Jan. 8, 1924. 1,480,236

C. ARELT

PAPER FOLDING MACHINE

Filed June 27, 1922 4 Sheets-Sheet 1

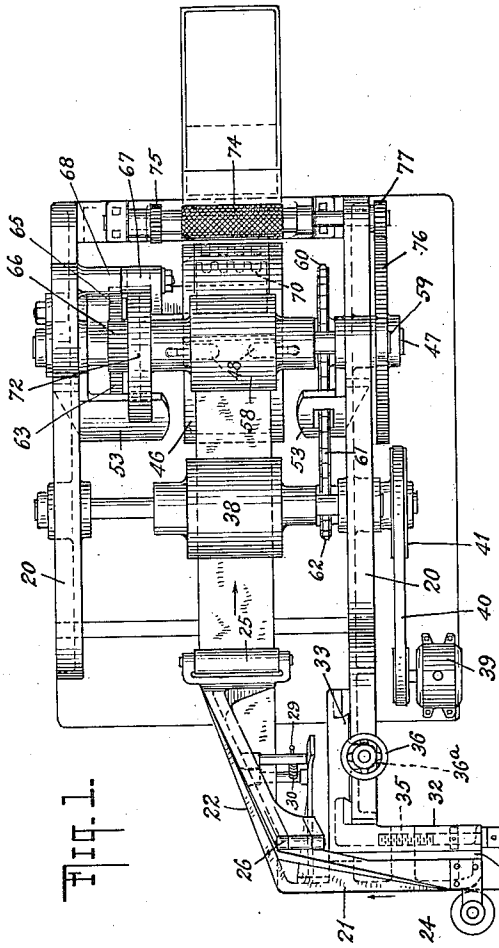


Fig. 1.

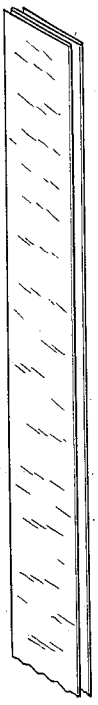


Fig. 14.

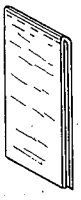


Fig. 15.

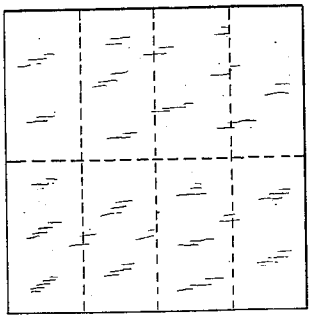
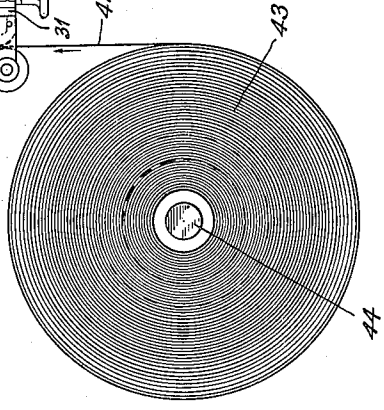


Fig. 16.



WITNESS

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Filed June 27, 1922 4 Sheets-Sheet 2

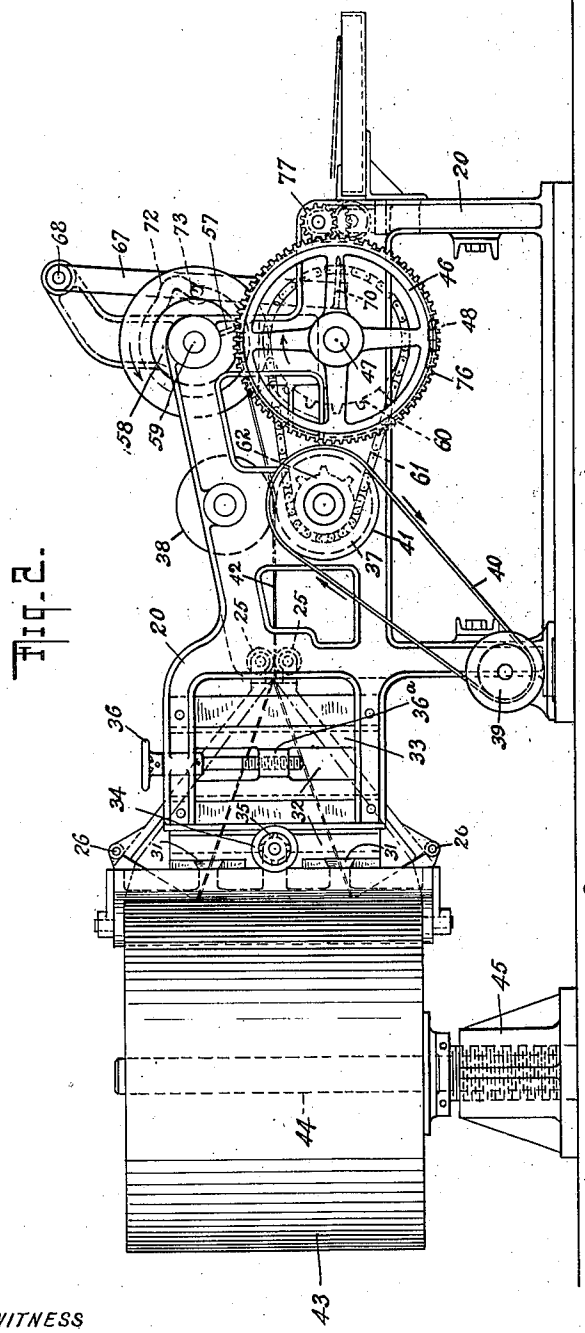


Fig. 2.

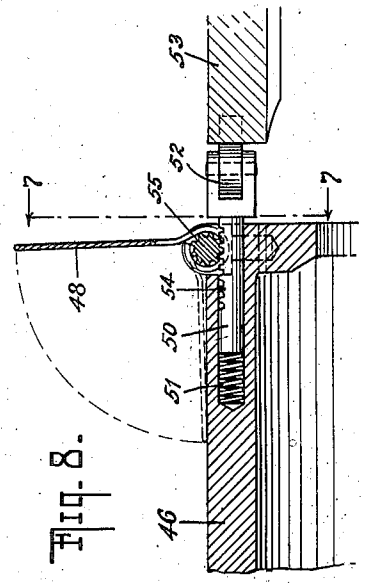


Fig. 8.

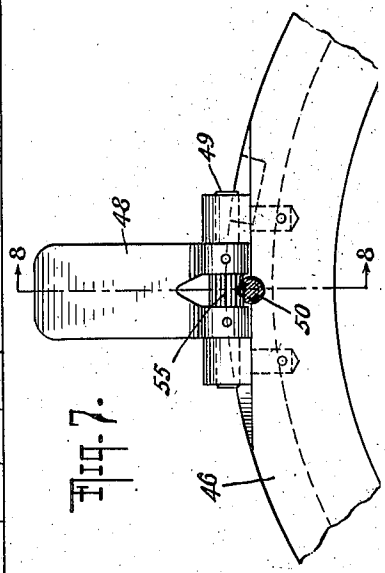


Fig. 7.

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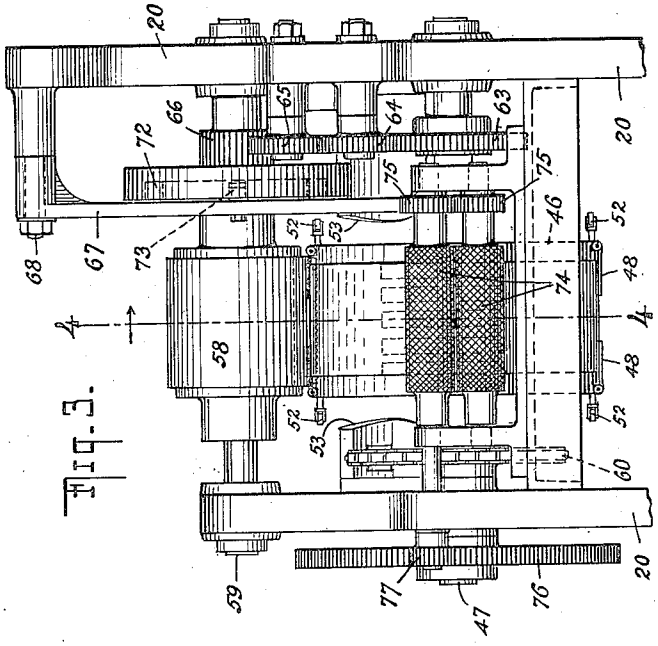


Fig. 3.

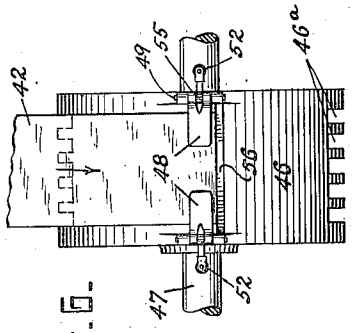


Fig. 6.

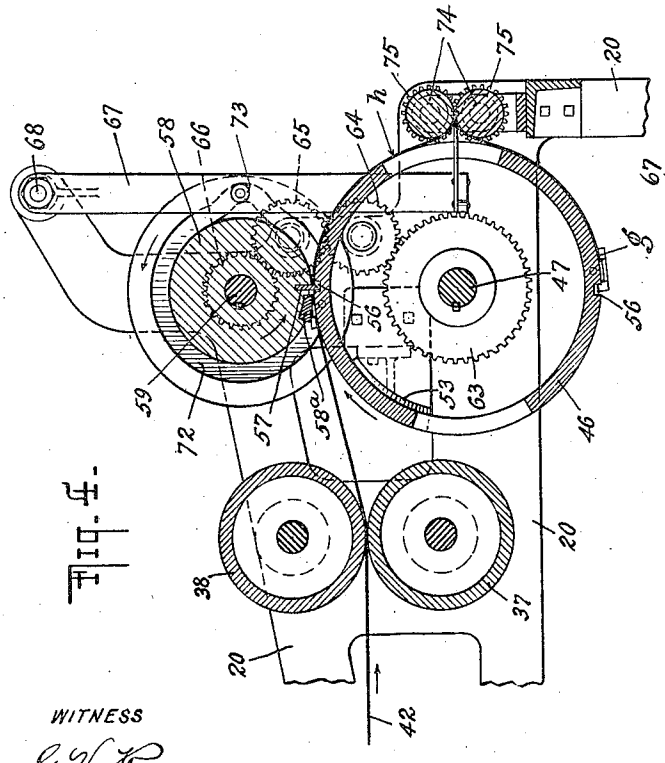


Fig. 4.

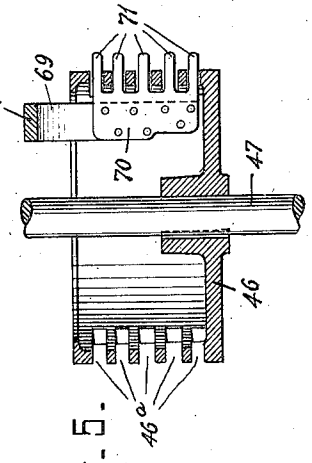


Fig. 5.

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Jan. 8, 1924. 1,480,236

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Filed June 27, 1922 4 Sheets-Sheet 4

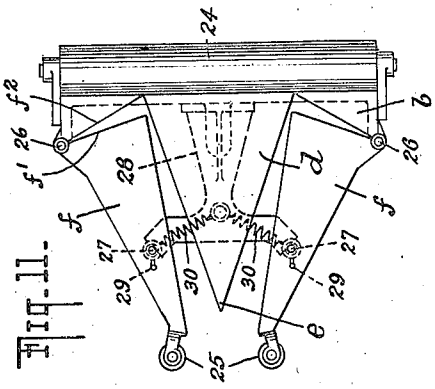


Fig. 11.

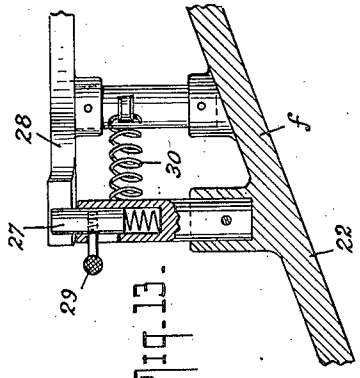


Fig. 13.

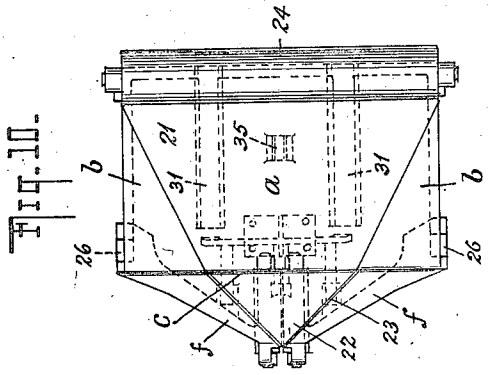


Fig. 10.

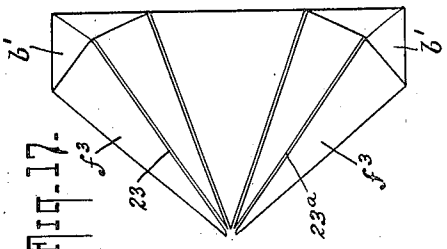


Fig. 17.

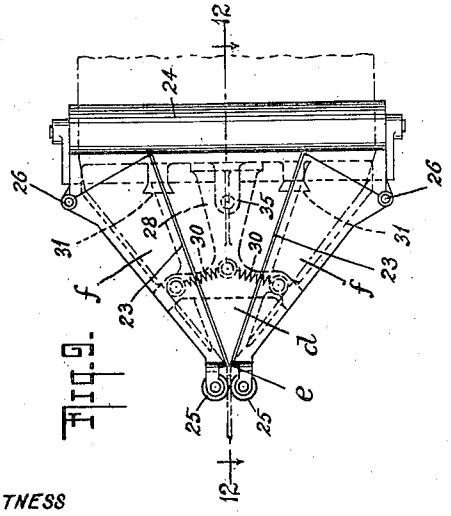


Fig. 9.

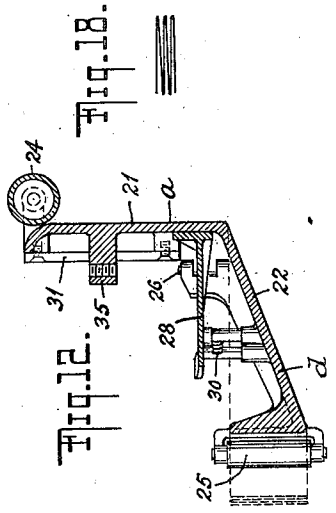


Fig. 12.

Fig. 18.

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Patented Jan. 8, 1924. 1,480,236

UNITED STATES PATENT OFFICE.

CHARLES ARELT, OF BROOKLYN, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO INDEPENDENT PAPER MILLS, INC., OF BROOKLYN, NEW YORK, A CORPORATION OF NEW YORK.

PAPER-FOLDING MACHINE.

Application filed June 27, 1922. Serial No. 571,256.

To all whom it may concern:

Be it known that I, CHARLES ARELT, a citizen of the United States of America, and a resident of the borough of Brooklyn, county of Kings, city and State of New York, have invented certain new and useful Improvements in Paper-Folding Machines, of which the following is a specification.

My invention relates to paper-folding machines, and has for its object to provide a novel and simple mechanism for folding a traveling web of paper in a predetermined manner and which is compact in construction and efficient in operation. A further object of my invention is to construct the machine in a manner to include a cutting mechanism arranged to cut the folded web into sections adapted for specific purposes. My invention further contemplates the provision of a combined paper-folding and cutting machine constructed in a manner adapted particularly for folding and cutting paper, and especially relatively flimsy paper, for instance such as is commonly employed for making paper napkins. Other more specific objects of the invention will appear from the description hereinafter and the features of novelty will be pointed out in the appended claims.

In the accompanying drawings, which illustrate an example of my invention without defining its limits, Figure 1 is a plan view of the machine; Fig. 2 is a side elevation thereof; Fig. 3 is an end view; Fig. 4 is a fragmentary section on the line 4—4 of Fig. 3; Fig. 5 is a detail sectional view of the gripping drum; Fig. 6 is a detail plan view thereof; Fig. 7 is a detail section of the gripping means taken on the line 7—7 of Fig. 8; Fig. 8 is a detail section on the line 8—8 of Fig. 7; Figs. 9, 10, 11, 12 and 13 are detail views illustrating the folding device; Figs. 14 and 15 are perspective views of the paper as folded and cut; Fig. 16 is a view showing the folded product of Fig. 15 in an unfolded condition; Fig. 17 is another form of folding device, and Fig. 18 is a diagrammatic view illustrating the folded product resulting from the use of the device of Fig. 17.

As shown in the illustrated example, the machine comprises a frame or support 20, upon which the folding device is carried. The latter consists of a pair of members 21 and 22 comprising continuations of each other and extending in directions at an angle to each other; thus, in the example shown, the member 21 extends in a direction transverse to the machine, while the member 22 projects from said member 21 in the general longitudinal direction of the machine but at an inclination to the longitudinal axis thereof, as shown in Fig. 1. The member 21 is composed of an intermediate section *a* and adjacent side sections *b*, the surfaces of which are inclined with respect to the surface of said section *a;* the lines of division between the sections *a* and *b* converge from opposite corners of the section *a* and approach each other toward the junction line *c* between the members 21 and 22, so that said inclined side sections *b* progressively increase in surface area from an apex at the free edge of the member 21 to a maximum width or base at the junction line *c*, as shown in Fig. 10. The member 22 comprises an intermediate section *d* which forms a surface continuation of the intermediate section *a* and converges to an apex *e*, as illustrated in Fig. 9, and further includes side sections *f* which, in their normal, operative positions, form surface continuations of the side sections *b* and form angles with the intermediate section *d*. In the operative condition of the folding device, the inner edges of the side sections *f* are spaced slightly from the opposite side edges of the intermediate section *d* so as to form a plurality of slots 23, which converge toward the free end or edge of the member 22. The folding device thus comprises six triangular flat sections, three of which comprise the first member and the other three constituting the second member of the device. The triangles of the second member provide a plurality of slots which converge from the line of junction between the members, that is, the base of the slotted member, toward the free end or edge thereof, all as clearly shown in Figs. 9 and 10. To facilitate the travel of the paper web and to complete the lengthwise folding thereof, as will be described more fully hereinafter, a guide roller 24 is mounted upon the member 21 adjacent to the free edge thereof, and cooperating guide rollers 25 are journalled at the free ends of the side sections *f* and at the apex *e*, as shown in Fig. 9.

In the preferred construction, the side

sections *f* are adjustable relatively to the intermediate section *d* in order to facilitate the insertion or threading of the paper web at the beginning of a folding operation, as will be more fully pointed out hereinafter; thus, in the illustrated example, said side sections are hinged at 26 so as to be movable in directions away from the intermediate section *d* to the positions indicated in Fig. 11. Any suitable means may be provided for maintaining the side sections *f* in these positions; for instance, said sections may be provided with spring latches 27 adapted to engage the opposite ends of a bracket 28 suitably mounted beneath the intermediate section *d*, as shown in Figs. 11, 12 and 13, the two last-named figures being inverted views. To release the side sections *f* for the purpose of restoring them to their normal, operative positions, the latches 27 may be provided with manipulating handles 29; springs 30 serve to automatically return said side sections *f* to their normal positions when the latches are released, said latches, during and after such return, being located upon the upper surface of the bracket 28 and the final position thereof being determined by the engagement of the edges *f'* with the contiguous edges f^2 of the member 22. To permit the folding device to be adjusted in vertical and horizontal directions, the member 21 is slidably mounted by means of dove-tail tracks 31 upon an angle iron 32, which itself is slidably mounted by means of a dove-tail track 33 upon the frame 20. An adjusting screw 34, in screw-threaded engagement with a lug 35 of the member 21 and rotatably mounted upon the angle iron 32 in a manner to be held against lengthwise movement but so as to be capable of rotation, serves to adjustably shift the folding device in a horizontal direction. Similarly, an adjusting screw 36 rotatably mounted upon the frame 20 in a manner to rotate freely thereon without being capable of lengthwise movement and having screw-threaded engagement with a lug 36^a of the angle iron 32, serves to adjust said folding device in vertical directions. The machine further includes a pair of feed rollers 37 and 38 rotatably mounted upon the frame 20 in superimposed relation to each other and operated in any suitable manner, as by means of an electric motor 39 positively connected with the roller 37 by means of a belt 40 and pulley 41 fixed upon the shaft which carries the roller 37. In the illustrated example a web of paper 42 is mounted in the form of a roll 43 upon an upright spindle 44 supported in a fixed bracket 45, as shown in Fig. 2.

The mechanism so far described constitutes in itself a complete machine, which may be utilized for the purpose of folding a traveling web of paper in a distinctive manner adapting it for particular and special uses; that is to say, in practice, the web of paper 42 is passed from the roll 43 which, in the illustrated example, is rotatable about an upright axis 44 and brought beneath the roller 24 and across and in surface contact with the member 21 of the folding device. At the line *c*, said web is turned or diverted in a path approximately at right angles to the path travelled by the web along the member 21 and is doubled upon itself into each of the slots 23 of the member 22; from the slots 23 the web of paper passes between the guide rollers 25 and then between the feed rollers 37 and 38, by which it is pulled and fed in the direction of its length. Because of the inclination of the member 22 with respect to the member 21 across the path into which the web is directed for the purpose of folding it, the web of paper is diverted not only in a direction at right angles to the direction of travel of the web across said member 21, but is also twisted 90° in a plane transverse to its direction of travel, as a result of being folded into the slots 23. For example, in Fig. 1, the web of paper leaves the folding device and travels in a horizontal direction with its width extending vertically and leaves said device in a horizontal direction with its folded width extending horizontally. As the feed roller 37 is actuated by the motor 39 to thereby actuate the feed roller 38, the web of paper 42 is drawn along under tension from the roll 43 and as it passes along the member 21, it is gradually bent along opposite edges by the sections *b* and is drawn through and lengthwise of the slots 23 and progressively folded or creased at three places into a quadruple fold, as shown in Fig. 14, which folds are completed by the action of the guide rollers 25 and the feed rollers 37 and 38. By providing the slots 23 in a plane which is inclined across the path of the folded web, and by converging these slots toward the rollers 25, the complete folding of the web is quickly brought about within a relatively short distance and in a manner to avoid unnecessary friction or strain upon said web, so that the folding device is capable of folding even the flimsiest of papers such as, for instance, the tissue paper commonly used for making paper napkins. To simplify the threading of the paper through the folding device, the sections *f* are moved to the open position indicated in Fig. 11 and restored to their initial position after the paper has been inserted, by simply lifting the latches 27 to permit the springs 30 to act as hereinbefore set forth. By manipulating the adjusting screws 34 and 36, the folding device may be shifted and adjusted into proper registry with the

feed rollers 37 and 38, as will be apparent from an inspection of Fig. 1. In the illustrated example, the folded web, after having passed beyond the feed rollers 37 and 38, is cut into sections which are folded transversely for use as paper napkins, the cutting and folding mechanism being incorporated directly in the apparatus in which the previously described folding device is included.

The mechanism referred to comprises a drum 46 carried by a shaft 47 journalled upon the frame 20 at a distance from the feed rollers 37 and 38. The drum is open at its one end and at diametrically opposite points is provided with a plurality of slots 46^a, the purpose of which will appear more fully hereinafter. In addition, said drum is provided with gripping members 48 located in co-operating pairs at diametrically opposite points of the drum and pivotally mounted thereon by means of shafts 49; any suitable means may be provided for operating the gripping members 48 at the proper time as, for instance, the mechanism shown in Figs. 7 and 8. This mechanism comprises plungers 50 slidably mounted in the drum at the proper points and normally pressed in an outward direction by means of springs 51, said plungers, at their outer ends, carrying rollers 52 adapted to engage and cooperate with stationary cams 53 located on the frame 20, as shown in Figs. 1 and 3. The plungers 50 are further provided with teeth 54 arranged in mesh with pinions 55 located upon the shafts 49 which carry the gripping members 48. At points contiguous to and slightly in advance of each pair of gripping members 48 the drum is formed with grooves 56 for the accommodation of the cutting member 57, as will appear more fully hereinafter. The cutting member 57 is carried by a roller 58 fixed upon a shaft 59 rotatably mounted on the frame 20, said roller 58 being so located as to bring its surface into close proximity with the drum 46, as shown in Fig. 4. The mechanism whereby the drum 46 and the roller 58 are operated may be of any suitable type, and in the illustrated example comprises a sprocket wheel 60 mounted upon the shaft 47 and connected by means of a sprocket chain 61 with a sprocket pinion 62 mounted upon the shaft which carries the feed roller 37. The driving mechanism referred to further comprises a gear 63 also carried by the shaft 47 and arranged to drive pinions 64 and 65 rotatably mounted on the frame 20, the pinion 65 being in mesh with a pinion 66 fixed upon the shaft 59 which carries the roller 58, as shown in Fig. 4. The mechanism whereby the severed sections of the web are folded transversely to the longitudinal folding thereof is shown in the form of an arm 67 pivoted at 68 upon a portion of the frame 20 and carrying at its lower end a member 69 which projects into the drum 46 and supports a device 70 provided with a fork having a plurality of teeth 71 corresponding in number to the slots 46^a and dimensioned so as to be capable of being projected therethrough. The arm 67 is actuated by means of a cam 72 fixed upon the shaft 59 and accommodating a roller 73 mounted upon said arm 67, as shown in Fig. 4. Folding rollers 74 are journalled upon the frame 20 and are geared together by means of pinions 75, said rollers 74 being driven by means of a gear 76 carried by the shaft 47 and meshing with a pinion 77 fixed upon one of the rollers 74.

In operation, as the folded web 42 passes beyond the feed rollers 37 and 38, the end g of said web is clamped upon the drum 46 by one of the pairs of clamping members 48 which, at this stage of the operation, are in a position to perform this function and are shifted to the clamping position shown in Fig. 6 by the action of the cams 53 upon the rollers 52. The web clamped in the manner described is then carried around with the drum to approximately the position shown in Fig. 4, at which time the next pair of clamping devices 48 are actuated to clamp the web upon the drum, as also indicated in Fig. 4. Coincidentally with this second clamping, the knife 57 moves into one of the grooves 56 to an operative position and thereby severs the folded web to form a section h, which lies upon the surface of the drum 46. At the same time, the arm 67 is operated by the cam 72 to shift the fork 71 through one set of slots 46^a and thereby to push the cut section h at an intermediate point therein between the nip of the rollers 74. The latter then draw the cut section h from the drum and fold it transversely to the position indicated in Fig. 15, it being understood that the parts are so arranged and proportioned that the resulting product, as illustrated in said Fig. 15, constitutes a napkin, towel or the like. When the cut section h is inserted between the rollers 74 by means of the fork 71, said section is withdrawn from the drum by said rollers 74, which revolve at an increased peripheral speed. As the machine continues to operate, the arm 67 and its co-related parts are moved back to an inoperative position to permit the drum 46 to rotate without interference, while the knife 57 travels in a circular path with the roller 58. In the meantime, the second pair of gripping members 48, having clamped the web to the drum 46, cause a new section of said web to be drawn about the drum to the position illustrated in Fig. 4 and the previously described operative steps to be repeated. It

will be understood that the roller 58 makes two complete revolutions to one complete revolution of the drum 46 and that the timing is such that the knife 57 occupies an operative position each time one of the grooves 56 comes into registry therewith. It will further be understood that the cams 53 are of such length and so positioned that the rollers 52 will remain in engagement therewith a sufficient length of time to maintain each pair of gripping members 48 in position to clamp the end of the web long enough to bring about the results set forth hereinbefore. In the preferred arrangement, a rubber or similar strip 58ª may be provided upon the periphery of the roller 58 to resiliently press upon the gripping members 48, whereby the gripping action of the latter is assisted during the cutting of the web.

While the machine shown and described is intended primarily for producing paper napkins, towels and the like, it will be obvious that the folding device thereof may be utilized for folding a traveling web of paper in a predetermined manner, adapting it for any other predetermined purposes. It will further be obvious that the method of folding the web, as indicated, for instance, in Fig. 14, may be varied by adding additional folds thereto, as indicated in Fig. 18. This result may be accomplished by simply constructing the folding device in accordance with the results desired. As shown in Fig. 17, the additional folds shown in Fig. 18 are procured by adding sections f^3 to produce two slots 23^a in addition to the previously mentioned slots 23. In this case, additional bevelled or inclined sections b' may be added to the member 21 to facilitate the folding of the web in the desired manner. The operation of this form of folding device is otherwise the same as the one previously described.

Various modifications may be made within the scope of the claims without departing from the nature of my invention.

I claim:

1. In a machine for holding a traveling web of paper, a folding device comprising a member formed with an intermediate section and inclined side sections, and a second member extending at an angle to said first member and provided with slots converging toward each other from the line of junction of said two members.

2. In a machine for folding a traveling web of paper, a folding device comprising a member formed with an intermediate section and side sections inclined relatively to said intermediate section and of progressively increasing width, a second member extending at an angle to said first member and provided with slots converging toward each other from the line of junction of said two members, and guide rollers carried by said second member contiguous to the exit ends of said slots.

3. In a machine for folding a traveling web of paper, a folding device comprising an intermediate member having sections extending in planes at angles to each other, side members extending in directions at angles to each other and lying contiguous to said intermediate member to form side sections inclined in planes at angles to the plane of the one section of the intermediate member, and continuing side sections spaced from the other section of the intermediate member to form converging slots.

4. In a machine for folding a traveling web of paper, a folding device comprising an intermediate member having sections extending in planes at angles to each other, side members extending in directions at angles to each other and lying contiguous to said intermediate member to form side sections inclined in planes at angles to the plane of the one section of the intermediate member, and continuing side sections spaced from the other section of the intermediate member to form converging slots, said last-named side sections being pivotally adjustable relatively to said intermediate member.

5. In a machine for folding a traveling web of paper, a folding device comprising an intermediate member having sections extending in planes at angles to each other, side members extending in directions at angles to each other and lying contiguous to said intermediate member to form side sections inclined in planes at angles to the plane of the one section of the intermediate member, continuing side sections spaced from the other section of the intermediate member to form converging slots, said last-named side sections being pivotally adjustable relatively to said intermediate member, and guide rollers carried by said continuing side sections at the free ends thereof.

6. A machine for producing paper napkins comprising a folding device, means for drawing a web of paper through said folding device to fold said web in the direction of its length, a rotatable drum, pivoted clamping members carried by said drum for clamping the web thereon, means for operating said clamping members, a cutting member operatively connected with said drum for severing said web into sections, and folding rollers adjacent to said drum for withdrawing the cut section therefrom and for folding it transversely of its length.

7. In a machine for producing paper napkins comprising a folding device, means for drawing a web of paper through said folding device to fold said web in the direction of its length, a rotatable drum provided at diametrically opposite points with a plurality of slots, clamping members on said

drum for clamping the web thereon, a cutting device for cutting said web into sections, folding rollers adjacent to said drum, a swinging member provided with teeth adapted to be projected through the slots of said drum to push the cut section of the web between said folding rollers, whereby said cut section is withdrawn from said drum and folded transversely of its length, a cam for actuating said swinging member, and means for operating said drum, cutting device, folding rollers and cam.

In testimony whereof I have hereunto set my hand.

CHARLES ARELT.