March 2, 1971 R. W. YANCEY 3,567,184

SAFETY FENCE

Original Filed Oct. 14, 1968 3 Sheets-Sheet 1

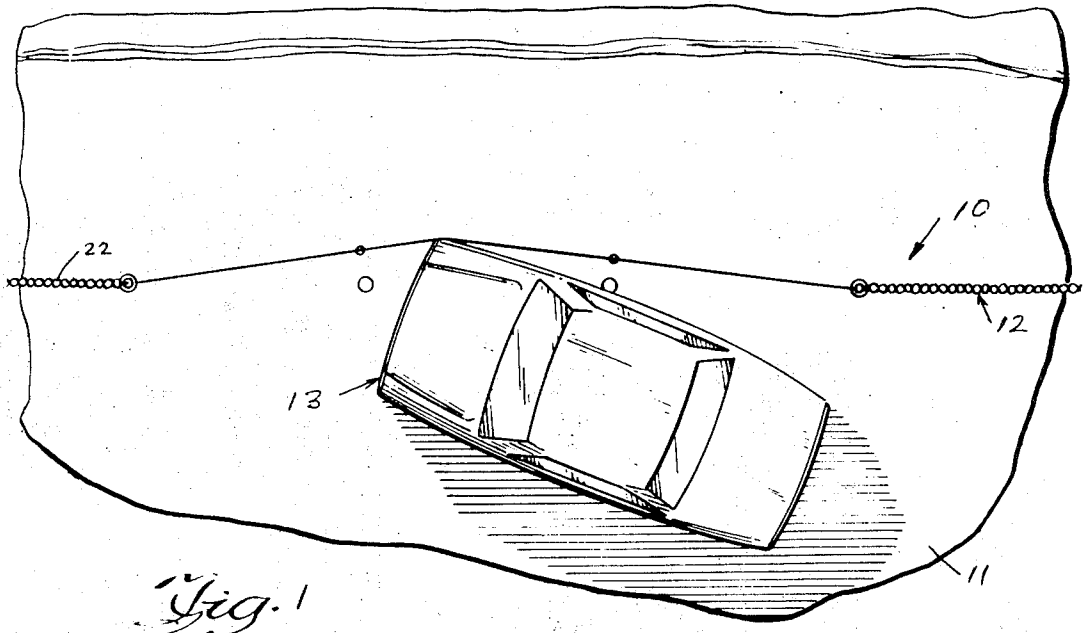


Fig. 1

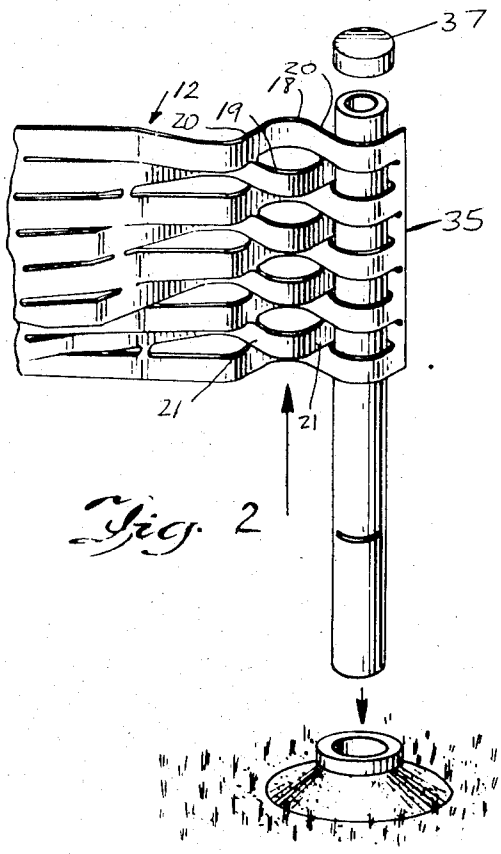
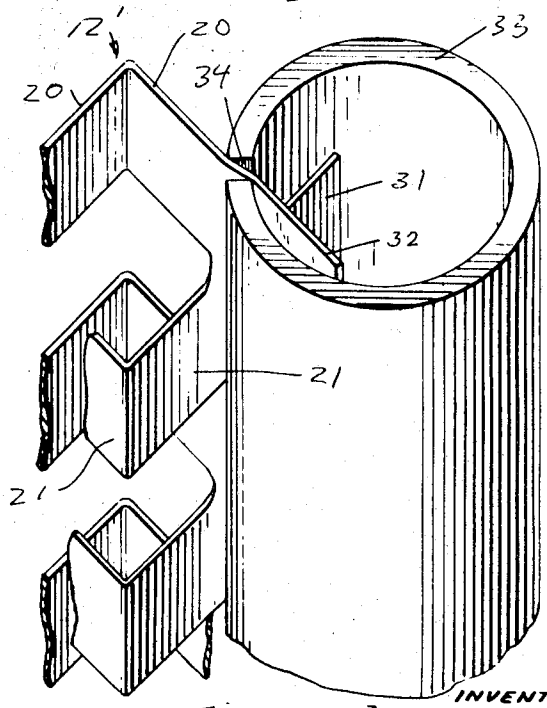


Fig. 2

Fig 3



INVENTOR

Raymond W. Yancey

BY Dressler, Goldsmith, Clement & Gordon

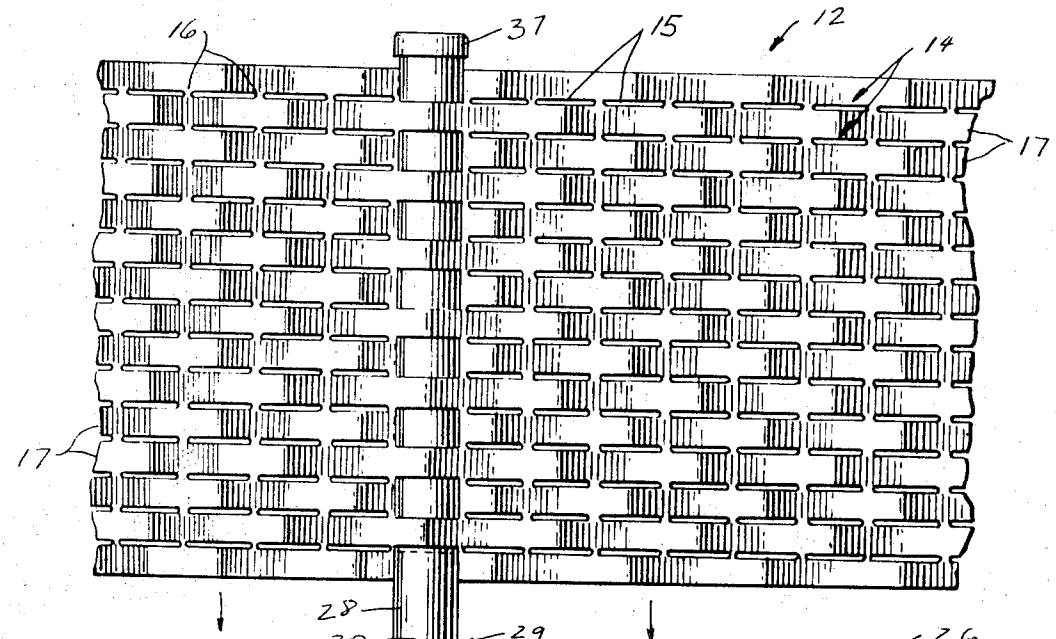
ATTORNEYS

March 2, 1971 R. W. YANCEY 3,567,184

SAFETY FENCE

Original Filed Oct. 14, 1968 3 Sheets-Sheet 2

Fig. 4



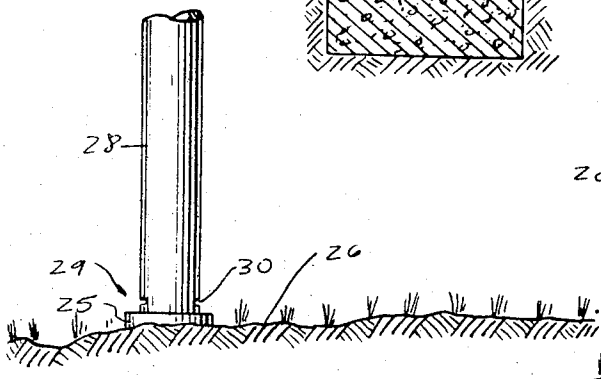


Fig. 5

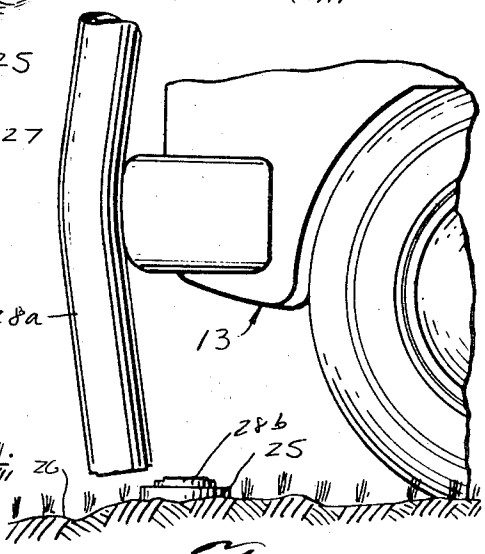


Fig. 6

INVENTOR

Raymond W. Yancey

BY Dressler, Goldsmith, Clement & Gordon

ATTORNEYS

March 2, 1971 R. W. YANCEY 3,567,184

SAFETY FENCE

Original Filed Oct. 14, 1968 3 Sheets-Sheet 3

Fig. 7

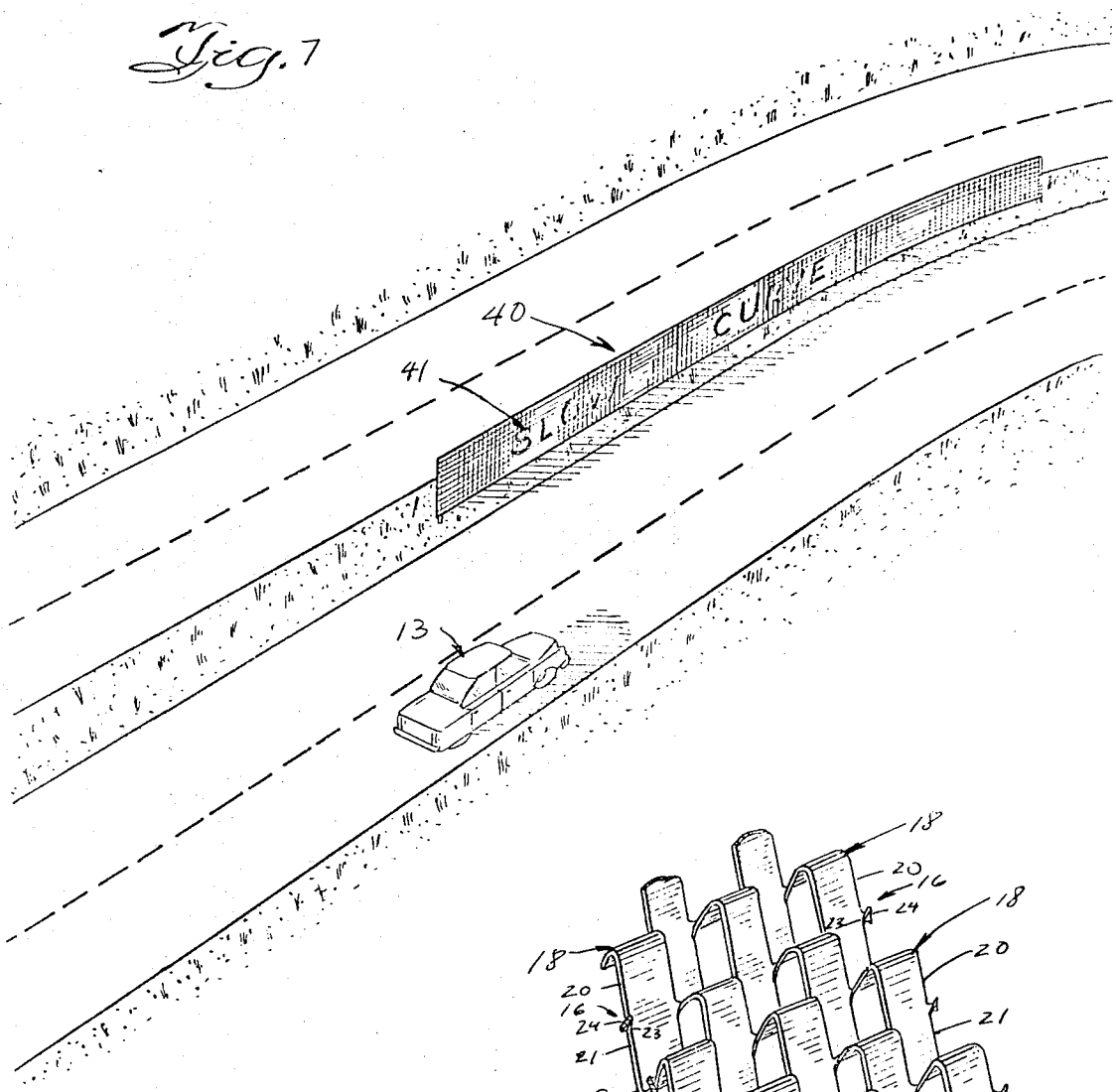


Fig. 8

INVENTOR

Raymond W. Yancey

BY Dressler, Goldsmith, Clement & Gordon

ATTORNEYS

United States Patent Office 3,567,184
Patented Mar. 2, 1971

3,567,184

SAFETY FENCE

Raymond W. Yancey, 880 Oak Spring Drive, Libertyville, Ill. 60048

Division of application Ser. No. 767,303, Oct. 14, 1968, and a continuation-in-part of application Ser. No. 849,233, July 18, 1969, which is a continuation of Ser. No. 767,286, Oct. 14, 1968. This application Sept. 19, 1969, Ser. No. 859,255

Int. Cl. E01f 15/00

U.S. Cl. 256—13.1 12 Claims

ABSTRACT OF THE DISCLOSURE

An easily erectable fence having impact absorbing energy dissipating characteristics which make the fence particularly useful as a roadway barrier. The fence includes a sheet of fencing material which is formed from an initial sheet having a plurality of transverse rows of longitudinally aligned openings defining longitudinally extending ribbons therebetween with the initial sheet being reduced in size by deforming the ribbons to provide alternating longitudinally spaced crests and troughs that are interconnected by webs having a multiplanar torsional deformation. The crests on the ribbons are aligned with troughs on adjacent ribbons to define passages in the fencing material that are perpendicular to the ribbons, so that the fence can be erected by merely sliding the fencing material over vertically disposed fence posts. The fence may be constructed of a suitable metallic material or of a suitable thermoplastic or thermosetting resinous material.

CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a division of my copending application Ser. No. 767,303 entitled, "Article of Manufacture and Method of Making the Same," filed Oct. 14, 1968. This application also is a continuation-in-part of my copending application Ser. No. 849,233, filed July 18, 1969, entitled, "Safety Fence," which is a continuation of my application Ser. No. 767,286, now abandoned, entitled, "Safety Fence," filed on Oct. 14, 1968. This application also discloses subject matter that is related to the subject matter disclosed in my application entitled "Plastic Fencing Structures" filed concurrently herewith.

BACKGROUND OF THE INVENTION

The desirability of providing a roadway barrier having characteristics that minimize the rebound effect when it is struck by a moving vehicle has been recognized in the past, but heretofore, structures that have been proposed for this purpose have not been satisfactory. Roadway barriers that are in common use today include corrugated metal members that are secured to fence posts by miscellaneous fasteners. Such barriers have successfully prevented vehicles from moving off of a roadway, as for example when the driver of the vehicle falls asleep, or when an accident occurs; however, the corrugations in the barriers have stiffened the barriers to such an extent that the vehicle rebounds off of the barrier back onto the roadway increasing the hazard to the driver of the rebounding vehicle and to other vehicles.

To obviate the rebounding effect, it has been proposed to form roadway barriers of woven wire structures, as shown for example in Ahles Pat. No. 2,204,558. Such structures have not met with wide commercial acceptance because of the difficulty in erecting the same, and their lack of sufficient structural integrity to resist the impact forces of a moving vehicle.

SUMMARY OF THE INVENTION

The fencing structure of the present invention obviates the problems discussed above in connection with prior art roadway barriers by providing an arrangement whereby the energy of a moving vehicle will be gradually dissipated when it strikes the fencing material, so that the movement of the vehicle will be arrested without it rebounding from the fencing structure. The energy absorbing characteristics are built into the fencing material by deforming the material in a manner such that the overall length of the material is significantly reduced, so that when a moving vehicle strikes the fencing material, the material will be first expanded to its normal length before a strain will be imposed upon the material itself. The initial material from which the fencing is formed includes a plurality of transverse rows of longitudinally extending openings, with parallel ribbons being provided between the rows of openings and with webs between the openings interconnecting the ribbons. The ribbons are deformed to provide longitudinally spaced alternating crests and troughs, and the webs are given a multiplanar torsional deformation, so that the webs are twisted throughout their length. The openings in the initial material are relatively wide, as compared to the thickness of the material, so that the crests and troughs may be deformed outwardly of the plane of the initial material a substantial distance, thereby increasing the energy absorbing capabilities of the material.

The fencing material has particular utility as a highway divider, since the relatively wide ribbons effectively mask the light from vehicles traveling in opposite directions, although the openings between the ribbons allow a small portion of the light to pass therethrough, so that a motorist is aware of a vehicle traveling in an opposite direction. The crests and troughs in the ribbon materials are defined by converging ribbon sections, and the converging ribbon sections present relatively wide surfaces to an oncoming motorist, which can be provided with indicia to advise the motorist of speed limits, curves and the like.

The crests on the ribbons are aligned with the troughs on adjacent ribbons, with the aligned crests and troughs cooperating to define transverse passageways in the fencing material. The passages are sized so as to allow the fencing material to be slidably positioned over vertically extending fence posts, and thus the use of separate fasteners to secure the fencing material to the posts is eliminated.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is a top plan view of an impact absorbing safety fence formed in accordance with the teachings of the present invention with an automobile being shown in the process of striking the fence;

FIG. 2 is an enlarged perspective view of the fence of the present invention and illustrating the mounting post structure for supporting the fence;

FIG. 3 is an enlarged perspective view illustrating the cooperative action between a trim piece at the end of the fence and a sheet of modified fencing material;

FIG. 4 is a front elevational view of the fencing structure of the present invention;

FIGS. 5 and 6 are front elevational views of the fence post of the present invention, with FIG. 6 illustrating the fence post shearing during impact;

FIG. 7 is a perspective view illustrating the fencing of the present invention as a highway divider; and

FIG. 8 is an enlarged perspective view of the fencing material.

DETAILED DESCRIPTION

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail a preferred embodiment of the invention and a modification thereof, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiments illustrated. The scope of the invention will be pointed out in the appended claims.

Referring now to the drawings, the fencing structure is illustrated generally at **10** in FIG. 1 as a road barrier adjacent a roadway **11**; and as will be hereinafter explained, the fencing structure **10** is formed of one or more sheets of fencing material **12** having impact absorbing characteristics for arresting the motion of a vehicle **13**. However, while the energy dissipating capability of the fencing material **12** makes the material particularly well suited for use as a roadway barrier, the fencing material is not limited to this specific use, since the material has other characteristics which make the material useful as a snow fence, or brakewater, or as an ordinary space divider.

The sheet of fencing material **12** is formed from an initially flat piece of material having a plurality of transverse rows **14** of elongate openings **15** that are separated from one another by webs **16**. Spaced parallel ribbons **17** are defined between the rows **14**, and the ribbons are connected by the webs **16**. Each of the ribbons **17** is deformed to provide alternating, longitudinally spaced crests and troughs which extend outwardly from opposite sides of the plane of the initial sheet, with the crests **18** being formed by converging ribbon portions **20** and with the troughs **19** being formed by converging ribbon portions **21**. The crests **18** on the ribbons **17** are longitudinally aligned with the troughs **19** on adjacent ribbons, so that the crests and troughs cooperate to collectively define parallel passages **22** in the fencing material **12** that are perpendicular to the length of the ribbons **17**. The openings or slideways **22** allow the fencing material to be easily and quickly erected, since it is necessary only to slide the fencing material over vertical fence posts. Thus, the need for fasteners to secure the fencing material to the fence posts is eliminated.

When the crests **18** and troughs **19** are formed in the initial sheet material by the process and apparatus described and claimed in my copending application Ser. No. 767,303 entitled, "Article of Manufacture and Method of Making the Same," filed Oct. 14, 1968, the webs **16** are given a multiplanar torsional deformation, such that one end portion **23** of the web is disposed in the plane of the transitional section of one ribbon between ribbon portions **20** and **21**, while the opposite end **24** of the web is positioned in the plane of the transitional section of an adjacent ribbon between the ribbon portions **20** and **21** thereon. The midportion of the webs **16** are generally uniformly twisted between the oppositely inclined end portions **23** and **24**. In the fencing material **12** illustrated in FIG. 2, the apexes of the crests **18** and troughs **19** are rounded, so that the openings **22** are generally circular. In the modified fencing structure **12'** illustrated in FIG. 3, the ribbon portions **20** and **21** merge at a sharp angle, so that generally rectangularly shaped openings are defined therebetween. The fencing structure **12** is adapted to be used in connection with a tubular fence post having a circular cross-section, while the fencing structure **12'** is adapted to be used with a fence post having a square or rectangular cross section. Obviously, any appropriate post, either solid or tubular, can be used with the fencing structure of the present invention, and the post may be formed of a material that is the same as, or different than, the material of the fencing structure.

The fence post structure for mounting the fencing material **12** will be best understood from FIG. 4, and as illustrated therein, an upwardly opening tubular socket **25** is permanently embedded in the ground **26**, preferably in concrete **27**. A vertically extending tubular fence post **28** is slidably inserted within socket **25**, preferably with a slight press fit to prevent unauthorized removal. The fence posts **28** preferably include weakening means **29** adjacent the lower end thereof, and the weakening means **29** may take the form of a circumferential groove **30** or a plurality of circumferentially spaced notches. The weakening means **29** allows the fence post **28** to shear into two sections **28***a* and **28***b*, when the post is struck by a vehicle **13**, as is illustrated in FIG. 6.

When the sheet of fencing material is initially fabricated to provide the crests **18** and troughs **19**, and to impart the multiplanar torsional deformation to the webs **16**, the overall length of the material is significantly decreased, with the reduction in size being on the order of 25%. This allows the fencing material **12** to have built in energy absorbing characteristics, since when the fencing material **12** is engaged by a vehicle **13**, as is shown in FIG. 1, the sheet will be stretched to the initial length, as shown at **12***a*, before a strain is imparted to the material itself. Obviously, if the material **12** is struck between fence posts **18** with only a slight impact, the material **12** will undergo only local deformation, and the fence posts **18** will not shear. As is illustrated in FIG. 1, the fencing material **12** preferably extends along a length including a plurality of fence posts **18**, so that if a vehicle at high speed strikes the fencing **10** to shear the fence posts **18**, several sections of fencing material are brought into play to arrest the motion of the vehicle. In this manner, the energy of the moving vehicle is gradually dissipated, and the tendency of the vehicle to rebound off of the fencing is substantially eliminated.

As is shown in FIG. 3, the ends of the fencing material may be severed across the crests **18** and troughs **19** to provide oppositely inclined ribbon end portions **31** and **32**. In such an arrangement, a split end tube **33** having opposed surfaces **34** may be slidably positioned over the web portions **16** to complete the fence, with the ribbon portions **31** and **32** cooperating to retain the end piece **33** upon the fencing material. Alternatively, the fencing material may have a straight line terminus, outwardly of the last openings **15** in the material **12**, as is illustrated at **35** in FIG. 2. End caps **37** may be driven onto the upper ends of at least some of the fence posts **18** to prevent unauthorized removal of the fencing material, it being understood that the end caps are larger in size than the openings in the fencing material.

In addition to having utility as a roadway barrier alongside of a road, the fence may be used in the center of a divided highway, as is shown at **40** in FIG. 7. In such an environment, the ribbons **17** serve to effectively mask the headlights of an oncoming vehicle, although the openings **25** allow a certain portion of the light to pass through the fence so that the driver of a vehicle is aware of a car moving in an opposite direction. The opposed ribbon portions **20** and **21** present a relatively broad surface area to an oncoming vehicle and indicia, such as shown at **41** in FIG. 7, may be provided on the ribbon portions **20** and **21** to advise motorists of speed limits, curves and the like. The indicia **41** may be provided by luminous paint, or any other suitable means.

The fencing structure of this invention may be constructed of any suitable meaterial having the desired mechanical properties, fabricatability and weathering properties. The structure may, for example, be made of a suitable steel which may be coated or otherwise treated to provide corrosion resistance. Aluminum and aluminum alloys are also suitable and can be coated.

Alternatively, the fencing structure may be made of a resinous material having adequate strength. Suitable resinous materials include thermoplastic materials such as high impact polystyrene, high density polyethylene, polypropylene, butyl methacrylate, acrylonitrile-butadiene, styrene copolymers and polyvinyl chloride; thermosetting

resinous materials such as phenol-formaldehyde, melamine-formaldehyde and ureaformaldehyde resins and mixtures thereof, including mixtures of thermoplastic and thermosetting materials. Reinforced resinous materials containing natural fibers, synthetic fibers, glass or metal fibers (which may be in the form of loose fibers or in the form of woven or non-woven baths) and powdered filler materials may also be used.

In the case of thermoplastic resinous materials, the fencing structure is fabricated in the manner disclosed in my copending application Ser. No. 767,303, filed Oct. 14, 1968 (e.g., by cutting and deforming a sheet of thermoplastic material, utilizing heat as required, to assist in the deformation step). In the case of thermosetting materials, the deformation step is followed by, or accompanied by, the application of sufficient heat to cure the material in its desired shape. Such processes are disclosed in detail in my copending application filed concurrently herewith.

What is claimed is:

1. An easily erectable fence comprising: a sheet of fencing material having a plurality of vertically spaced rows of openings, each row of openings being separated by a horizontally disposed ribbon portion and the openings in each row being separated by a vertically extending web portion, each ribbon including alternating longitudinally spaced crests and troughs, the crests extending forwardly from a vertical reference plane and the troughs extending rearwardly from the reference plane, the transitional portion of each ribbon between the crests and the troughs extending at an angle with respect to the reference plane, the crests on each ribbon being aligned with a trough on an adjacent ribbon whereby the aligned transitional portions of adjacent ribbons are disposed at angles that are inclined oppositely with respect to said reference plane, said webs each having a first end portion merging with a transitional portion of one ribbon and a second end portion merging with the aligned transitional portion of an adjacent ribbon, the intermediate portion of each web between its end portions being twisted throughout its length, said aligned crests and troughs cooperating to collectively define vertical slideways; and at least one vertical fence post, impaling one of said slideways to support said sheet of fencing material.

2. A fence as set forth in claim 1 wherein a pair of vertical fence posts impale spaced slideways of said sheet.

3. A fence as set forth in claim 1 wherein said sheet of fencing material has an initial length, prior to the formation of said crests and troughs, that is substantially in excess of the final length of the sheet, whereby said fence has a built-in impact absorbing capacity.

4. A fence as set forth in claim 3 wherein the initial length of the sheet is approximately 25% greater than the final length of the sheet.

5. A fence as set forth in claim 1 wherein said fence posts are defined by tubular members.

6. A fence as set forth in claim 5 wherein at least two sockets are embedded in the ground, said sockets opening upwardly and each slidably receiving a fence post.

7. A fence as set forth in claim 6 wherein said sockets are defined by tubular sections embedded in concrete.

8. A fence as set forth in claim 7 wherein said fence posts are weakened above the upper ends of said sockets.

9. A fence as set forth in claim 5 wherein the apexes of said crests and troughs are rounded, and said tubular members are circular in cross section.

10. A fence as set forth in claim 5 wherein retention members are provided on the upper ends of said fence posts to prevent unauthorized removal of said sheet.

11. A fence as set forth in claim 1 wherein a C-shaped tubular member is provided at each end of said sheet, said C-shaped members including facing surfaces slidably positioned over an aligned set of webs.

12. A fence a set forth in claim 1 wherein indicia are provided on at least some of said crests and troughs.

References Cited

UNITED STATES PATENTS

1,372,741	3/1921	Dickinson	29—160UX
1,643,123	9/1927	Kyle	256—13.1
1,793,675	2/1931	Camp	256—13.1
2,145,073	1/1939	Drake	29—160X
2,740,613	4/1956	Berliner	256—21
2,990,163	6/1961	Farrell	29—163.5X
3,083,662	4/1963	Zeidler	29—163.5X
3,114,303	12/1963	Oberbach	256—13.1X
3,307,833	3/1967	Muller et al.	256—13.1

FOREIGN PATENTS

272,943	8/1964	Netherlands	256—24

DENNIS L. TAYLOR, Primary Examiner