# United States Patent [19]

**Rutty et al.**

[11] **4,429,462**

[45] **Feb. 7, 1984**


[54] **VARIABLE STIFFNESS RULE BLADE, RULE EMPLOYING SAME, AND METHOD OF MAKING SAME**


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[73] Assignee: **The Stanley Works**, New Britain, Conn.



[21] Appl. No.: **430,730**

[22] Filed: **Sep. 30, 1982**

[51] **Int. Cl.³** .......... **G01B 3/02**

[52] **U.S. Cl.** .......... **33/138**; 242/84.8

[58] **Field of Search** .......... 33/138, 137 R; 242/84.8


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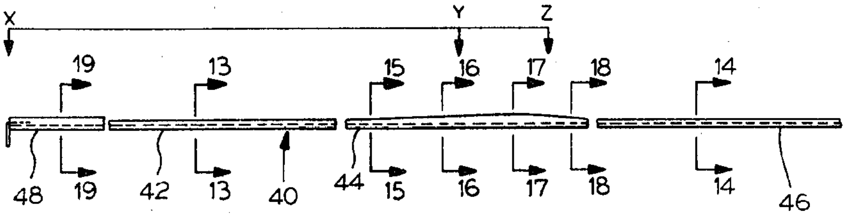
*Primary Examiner*—Willis Little


[57] **ABSTRACT**

A coilable measuring blade for coilable rules has a concavo-convex cross section which has an intermediate portion with a smaller arc and greater height extending through and beyond the normal standout length to provide greater standout length. The blade may also have an outer terminal portion of greater height to require its deflection as it enters the rule casing and thereby provide reduction of the speed with which the blade is being retracted into the casing.


**25 Claims, 20 Drawing Figures**



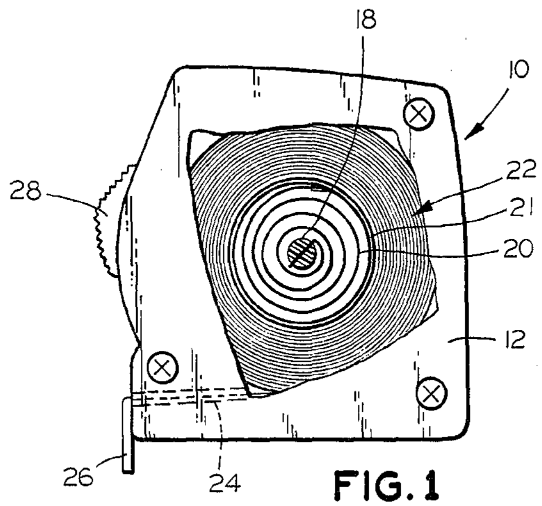



FIG.1

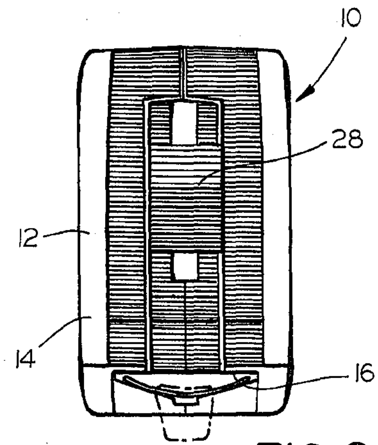



FIG.2

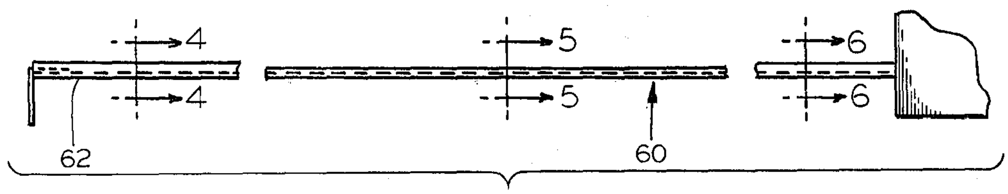



FIG.3

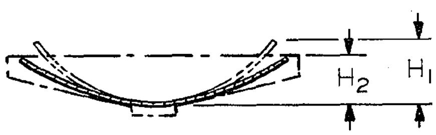



FIG.4

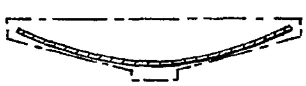


FIG.5

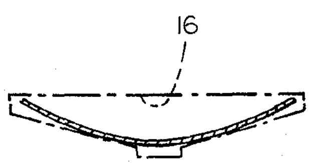



FIG.6

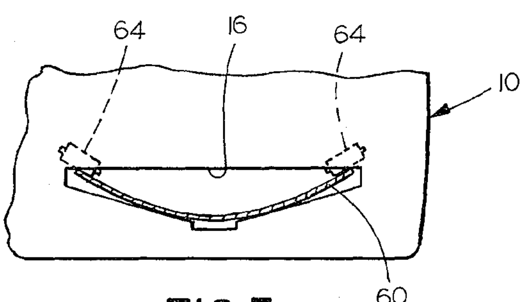



FIG.7

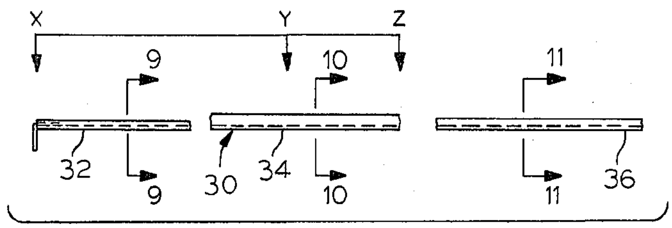



FIG. 8

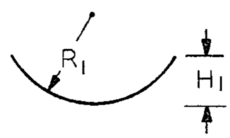



FIG. 9

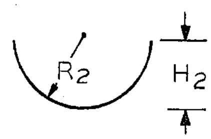



FIG. 10

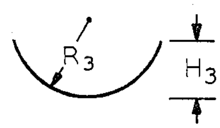



FIG. 11

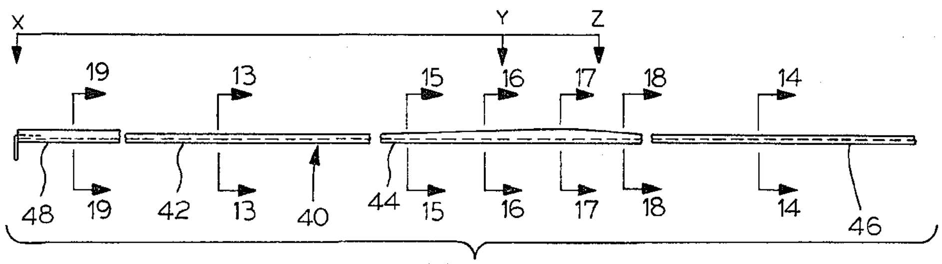



FIG. 12

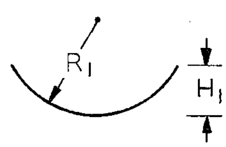



FIG. 13

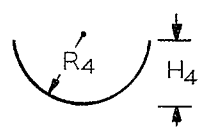



FIG. 19

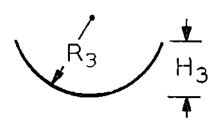



FIG. 14

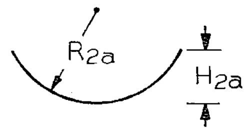



FIG. 15

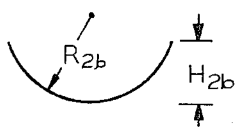



FIG. 16

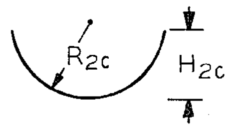



FIG. 17

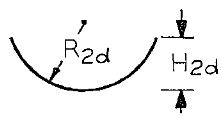



FIG. 18

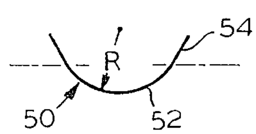



FIG. 20

# VARIABLE STIFFNESS RULE BLADE, RULE EMPLOYING SAME, AND METHOD OF MAKING SAME

## BACKGROUND OF THE INVENTION

The present invention relates to coilable rules and more particularly to such rules employing coilable metal blades with greater standout length when unsupported as extended from the casing.

Coilable metal rules are widely used and frequently employ a concavo-convex cross section or other cross sectional configuration which will stiffen the blade so that the user may singlehandedly bridge a distance with the blade tip extended in a straight line. This enables the user to bridge doorways, shaftways, excavations and the like with the unsupported blade. It is known that the degree of curvature or cross section will influence and substantially determine the standout length (the length of the blade which can be extended unsupported without collapsing at the support point) or breakpoint (the point at which the unsupported rule will collapse) for a rule of any particular width, thickness and metal characteristics.

Such blades are generally used in power returnable coilable rules that include a coiled spring which has the effect of retracting the extended blade into the rule housing or casing wherein it coils about the reel in its retracted position. It will be appreciated that the concavo-convex cross section of the blade is flattened as it is coiled within the rule casing, whether by manual action or by the retracting effect of such a power return spring. The stiffer the blade, the more spring power required to effect such flattening of the blade upon retraction.

As is also well known, blades employing such a concavo-convex cross section generally must be heat treated to achieve the desired flexural characteristics to withstand the repeated flattening operation that occurs in the coiling of the blade within the rule casing. It has been necessary to balance the advantages to be gained by increasing the depth of curvature of the blade for increased length of blade standout with the power requirements for the spring to effect its retraction and also with the life characteristics resulting from repeated deflection into the flattened condition when the blade is coiled.

Moreover, because the extended blade will assume the concavo-convex cross section, the indicia which are imprinted thereon become more difficult to read when the arcuate cross section becomes steeper. Lastly, when there is a very high cross curve or deep cross section, there is a stress point at the point where the blade does buckle when fully extended, which, over repeated usage, may cause a stress fracture.

Because of the necessity for balancing these various factors, the range of average standout lengths for commercially available widths of concavo-convex blades is set forth in the following table:

| BLADE WIDTH, INCHES | STANDOUT LENGTH, INCHES |
|---|---|
| ¼ | 12–16 |
| ½ | 35–43 |
| ¾ | 55–73 |
| 1 | 86–97 |



Various cross sections have been used for the concavo-convex blade construction. Generally, the cross section is a segment of a circular arc or a segment of a circular arc with straight segments at its ends (e.g, rectilinear portions which are tangential to the center arcuate segment). In this manner the concavo-convex cross section will not have any sharp bends which would produce points where the blade will be overstressed during the repeated flattening operation, and the amount of force required to flatten the curve is more readily available from economically utilizable power return springs.

It is an object of the present invention to provide a novel coilable metal blade for a rule which provides greater standout length.

It is also an object to provide such a blade which can be readily and economically fabricated and which will enjoy long life.

Another object is to provide such a blade which will slow the rate of retraction as the blade is almost fully retracted into the casing.

A further object is to provide a novel rule employing such a blade and which may be fabricated readily and relatively economically.

Yet another object is to provide a novel method for fabricating such coilable metal rule blades offering enhanced or great standout.

## SUMMARY OF THE INVENTION

It has now been found that the foregoing and related objects may be readily attained in a coilable rule blade providing greater standout length and comprising an elongated strip of resiliently deflectable metal having a substantially uniform width in its coiled flattened state and, in its uncoiled state, a concavo-convex cross section along substantially its entire length. This concavo-convex cross section has a central segment of arcuate configuration defined by a radius R and has a depth H.

The blade has a first portion adjacent one end thereof having a depth $H_1$ and a radius $R_1$, a second portion which extends from the first portion and has a depth $H_2$ and a radius $R_2$, and a third portion which extends from the second portion to adjacent the other end with a depth $H_3$ and a radius $R_3$. The depth $H_2$ of the second portion is greater than the depth $H_1$ and $H_3$ of the first and third portions, and its radius $R_2$ is less than the radii $R_1$ and $R_3$ of the first and third portions. The second portion extends for a portion of the length of the blade including the normal breakpoint for a blade of that width and having a uniform cross section corresponding to the depth $H_1$ and radius $R_1$ of the first portion, and the second portion continues beyond such breakpoint towards the other end of the blade to provide the greater standout length.

In its preferred form, the entire cross section of each of the blade portions is defined by a single continuous arc of the respective radius, or the cross section of each of the blade portions includes substantially rectilinear segments tangential to the ends of the central arcuate segment.

Conveniently, the depth $H_3$ and radius $R_3$ of the third blade portion are substantially equal to the radius $R_1$ and depth $H_1$ of the first blade portion. The radius $R_2$ and depth $H_2$ of the segment in the second blade portion is conveniently substantially uniform over substantially the entire length of the second portion for ease of fabrication. However, a highly effective structure is one in which the radius $R_2$ of the arcuate segment of the second portion decreases in length and the depth $H_2$ increases from the first portion towards the third portion of the blade. In such an embodiment, the decrease in radius $R_2$ and increase in depth $H_2$ in the second portion is preferably at a substantially uniform rate over substantially the entire length of the second portion. However, the radius $R_2$ of the second portion most desirably increases, and the depth $H_2$ correspondingly decreases, at a rapid rate adjacent the third portion so as to blend thereinto. In one embodiment, the blade has a terminal portion adjacent its one or outer end which has a radius $R_4$ for its arcuate segment which is smaller than the radius $R_1$, and it correspondingly has a depth $H_4$ greater than the depth $H_1$, of the first portion of the blade.

The blade is used in a coilable rule assembly which includes a casing having end walls and a peripheral sidewall defining a chamber therebetween and in which the sidewall has an exit aperture therethrough. As is conventional, the coiled rule blade in the chamber has one end extending outwardly of the casing aperture. The rule assembly will generally include a coiled power return spring within a reel in the chamber and which has its outer end engaged with the inner end of the blade which is coiled thereabout.

In one embodiment, the rule casing cooperates with a blade having a deeper cross section for its outer end portion and has an exit aperture which is of a depth $H_5$ less than the depth $H_4$ of the terminal portion of the blade so as to cause deflection thereof as it passes therethrough to reduce the rate of retraction of the blade under the action of the power return spring.

In making the coilable rule blade, a length of resiliently deflectable metal strip having a width W is provided, and the blade is formed to provide in a first portion of the length a concavo-convex cross section having a central segment of arcuate configuration defined by a radius $R_1$ and having a depth $H_1$. A second portion of the length is formed into a concavo-convex cross section having a central segment of arcuate configuration defined by a radius $R_2$ and having a depth $H_2$, and the radius $R_2$ is less than, and the depth $H_2$ is greater than, $R_1$ and $H_1$, respectively. A third portion of the length extending from the second portion is formed into a concavo-convex cross section having a central segment of arcuate configuration defined by a radius $R_3$ and having a depth $H_3$, with the radius $R_3$ being greater than, and the depth $H_3$ being less than, $R_2$ and $H_2$, respectively.

The forming step may be by a cold forming technique in which the length is hardened and tempered and thereafter roll formed to shape the several portions of the length into the desired cross section, or by a hot forming technique in which the heated blade is roll formed, quenched and tempered. Conveniently, the several portions of the length of metal strip are formed initially in a roll forming operation in which the length is passed through a series of roll forming dies providing a constant configuration for the several portions, and thereafter the second portion is further formed to the desired configuration. If so desired, a section of the length of strip at the end of the first portion which is spaced from the second portion may be formed into a concavo-convex cross section having a central segment of deep arcuate cross section defined by a radius $R_4$ and a depth $H_4$ respectively lesser and greater than $R_1$ and $H_1$.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a elevational view of a power returnable coilable rule embodying the present invention with a portion of the housing end wall broken away to reveal internal construction;

FIG. **2** is a side elevational view thereof with the end hook in phantom line for clarity of illustration of the exit aperture in the housing;

FIG. **3** is a fragmentary elevational view of the rule with the blade partially extended from the housing;

FIG. **4** is a partially diagrammatic cross sectional view of the blade at the line **4—4** of FIG. **3** with the housing exit aperture shown in phantom line and with the blade cross section shown in full line as deflected for passage therethrough and in phantom line before such deflection;

FIG. **5** is a similar diagrammatic sectional view of the blade at the line **5—5** in the housing exit aperture;

FIG. **6** is a similar diagrammatic sectional view of the blade at line **6—6** in the housing exit aperture;

FIG. **7** is a fragmentary side elevational view of another embodiment of rule using guide rollers in the rule housing for the blade adjacent the exit aperture and with the blade shown in section;

FIG. **8** is a fragmentary side elevational view of the blade showing the several portions thereof;

FIGS. **9–11** are sectional views thereof along the section lines **9—9**, **10—10** and **11—11** of FIG. **8**;

FIG. **12** is a fragmentary side elevational view of another blade embodying the present invention;

FIGS. **13–19** are sectional views thereof along the section lines **13—13**, **14—14**, **15—15**, **16—16**, **17—17**, **18—18** and **19—19** of FIG. **12**; and

FIG. **20** is a cross sectional view of another embodiment of blade employing a modified cross section.

## DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Turning first to FIGS. **1** and **2**, therein illustrated is a power returnable coilable blade embodying the present invention and having a housing generally designated by the numeral **10** with end walls **12** and a peripheral sidewall **14** extending therebetween and in which there is provided an exit aperture **16**. The walls **12**, **14** define an internal cavity in which there is a hub **18**, and a coiled power return spring **20** thereabout which has its outer end secured to the inner end of the blade generally designated by the numeral **22** and which is coiled about the reel **21**. The terminal portion of the blade **22** extends through the passage **24** and outwardly of the exit aperture **16**. As is conventional, a hook **26** is provided at its end which abuts the sidewall **14** about the aperture **16** and limits movement of the blade **20** inwardly of the housing **10**.

Also shown is a blade locking lever **28** which cooperates with mechanism (not shown) within the casing to hold the blade **20** in an extended position as originally illustrated and described in Robert F. West U.S. Pat. No. 3,214,836 granted Nov. 2, 1965.

Turning next to FIGS. **8–11**, therein fragmentarily illustrated are the several portions of an uncoiled blade generally designated by the numeral **30** and which is of substantially uniform width in its flattened or coiled condition and of concavo-convex cross section in its relaxed or extended position. The outer or first end portion **32** of the blade **30** has an arcuate cross section defined by a radius $R_1$, and it has a depth or height $H_1$.

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