Nov. 6, 1962 A. B. WILSON 3,061,921

METHOD OF BINDING

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Fig. 1.

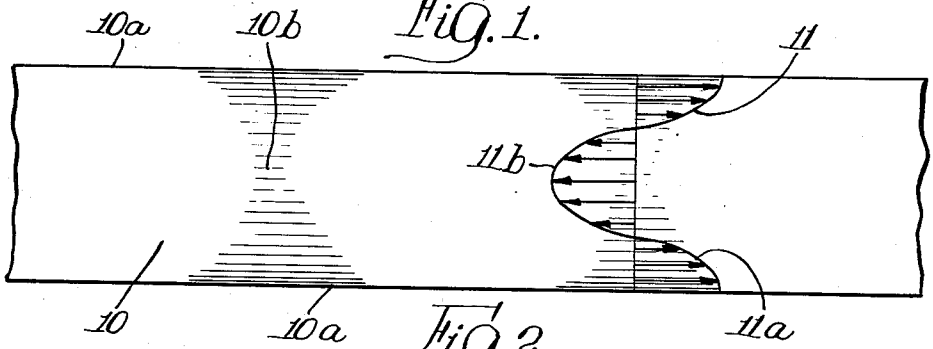

Fig. 2.

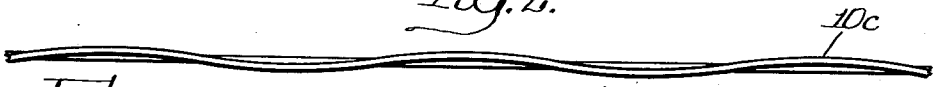

Fig. 3.

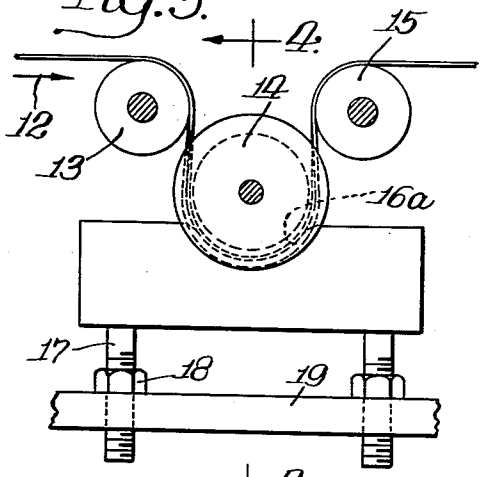

Fig. 4.

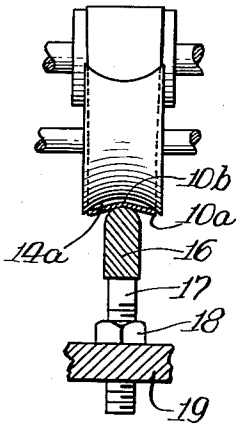

Fig. 5.

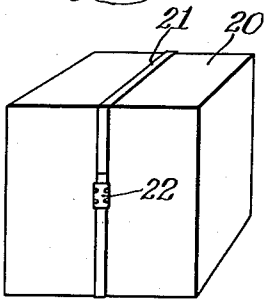

Fig. 6.

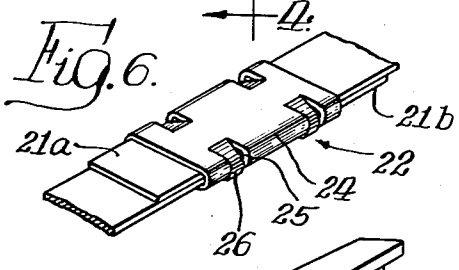

Fig. 7.

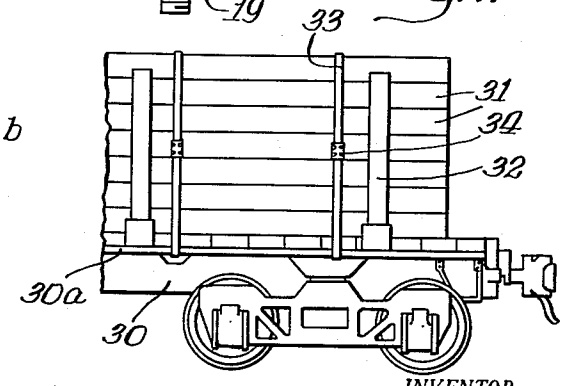

Fig. 8.

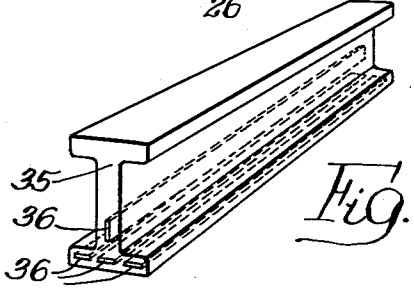

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Fig. 9.

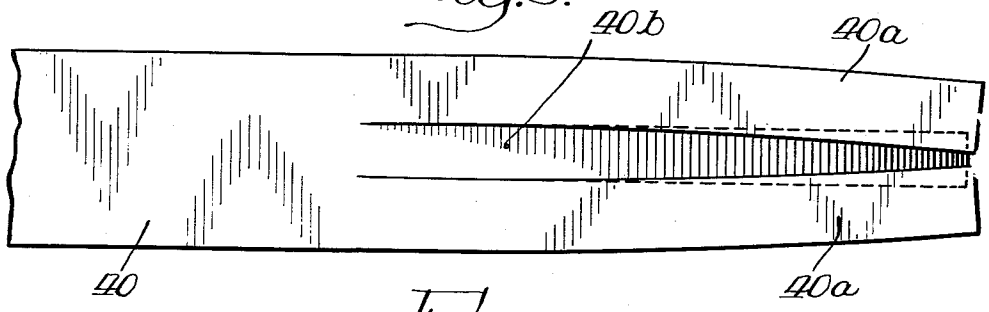


Fig. 10.

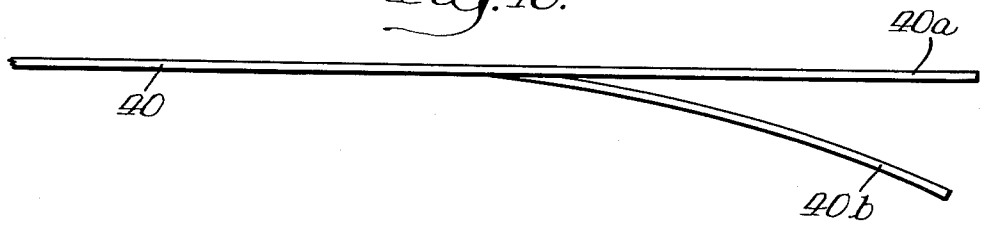
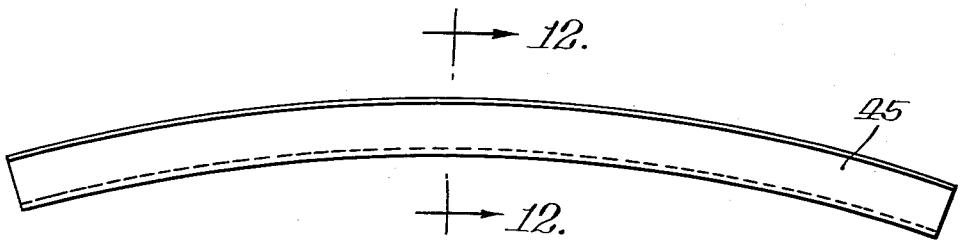


Fig. 11.



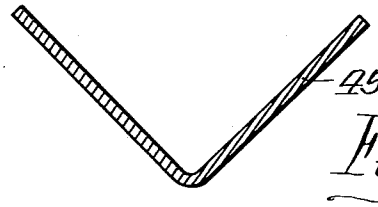


Fig. 12.

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METHOD OF BINDING

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Filed Aug. 18, 1955, Ser. No. 529,128
2 Claims. (Cl. 29—452)

This invention relates to improvements in the use of metal strapping and in producing objects reinforced thereby and its purpose is to provide an improved method of reinforcing boxes or packages and of binding a plurality of such objects together in the loading of freight cars and other carriers and in producing reinforcing concrete or other molded products.

In the use of steel strapping as a surrounding binder for boxes or packages or when binding such objects together or to the car in the loading of freight cars and the like, the binding strap is sometimes accidentally broken due to rough handling of the boxes or packages or sudden jolts or impacts or to contact with adjacent objects. The tendency to breakage is greatest at the places where the strapping is bent sharply around the corners of the bound objects or where the longitudinal tension in the strap is largely concentrated at or adjacent to the edge of the strap due to camber in the strap or to uneven alignment of the ends of the strap at a joint. In general, where there is a failure of a binding strap, the strap fails first at one or the other of its lateral edges and pulls apart progressively toward its center line. It is usually desirable to maintain a high degree of tension in a binding strap in order to obtain security and protection for the bound package or load but the permissible tension in strapping material heretofore used has been limited by the tendency of the edge portions of the strap to fail under tensions substantially below those which the strap as a whole could be expected to withstand.

The principal object of the present invention is to provide a new and improved method of binding and reinforcing objects which includes forming and utilizing in a particular way a metal strip or binding strap having edge portions which are longer than its center portion so that, when no load is applied to the strip, the metal in its central portions is under tension while that in its edge portions is under compression and, when the strap is used for binding purposes in accordance with the present invention, the maximum tension is set up in the central portion of the strap which can withstand, without failure, greater tension than the edge portions. When a load is put on such a strip to set up longitudinal tension therein, the load is carried primarily by the central portion of the strip and the tension decreases toward the edges so that the tendency for failure at the edges is minimized or removed. It has been found that metal strapping having elongated edges, as compared with its center, is capable of withstanding much greater tensile stresses under load than ordinary flat metal binding strap, even when there is camber in the strip or when the loading conditions are such as would ordinarily cause failure at the edges.

The nature of the invention will be understood from the following specification taken with the accompanying drawings in which the improved method is illustrated together with several embodiments of objects which are bound or reinforced according to the present invention. In the drawings,

FIGURE 1 shows a top plan view of a portion of metal strap formed and used in the practice of the present invention and illustrating diagrammatically on the strap the nature of the forces which are set up in the strap by the operation of elongating its edges;

FIG. 2 shows a side elevation of the portion of strap

illustrated in FIG. 1, the elongation or rippling of the edge portions of the strip being greatly magnified;

FIG. 3 shows a side elevation of one form of apparatus which may be used in stretching the edge portions of a metal strap to produce the structure illustrated in FIGS. 1 and 2;

FIG. 4 is an end elevation of the apparatus illustrated in FIG. 3;

FIG. 5 is a perspective view of a box or package which is bound by a metal strap pursuant to the features of the present invention;

FIG. 6 is an enlarged perspective view of one form of joint which may be used in uniting the ends of the metal strap illustrated in FIG. 5;

FIG. 7 shows a partial side elevation of a freight car having its load bound thereto by metal strapping according to the present invention;

FIG. 8 shows a perspective view of a portion of a concrete bar or slab which is reinforced by embedding therein metal strapping having elongated edges according to the present invention.

FIG. 9 is a plan view of a metal strip having elongated edges produced in the practice of the present invention which has been slitted longitudinally parallel to its edges, thus forming from the lateral edge portions of the strip two tongues which are bowed inwardly toward each other due to the release of the compressive stresses in the edges, thus showing that the edge portions of the strip are longer than the center portion;

FIG. 10 shows a side elevation of the metal strip illustrated in FIG. 9;

FIG. 11 shows a metal strip or bar which, after having its edges elongated with respect to the center, is bent transversely into angle bar form with the result that the strip assumes a longitudinal curvature due to the fact that the edge portions are longer than the center; and

FIG. 12 is a sectional view taken on the line 12—12 of FIG. 11.

In FIGS. 1 and 2 there is illustrated a metal strap **10**, preferably a steel strap, which has its edge portions **10***a* and central portions **10***b* stressed longitudinally with the result that the edge portions are longer than the central portions so that when the strap is laid upon a flat surface the edge portions **10***a* tend to assume the form of waves or ripples **10***c*. This condition in the strip is created by either stretching of the edges, compression of the center or a combination of both. The degree of longitudinal change in dimension which is necessary in order to attain the objects of the present invention is comparatively slight and the edge portions do not actually have ripples **10***c* which are of the magnitude shown in FIG. 2 and may not be visible depending upon the thickness and width of the strip. But the compression due to the elongated edges is of sufficient magnitude so that when the strap is bound around a box or package or is drawn taut in binding a plurality of packages or other load elements to a freight car or other carrier, the tension due to the load on the strap is first applied to the central portion of the strap and then gradually toward the edges so that the tension at the edges is always substantially less than it is in the central portions with the result that any tendency for the strap to fail along its edges is substantially eliminated.

After the metal strap has been operated upon to elongate the edge portions thereof, the condition of the stresses in the metal strap may be said to be indicated on a magnified scale by the curve **11** shown in FIG. 1. When the longitudinal tension applied to the strip is relieved, the edge portions of the strap are under compression as shown at **11***a* while the intermediate portions of the strip are under compression as shown at **11***b*. This

is merely a diagrammatic representation of the condition which is shown on an enlarged scale in FIG. 2.

The metal strip having elongated edges may be produced in various ways. One form of apparatus adapted to serve this purpose is illustrated in FIGS. 3 and 4 where the metal strap such as ordinary commercial strip steel in a substantially flat condition, is pulled endwise under tension in the direction of the arrow **12** over a roller **13**, thence under a second roller **14** and then over a third roller **15**. These rollers are mounted on shafts supported in suitable bearings and the rollers **13** and **15** are preferably cylindrical in form as shown in FIG. 4. The roller **14** has a concave annular surface **14***a* and, as the metal strap passes around this roller, it is forced partially into the concavity **14***a* by a bar **16** which is adjustably mounted by means of bolts **17** and nuts **18** on a stationary member **19**. The upper surface of the bar **16** is provided with a concave portion **16***a* which conforms to the curvature of the periphery of the roller **14** and this surface is also transversely curved as shown in FIG. 4. Thus, as the metal strip passes around the roller **14** the central portion **10***b* of the strip is pressed upwardly into the concavity of the roller **14** while the edge portions **10***a* contact the concave surface **14***a* with the result that these edge portions are stretched longitudinally and they emerge over the roller **15** in a rippled or elongated state, i.e., they are longer than the central portion **10***b* of the strip. The degree to which the edge portions are stretched may be regulated by adjusting the position of the bar **16**.

Metal strapping made according to the present invention may be employed in the binding of boxes or packages for reinforcing purposes as illustrated in FIG. 5 where a box **20** has a metal strap **21** extending about it under tension with its ends overlapping each other and secured together by a sealed joint **22**. The joint may be of the form shown in FIG. 6 where the ends **21***a* and **21**b of the strap are shown as being overlapped and enclosed within a tubular metal seal **24**. The edges of the seal and the enclosed strap ends are sheared transversely in parallel planes as shown at **25**. The metal between the cuts of each pair is deflected downwardly to form lugs **26**, thus providing interlocking shoulders between the seal **24** and the strap ends to form an interlocking joint.

In FIG. 7 of the drawings, there is illustrated the use of the metal strapping in the binding of a load upon a freight car **30**. This freight car is loaded with a plurality of load elements **31** which are mounted between posts **32** extending vertically at the sides of the car and these load elements are secured together and to the car by means of metal binding straps **33** made according to the present invention and extending around the load elements and around the floor **30***a* of the car with their ends secured together by joints **34** of the type previously described. With this arrangement of the load, the metal strapping **33** having elongated edges serves to bind the load securely to the car while the stresses set up by the movement of the car and a tendency for relative movement of the load elements **31** is resisted by the longitudinal tension in the metal straps **33** which is set up primarily in the central portions of these straps so that the tendency of the straps to fail at the edges is removed.

In FIG. 8 of the drawings there is illustrated a concrete bar or beam **35** which is reinforced by a plurality of metal strips **36** having edges which are elongated relatively to their central portions. These metal strips in the practice of the present invention are placed under tension in the mold prior to the setting of the concrete and, due to the fact that the edges of the reinforcing members are longer than their central portions, any tendency of the strips to fail at their edges or to become misaligned due to camber, is essentially removed so that a more perfect reinforced concrete product is obtained than has been possible by the previous practice where the ordinary metal strapping was untreated and was often imperfect due to the presence of camber.

An elongation of the edges of the metal strip with respect to the central portion which is sufficient to accomplish the objects of the present invention is ordinarily very slight and is not visible to the naked eye except in the case of very thin strips. However, the presence of the edge elongation may be readily detected by the method which is illustrated in FIGS. 9 and 10 where a steel strip **40** having long edges is slitted longitudinally parallel to its lateral edges, thus forming two edge tongues **40***a* and an intermediate central tongue **40***b*. Due to the fact that the edge portions of the strip are longer than the center, the longer edge tongues **40***a* spring inwardly toward each other and overlap the central tongue **40***b* when the compressive forces are released by the slitting operation.

Another method of detecting edge elongation in a metal strip is shown in FIGS. 11 and 12, where a metal strip **45** having edges which are longer than its central portion is bent transversely along its longitudinal center line into angle bar form, with the result that the strip promptly assumes a longitudinal curvature due to the effect of the long edges.

Although one embodiment of the metal strapping produced and employed in the present invention has been shown and described by way of illustration together with certain embodiments of reinforced loads or packages or other objects produced in the practice of the method it will be understood that the invention may be varied in numerous ways without departing from the scope of the appended claims.

I claim:

1. The method of binding a box or lading or the like with a substantially flat metal strip, comprising the steps of stressing said strip longitudinally to render its edge portions longer than its central portion, wrapping the strip about the box or lading, and then tensioning the strip to produce in the central portion thereof a state of tension greater than that in its edge portions.

2. The method of binding a box or lading or the like with a substantially flat metal strip, comprising the steps of elongating the edge portions of the strip with respect to its central portion, wrapping the strip about the box or lading, and then tensioning the strip to produce in the center portion thereof a state of tension greater than the state of tension in the edge portions thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

673,382	Chaffee	May 7, 1901
749,987	Franke	Jan. 19, 1904
809,756	Staude	Jan. 9, 1906
857,671	Reyburn	June 25, 1907
858,410	Mueller	July 2, 1907
943,878	Hughes	Dec. 21, 1909
1,460,833	Abraham	July 3, 1923
1,866,705	Harvey	July 12, 1932
2,097,444	Childress	Nov. 2, 1937
2,255,022	Emperger	Sept. 2, 1941
2,327,209	Otte	Aug. 17, 1943
2,337,047	Hunter	Dec. 21, 1943
2,424,395	Hedges	July 22, 1947
2,455,153	Abeles	Nov. 30, 1948
2,571,748	Newman	Oct. 16, 1951
2,778,489	Shoemaker	Jan. 22, 1957

FOREIGN PATENTS

705,073	Great Britain	Mar. 10, 1954