

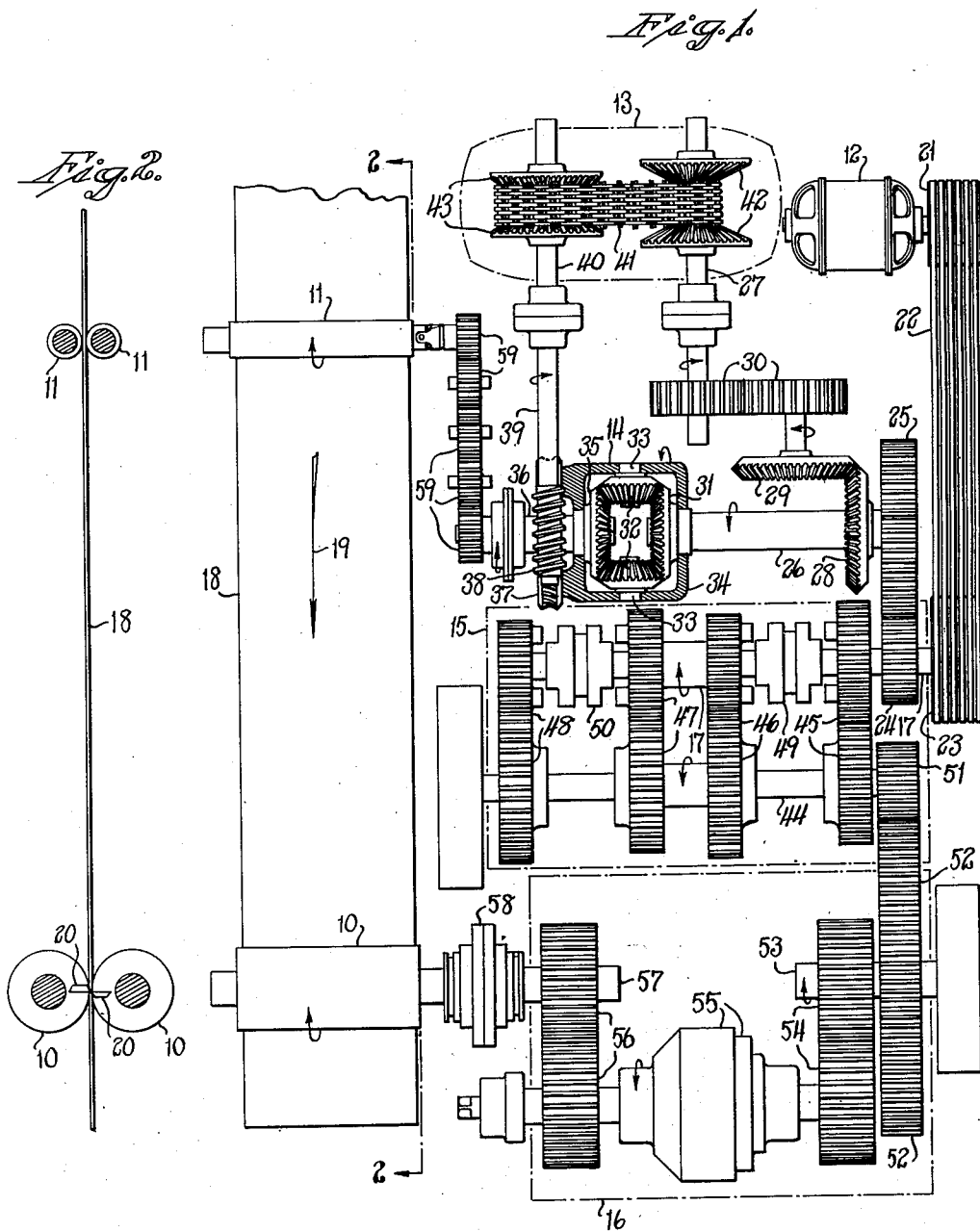
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FLYING CUTTING DEVICE

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FLYING CUTTING DEVICE

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2 Claims. (Cl. 164—68)

This invention relates to improvements in flying cutting devices in which stock, for example, sheet metal, is continuously fed by feed-means to cutter-means which cuts the stock into lengths without stopping the feed of the stock, and more particularly relates to flying cutting devices having means for adjusting the relative speeds of the feed-means and cutter-means to accomplish different lengths of cut.

One object of this invention is to provide a flying cutting device having an improved combination of feed-means, cutter-means and adjustable means interconnecting the feed-means and cutter-means, said adjustable means including an infinitesimally-adjustable unit and a step-gear unit and serving for adjusting the relative speeds of, and being so combined with, the feed-means and cutter-means, that shocks caused by the cutter-means in making cuts will not be transmitted to the necessarily relatively-delicate infinitesimally-adjustable unit.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the accompanying drawing forming part of the present disclosure, in which one way of carrying out the invention is shown for illustrative purposes:

Fig. 1 is a top plan diagrammatic view illustrating one embodiment of the invention; and

Fig. 2 is a sectional view on line 2—2 of Fig. 1.

In the description and claims, the various parts are identified by specific names for convenience, but they are intended to be as generic in their application as the prior art will permit.

Referring to the drawing showing the particular form of the invention chosen for illustration, the cutter-means in the form of cutter-rolls 10 and feed-means in the form of feed-rolls 11 are driven by drive-means in the form of an electric motor 12 through mechanism interconnecting the cutter-rolls 10 and feed-rolls 11 and including a presettable infinitesimally-adjustable speed-ratio unit 13, a differential-gear unit 14, a change-gear or step-gear unit 15, and synchronizing means 16.

The infinitesimally-adjustable speed-ratio unit 13 and the differential-gear unit 14 are interposed in driving relation between the feed-rolls 11 and shaft 17 driven by the drive motor 12. The change-gear unit 15 and synchronizing means 16 are arranged in driving relation between the cutter-rolls 10 and the shaft 17.

The particular form of the flying cutter-means

10 and the synchronizing means 16 forms no part of the present invention and may be of any suitable type.

The stock to be cut, which may, for example, be in the form of sheet-metal 18, is continuously fed by the feed-rolls 11 to cause the stock 18 to be fed in the direction of the arrow 19 to the cutter-rolls 10, each of which carries a cutter-blade or shear-knife 20. In order to cut the stock 18 into any of various pre-selected lengths desired while the stock continues to be fed through the machine, it is necessary to change the speed of either the feed-rolls 11 or the cutter-rolls 10, or both.

I have found that due to various factors, the cutter-means 10 in performing the cutting operation, at times cause severe shock to be transmitted back through the mechanism toward the driving motor, and as the infinitesimally-adjustable speed-ratio unit 13 is a relatively-delicate piece of mechanism, I have devised a way to utilize the same without having it in the line of direct shock between the cutter-means 10 and the motor 12 by arranging it between the feed-means 11 and the shaft 17 driven by the drive-motor 12, as previously described, employing the relatively-rugged synchronizing means 16 and change-gear unit 15 between the cutter-means 10 and the shaft 17 driven by the drive-motor 12.

Thus, and as will be more fully explained in detail hereinafter, the change-gear unit 15 provides for varying the relative speed between the shaft 17 and the cutter-means 10 by a series of relatively-large steps, while the differential-gear unit 14 and infinitesimally-adjustable speed-ratio unit 13 provide means for varying the relative speed between the shaft 17 and the feed-means 11 by infinitesimally-small adjustments, and by the particular relationship of the units 13 and 14 with the unit 15, as will be more fully explained hereinafter, any desired speed relation between the cutter-means 10 and feed-means 11 can be obtained.

The shaft 17 driven from the drive-motor 12 through pulley 21, belt 22 and pulley 23, has secured thereto a pinion 24 in driving relation with a gear 25 secured to a shaft 26. Shaft 26 drives the input shaft 27 of the infinitesimally-adjustable speed-ratio unit 13 through the pair of bevel gears 28, shaft 29, and a pair of spur gears 30. The left end of shaft 26 has a bevel gear 31 secured thereto which meshes with two bevel sun-gears 32 pivoted at 33 to the differential housing 34, the gears 32 in turn meshing with a bevel gear 35 secured to a differential output-shaft 36 which,

through suitable gearing 50 drives one of the feed-rolls 11, the two feed-rolls being geared together to rotate at equal speeds in opposite directions in a usual manner. The differential-gear unit 14 comprises the differential gears 31, 32 and 35 and differential housing 34.

A worm gear 37 is secured to the differential housing 34 and meshes with a worm 38 carried by or formed on a shaft 39 which is coupled to the output shaft 40 of the unit 13. The unit 13 has a special sprocket chain 41 in driving relation between two pairs of conical sprocket wheels 42 and 43, the wheels of each pair of sprocket wheels being adjustable toward and from one another by suitable means, not shown, the particular unit 13 shown, being a commercial device known as the "P. I. V." made by the Link-Belt Company of Philadelphia, Pennsylvania. Most of the power transmitted from the shaft 17 to the feed-rolls 11 is transmitted through the differential-unit 14, a minor portion of the power passing through the unit 13 which can be set to give, through the worm 38 and worm gear 37, any desired speed of rotation to the differential housing 34 within the range provided by the infinitesimal adjustability of the unit 13, to thus act as a control or governor for the differential-unit 14 to give any desired speed to the feed-rolls 11.

The shaft 17 is adapted to drive a shaft 44 through any one of four pairs of selectively-engageable change-gears or step-gears 45, 46, 47 and 48, by suitable actuation of one or the other of the clutch members 49 or 50 in a way that is well known.

The shaft 44 has secured thereto, a pinion 51 which meshes with a gear 52 which drives one of the cutter-rolls 10 through shaft 53, pair of eccentric gears 54, friction clutch 55, a second pair of eccentric gears 56, shaft 57 and coupling 58, the two cutter-rolls being geared together to rotate at equal speeds in opposite directions in a usual manner. The pairs of eccentric gears and clutch elements just described, comprise the synchronizing means 16. No detailed description is necessary, of the manner of obtaining the synchronizing by the synchronizing means, as this not only forms no part of the present invention, but is also amply and fully described in applicant's copending application, Ser. No. 167,192, filed October 4, 1937.

The pairs of change-gears or step-gears 45, 46, 47 and 48 provide means whereby the speed of rotation of the cutter-rolls 10 can be varied in steps to thus correspondingly vary the length of cuts being made from the stock 18 fed there-through by the feed-rolls 11, and the infinitesimally-adjustable speed-ratio unit 13 in conjunction with the differential-gear unit 14 provides infinitesimally-adjustable means whereby the feed-rolls 11 can have their speed varied by infinitesimal gradations covering the gaps between the pairs of step-gears 45, 46, 47 and 48. Thus, the step-by-step adjustment of the cutter-means 10 and the infinitesimal adjustment of the feed-means 11 together provide for complete infinitesimal adjustment of the speed-ratios between the cutter-means 10 and the feed-means 11 over the whole range of the step-gears. The electric motor 12 is preferably one whose speed can be readily adjusted so that, when the speed of feed of the feed-rolls 11 is lowered by an adjustment of unit 13 below a desired speed of output of cut stock, the speed of the motor 12 can be adjusted to a higher speed so as to hold the speed of out-

put substantially constant at all times, if so desired.

When any change in speed of the feed-rolls 11 or of the cutter-rolls 10 is made, proper adjustment of the synchronizing means 16 is made to bring the speed of the cutter-blades 20 at the instant of cut to exactly the speed of travel of the stock 18 being cut so as not to tear or buckle the stock.

It will be seen that by having the relatively-delicate infinitesimally-adjustable unit 13 located between the feed-means 11 and the shaft 17 driven by the drive-motor 12, that shocks resultant from the action of the cutter-blades 20 are not imposed on the unit 13, but instead, the shocks are born by the step-gear unit 15 which is the relatively rugged part of the adjusting means. Also less power is required to operate the feed-rolls than is required to operate the cutter-rolls.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. A flying cutting device comprising: drive-means; cutter-means and feed-means for said cutter-means, driven by said drive-means; and precision infinitesimally-adjustable means inter-connecting said cutter-means and said feed-means and including, a change-gear unit having a plurality of selectively-engageable pairs of change-gears of different speed-ratios differing by relatively-large steps, a differential-gear unit having a differential output-shaft, and a pre-settable infinitesimally-adjustable speed-ratio unit having a rotatable mechanical-drive connection with said differential-gear unit and adapted to rotate said connection uninterruptedly to operatively control the speed of rotation of said differential output-shaft and having an infinitesimally-adjustable speed-ratio range at least equal to the speed-ratio range between each two successive speed-ratios provided by said pairs of change-gears and designed and adapted to be set to give and maintain any desired predetermined speed-ratio between each two successive speed-ratios provided by said pairs of change-gears; said change-gear unit, differential gear-unit and infinitesimally-adjustable speed-ratio unit together forming means designed and adapted to provide a continuous precision infinitesimally-adjustable range of speed-ratios between said cutter-means and said feed-means, over the whole range of steps provided by said pairs of change-gears; said change-gear unit being operatively interposed between said drive-means and said cutter-means; and said differential gear-unit and said infinitesimally-adjustable speed-ratio unit being operatively interposed between said drive-means and said feed-means.

2. A flying cutting device comprising: drive-means; cutter-means and feed-means for said cutter-means, driven by said drive-means; and precision infinitesimally-adjustable means inter-connecting said cutter-means and said feed-means and including, a change-gear unit having a plurality of selectively-engageable pairs of change-gears of different speed-ratios differing by relatively-large steps, a differential-gear unit

having a differential output-shaft, and a presettable infinitesimally-adjustable speed-ratio unit having a rotatable mechanical-drive connection with said differential-gear unit and adapted to rotate said connection uninterruptedly and at substantially-uniform angular speed at any adjustment of said infinitesimally-adjustable speed-ratio unit to operatively control the speed of rotation of said differential output-shaft and having an infinitesimally-adjustable speed-ratio range at least equal to the speed-ratio range between each two successive speed-ratios provided by said pairs of change-gears and designed and adapted to be set to give and maintain any desired predetermined speed-ratio between each two successive speed-ratios provided by said pairs of change-gears; said change-gear unit, differential-gear unit and infinitesimally-adjustable speed-ratio unit together forming means designed and adapted to provide a continuous precision infinitesimally-adjustable range of speed-ratios between said cutter-means and said feed-means, over the whole range of steps provided by said pairs of change-gears; said change-gear unit being operatively interposed between said drive-means and said cutter-means; and said differential gear-unit and said infinitesimally-adjustable speed-ratio unit being operatively interposed between said drive-means and said feed-means.

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