Nov. 6, 1956 W. A. SPURRIER ET AL 2,769,494

BALANCED-FORCE ROTARY-CUTTING MECHANISM

Filed June 24, 1954

Fig. 1

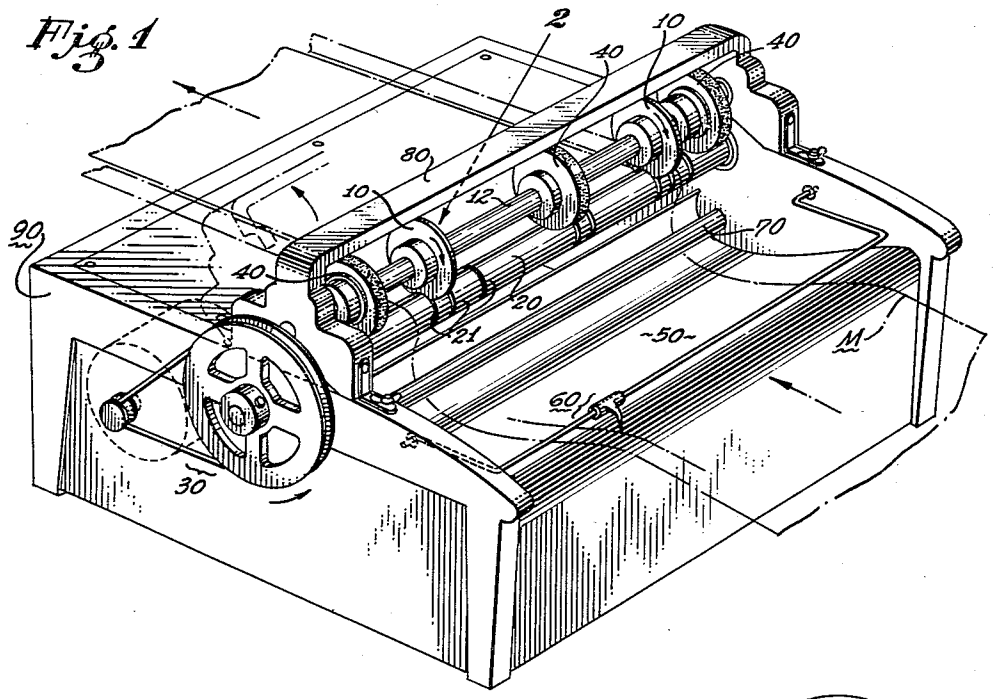


Fig. 3

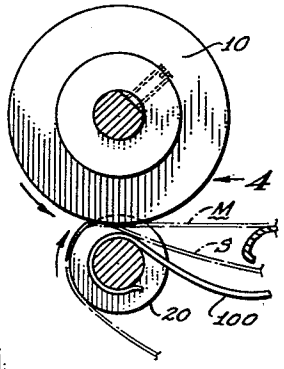


Fig. 2

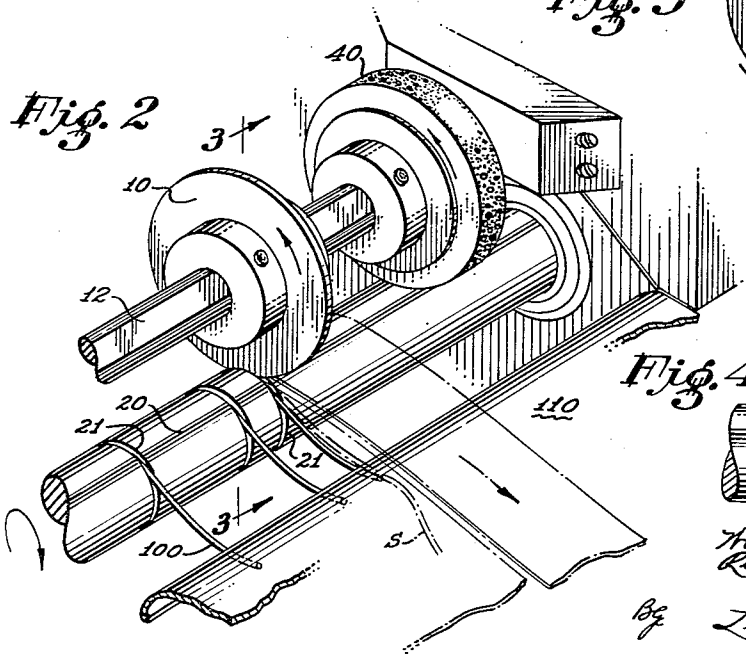
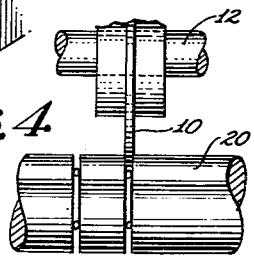


Fig. 4



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United States Patent Office 2,769,494
Patented Nov. 6, 1956

2,769,494

BALANCED-FORCE ROTARY-CUTTING MECHANISM

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Application June 24, 1954, Serial No. 438,908

4 Claims. (Cl. 164—61)

This invention relates to balanced-force rotary-cutting mechanisms and, more particularly, to balanced force rotary-cutting or shearing devices which may be utilized to trim paper or other material along a predetermined line; the trimming action being achieved by means of a balanced rotary scissors action making its possible to achieve a very precise cutting action while permitting accurate control of the paper or material to insure that the cutting is performed along the specified line.

The present invention is especially useful for trimming rolled stock or strips of paper or other material to a predetermined width, and may be utilized to trim parallel borders along rolled graph paper even though the original borders may not be parallel to lines on the graph paper.

Although many rotary-cutting devices have been previously devised, these devices may be conveniently separated into two general classes. In one class of cutting devices, the cutting edge is directly pressed against the material or paper to be trimmed, slit, or otherwise cut, the pressure of the cutting edge against the material being sufficient to provide the desired cutting action. This type of rotary-cutting device may be logically termed a "pressure-actuated cutting device." Typical examples of the pressure-actuated rotary-cutting devices may be found in U. S. Patent 2,467,700 dated April 19, 1949, to W. S. Riesenfeld, and in U. S. Patent No. 2,637,395 dated May 5, 1953, to O. Muller.

The principal disadvantage of the pressure-actuated rotary-cutting device is that a sharp, precise cut cannot be obtained since the cutting action itself requires that the material or paper be crushed at the cutting edge. Moreover, the direct pressure method either requires special metals in the cutting edge or will result in a reduced life of the cutting mechanism.

As a result of the recognition of the limitations of the pressure-actuated rotary-cutting devices, a second type of mechanism has been devised where two rotary-cutting edges are utilized to obtain what may logically be referred to as a "scissors-action cutting device." Examples of this latter type of cutting device are found in U. S. Patent 2,241,007 dated May 6, 1941, to B. M. Thomas; U. S. Patent 2,571,201 dated Octover 16, 1951, to E. W. Clem; and U. S. Patent 2,627,922 dated February 10, 1953, to O. E. Teall.

While the scissors-action cutting devices do not have the undesirable features of the direct-pressure type of cutting devices discussed above, they nevertheless have several limitations. The scissors action itself introduces a cutting force or couple which tends to move the paper or material to be trimmed. Thus, where it is necessary to carefully guide rolled stock or strips of paper along a predetermined cutting line, an unwanted force is introduced by the conventional cutting device which tends to draw the material along one of the cutting edges slightly so as to gradually move the rolled stock or strips of paper toward that cutting edge.

Another disadvantage of the conventional scissors-action cutting device is that two specially-machined

cutting wheels are required, whereas it will be shown that only a single cutting wheel need be machined, according to the present invention. Moreover, in utilizing two cutting wheels to obtain each rotary cutting action, the conventional practice is to utilize the rotary-cutting action to move the paper or material to be cut. This type of operation tends to reintroduce some of the undesirable features of the direct-pressure technique whereby the edge which is cut is somewhat distorted and is not as sharply cut as in cutting mechanisms of the present invention.

In the typical practice of the prior art such as is shown in patent to Stacy, No. 840,592, and to Powell, No. 1,804,642, the material or paper to be cut is driven by the same means utilized to provide the rotary cutting action. Thus in the device shown in the disclosure of Stacy the cutters 21 and 22 also feed the material (stamped sheets to be cut).

The prior art, therefore, cannot be utilized satisfactorily to trim paper or similar material along a predetermined line where it is necessary to achieve a very precise cutting action while permitting accurate and easy movement of the paper through the cutting edges along a specified line, which may vary considerably from a straight or linear direction. In a sense, the typical prior art referenced provides conflicting results. Where rotary balanced cutting devices are utilized, all movement of the paper or material to be cut in any direction other than a straight line is prevented; and where nonlinear motion is possible, the prior art has failed to provide the necessary balanced rotary cutting action.

The present invention, on the other hand, obviates the above and other disadvantages of the prior art in providing a scissors-action rotary cutting mechanism where a double-edged rotary cutting wheel is utilized to provide balanced cutting action; and the cutting devices are in no way utilized to drive the paper or other similar material to be trimmed along predetermined boundaries.

According to another feature of the invention, a corresponding pair of second cutting edges related to the double-edge cutting discussed above are obtained as cutting grooves in a cutting roller which is also used to guide the material or paper to be trimmed or cut. The cutting grooves are quite easily machined into the cutting roller, as many grooves being introduced into the cutting roller as cutting positions are desired.

The double-edged cutting wheels are in no way utilized to drive the material to be cut since this action may be achieved by a separate drive wheel which presses the paper or material to be cut against the cutting roller. Thus, in this manner, the cutting roller may co-act with the drive wheel to provide the desired paper motion and at the same time, through the provision of cutting grooves therein, effectively function as a series of sets of double-edged cutting wheels.

Essentially the double-edged cutting action provided by the present invention may be considered as providing a balanced pair of rotary-scissors-like cutting edges which provide an extremely precise cutting action while introducing no undesirable paper or material motion.

Accordingly, it is an object of the present invention to provide an improved rotary-cutting mechanism wherein a precise scissors-action cutting may be performed without the introduction of unwanted cutting forces which interfere with the proper guidance of the material or paper to be cut.

Another object of the invention is to provide a rotary-cutting device wherein only a single cutting wheel having a double cutting edge, is required for each cut to be performed; a corresponding set of cooperating cutting edges being obtained through a cutting roller which may also guide the paper or material to be cut.

A further object of the invention is to provide a simple rotary trimmer wherein a sharp, balanced cutting action is achieved by means of a double-edged cutting wheel cooperating with a corresponding pair of cutting grooves in a cutting roller.

Yet another object of the invention is to provide an improved rotary trimmer wherein a sharp cutting edge may be obtained by means of a simple cutting wheel mechanism without the introduction of undesirable cutting forces.

An additional object of the invention is to provide a scissors-action rotary-cutting mechanism wherein substantially no pressure is exerted upon the material to be cut by the cutting edges, assuring a precise, sharp cutting action.

A more specific object of the invention is to provide an improved scrap pickoff device for a rotary cutting mechanism of the above-mentioned type whereby a minimum of adjustment is required to insure the proper scrap removal.

The novel features which are believed to be characteristic of this invention, both as to its organization and method of operation, together with further objects and advantages thereof, will be better understood from the following description considered in connection with the accompanying drawings in which one embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only, and are not intended as a definition of the limits of the invention.

Fig. 1 is a perspective over-all view of a scissors-action rotary-cutting device according to the present invention;

Fig. 2 is an enlarged rear perspective view of a portion of the embodiment of Fig. 1 in the direction of arrow **2**, showing in specific detail the double-edged cutting wheel, the drive wheel, the grooved cutting roller, and the paper scrap pick-off fingers of Fig. 1;

Fig. 3 is a sectional view taken along lines **3—3** of Fig. 2, indicating more precisely the cutting action of the cutting wheels; and

Fig. 4 is another partial sectional view of the rotary-cutting action, looking in the direction indicated in Fig. 3.

Reference is now made to Fig. 1 wherein one form of the rotary-cutting mechanism according to the present invention is shown. As indicated in Fig. 1, the essential features of the invention include at least one double-edged cutting wheel **10**, although two are shown in order to illustrate the manner in which parallel lines may be cut on graph paper. A balanced, double-edged rotary-cutting action is obtained by means of the co-action of cutting wheel **10** and the cutting groove **21** in a cutting roller **20**. It will be noted that several cutting grooves **21** are included in roller **20** so that any number of cutting wheels **10** may be included as desired, or a particular wheel **10** may be moved along cutting wheel bar **12** to the desired cutting position.

The other improved feature of the invention to be especially noted in Fig. 1 is that cutting roller **20** also guides the paper or other material M to be cut, the driving force being obtained by means of a conventional motor and pulley arrangement **30** and the co-action with at least one drive wheel **40**. Thus, it is apparent that the cutting roller **20** not only provides a pair of cutting edges cooperating with those of a corresponding cutting wheel **10**, but also guides the material M pressed thereagainst by drive wheel **40**. Again, it will be noted that three drive wheels **40** are shown, although any number may be utilized, depending upon the particular operation contemplated. In some applications, for example, a single center driving wheel may be sufficient.

The features of the embodiment of Fig. 1 thus far described are essential to the invention and, therefore, have been enumerated at the outset. The remaining structure will be described, however, in order to more particularly point out the manner in which the basic features of the invention may be incorporated into a typical installation. Referring to Fig. 1, it is noted that the material M which may, for example, be rolled stock graph paper, rests on a paper receiving tray **50** and passes under an indicator bar and finger **60** which may be utilized as a guiding device to perform cuts along a predetermined line or a set of parallel lines. The paper or material M also passes under a paper tension bar **70** which aids in properly guiding material M around cutting roller **20**.

It will be noted that cutting wheel bar **12** is supported in a cutting wheel frame **80** which may be released from the main housing **90** so that the cutting wheel positions may be readily adjusted or, if necessary, so that the cutting wheel bar **12** may be removed and cutting wheels **10** or drive wheels **40** added or subtracted therefrom.

The particularly novel features of the invention are shown in more specific detail in Figs. 2, 3, and 4, where the cutting action of a single double-edged cutting wheel **10** cooperating with a corresponding groove **21** is shown in enlarged detail. Referring specifically to Fig. 2, it is noted that the double-edged cutting action of cutting wheel **10** co-acting with groove **21** in cutting roller **20** results in a strip S being cut from material M. The fact that a strip S is cut through the rotary-cutting action, according to the present invention, is characteristic since it is by this means that the separate rotary-cutting forces of each edge of wheel **10** are balanced across strip S. For simplicity, it may be stated that the rotary-cutting forces which normally would move material M are balanced out across strip S. As a result of this characteristic strip-cutting action, the embodiments of the present invention require some means for removing the scrap strip from groove **21** to prevent hinderance of subsequent cutting. This scrap strip removal is effected quite simply by means of scrap pick-off fingers **100**, each finger being essentially a spring wire embedded in a corresponding groove **21** and extending therefrom to a scrap receiving chamber **110** in main housing **90**.

While the invention is not limited to the particular type of pickoff fingers or wires, novel features are provided thereby which will now be described. It will be noted in Figs. 2 and 3 that each pickoff wire **100** includes a first portion which is curved to the same diameter as the inter-diameter of the groove in the cutting roller. An opening is left in this first portion which will allow the spring wire to be forced over the cutting groove and then, through its spring action, to wrap itself around the cutting groove providing frictional engagement therewith.

As the cutting roller is rotated, the second portion of the spring wire is forced against the scrap receiving chamber **110** so that the cutting groove then slips in rotation inside the first portion of the spring wire. In this manner, the pickoff fingers **100** may be simply inserted in the cutting grooves and need not be adjusted in place since the rotation of the cutting roller holds them in position as required.

It is not considered necessary for the purpose of describing the present invention to consider the particular form of the double-edged rotary-cutting wheels **10**, or driving wheels **40**, or any of the components which form the embodiments of the invention. This is believed to be unnecessary since the invention resides rather in a generic class of rotary-cutting devices which may appear in a multitude of forms, but yet, nevertheless, fall within the same basic conception of balanced, double-edged rotary-scissors cutting.

Thus, it is not considered necessary to point out certain mechanical features of the embodiment shown. For example, a particular mounting arrangement is shown for cutting wheels **10** so that they may be released from cutting wheel bar **12** and be slid along to any desired cutting position cooperating with a corresponding cutting groove **21**. In a similar manner, arrangement is made so that driving wheels **40** may be adjusted to the desired operating position. Furthermore, a specific wing-nut ar-

rangement is shown for securely fastening cutting wheel frame **80** to main housing **90**. This has not been specifically described since it is assumed to be a conventional technique.

However, the following constructional features have been described and are believed to be of the essence. First, the cutting action is a double-edged, balanced rotary-scissors action. It is achieved by means of cooperation between a wheel of the general type **10** and a cutting groove in a cutting roller which also guides the material to be cut. As has been previously pointed out, this arrangement obviates the necessity for a pair of cutting wheels for each cut and provides a simple expedient for obtaining the equivalent of a corresponding pair of cutting edges for each cutting wheel by means of simply-machine grooves in a cutting roller.

As a result of the characteristic cutting action of embodiments of the invention, it has been pointed out that some means is required to remove the scrap strip from the cutting groove. This is achieved in a specific simple manner in the particular embodiment illustrated. However, it will be understood that the basic concept of the invention is not limited to the particular scrap strip removing technique shown. It may be possible, for example, to remove the scrap by means of air pressure or other extraction means. It has been pointed out that the invention may be used in cutting a wide variety of material and does not require any fixed number of cutting and driving wheels or of corresponding cutting grooves.

The modifications herein suggested are by no means intended to be exclusive since other such modifications will be apparent to those skilled in the art.

What is claimed as new is:

1. In a rotary cutting mechanism for trimming paper or other similar material, wherein a double-edged rotatable cutting device is operated cooperatively with a rotatable cutting roller, said roller including a cutting groove having two edges cooperatively associated with the edges of said rotary cutting device, the material to be trimmed being passed through the rotatable cutting device to a receiving surface; a device for removing scrap material from said cutting groove, said device comprising: a spring wire including first and second portions having opposite curvatures, said first portion being of substantially the same circular curvature as the inner edge of said cutting groove, including an opening allowing the entry of said cutting groove therein, and having a spring constant such that the insertion of said first portion around said cutting groove causes a frictional engagement therewith; and said second portion being arranged to engage said surface whereby the insertion of said first portion around said cutting groove, and the rotation of said roller causes said spring wire to engage said surface and to provide a scrap removable path for said material.

2. In a rotary cutting system for trimming paper or other material along predetermined borderlines, the combination comprising: first and second double-edged cutting wheels; a cutting roller including first and second grooves cooperatively associated with said cutting wheels, respectively, to provide two pairs of cutting edges; a driving wheel attached for rotation with said cutting wheels and for engagement with said roller, the paper or material to be cut being entered between said driving wheel and said cutting roller and driven through said pairs of cutting edges; a shelf for receiving said material as it is passed between said driving wheel and said cutting roller; and a pair of spring pickoff wires, one for each of said cutting grooves, each of said wires including a head section adapted to be inserted around the associated cutting groove to provide frictional engagement therewith and a tail adapted to engage said shelf to inhibit movement of said wire, whereby said pickoff wire may be snapped onto by said cutting groove and is self-positioning as said cutting roller is rotated.

3. A border trimming mechanism for roll-stock material comprising: a cutting wheel bar; first and second cutting wheels mounted on said bar, said wheels being spaced by an amount corresponding to the desired width for said roll-stock paper, after trimming, each of said wheels having parallel cutting edges; a cutting roller parallel to said bar and including a cutting groove for each of said wheels, each groove forming a pair of trimming edges in cooperation with the associated wheel; a driving roller mounted on said bar adapted for cooperation with said roller for driving said material into said trimming edges; a receiving shelf for said material as it passes through said trimming edges; first and second pickoff wires each including a circular head having substantially the same diameter as the interdiameter of said cutting grooves and an opening allowing the insertion of said pickoff wires around said cutting grooves, respectively, said head having a spring action resulting in a frictional engagement with the associated cutting groove, and each pickoff wire including a tail arranged for engagement with said receiving shelf to position said pickoff wire for removal of scrap material.

4. A rotary trimming device for cutting parallel borders along roll-stock material, said device comprising: a driving shaft; first and second double-edged rotary cutters mounted on said shaft at points separated by the desired distance between said parallel borders; a cutting roller including two cutting grooves positioned for cooperation with said rotary cutters, respectively; a driving roller mounted upon said shaft and rotatable therewith for engaging said cutting roller during the rotation thereof; a surface for receiving said material as driven between said driving roller and said cutting roller; and first and second pickoff fingers, each of said fingers having a first circular portion for frictionally engaging the inter-diameter of said grooves, respectively, and a second portion for engaging said receiving surface as said cutting roller is rotated.

References Cited in the file of this patent

UNITED STATES PATENTS

310,534	Murray	Jan. 6, 1885
459,920	Wright	Sept. 22, 1891
595,092	Basley	Dec. 7, 1897
740,201	Stimpson	Sept. 29, 1903
801,916	Rudolphi	Oct. 17, 1905
840,592	Stacy	Jan. 8, 1907
1,804,642	Powell	May 12, 1931
1,866,941	Peters	July 12, 1932
2,039,831	Page	May 5, 1936
2,241,395	Egling	May 13, 1941