Acting Commissioner of Patents.