May 23, 1950 W. H. BROWNE ET AL 2,508,489

CRIMPING MACHINE

Filed Oct. 25, 1945 2 Sheets-Sheet 1

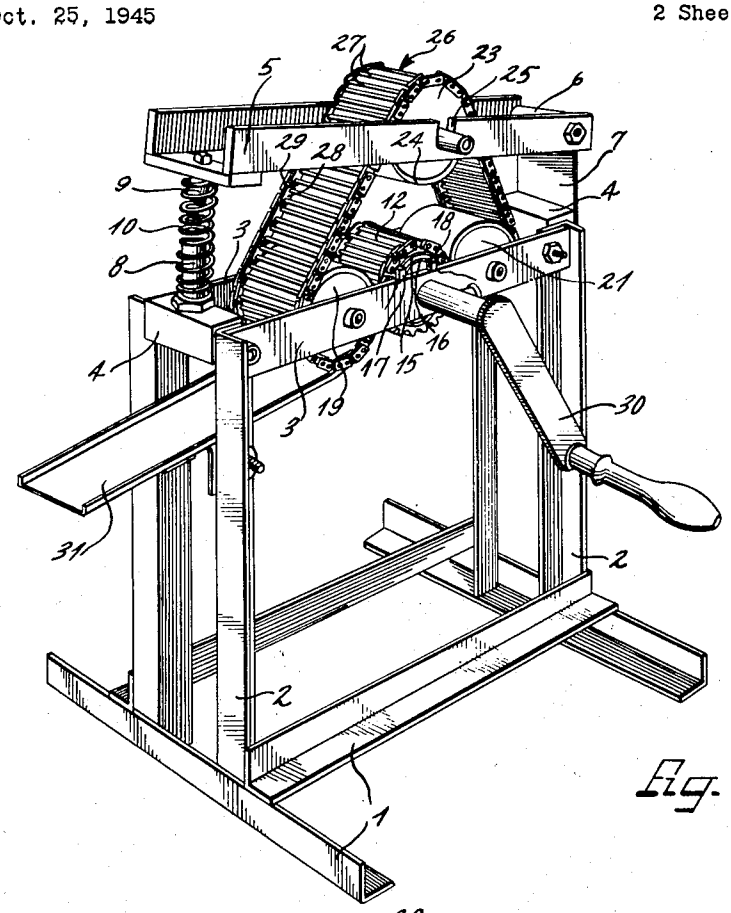


Fig. 1

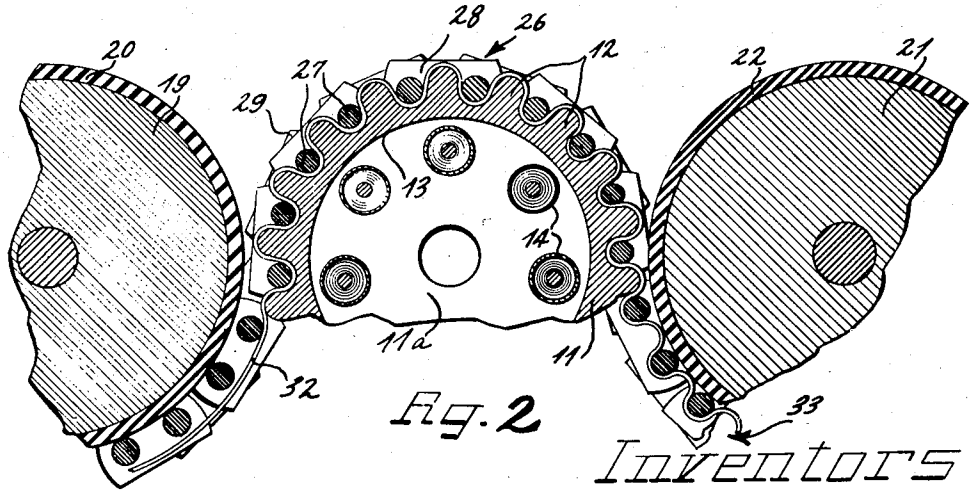


Fig. 2

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Fig. 3

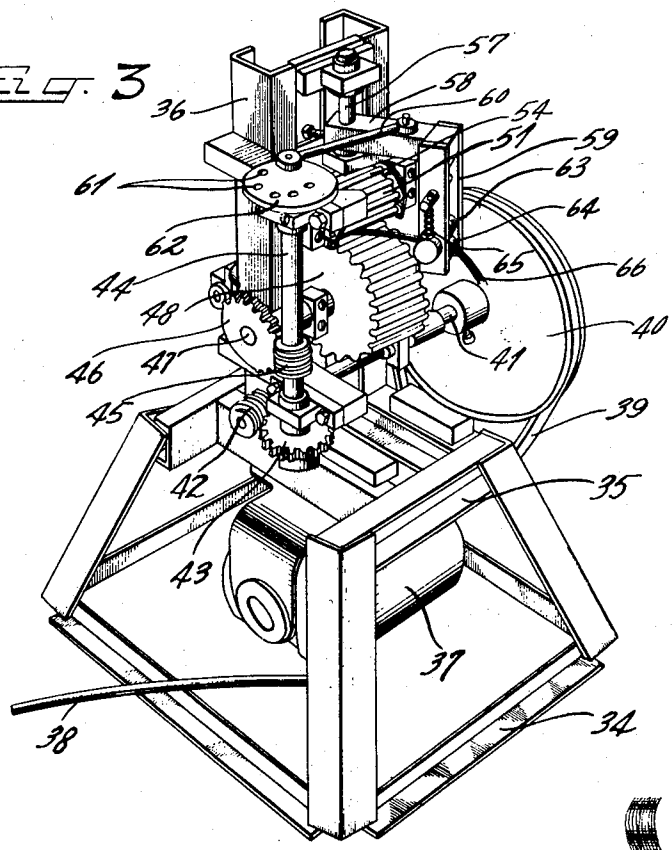


Fig. 4

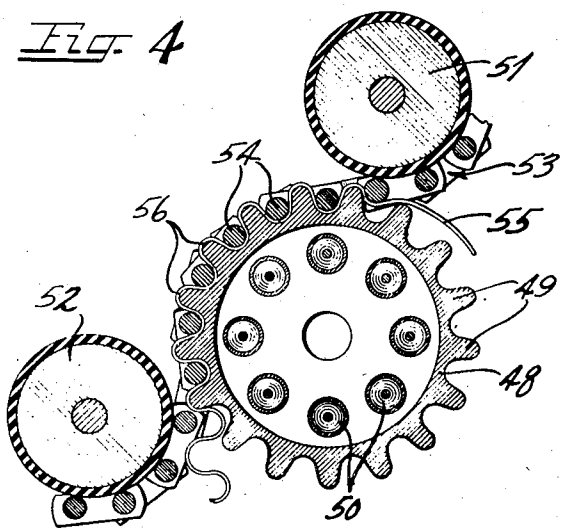


Fig. 6

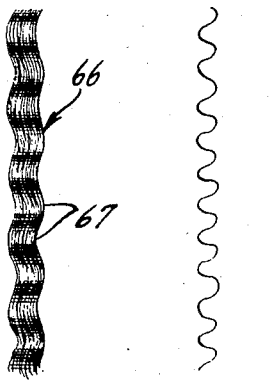


Fig. 5

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UNITED STATES PATENT OFFICE

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CRIMPING MACHINE

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9 Claims. (Cl. 19—66)

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This invention relates to improvements in a crimping machine, and more particularly to a crimping machine highly desirable for crimping fibrous material such as vegetable fiber and the like, lengthwise of the strands, although the invention may be used for crimping metallic or plastic strands, as will be apparent to one skilled in the art.

In the past, many and various types of crimping machines for crimping or waving various substances have been developed, but insofar as we are aware, these formerly known machines were not as efficient or desirable in connection with the crimping of numerous strands of material simultaneously, and especially when the strands were of vegetable fiber. Further, although crimping machines heretofore known might place a crimp in an article such as a metallic strand, they would not efficiently crimp a flat mat embodying numerous individual strands, and in connection with vegetable fibers or plastic strands, these formerly known machines would not simultaneously heat treat the strands so as to set the crimp. In addition, these formerly known crimping machines, insofar as we are aware, were not capable of providing a double wave or double crimp, especially in a bundle or mat of strands, so as to provide both an up and down or vertical wave in the strands as well as a lateral wave.

With the foregoing in mind, it is an object of the instant invention to provide a crimping machine which both forms and sets the crimps in fibers or strands.

Another object of the invention is the provision of a crimping machine arranged for continuous operation, especially with a substantially endless flat mat containing numerous individual strands.

A further object of the invention is the provision of a crimping machine arranged to automatically compensate for various thicknesses of material going through the machine, and thus avoid jamming or any injury to the machine by virtue of sudden changes in thickness.

Still a further feature of the instant invention resides in the provision of a crimping machine arranged to heat treat articles passing through the machine to set the crimp at substantially the same time as the crimp is made in the material.

Also an object of the invention is the provision of a crimping machine using an endless belt arrangement as an active crimping element, and which arrangement, is so constructed

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as to be self-guiding so as to automatically maintain its alignment.

Still another object of the instant invention is the provision of a crimping machine capable of handling bundles or mats of wet fibers, and simultaneously crimping and drying the wet fibers, thus taking advantage of steam to aid in the setting of the crimps in the fibers in the event water is at least a part of the medium with which the fibers were wetted.

It is also an object of this invention to provide a crimping machine capable of handling bundles or mats of strands, as well as individual strands if so desired, and in a single operation provide both a vertical and lateral crimp or wave in the strands.

Still another feature of the instant invention resides in the provision of a crimping machine capable of simultaneously providing even and uniform double crimping of a strand or bundle of strands.

It is also an object of this invention to provide a crimping machine capable of handling fiber or other types of strands, either singly or in bundles or mats, and automatically maintaining an adequate tension upon the strands during the crimping operation.

A further object of the instant invention is the provision of a crimping machine which is simple in construction, highly durable, rapid in operation, and economical both to build and operate.

While some of the more salient features, characteristics and advantages of the instant invention have been above pointed out, others will become apparent from the following disclosures, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a view in projection of a crimping machine embodying principles of the instant invention;

Figure 2 is an enlarged fragmentary vertical sectional view, somewhat diagrammatic in character, taken in the upper central portion of Figure 1 through the crimping wheel and adjacent idler rolls;

Figure 3 is an isometric view of another form of crimping machine embodying principles of the instant invention, this form of the machine being capable of providing a double wave or crimp in the strands or other material passing through the machine;

Figure 4 is an enlarged fragmentary vertical sectional view, somewhat diagrammatic in character, and similar in character to the showing of

Figure 2, illustrating the arrangement of the crimping roll and idler rolls in the structure of Figure 3;

Figure 5 is a fragmentary plan view of a bundle of strands illustrating the double wave or crimp in the strands after they have passed through the structure of Figure 3; and

Figure 6 is a fragmentary side elevational view of a single strand taken from the bundle of Figure 5.

As shown on the drawings:

The first illustrated embodiment of the instant invention includes a fabricated frame structure embodying a base arrangement 1, a series of uprights 2, a pair of spaced top rails 3—3 and end members 4—4. A superstructure is also provided in the nature of a sub-frame 5 one end of which is pivoted as indicated at 6 to a bracket 7 connected to one of the end members 4. Mounted on the opposite end member 4 is a stud 8 and a similar stud 9 depends from the adjacent end of the sub-frame 5. Engaged around both studs 8 and 9 is a coiled spring 10 which constantly urges the free end of the sub-frame upwardly.

Journaled substantially centrally of the structure in the top rails 3—3 is a wheel 11 having equally spaced rounded teeth 12 extending thereacross. Thus, the wheel 11 is substantially a relatively wide gear or sprocket wheel. The interior of the wheel is hollow, as indicated at 13, although the hollow is closed at the ends of the wheels by plates 11*a*. Inside the hollow 13 is a plurality of heating elements, and in the illustrated instant these heating elements 14 are electrical heating elements of the resistance type. The heating elements are disposed as closely to the circumscribing solid portion of the wheel as possible so that the heat is transmitted to the outside of the wheel. The heating elements are connected in a known manner to a pair of contact rings 15 and 16 carried by one of the end plates 11*a*. The circuit is established with the contact ring 15 by means of a brush 17 which may be feasibly mounted upon the adjacent side rail 3 of the frame construction, and in similar manner the contact ring 16 is engaged by a brush 18. It will be understood that suitable insulation is used where necessary to prevent the heating circuit being grounded. Suitable conductors, as indicated diagrammatically in Figure 1 may extend from the respective brushes 17 and 18 to a convenient source of electrical energy.

Journaled between the top rails 3—3 on one side of the wheel 11 is an idler roll 19 preferably provided with a friction establishing cover 20, rubber being a satisfactory material. Another idler roll 21 is similarly journaled on the opposite side of the wheel 11, and this other roll is likewise covered as indicated at 22. A third idler roll 23 also having a friction establishing cover 24 is journaled in notches 25 in the superstructure or sub-frame 5 as seen clearly in Figure 1, so that this upper roll is readily removable. Preferably, the upper roll 23 is positioned almost directly above the crimping wheel 11.

Trained over the idler rolls and crimping wheels is an endless chain crimping element generally indicated by numeral 26. This endless chain element is made up of a series of cross rods 27 spaced apart in keeping with the pitch of the teeth 12 on the wheel 11, and of such diameter as to seat well within the grooves between adjacent teeth. At the sides thereof the chain crimping element includes a series of inside links 28 each of which is pivotally connected to a pair

of rods 27. Similar outside links 29 are also provided and each of these links is pivotally connected to the ends of rods 27, over the space between the links 28; that is, a link 29 connects with a rod at one end of a link 28 and with the rod at the adjacent end of another link 28.

As clearly evident from the showing in the drawings, the links 28 and 29 are of sufficient breadth to extend beyond the rods 27 and overlie the end faces of the idler rolls and crimping wheel so that the endless chain arrangement is in effect self-aligning, in that by its own construction it is prevented from slipping axially along any of the rolls or the crimping wheel.

The crimping wheel 11, acting as a sprocket wheel, drives the endless chain crimping element 26, and any suitable means either for manual operation or power operation of the machine may be provided. In the illustrated instance, the drive means are in the form of a handle 30 connected with the shaft of the crimping wheel 11. In order to feed material to be crimped to the proper location between the endless chain 26 and the crimping wheel 11, a suitable feed trough or chute 31 may be provided, and preferably this trough is substantially the width of the respective rolls and crimping wheel. The crimped material exits from the machine near the low point of the idler roll 21, such material then being on the outside of the endless chain, and any suitable means for gathering the crimped material may be provided.

In operation, a substantially flat mat of fibers or strands may be fed along the trough 31, and the fibrous mat will pass underneath the endless chain 26 as the chain turns around the underside of the idler roll 19, and then enters between the chain and the crimping wheel 11 indicated by the diagrammatic strand showing 32 in Figure 2. As the fibers or strands pass over substantially the upper half of the crimping wheel, they are effectively crimped as clearly seen in Figure 2 in substantially even waves throughout their length. While being crimped and while held tightly in crimped position, the strands are subjected to heat from the crimping wheel so that the crimps are set in the strands or fibers. It will be understood that if only a relative few fibers or a single fiber is desired to be crimped, the process is the same as for a mat of fibers or strands. The material being crimped becomes free to exit from the machine substantially at the point 33 in Figure 2, and, as stated above, any suitable gathering means may be employed.

In the event vegetable fibers are used, and in many cases such as the preparation of filter means for automotive air cleaners, such fibers will be moist at the time of the crimping operation by virtue of the application of a fireproofing compound, and when moist, in the event the heat of the crimping wheel 11 is high enough, the crimps may be steamed into the fibers.

During the operation of the machine it will be noted that the endless chain 26 will not become out of alignment but will faithfully retain its proper position in association with the idler rolls and crimping wheel. The coverings on the idler rolls aid in providing frictional contact for the chain to enhance the driving of the chain by the crimping wheel. Further, it will be especially noted that variances in thickness of the material being crimped will be automatically compensated for by the spring 10 so that no undue strain by virtue of suddenly increased thicknesses is placed upon the machine. In addition, in normal

operation with even thicknesses of material being crimped the crimping chain 26 is always held or maintained taut by virtue of the spring 18 acting against the superstructure or sub-frame 5. It is apparent that we have provided a machine not only possessing all of these advantages, but a machine that possesses the virtue of simplicity, is highly efficient, very durable, and economical to manufacture and use.

In many cases, especially in the provision of vegetable fiber filter elements for automotive air cleaners, it is desirable to augment the efficiency of the resultant filter element by providing an additional tortuous contour to the strands going to make up that element. Consequently, it many times may be desirable to double crimp or double wave the strands. In the present instance, such a double wave, which includes both a vertical undulation and a lateral undulation, may be provided in a single operation in that embodiment of our invention illustrated in Figures 3 and 4 of the drawings.

This illustrated embodiment includes a frame assembly embodying a base portion 34 upon which a fabricated platform portion 35 may be provided, from which a fabricated superstructure 36 extends from the rear of the machine. It will be understood that this frame structure embodies suitable bearing means in a well known manner to accommodate all shaft journals.

A prime mover 37 which may be in the form of an electric motor energized by way of a cable 38 leading to any suitable source of current, may be mounted in the lower portion of the frame structure. The shaft of this prime mover may carry a pulley (not shown in the drawings), from which a belt 39 may extend over a drive pulley 40 carried on the end of a shaft 41. The opposite end of the shaft 41 carries a worm 42 in mesh with the gear 43 on the lower end of an upright shaft 44. This upright shaft 44 also carries a worm 45 in mesh with the gear 46 on the end of a shaft 47 which carries in intermediate portion a crimping wheel 48 provided with transverse crimping teeth 49 and suitable heating elements 50 in the interior, the same as the crimping wheel 11 above described.

As seen best in Figure 4, a pair of spaced idler rolls 51 and 52 are associated with the crimping wheel 48. These idler rolls are preferably surfaced with a friction establishing cover the same as the rolls 19 and 21 previously described in connection with the showing in Figures 1 and 2. Also as previously described, an endless chain 53 having cross bars 54 spaced to seat between the teeth 49 of the crimping wheel 48 is trained over the idler rolls 51 and 52 and a portion of the crimping wheel. These parts function in the manner previously described to provide a vertical substantially sine wave crimp in a strand 55 of material, as indicated at 56 in Figure 4.

Mechanism is added to the structure of Figures 3 and 4, however, to provide a lateral wave in a strand or bundle of strands in addition to the vertical wave 56, and provide that lateral wave at the same time that the vertical wave is provided so that the resultant strand is double waved or double crimped simultaneously. This mechanism includes a vertical shaft 57 journaled in a part of the superstructure 36, which shaft functions as a pivot for a sub-frame structure including both a horizontal supporting arm 58 and a fabricated vertical portion 59 having spaced side rails. The sub-frame is pivoted back and forth about the shaft 57 in an oscillatory manner

by means of a pitman 60 pivotally connected at one end to the arm 58 and selectively connected at the other end through any one of a somewhat spiral row of apertures 61 in a plate or disk 62 carried on the upper end of the aforesaid upright shaft 44. Obviously, the sweep of the sub-frame may be varied as desired depending upon which of the apertures 61 is selected for connection with the end of the pitman 60.

The vertical portion 59 of the sub-frame carries a pair of idler rolls 63 and 64 which function in the manner of the commonly known wringer rolls attached to washing machines. The upper roll 63 may be resiliently pressed down against the lower roll 64 by means of suitable springs 65 or in an equivalent manner. Thus, these rolls effectively and firmly grip a bundle or mat 66 of strands as they pass through the machine.

If, as is desired in the manufacture of filter elements for automotive air cleaners, this bundle of strands has first been passed through a wet fireproofing solution, the rolls 63 and 64 will tend to wring out some of the excess moisture carried by the bundle of strands. It will also be noted that these rolls maintain a tension upon the bundle of strands as it passes through the machine, that portion of the bundle between the rolls and the point of engagement between the cross bars of the chain 53 and the crimping wheel 48 will be under tension at all times during the travel of the bundle or mat.

Preferably, the pivot shaft 57 is located directly above the initial point of positive engagement between a cross bar 54 of the chain 53 and a tooth of the crimping wheel 48, which point of engagement will be substantially beneath the upper idler roll 51. Thus, it will be noted that the strand bundle is pivoted sidewise about that point of engagement as a center.

In use, it will be seen that as the bundle 66 is fed through the machine, it is provided with a vertical wave or crimp as previously described, and as the carriage or sub-frame is swung or oscillated back and forth by the pitman 60, the bundle is successively engaged by the crimping roll and the chain at different points along the lateral face of the roll. This alternate deviation from one side to the other of the bundle produces a lateral wave in the bundle of strands as indicated at 67 in Figure 5. This lateral wave is interspersed or interdigitated in the vertical wave. Provided the shaft 44 is driven in proper synchronism with the crimping wheel 48, there will be one lateral wave for each vertical wave, but alternate lateral waves will be in the opposite direction. Preferably, the lateral waves are kept within the confines of the vertical waves, so that if a strand is separated from the bundle and looked at from the right or left-hand side of the showing in Figure 5, the strand will appear as seen in Figure 6 with merely a single undulation visible.

It will be noted that the sizes of the lateral waves may be varied as desired by merely connecting the end of the pitman 60 to a selected one of the holes 61 in the plate 62. By connecting the pitman to a hole nearer the center of the plate, the lateral waves may be descreased in size, and vice versa. Thus, there is means provided for simultaneously producing both a vertical wave and a lateral wave, the latter being of a predetermined or desired amplitude.

It will be apparent that the machine illustrated in Figures 3 and 4 not only provides both crimps in a single operation, but also maintains the bundle under a desired tension during the crimp-

ing operation, as well as wringing out excess moisture from the bundle. This modification of the invention possesses all the advantages of the previously described modification, including simplicity, efficiency, durability, and economy.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

We claim as our invention:

1. In a crimping machine, a frame, a toothed wheel journaled in said frame, an idler roll on each side of said wheel, an endless crimping chain including transversely extending rods spaced in accordance with the pitch of the teeth on said wheel, said crimping chain passing sinuously over said idler rolls and said wheel, a superstructure pivoted to said frame, an idler roll carried by said superstructure and over which said crimping chain is also trained, resilient means urging said superstructure upwardly away from said wheel to yieldably maintain said chain taut, feed means to guide material to be crimped between said chain and said wheel, and means to drive said wheel.

2. In a crimping machine capable of crimping wet material, complemental crimping elements between which the material passes, a pivotal carriage in advance of said crimping elements, means on said carriage to grip the work material as it passes toward the crimping elements, and means for swinging said carriage and said gripping means laterally back and forth to cause a lateral wave as well as a vertical wave to be formed in the material.

3. In a crimping machine capable of crimping wet material, complemental crimping elements between which the material passes, a pivotal carriage in advance of said crimping elements, means on said carriage to grip the work material as it passes toward the crimping elements, and means for swinging said carriage and said gripping means laterally back and forth to cause a lateral wave as well as a vertical wave to be formed in the material, said carriage pivoting about a center in alignment with the point of contact between the crimping elements to oscillate the material about that point as a center.

4. In a crimping machine, complemental elements arranged to apply a vertically undulating crimp in an elongated strand of material, means to oscillate the strand back and forth as it enters between said elements to cause lateral undulations to be formed in the strand, and means to gauge the amplitude of the lateral undulations.

5. In a crimping machine, complemental elements arranged to crimp material passing therebetween, holding means to maintain the material under tension as it enters between said elements, and means to oscillate said holding means transversely to provide lateral waves in the material.

6. In a crimping machine, complemental elements arranged to crimp material passing therebetween, holding means to maintain the material under tension as it enters between said elements, and means to oscillate said holding means transversely to provide lateral waves in the material, and adjustable driving connections for said means to selectively determine the amplitude of the lateral waves.

7. In a crimping machine, complemental members arranged to crimp material passing therebetween in one direction, means to cause said members to crimp material in another direction simultaneously with crimping in the first direction, and control means adjustable to permit a selection between single and double crimping of the material.

8. In a crimping machine, complemental elements positioned adjacent each other to crimp material passing therebetween, and provide vertical undulations in the material, and transversely oscillatable means in advance of said elements to engage the material and shift it laterally to cause said elements to provide lateral undulations in the material.

9. In a crimping machine, complemental elements positioned adjacent each other to crimp material passing therebetween, and provide vertical undulations in the material, and transversely oscillatable means in advance of said elements to engage the material and shift it laterally to cause said elements to provide lateral undulations in the material, said oscillatable means being positioned to swing the material laterally about the point of contact between said elements as a center.

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