Sept. 26, 1939. C. D. MILLER 2,173,852

MACHINE FOR MAKING CORRUGATED PAPER

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Fig. 1.

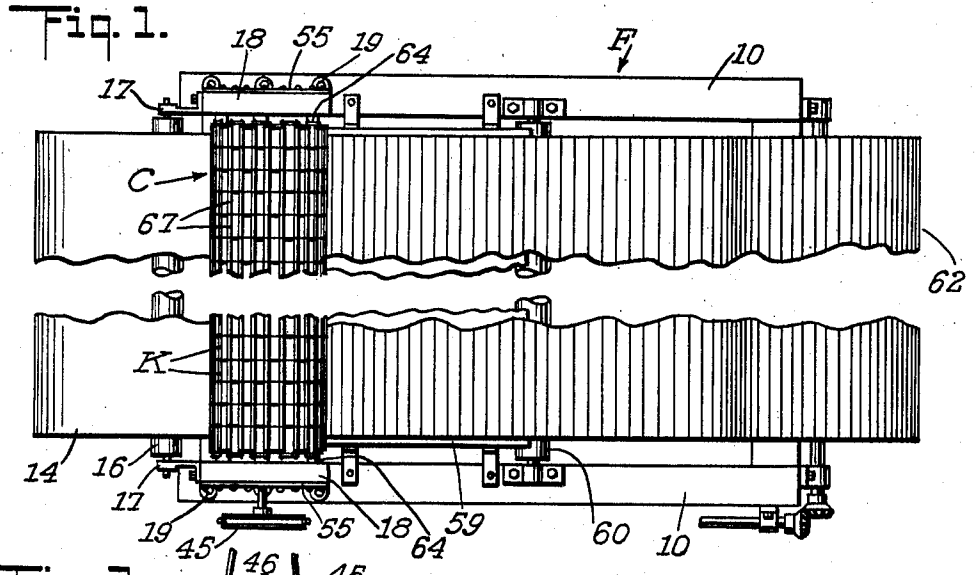
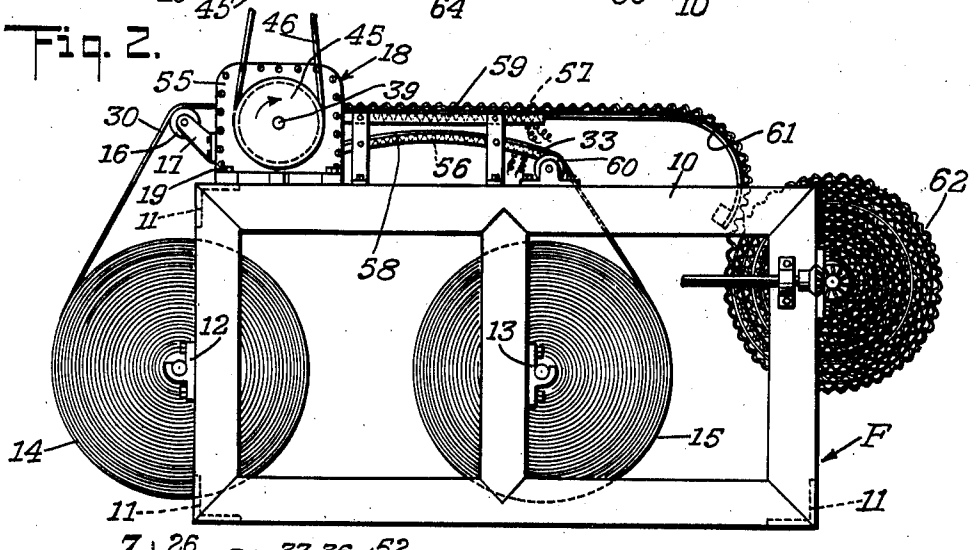


Fig. 2.



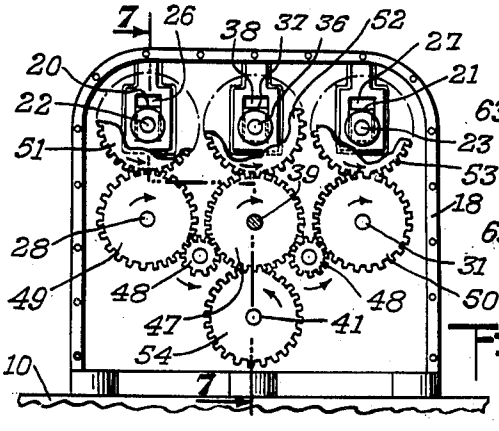


Fig. 3.

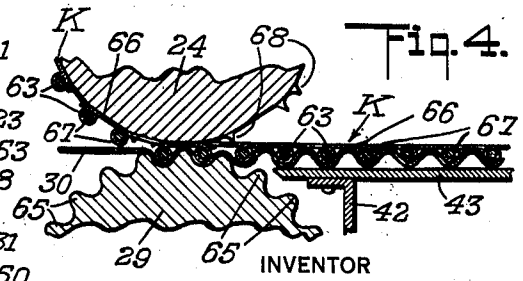


Fig. 4.

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Fig. 5.

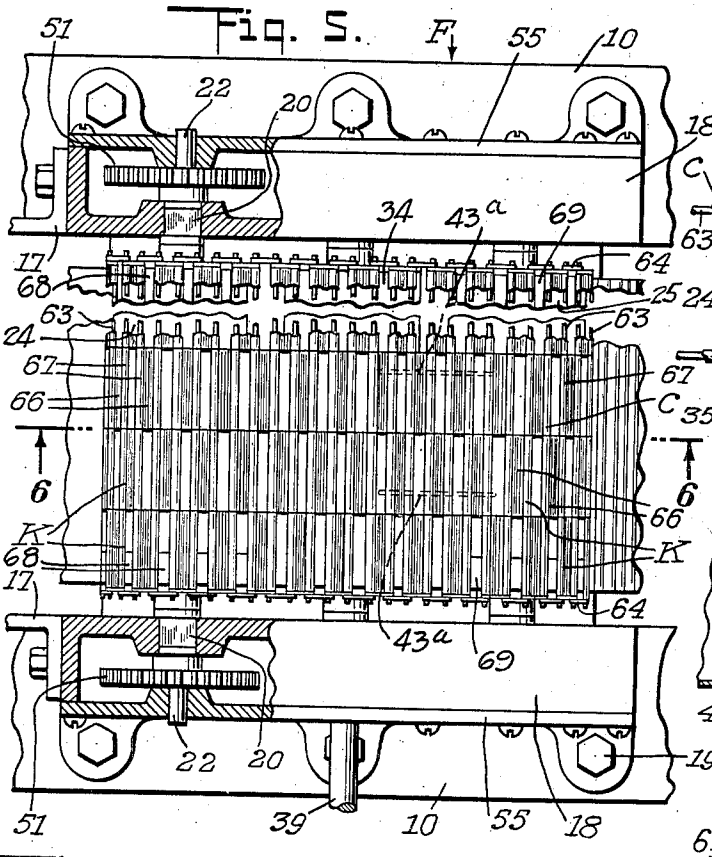


Fig. 7.

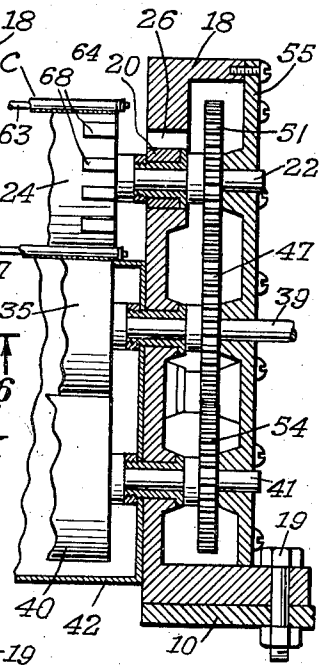


Fig. 6.

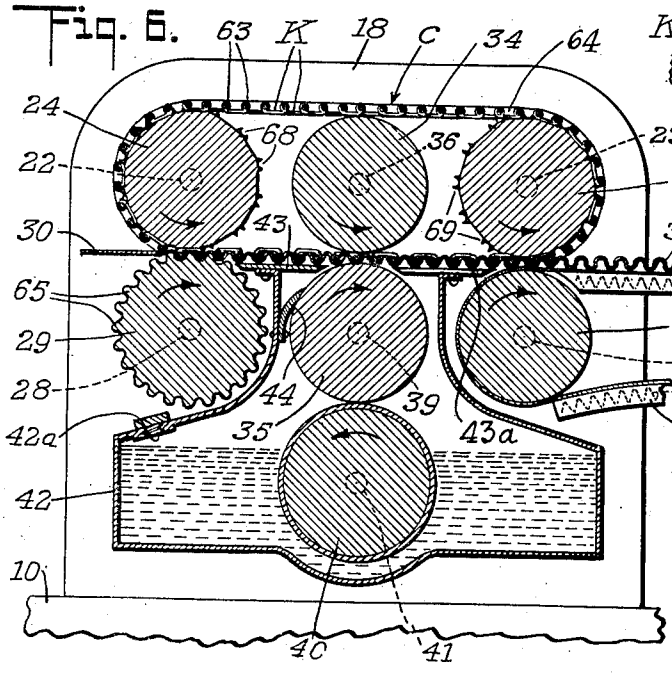
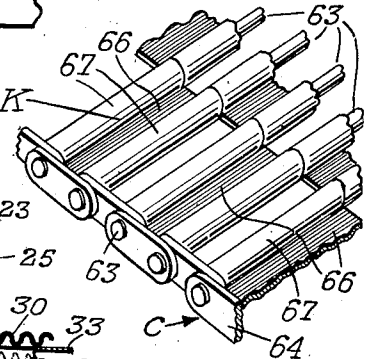


Fig. 8.



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2,173,852

MACHINE FOR MAKING CORRUGATED PAPER

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Application March 10, 1937, Serial No. 129,995

13 Claims. (Cl. 154—31)

This invention relates to the art of manufacturing corrugated paper in a continuous operation.

An object of the invention is to provide a machine for making corrugated paper, which is structurally and functionally characterized to obviate the necessity for using steam, water or other agent to soften the paper stock, thereby eliminating all extraneous apparatus otherwise necessary when a stock softening process is employed; to form the corrugations in a dry sheet while effectively supporting the corrugations against deformation during the application of an adhesive to the corrugations and the subsequent application of a liner or facing sheet thereto; and to heat the liner prior and subsequent to its application to the adhesive bearing corrugations in order to materially accelerate the drying of the adhesive without affecting the efficiency thereof in permanently securing the sheets together, with the result of greatly increasing the output of the machine.

Another object of the invention is to provide a corrugated paper making machine of the above described character which is of compact construction requiring but a small area of floor space in comparison to that required for machines of similar capacity as at present constructed; which is of much less weight as compared to machines now in use, to the end of obtaining a very considerable saving in power and operating costs; and which facilitates assembly and disassembly so as to permit profitable shipment of a machine and paper stock to various market centers rather than to ship from a central manufacturing point to such market centers the completed product which is extremely bulky in proportion to its weight.

A further object of the invention is to provide a corrugating mechanism including a corrugating roll with which an endless corrugating web co-acts to form the corrugations in the paper stock, and is constructed in a novel manner obviating any flexural stresses on the corrugating elements composing the web, which elements are so interconnected as to effectively prevent misalignment of the elements and "whipping" of the web when in motion, all to the end of greatly prolonging the useful life of the web by reducing fatiguing stresses thereon to a negligible minimum.

With these and other objects in view, the invention consists in the combinations, arrangements and functional relationships of elements as set forth in the following specification and particularly pointed out in the appended claims.

In the accompanying drawings,

Figure 1 is a plan view of the machine with a portion of the width of the machine broken away;

Figure 2 is a view of the machine in side elevation;

Figure 3 is an enlarged view in side elevation partly broken away, and illustrating the driving mechanism for the corrugating mechanism embodied in the invention;

Figure 4 is an enlarged fragmentary sectional view of a portion of the corrugating mechanism;

Figure 5 is an enlarged fragmentary view of the corrugating mechanism in plan and partly in horizontal section;

Figure 6 is a vertical longitudinal sectional view taken on the line 6—6 of Figure 5;

Figure 7 is a vertical transverse sectional view taken on the line 7—7 of Figure 3;

Figure 8 is a fragmentary perspective view showing a portion of the corrugating web embodied in the corrugating mechanism.

Referring specifically to the drawings, the invention comprises a generally rectangular frame F including longitudinal side members 10—10 and suitably arranged transverse members 11 rigidly connecting the side members together in spaced parallelism. Bearings 12 and 13 are provided on the side members 10 to removably receive and rotatably mount rolls 14 and 15 of paper between the members 10, as shown in Figure 2.

Paper from the roll 14 is trained about an idler roll 16 journaled in bearings 17—17 fixed to identical housings 18—18 secured by bolts 19 on the side members 10 at one end of the frame F.

Journaled respectively in guide blocks 20 and 21 are trunnions 22 and 23 of rolls 24 and 25 about which is trained an endless corrugating web designated generally at C, the guide blocks being freely movable in guides 26 and 27, (Figure 3), in the housings 18, to the end that the rolls and web will be yieldingly urged downwardly under the action of gravity to a position definitely limited by the bottoms of the guides.

Journaled in the housings 18 by trunnions 28 is a corrugating roll 29 which is disposed directly below the roll 24 for the corrugating of the sheet 30 from the roll of paper 14, by co-action of the web and corrugating roll when the sheet is fed therebetween.

Journaled in the housings 18 by trunnions 31 is a smooth surfaced roll 32 disposed directly below the other web mounting roll 25, and about which the facing or liner sheet 33 from the roll of

paper 15 is trained for application to the sheet 30 following corrugating of the latter and the application of an adhesive thereto.

Intermediate the web mounting rolls 24 and 25 and the rolls 29 and 32 are smooth surfaced rolls 34 and 35, the former of which is disposed between the stretches of the endless corrugating web C and is provided with trunnions 36 journaled in guide blocks 37 freely slidable vertically in guides 38 in the housings 18.

The roll 35 which is directly below the roll 34 and is provided with trunnions 39 journaled in the housings 18, constitutes a doctor roll to which adhesive is supplied from a pick-up roll 40 disposed directly below the roll 34 and provided with trunnions 41 by which it is also journaled in the housings 18.

The roll 40 is immersed in a body of liquid adhesive contained in a suitable tank 42 supported between the housings 18 and having a flat top wall 43 slotted to expose the uppermost portion of the doctor roll 35 and extending in opposite directions to the uppermost portions of the rolls 29 and 32, to the end of providing a platform on which the corrugated sheet 30 rides during travel from the corrugating roll 29 to the roll 32. That portion of the top wall 43 between the doctor roll 35 and the roll 32 is cut away except for a number of widely spaced longitudinally extending narrow strips or ribs 43a which provide sufficient support for the corrugated sheet until the facing sheet 33 is applied thereto, and avoid the wiping off of any appreciable amount of adhesive from the corrugations as applied thereto by the doctor roll.

Liquid adhesive can be supplied to the tank 42 through a filling opening 42a, and excess adhesive is removed from the doctor roll 35 by a scraper 44.

One of the trunnions 39 of the doctor roll 35 is extended from the respective housing 18 and has fixed thereto a drive pulley 45 adapted to be connected by a belt 46 to a suitable source of power (not shown) to rotate the pulley in the direction of the arrow in Figure 2.

Fixed to the trunnions 39 within the respective housings 18 are gears 47 driving idler pinions 48—48 meshing with gears 49 and 50 fixed, respectively, to the trunnions of the rolls 29 and 32. Other gears 51, 52 and 53 fixed to the trunnions of the rolls 24, 34 and 25, respectively, mesh with the gears 49, 47 and 50, whereas the gears 47 also mesh with gears 54 fixed to the trunnions of the pick-up roll 40, to the end that the several rolls will be positively driven at the same lineal speed and in the directions of the respective arrows in Figure 6. The aforestated gears are enclosed in the housings 18 by removable cover plates 55 thereon.

Suitable electrical heating elements 56 and 57 disposed in heating plates 58 and 59 over which the facing sheet 33 rides from an idler roll 60, prior and subsequent to its application to the corrugated sheet 30, are adapted to be supplied with current from a suitable source (not shown). The completed product is supported by an apron 61 and is adapted to be wound into a roll 62, which can be frictionally driven by mechanism not shown and forming no part of the present invention, to take up the completed product in synchronism with the operation of the machine.

The endless corrugating web C is composed of a multiplicity of round rods 63 of uniform external diameter which are co-extensive in length with the mounting rolls 24 and 25 and are pivotally connected at their ends by links 64—64 in spaced parallel relationship corresponding to the pitch of the longitudinally extending corrugating ribs or teeth 65 on the corrugating roll 29.

Identical connectors K in the form of rigid rectangular plates 66 having sleeves 67—67 receiving the rods 63, hingedly connect adjacent rods at intervals along their lengths as shown particularly in Figures 4, 5 and 8. The connectors K are in staggered relationship along the lengths of the rods, and the sleeves of one connector are in end abutting relationship to the sleeves of other connectors so as to have the effect of continuous sleeves on the rods, throughout the length thereof between the links 64, for meshing relationship of the sleeves with the ribs 65 of the corrugating roll 29.

At their opposite ends the rolls 24 and 25 are provided with teeth 68 and 69, respectively, which intermesh with the sleeves 67 of adjacent connectors K along the length of the corrugating web, so that the web will be positively driven at the same lineal speed as the rolls. The length of each of these teeth is less than that of a connector as shown, for example, in Figure 7.

The rolls 24 and 25 are peripherally polygonal between the teeth 68 so as to provide flat bearing surfaces for the plates 66 of the connectors, and it will be noted from Figure 4 that the teeth 68 are recessed or cupped so as not to interfere with the corrugating ribs 65, and that the plates 68 are tangentially related to the peripheries of rods 63 for the same reason.

The operation of the invention is as follows:

With power supplied to the pulley 45, and the sheets 30 and 33 fed into the machine, as shown in Figures 2 and 6, the weight of the corrugated web C and the rolls 24, 25 and 34 is imposed under the action of gravity upon the respective rolls 29, 32 and 35, to the end that the sleeves 67 of the connectors K will co-act with the ribs 65 of the corrugating roll 29 in corrugating the sheet 30, which is then confined by the sleeves and the wall 43 of the tank 42, in corrugated form for the application of adhesive to the tip portions only of the corrugations by the doctor roll 35. The sheet 30 is maintained in its corrugated form by the wall 43 and the sleeves 67 until the facing sheet 33 is applied to the adhesive bearing portions of the sheet 30. It will be appreciated that by dividing the heating of the facing sheets into two applications immediately prior and subsequent to the application of the facing sheet to the corrugated sheet, that maximum speed in drying the adhesive is obtained without destroying its adhesiveness before the facing sheet is applied. As a result, the output of the machine can be materially increased while insuring that the facing sheet will not separate from the corrugated sheet because of inefficient bonding or wet adhesive.

The vertical adjustability of the corrugating web C provides the necessary pressure to insure efficient corrugating, adhesive applying, and facing sheet applying operations at a maximum speed while compensating for variations in the thickness of paper stock, as well as preventing damage to the machine should a foreign body enter between any of the mating rolls.

By the above described specific construction of corrugating web, the wear thereon is reduced to a minimum, and such flexural stresses as would cause "fatigue" are avoided. It will be appreciated that the rigid connectors K hingedly interconnecting all the rods 63 by means of the

sleeve portions 67 of the connectors which produce the effect of continuous sleeves throughout the lengths of the rods, positively prevent deformation of the rods by sufficiently reinforcing them against bending and "whipping" so as to insure that they will be maintained in rectilinear form and in parallelism for accurate corrugating co-action of the sleeves 67 with the ribs 65 of the corrugating roll 29. The connectors rigidly tie adjacent rods in definite spaced relationship corresponding to the pitch of the ribs 65 and yet are free for hinging movements relative to the rods without setting up any injurious stresses. Furthermore, should any connector or rod become defective or in any way unfit for use, the substitution of new parts can be economically effected with ease and dispatch.

It will also be clear that by applying adhesive only to the tip portions of the corrugations of the sheet 30, a considerable saving in adhesive is effected without sacrificing the efficiency with which the sheets are bonded together, as adhesive applied to any other location on the sheets would be wasted.

What is claimed is:

1. In a corrugating machine, a corrugating roll mounted for rotation; an endless corrugating web mounted for movement and co-action with the roll in corrugating sheet stock between the roll and web; said web comprising a multiplicity of rods; and means providing linked connections between the rods; said means including rigid connectors hingedly connecting adjacent rods in parallelism at intervals along the lengths thereof and having corrugating die surfaces concentric with the axes of the rods for corrugating co-action directly with the corrugations of said roll when the machine is in operation.

2. In a corrugating machine, a corrugating roll mounted for rotation; an endless corrugating web mounted for movement and co-action with the roll in corrugating sheet stock between the roll and web; said web comprising a multiplicity of rods; links at the ends of the rods pivotally connecting them in spaced parallelism to provide a predetermined width of web; and plates having sleeves hingedly connecting adjacent rods at intervals along the lengths thereof to maintain the rods in rectilinear form and in parallelism against whipping motion when the web is in operation.

3. In a corrugating machine, a corrugating roll mounted for rotation; an endless corrugating web mounted for movement and co-action with the roll in corrugating sheet stock between the roll and web; said web comprising a multiplicity of rods; links at the ends of the rods pivotally connecting them in spaced parallelism to provide a predetermined width of web; and plates having sleeves hingedly connecting adjacent rods at intervals along the lengths thereof to maintain the rods in rectilinear form and in parallelism against whipping motion when the web is in operation, the plates being in staggered relationship along the lengths of the rods, and the sleeves being co-extensive in length with the plates so that the sleeves of one plate are in end abutting relationship to the sleeves of other plates, whereby to have the effect of continuous sleeves along the lengths of the rods for co-action with the corrugating roll.

4. In a corrugating machine, a corrugating roll mounted for rotation; an endless corrugating web mounted for movement and co-action with the roll in corrugating sheet stock between the roll and web; said web comprising a multiplicity of rods; links at the ends of the rods pivotally connecting them in spaced parallelism to provide a predetermined width of web; and plates having sleeves hingedly connecting adjacent rods at intervals along the lengths thereof to maintain the rods in rectilinear form and in parallelism against whipping motion when the web is in operation, the plates being in staggered relationship along the lengths of the rods, and the sleeves being co-extensive in length with the plates so that the sleeves of one plate are in end abutting relationship to the sleeves of other plates, whereby to have the effect of continuous sleeves along the lengths of the rods for co-action with the corrugating roll, said plates being in tangential relationship to the peripheries of the rods on which the sleeves of the respective plates are mounted so as to permit unrestricted corrugating co-action of the sleeves with the corrugations of said roll.

5. In a corrugating machine, a corrugating roll mounted for rotation; an endless corrugating web mounted for movement and co-action with the roll in corrugating sheet stock between the roll and web; said web comprising a multiplicity of rods; and means providing linked connections between the rods; said means including a multiplicity of rigid connectors having sleeve portions receiving adjacent rods and arranged to interconnect all rods hingedly in spaced parallelism throughout their lengths, the peripheries of said sleeve portions providing corrugating dies intermeshing directly with the corrugations of said roll when the machine is in operation.

6. In a corrugating machine, a corrugating roll mounted for rotation; an endless corrugating web mounted for movement and co-action with the roll in corrugating sheet stock between the roll and web; said web comprising a multiplicity of rods; links at the ends of the rods pivotally connecting them in spaced parallelism to provide a predetermined width of web; and a multiplicity of rigid connectors having sleeve portions receiving adjacent rods with the connectors disposed in staggered relationship along the lengths of the rods, and with the sleeve portions of one connector in end abutting relationship to the sleeves of other connectors, whereby to have the effect of continuous uniform-diametered sleeves along the lengths of the rods adapted for corrugating co-action with said roll.

7. In a corrugating machine, a corrugating roll mounted for rotation; an endless corrugating web; rolls about which the web is trained, for co-action with the corrugating roll in corrugating sheet stock between the latter and web; said web comprising a multiplicity of rods; links pivotally connecting the rods at their ends in spaced parallelism so as to provide a predetermined width of web; flat connector plates having sleeves hingedly connecting adjacent rods at intervals along the lengths thereof to maintain the rods in rectilinear form and in parallelism; the web mounting rolls being polygonal peripherally to define flat surfaces with which said plates have flat bearing contact; and driving connections between the web mounting rolls and the web.

8. In a corrugating machine, a corrugating roll mounted for rotation; an endless corrugating web; rolls about which the web is trained for co-action with the corrugating roll in corrugating sheet stock between the latter and web; said web comprising a multiplicity of rods; links pivotally connecting the rods at their ends in spaced parallelism so as to provide a predetermined width of web; flat connector plates having sleeves hingedly connecting adjacent rods at intervals along

the lengths thereof to maintain the rods in rectilinear form and in parallelism; the web mounting rolls being polygonal peripherally to define flat surfaces with which said plates have flat bearing contact; and teeth on the web mounting rolls co-acting with sleeves of said plates to provide driving connections between the web mounting rolls and the web.

9. In a corrugating machine, an endless corrugating web; rolls about which the web is trained; a corrugating roll below and opposite one of said rolls for co-action with the web in corrugating sheet stock between the web and corrugating roll; rolls intermediate the web mounting rolls and disposed one above the other to co-act in confining one stretch of the web and the corrugated sheet therebetween; means for supplying an adhesive to the lower one of said intermediate rolls to be transferred thereby to the corrugations of the sheet; and a roll co-acting with the other web mounting roll to apply a facing sheet to the adhesive bearing portions of the corrugated sheet.

10. In a corrugating machine, an endless corrugating web comprising a multiplicity of rods; and means providing linked connections between the rods to connect them in parallelism; said means including rigid connectors having corrugation-forming peripheral surfaces concentric with the axes of the rods and adapted to intermesh with corrugations of a mating corrugating element.

11. In a corrugating machine, an endless corrugating web comprising a multiplicity of rods; links pivotally connecting the rods at their ends in parallelism; and rigid connector plates having sleeves hingedly connecting adjacent rods at intervals along the lengths thereof to maintain the rods in rectilinear form and in parallelism throughout their lengths.

12. In a corrugating machine, an endless corrugating web comprising a multiplicity of rods; links pivotally connecting the rods at their ends in parallelism; and rigid connector plates having sleeves hingedly connecting adjacent rods at intervals along the lengths thereof to maintain the rods in rectilinear form and in parallelism throughout their lengths, the plates being in staggered relationship along the lengths of the rods, and the sleeves being co-extensive in length with the plates so that the sleeves of one plate are in end abutting relationship to the sleeves of the other plates, whereby to have the effect of continuous sleeves along the lengths of the rods.

13. In a corrugating machine, an endless corrugating web comprising a multiplicity of rods; links pivotally connecting the rods at their ends in parallelism; and rigid connectors having sleeve portions receiving adjacent rods and arranged to interconnect all rods hingedly between the links in order to maintain the rods in rectilinear form and in parallelism.

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