This invention relates generally to the mechanical fraying of fabric materials, and is directed particularly to novel methods and apparatus for fraying the edge or edges of strip fabrics to be used typically for ornamental trimmings on such objects as lamp shades, draperies and the like.

My primary object is to accomplish the continuous fraying of such strip materials in a manner productive of a highly attractive and durable product, and by such simplicity and speed of operation as to render the frayed strip stock available at costs well below those at which the materials could be made by the conventional hand methods. Also contemplated, is the production of the frayed strip in a manner such that it is given adjacent its frayed edge a definite and continuous ruffle which enhances considerably the attractive appearance of the product and its superiority for many decorative purposes.

In accordance with the invention, the strip stock to be frayed is cut on a bias, i.e., with two or more courses or series of the threads running angularly or diagonally across the strip, thus rendering the ends of one series of the threads susceptible to being substantially permanently deflected laterally of the fabric and released from woven relation with one or more other series of the threads, by advancing the material to the fraying mechanism as later described. The invention contemplates generally the continuous passage of the bias-cut strip stock against a support positioned opposite a means for exerting against the edge portion of the strip a fraying force, all in a manner such that the applied force deflects and frees one of the thread series to a predetermined distance from the edge of the fabric, while simultaneously the pressural and working conditions of the mechanism act to ruffle the fabric continuously along and adjacent its frayed edge.

According to a preferred though typical form, the fraying mechanism employs a pair of rolls or wheels between which the strip stock is advanced, at least one of the wheels acting to engage and deflect outwardly the threads to produce the fraying. As will later appear, the wheels have opposed complementary strip engaging surfaces so shaped that not only to fray the fabric, but also to produce the ruffled deformation referred to in the foregoing, particularly under the influence of a high differential in the peripheral speeds of the wheels.

The invention has a further important feature and object in connection with the form and com-
3, the latter (see Fig. 3) being associated with a switch 38 connected in the circuit of motor 12 and comprising a finger 40 urged by coil spring 41 against the strip 38. The function of the switch 38 is to automatically discontinue the motor operation when the last of the strip stock has passed the guide 30, at which time finger 40 directly contacts the surface of the metal guide 38, also connected in the motor circuit, to short out and stop the motor through the conventional circuit control.

The strip then is advanced between a pair of wheels 42 and 43 carried respectively by shafts 24 and 18, acting to fray and ruffle the material along one edge, following which the strip passes over guide 44, is given a reversing twist at 45, and thence passes over guides 46, 47 and 48 to be advanced between wheels 49 and 50, carried respectively by shafts 22 and 28, which fray and ruffle the opposite edge of the strip. The finished strip, frayed and ruffled along both edges, is taken off past guide 51 for such further disposition as may be desired. The two pairs of fraying wheels 42, 43 and 40, 50 are similar, and a description of one of the pairs with reference to Figs. 4 and 5 will suffice for both.

The wheel 42 has a body 52 composed of a braided mass of radial fibers confined between washers or plates 53 and 54 and having yielding surface characteristics. Preferably the fiber mass contains a filler of wax or other equivalent material to give added body to the fiber mass and to some extent lubricate the angular strip engaging face of the wheel which frictionally engages the face sufficiently roughened by reason of the fiber ends, to effectively and permanently deflect one parallel series of the threads laterally of the fabric, and in so doing, strip such threads out of working relation with the others so that when so displaced the threads have free end portions presenting a uniform fray. As previously indicated, the fraying action of the brushes is due in part to the capacity of their fibers or bristles to at least partially penetrate the fabric.

The peripheral face 55 of the wheel may be given the illustrated angularity in any suitable manner, though preferably through deformation of the fibers under the influence of an annular pressure plate 56 the flange 57 of which angularly engages the outer end face of the fiber mass near its edge to deform and shape the working portion of the wheels substantially as shown. Axial displacement of the fiber wheel responsive to pressure applied by plate 56 as nut 58 is tightened, is resisted by coil spring 59.

Wheel 42, or at least the strip-working portion thereof, similarly has a body 60 composed of a mass of radial wax filled fibers confined between washers 61 and 62. As in the case of wheel 42, the working face 60a of wheel 43 is angularly deformed in complementary relation to the peripheral 65 of the other wheel, by the thrust of an annular pressure plate 66 for reception of the fabric strip and a bell 57.

Referring to Fig. 1, it will be seen that between the wheels is held positively against the face of wheel 43, and within recess 65, by belt 67 passing over idler pulleys 68 and 69, the latter being carried by an arm 70 pivoted at 71, which has an adjustable coil spring connection 72 acting to properly tension the belt. A second belt 73 similarly engaging wheel 49 (corresponding to wheel 43) is carried by idler pulleys 74 and 75.

Wheels 42 and 59 are bocily pressed against the strip surface by means of the spring controls 76 yieldingly urging arms 25 and 52 and their wheels, toward the wheels 48 and 69. Each adjustment 76 typically may comprise a link 77 pivotally connecting the wheel arm with a guide pin 10 received within the bore of a nut 78 threaded into the support 19. The end of the nut bears against a coil spring 71 confined against a flange or washer 72, all in a manner such that adjustment of the nut varies the spring compression and therefore the thrust transmitted to the fraying wheel.

In considering the operation of the apparatus, assume the strip fabric 35 to be fed between the wheels 42 and 43, and specifically between their angular faces 55 and 60a as particularly shown in Figs. 4 and 5. Wheel 42 has a high peripheral speed as compared with the peripheral speed of wheel 43, the ratio of about 50 to 1. Higher or lower speed ratios may be employed where required in accordance with variations in the composition or weave of different fabrics to be frayed. With the wheels being driven in opposite directions, the effect of the relative high speed rotation of wheel 42 is to feed the strip 35, throughout an extent of say ¼ inch inwardly from the edge 35a of the strip, wheel 42 acts to deflect laterally and free the end extents of the series of bias threads running forwardly at that edge in the direction of the strip travel, thus enabling the other wheel 43, by reason of the sense that such deflection free all the threads from woven relation and tends to give them uniform lateral end freedom. Second, inwardly of and adjacent the frayed edge portion of the strip, the peripheral and relative speed association of the wheels appears to produce a distinct and permanent ruffling of the strip, as indicated at 84 in Fig. 6, an effect which may be additive to certain woven thread groupings tendencies of the first described effect. A ruffling effect apparently is created by an irregularized friction relation between wheels 42 and the strip, and probably by reason of the tendency of the high speed wheel to intermittently and locally bring together the fabric threads with resultant formation of ruffles at corresponding intervals. Simultaneously with the described fraying and ruffling action of the wheels, the strip material is being positively advanced between them at a uniform rate by reason of the engagement and confinement of the strip against the surface of wheels 43 by the belt 61. As will be understood from the foregoing, upon reversal and advancement of the strip between wheels 49 and 50, a similar fraying and ruffling of the opposite edge of the strip results.

Figs. 7 and 8 illustrate a varitional form of the invention in accordance with which the bias cut strip stock is edge-frayed and ruffled by the actionary and fraying action of the strip 85 is shown to be fed from between a series of guides 86 past one or a succession of fraying devices 87, finally to be taken off past a second assembly of guides 89. The fraying device 87 comprises a blade 90, having a more or less sharp strip fabric strip 91 engaging edge, pivotally carried and a suitable support 92. The blade is urged against the top and edge surface of the strip by compression spring 93, and the blade pressure downwardly against the fabric is taken by a pad 94 over which the edge of the strip passes. The strip preferably is given yielding support against
the blade pressure, as by forming the pad 54 of rubber. As will be noted, the blade 90 is positioned angularly in a direction opposite the course of the strip travel, with the result that the blade will produce a tendency to laterally deflect and free the bias threads whose ends are running forwardly of the direction of the fabric travel. By mounting the blade 90 in relation to the strip 55 and pad 54 at an elevation such that the working edge of the blade tends to lie across the strip an appreciable distance from its edge, the blade will produce a tendency to laterally deflect and free the end extents of the fabric threads adjacent said edge out of woven relation while retaining the woven condition of the threads inwardly of the strip.

4. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising a support engaged by one surface of the strip adjacent said edge, means exerting a thread fracturing force against the opposite surface of the strip locally in proximity to said edge, and means for producing relative movement of said means and strip longitudinally of the strip, said force exerting means acting to laterally deflect and free the end extents of the fabric threads adjacent said edge out of woven relation while retaining the woven condition of the threads inwardly of the strip.

5. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising means forming a pair of bearing surfaces adapted to engage opposite faces of the strip adjacent said edge, means for producing relative movement of said surfaces and strip longitudinally of the strip with the strip positioned between said surfaces, one of said surfaces engaging the strip only locally near said edge and acting to laterally deflect and free the threads adjacent said edge and the strip in said edge thereof while retaining the woven condition of the threads inwardly from the frayed portion, and means for pressing one of said surfaces against the strip to fractionally ruffle the strip adjacent its frayed portion.

6. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising two pairs of members each pair adapted to bear against opposite faces a continuous extent of the strip respectively adjacent opposite edges thereof, means for producing relative movement of said members and strip longitudinally of the strip while retaining the edges of the threads adjacent said edges thereof, and means for twisting the strip between said pairs of members so that said pairs fray opposite edges of the strip.

7. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising supporting means adapted to bear against a face of the strip adjacent said edge, a member having a roughened peripheral surface rotatable longitudinally of the strip and bearing against the face thereof opposite the first mentioned face, and means for producing relative movement of said rotatable member and strip longitudinally of the strip with the strip positioned between said member and the supporting member, said member acting to laterally deflect and free the threads locally adjacent said edge of the strip to fray the edge thereof while retaining the woven condition of the threads inwardly from said frayed portion.

8. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising a pair of members adapted to bear against opposite faces of the strip adjacent said edge, one of said members comprising a rotatable circular mass of radial fibers, and means for producing relative movement of said members and strip longitudinally of the strip with the strip positioned between said members, said fibers acting to laterally deflect and free the threads adjacent said edge of the strip to fray said edge thereof while retaining the woven condition of the threads inwardly from the frayed portion.

9. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising a pair of rotatable wheels adapted to bear peripherally against opposite faces of the strip adjacent said edge, means directing the strip between the wheel peripheries, and means for rotatably driving one of the wheels to advance the strip between them, one of said wheels having a rough surface acting locally against the strip adjacent said edge to laterally deflect and free the threads adjacent said edge of the strip to fray the edge thereof while retaining the woven condition of the threads inwardly from the frayed portion.

10. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads,
comprising a pair of rotatable wheels adapted to bear peripherally against opposite faces of the strip adjacent said edge, means directing the strip between them, the higher peripheral speed wheel having a rough surface acting to laterally deflect and free the threads adjacent said edge of the strip to fray the edge thereof.

11. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising a pair of rotatable wheels adapted to bear peripherally against opposite faces of the strip adjacent said edge, each of said wheels comprising a compact mass of radial fibers, means directing the strip between the wheel peripheries, and means for rotatably driving one of the wheels to advance the strip between them, the fibers of one of said wheels acting to laterally deflect and free the threads adjacent said edge of the strip to fray the edge thereof.

12. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising a pair of rotatable wheels adapted to bear peripherally against opposite faces of the strip adjacent said edge, means directing the strip between them, and bristles carried by one of said wheels and presenting a rough surface acting to laterally deflect and free the threads adjacent said edge of the strip to fray the edge thereof, said wheels engaging the strip adjacent and along its edge portion being frayed and acting to ruffle the strip adjacent its frayed edge.

13. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising a pair of rotatable wheels adapted to bear peripherally against opposite faces of the strip adjacent said edge, one of said wheels having a peripheral tapered strip engaging surface opposite a complementary tapered peripheral surface of the other wheel, means directing the strip between said surfaces of the wheels, and means producing rotation of the wheels at differential peripheral speeds to advance the strip between them, one of the wheels carrying a mass of bristles acting to laterally deflect and free the threads adjacent said edge of the strip to fray the edge thereof and acting also to ruffle the strip along and adjacent to its frayed edge.

14. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising a pair of rotatable wheels adapted to bear peripherally against opposite faces of the strip adjacent said edge, one of said wheels having a peripheral tapered strip engaging surface opposite a complementary tapered peripheral surface of the other wheel, means directing the strip between said surfaces of the wheels, and means producing rotation of the wheels at differential peripheral speeds during advancement advance the strip between them, said wheels each comprising a compact mass of radial fibers and the fibers of one of the wheels acting to laterally deflect and free the threads adjacent said edge of the strip to fray the edge thereof and acting also to ruffle the strip along and adjacent its frayed edge.

15. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising a pair of rotatable wheels adapted to bear peripherally against opposite faces of the strip adjacent said edge, one of said wheels having a peripheral tapered strip engaging surface opposite a complementary tapered peripheral surface of the other wheel, means directing the strip between said surfaces of the wheels, means producing rotation of the wheels at differential peripheral speeds to advance the strip between them, the higher peripheral speed wheel having a rough surface acting to laterally deflect and free the threads adjacent said edge of the strip to fray the edge thereof and acting also to ruffle the strip along and adjacent its frayed edge.

16. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising a pair of rotatable wheels adapted to bear peripherally against opposite faces of the strip adjacent said edge, means directing the strip between the wheel peripheries, means for rotatably driving one of the wheels to advance the strip between them, one of said wheels having a rough surface acting to laterally deflect and free the threads adjacent said edge of the strip to fray the edge thereof, and a member engaging and pressing the strip against the surface of the other of the wheels.

17. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising a pair of rotatable wheels adapted to bear peripherally against opposite faces of the strip adjacent said edge, means directing the strip between the wheel peripheries, means for rotatably driving one of the wheels to advance the strip between them, one of said wheels having a rough surface acting to laterally deflect and free the threads adjacent said edge of the strip to fray the edge thereof, and an endless movable member engaging and pressing the strip against the surface of the other of the wheels.

18. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising a pair of rotatable wheels adapted to bear peripherally against opposite faces of the strip adjacent said edge, one of said wheels having a peripheral tapered strip engaging surface opposite a complementary tapered peripheral surface of the other wheel, means directing the strip between said surfaces of the wheels, means producing rotation of the wheels at differential peripheral speeds to cause the higher peripheral speed wheel to laterally deflect and free the threads adjacent said edge of the strip to fray the edge thereof and acting along any peripheral speed wheel acting to laterally deflect and free the threads adjacent its frayed edge, and an endless belt engaging and pressing the strip against and within a recess in the peripheral surface of the other peripheral wheel.

19. Apparatus for fraying the edge of a woven fabric strip having oppositely biased threads, comprising a pair of rotatable wheels adapted to bear peripherally against opposite faces of the strip adjacent said edge, one of said wheels having a peripheral tapered strip engaging surface opposite a complementary tapered peripheral surface of the other wheel, means directing the strip between said surfaces of the wheels, means producing rotation of the wheels at differential peripheral speeds to cause the higher peripheral speed wheel to laterally deflect and free the threads adjacent said edge of the strip to fray the edge thereof and acting along any peripheral speed wheel acting to laterally deflect and free the threads adjacent its frayed edge, and an endless belt engaging and pressing the strip against and within a recess in the peripheral surface of the other peripheral wheel.
opposite a complementary tapered peripheral surface of the other wheel, means directing the strip between said surfaces of the wheels, means producing rotation of the wheels at differential peripheral speeds during advancement of the strip between them, said wheels each comprising a compact mass of radial fibers and the higher peripheral speed wheel fibers acting to laterally deflect and free the threads adjacent said edge of the strip to fray the edge thereof and acting also to ruffle the strip along and adjacent its frayed edge, and an endless belt engaging and pressing the strip against and within a recess in the peripheral surface of the lower peripheral speed.

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