May 3, 1966 G. CARDINET ETAL 3,248,987

ROTARY CUTTER

Original Filed June 7, 1960 2 Sheets-Sheet 1

FIG. 1

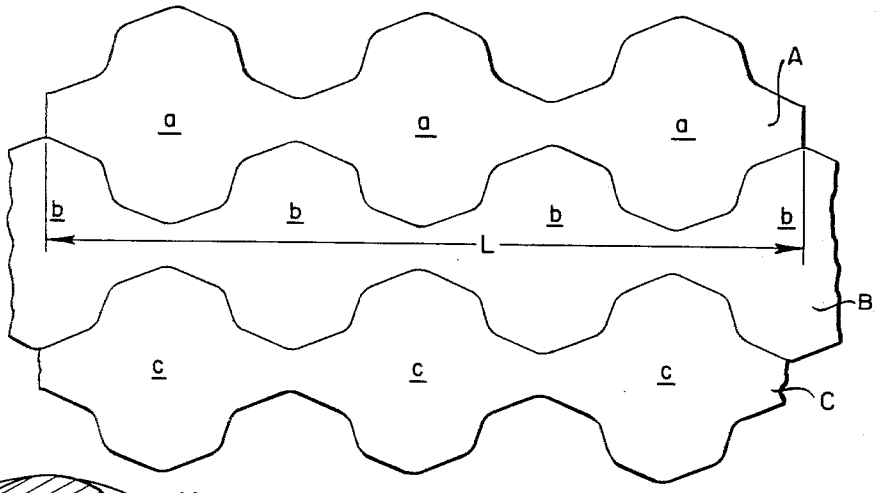


FIG. 2

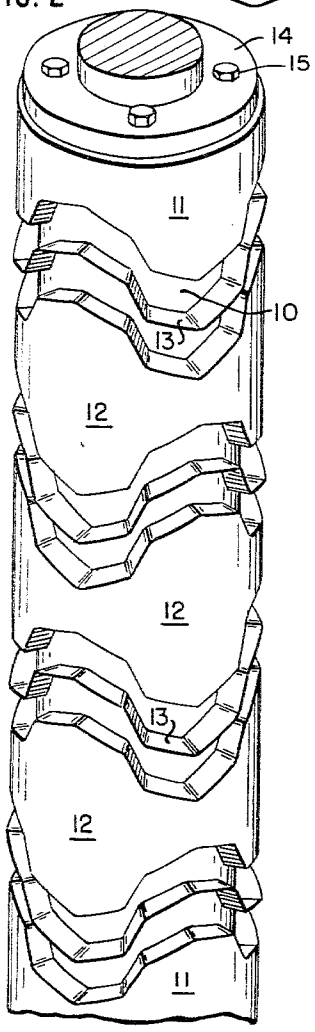
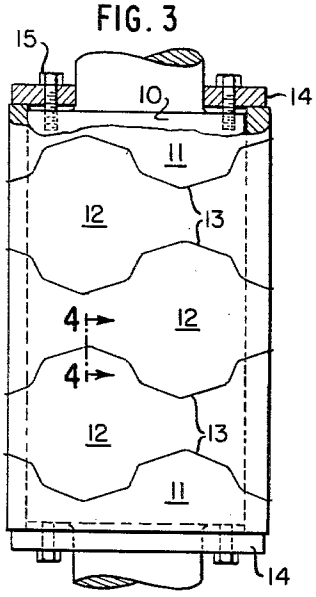


FIG. 3



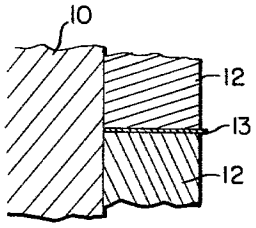


FIG. 4

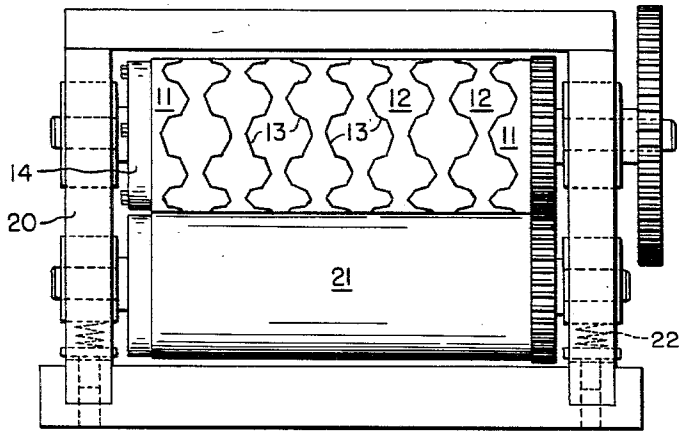
INVENTORS
Guy Cardinet
Edmond L.J. Faudemay

May 3, 1966 G. CARDINET ETAL 3,248,987

ROTARY CUTTER

Original Filed June 7, 1960 2 Sheets-Sheet 2

FIG. 5



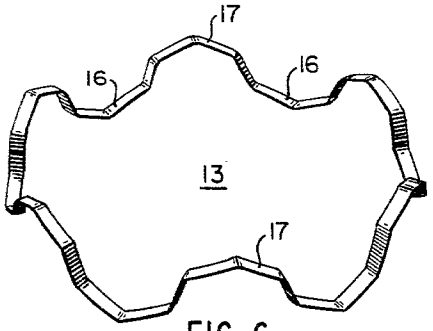


FIG. 6

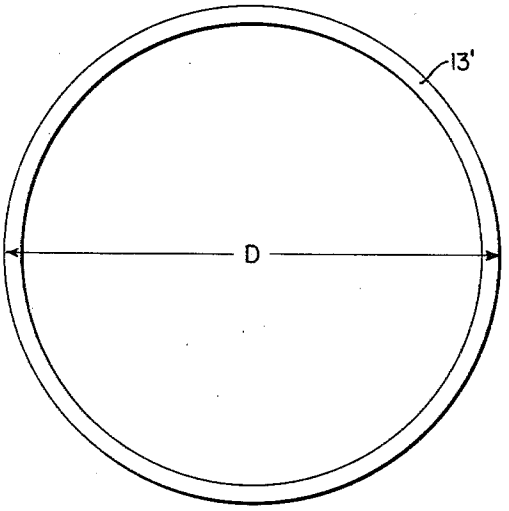
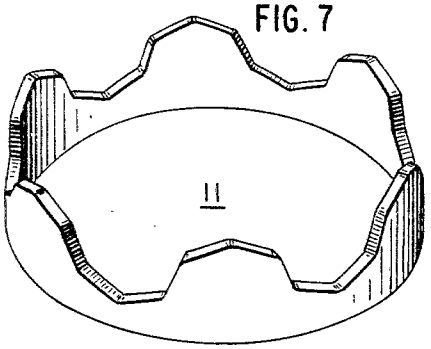


FIG. 8

FIG. 7



INVENTORS.
Guy Cardinet
Edmond L.J. Faudemay

United States Patent Office 3,248,987
Patented May 3, 1966

3,248,987

ROTARY CUTTER

Guy Cardinet, Annecy, and Edmond Lucien Jean Faudemay, Annecy-le-Vieux, France, assignors to Gillette France S.A., Annecy, France, a corporation of France

Continuation of application Ser. No. 37,548, June 7, 1960. This application Jan. 25, 1965, Ser. No. 433,528
Claims priority, application France, July 8, 1959, 799,626, Patent 1,238,852
5 Claims. (Cl. 83—664)

This is a continuation of application Serial No. 37,548, field June 7, 1960, and now abandoned.

This invention comprises an improved rotary machine for cutting from sheet material bands, strips or ribbons having undulating, sinuous or angular longitudinal edges as distinguished from ribbons of rectilinear shape having straight parallel edges. The machine may be utilized with particular advantage in the production of strips of characteristic pattern recurring at regular intervals arranged in mating relation and produced preferably without waste. Among other applications, such bands can be used after being cut into unit lengths, as wrappings for identical objects such as razor blades or razor blade packages. However, the invention is not limited to this or any specific field but is of general application.

Heretofore paper strips of this type have been produced in presses having a flat cutting bed with knives of the desired outline operating in a reciprocatory head. These machines have the drawback of all such machinery i.e. the cutting stroke is only a small portion of the working cycle so that the product efficiency of the machine is low.

An object of the present invention is to provide for this special work a rotary machine of the general type heretofore used in the production of bands having parallel edges, that is to say a machine having cooperating cylinders between which the paper is fed, one being equipped with rotary knives and the other serving as a cutting bed or anvil.

In accordance with the present invention, however, the cutting blades instead of being plane and located parallel to each other are undulating, sinuous or angular in contour. The development of this blade shape corresponds to the shaping of the edges of the strip to be cut i.e. to an integer number of identical repetitive patterns desired in the strip. In one aspect the invention includes within its scope a novel process for producing blades of the required shape. In another aspect, the invention includes novel structure for incorporating such a blade in a rotary cylinder.

Heretofore the attempt has been made to employ in the production of such strips cylinders carrying upon their circumference solid blades formed integrally with the metal of the cylinder, but such construction is extremely expensive. Since it is practically impossible to re-sharpen blades made in this manner the cylinders require frequent replacement. The present invention obviates these difficulties and provides at a moderate expense a highly satisfactory machine having even greater capacity and adaptability for the production of a wider range of product than has been heretofore possible.

In accordance with the present invention, the contoured circular blade required is produced by first cutting a flat ring from sheet steel, then deflecting portions of the ring out of its plane and hardening the blade thus formed. In deflecting portions of the ring, the length of its outside perimeter is made equal to the development of the trace that will be cut by the knife. The ring may be preformed by suitable equipment, such as a press provided with cooperating dies curved and arched at regular intervals and at the same time holding both the inner and

outer diameters of the conformed knife to a predetermined radius of cylindrical curvature. Having formed the knife in this manner, it is now hardened in its conformed shape and ready to be incorporated in a rotary cuting machine.

The cuting machine of the present invention includes in its structure a knife-carrying roll or cylinder comprising an inner drum having a smooth continuous cylindrical surface and a series of cylindrical sleeves slidable axially on the drum and having axially undulating or angular circumferential end walls of complementary contour inter-fitting about the entire circuit of the drum and clamped in position to support the ring-shaped ribbon blade upon both sides.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof, selected for purposes of illustration and shown in the accompanying drawings, in which:

FIG. 1 is a plan view of a short section of three mating strips produced by the rotary cutter of this invention;

FIG. 2 is a view in perspective of the rotary cutter in partially assembled condition;

FIG. 3 is a view in elevation of the assembled cutter;

FIG. 4 is a fragmentary sectional view on the line 4—4 of FIG. 3;

FIG. 5 is a view in elevation of a complete machine equipped with a rotary cutter of the present invention;

FIG. 6 is a view in perspective of a conformed blade;

FIG. 7 is a view in perspective of one of the blade-clamping sleeves, and

FIG. 8 is a plan view of the ring blank from which the blade is formed.

One example of the type of product which it is desired to produce, as shown in FIG. 1, comprises mated strips A, B and C designed to be cut at each revolution of the rotary cutter and having the length L. In each section of the strips is included three identical connected blanks *a*, *b* and *c* that when severed may serve as envelopes or tucks for safety razor blades or packages thereof. Each blank has oppositely directed tapering end tongues and a wider central area of roughly octagonal contour.

In FIGS. 2 and 3 is shown the rotary cutter designed to produce the strips of FIG. 1. It comprises an inner drum or cylinder **10** upon which are mounted a pair of cylindrical end sleeves **11** and three intermediate sleeves **12** all making a close sliding fit on the drum **10**. The end walls of the sleeves **11** and **12** are contoured accurately in accordance with the pattern of the strips A, B and C and all portions of these walls are therefore inclined axially or longitudinally with respect to the axis of the drum.

Between the contoured end walls of each contiguous pair of sleeves **11** or **12** is rigidly clamped an endless blade **13** of thin ribbon steel in the order of .004" in thickness. The inner edge of the blade rests upon the smooth cylindrical surface of the drum **10** and its outer edge protrudes beyond the outer cylindrical surface of the sleeves **11** and **12** a small amount, as for example, by an amount equal to the thickness of the paper to be cut. The blade **13** is itself flexible and must be firmly supported on both sides in order to be operative in its rotary assembly.

As already stated the novel manner herein shown of forming the blade and of organizing it as the cutting component of the rotary cutter comprise important aspects of the present invention.

The first step in the production of the blade consists in cutting or punching from sheet steel a flat ring **13'** as suggested in FIG. 8. The cutter diameter of the ring is calculated from the length L of the trace to be cut at each revolution of the cutter in producing the repeating pattern desired. The outside diameter D of the flat ring **13'** must therefore be L divided by π and the thickness of the ring

must be slightly greater than the thickness of the cylindrical sleeves **11** and **12**.

The flat ring, while still unhardened, is shaped to coincide with the contour of the end walls of the sleeves **12** by being subject to forming pressure between the sleeves acting as cooperating dies, or between similarly shaped dies operating in a die press. In this shaping operation various sections of the ring are deflected longitudinally or axially with respect to the axis of the ring, forming in effect a series of oppositely directed open loops, viz. the loops **16** opening outwardly and the loops **17** opening inwardly as shown in FIG. 6. In this shaping operation the material of the flat steel ring may be slightly elongated or the outside diameter decreased. The blade **13** preformed as abovedescribed is now heat treated for hardening and tempering.

As an optional step of the process and as a justifiable precaution the inside diameter of the preformed and tempered blade may be ground in order to make the blade fit with extreme accuracy to the cylindrical surface of the drum **10**. This step is useful in removing from the inner edge of the blade any departure from the desired true cylindrical contour that may have been introduced in the heat treatment of the blade.

The tempered and ground blades **13** are now assembled on the drum **10** between the contoured end walls of the sleeves **11** and **12** as suggested in FIG. 2. The sleeves and blades are drawn into rigid clamping engagement between circular end plates **14** secured to the ends of the drum by bolts **15** thus uniting all the elements of the rotary cutter of the present invention.

The final step of the process, which converts the rotary cutter into a precision instrument, consists in grinding the protruding blade edges to insure that they lie in a single predetermined cylindrical plane true to the axis of the cutter. This cylindrical grinding of the blades imparts to them a square end surface with sharp corner edges and also determine the amount of their edge exposure above the cylindrical surface of the sleeves **11** and **12**. If now the drum surface is perfectly cylindrical and is revolving about its true axis, the cutting edge of all the blades will thus lie in a cylindrical plane which is exactly parallel to the plane of the drum surface and spaced therefrom by the height of the blades.

In FIG. 5 is shown a typical machine having a rotary cutter with blades **13** for cutting eight strips or bands. The cutter is journaled in a frame **20** and cooperates with a smooth anvil roll **21**. The latter is geared to the rotary cutter and maintained under spring pressure against the cutter by compression springs **22** at the base of the frame.

The rotary cutter may include any convenient or desired number of blades depending upon the number of strips to be cut. The edge exposure of the blades will depend on the sheet material to be cut and whether it is to cut as a single sheet or in multiple. For cutting a single sheet of paper an edge exposure of about the thickness of the paper has proved satisfactory. The individual blades are all identical in shape and may be replaceably and interchangeably used in the machine.

In operating the machine of FIG. 5 the sheet is fed at high speed through the bite of the rotary cutter and the anvil roll **21** and the mating strips A, B, C, etc. leaving the rolls are severed by the action of the blades **13**. It is usually convenient to direct the severed strips alternately in divergent paths as this contributes to clean separation between the strips and facilitates coiling them on separate take-up reels.

It will be understood that the endless blades as shown in FIG. 6 are in themselves flexible and so require rigid support on both sides nearly up to the cutting edge in order to be maintained in operative cutting condition. On account of the preforming and tempering operations however the blades are given an initial shape conforming to that of the sleeve walls and the trace of the pattern to be cut. They thus tend naturally to assume the desired contour without the development of appreciable initial strain. They may have any desired contour, departing little or none from the original plane of the flat ring, so long as they are shaped to be supported internally by the inner drum and clamped on both sides by the sleeves against flexing when in operation.

Having thus disclosed our invention and described in detail an illustrative embodiment thereof, we claim as new and desire to secure by Letters Patent:

1. A rotary cutter for sheet material, comprising an inner drum having a smooth continuous cylindrical surface, cylindrical sleeves on said drum, and a flexible endless thin ribbon steel blade supported by said drum surface at its inner edge and extending perpendicular to said surface, said blade being clamped rigidly on both sides between a pair of said cylindrical sleeves and protruding therefrom, said blade being of such thinness and flexibility as to require firm support on both sides to give rigidity to its cutting edge, said cutting edge being formed by an end surface with opposed sharp corner edges, lying wholly in a cylindrical plane coaxial with the inner drum and merging at each side with a sharp corner edge.

2. A rotary cutter for sheet material, comprising an inner drum having a smooth continuous cylindrical surface, cylindrical sleeves on said drum and having axially undulating circumferential end walls of complementary contour interfitting about the entire circuit of the drum, and a flexible endless thin ribbon steel blade in the order of .004" thickness supported by said drum surface at its inner edge and extending perpendicular to said surface, said blade being clamped rigidly between said cylindrical sleeves on both sides with its cutting edge protruding therefrom and conformed by axially deflected blade portions to the axially undulating contour of contiguous cylindrical sleeves, said blade being of such thinness and flexibility as to require firm support on both sides to give rigidity to its cutting edge, said cutting edge constituting an end surface lying wholly in a cylindrical plane coaxial with the inner drum and defined between sharp corner edges.

3. A rotary cutter for sheet material, comprising an inner drum, cooperating sleeves thereon, and an endless flexible blade of such thinness and flexibility as to require firm support on both sides to give rigidity to its cutting edge clamped securely between a pair of sleeves with its cutting edge protruding therefrom, said cutting edge being formed by a square end surface with opposed sharp corner edges, said end surface lying wholly in a cylindrical plane coaxial with said inner drum.

4. A rotary cutter for sheet material, comprising an inner drum, cooperating sets of sleeves thereon having mating end walls contoured in the form of oppositely directed open loops, and an endless flexible blade of such thinness and flexibility as to require firm support on both sides to give rigidity to its cutting edge clamped securely between each pair of contiguous sleeves and held in the contoured shape of said sleeves with its cutting edge protruding therefrom, said cutting edge being formed by a square end surface with opposed sharp corner edges, said end surface lying in a cylindrical plane with said inner drum.

5. A rotary cutter for sheet material, comprising an inner drum, cooperating sleeves thereon having mating end walls, an endless flexible blade of such thinness and flexibility as to require firm support on both sides to give rigidity to its cutting edge located between the end walls of said sleeves and having protruding cutting edge, and means for clamping the sleeves together in position supporting the flexible blade on both sides up to near the cutting edge and with its inner edge shaped to engage the cylindrical surface of the drum, said cutting edge being formed by a square end surface with opposed sharp

corner edges, said end surface lying in a cylindrical plane coaxial with said inner drum.

References Cited by the Examiner

UNITED STATES PATENTS

422,486	3/1890	Anderson	107—50
958,809	5/1910	Hawkins	30—307

1,256,657	2/1918	Cameron et al.	83—56 X
1,682,606	8/1928	Dvilnsky	83—333 X
2,400,527	5/1946	Aycock	83—333 X

WILLIAM W. DYER, JR., *Primary Examiner.*

FRANK T. YOST, *Assistant Examiner.*