This invention relates to a folding apparatus and method. While the invention is applicable to different uses, it particularly is designed for folding paper napkins. Paper napkins are now used in immense numbers in eating places and it is desirable to have an apparatus which will quickly and inexpensively fold the same. Such napkins are now commonly folded first into a four-ply quarter fold and are then folded along lines radial with one corner of the quarter folded napkin so as to produce a double pointed fold often referred to as a V-shaped fold.

It is an object of this invention to provide an apparatus for rapidly and efficiently folding napkins into said V-shaped fold.

It is another object of the invention to provide an entirely novel and distinctive type of folding machine for successively folding a paper napkin into the desired shape.

It is still another object of the invention to provide a machine for folding a continuous strip of material into two-ply form, severing said folded strip to form the separate napkins, then folding said napkins successively into four-ply quarter folds, and then by reversible means folding over triangular portions at the corners thereof to give said V-shaped form.

It is a further object of the invention to provide such an apparatus comprising a roller about which the napkins are carried, together with means for engaging said napkins along an intermediate line and transferring the same to another roller and folding the napkins.

It is also an object of the invention to provide a folding apparatus comprising a roller having means engaging one end of a napkin to carry the same therewith, together with another roller having means for pinching a bight in said napkin along an intermediate line, gripping said bight and carrying the napkin about said second roller to fold the same.

It is still another object of the invention to provide a folding machine comprising a cylindrical roller having means engaging the napkin to carry the same therewith, together with a conical roller having its surface running adjacent the surface of said cylindrical roller and having means for gripping a napkin on said cylindrical roller and moving the same therefrom and folding the same.

It is also an object of the invention to provide such an apparatus as set forth in the preceding paragraph, together with one or more additional conical rollers adapted to successively grip the napkin and carry the same about their surfaces to fold the napkin.

It is also an object of the invention to provide a folding machine comprising a cylindrical roller about which the napkin is carried, one or more conical rollers by which the napkin is gripped and carried, together with a packing and folding means adapted to receive the folded napkins, place the same in a stack, and fold over the ends thereof.

It is furthermore an object of the invention to provide a novel method of folding the napkins.

These and other objects and advantages of the invention will be fully set forth in the following description made in connection with the accompanying drawings, in which like reference characters refer to the same parts throughout the different views, and in which:

- Fig. 1 is a view in side elevation of the apparatus;
- Fig. 2 is a horizontal section taken on line 2–2 of Fig. 1 as indicated by the arrows, certain parts being broken away and others shown in horizontal section;
- Fig. 3 is a diagrammatic view showing the ends of the folding rollers and means carried thereby;
- Fig. 4 is a partial view of a portion of the folding rollers;
- Fig. 5 is a view similar to Fig. 4 showing a later operation;
- Fig. 6 is a view similar to Fig. 4, showing a still later operation, Figs. 4 to 6 being shown on an enlarged scale;
- Fig. 7 is an end view of certain of the rollers, illustrating their operation;
- Fig. 8 is a view similar to Fig. 7, showing a later operation;
- Fig. 9 is a partial view similar to Fig. 7 and shown on an enlarged scale;
- Fig. 10 is an end view of a pair of rollers, showing a later folding operation than that of Fig. 7;
Fig. 11 is a partial end view similar to Fig. 7 and shown on an enlarged scale;
Fig. 13 is an end view of some of the folding rollers, showing a later operation than that shown in Fig. 10;
Fig. 13 is a view partially in elevation and partially in vertical section, showing the stacking device for the napkins;
Fig. 14 is a view in vertical section of the stacking apparatus, showing the parts in a different position;
Figs. 15 to 18 are plan views of the stacking and folding means, showing the parts in different positions;
Fig. 19 is a vertical section taken on line 19—19 of Fig. 13, as indicated by the arrows;
Fig. 20 is a perspective view of a napkin folded into the four-ply quarter fold with means indicating subsequent folds;
Fig. 21 is a view in elevation of the napkin as folded by the second conical roller;
Fig. 22 is a perspective view showing a subsequent stage of the folded napkin, and
Fig. 23 is a view in elevation showing the completely folded napkin.

Referring to the drawings, a folding apparatus is shown comprising a machine having a frame 20 of rectangular form in plan, said frame having upstanding columns 20 at one side in which are journaled the trunnions of the roller 21 over which a sheet S of flexible material such as paper, is adapted to run. The roller 21 has adjacent thereto a triangular plate or form 22 over which the sheet S passes and a pair of rollers 23 are disposed some distance beneath the roller 21, which rollers 23 run in opposite directions as indicated by the arrows in Fig. 1 and have their surfaces substantially in contact along the line disposed substantially centrally of the sheet S. The rollers 23 have gears 24 secured thereto meshing with each other by means of said rollers are driven. The sheet S passes from the form or plate 22 between the rollers 23 and is thus folded along a central line to make a two-ply thickness. This means for so folding a sheet along the central line and passing the same between two rollers is old and well known as disclosed in the patent to Goss, 330,710 granted October 12, 1909. One of the gears 24 meshes with and is driven by a gear 25 which in turn meshes with and is adapted to be driven by a larger gear 26.

A roller 27 is carried on a shaft 28 journaled in bearings 29 on frame 20 and a smaller roller 30 has trunnions 31 journaled in brackets 32 secured to the top of bearings 29, the roller 30 being disposed above and at one side of the center of roller 27. A large cylindrical roller 33 is carried on a shaft 34 journaled in bearings 35 on frame 20, shafts 34 and 28 having their centers substantially in the same horizontal plane and rollers 33 and 27 being substantially tangent.

A conical roller 36 is provided having its axis extending horizontally in substantially the same plane as the axis of shafts 28 and 34, which roller is carried on a shaft 37 journaled in a bearing 38 secured to frame 20. The roller 36 is substantially tangent to the roller 33. Another conical roller 39 is provided, carried on a shaft 40 journaled in the bearing 41 bolted to frame 20. Roller 39 has its axis in the horizontal plane of shaft 37 and said roller is substantially tangent to roller 36. Another conical roller 42 is provided carried on a shaft 43 journaled in a bearing 44 on frame 20, shaft 43 having its axis horizontal and in the same plane as shafts 37 and 40 and roller 42, being substantially tangent to roller 39. The conical rollers 36, 39, and 42 have their pointed ends meeting substantially in one point located at one edge of roller 33 as shown in Fig. 2.

The folded sheet S of material passes downwardly beneath roller 30 and is engaged by and carried between rollers 27 and 33. Roller 27 has a recess 27a formed longitudinally of one side and a knife 45 projects centrally and radially of said recess, having a sharpened fine saw edge at its outer side, which edge extends parallel to the side of roller 27. At each side of recess 27a a plate or bar 46 is disposed, extending outwardly past the side of the roller 27, parallel to knife blade 45, said plates 46 preferably having rounded outer edges parallel to the side of the roller 27. Roller 33 has recesses 33a extending longitudinally thereof at opposite sides thereof, having side surfaces 33b, said recesses having a shallower portion 33c having side surfaces 33d through which project outwardly from roller 33 the plates or bars 47 preferably having rounded outer edges parallel to the side of roller 33. Shafts 48 are carried in and journaled in roller 33 respectively in the rear of recesses 33a, which shafts each carry arms 49, 51 respectively at each end thereof between which arm extends a bar or blade 52, projecting radially outwardly from said arm and outwardly in recess 33a at one side of the plate 47, the outer edge of the plate or bar 50 extending parallel to the side of roller 33. Said arms 51 also each have a portion 51a the outer end of which is engaged by a spring 52 secured to and engaging at its other end with a lug 53 projecting in one end of roller 33. The portions 51a each carry a cam roller 54 journaled on a pin 55 which cam roller projects away from roller 33 at one end thereof and is held by a spring 56 against a stationary cam 56 secured by screws 57 to one of the bearings 55. The roller 33 also has at opposite sides and disposed 90 degrees from recesses 33a, similar cylindrical recesses.
33° and plates or bars 58 are carried by said roller and project outwardly radially in said recesses 33° preferably having their outer edges rounded and extending parallel to the side of roller 33.

The conical roller 36 (see Figs. 3 and 7 to 11) has a recess 36° formed therein adjacent its rear end and extending a short distance longitudinally thereof at one side of which is disposed a plate or bar 59 projecting outwardly radially of said roller some distance beyond its periphery and preferably having an outer rounded edge extending parallel to the surface of said roller. Shaft 60 is carried and journaled in the rear end of said roller and has secured thereto an arm 61. The shaft 60 has connected thereto by universal joint shaft 62 extending at an angle thereto, which latter shaft extends through a gear 76 and gear 63 which are rigid relatively to roller 36 and has secured to its outer end an arm 64. A spring 65 has one end engaging the arm 64 adjacent its outer end and has its other end secured to and engaging a member 66 carried by gear 63. The arm 64 at its outer end has a cam roller 67 journaled on a pin 68 carried in said arm, which cam roller 67 is thus held by spring 65 against a cylindrical cam 69 having a cylindrical sleeve portion 69a fitted in the end of bearing 38 and held therein by the set screw 70. The roller 36 has a shallow recess 36° at one side opposite the recess 36° and has another recess 36° extending longitudinally thereof throughout the greater part of its length and along an element thereof, which recess has a plate or bar 71 carried in roller 36 projecting outwardly therein a short distance beyond the periphery of roller 36. The plate 71 is located substantially 60 degrees from the center of recess 36°.

The conical roller 39 has a recess 39° in its surface extending parallel to an element therein and throughout the greater part of the length of said roller and a plate 72 is disposed at one side of said recess and projects radially slightly beyond the surface of roller 39 which preferably has a rounded outer edge extending parallel to the surface of said roller. Roller 39 has a shaft 73 journaled therein to which is secured a plate-like arm 74, shaft 73 having connected thereto by universal joint a shaft 75 journaled in a gear 77 which meshes with gear 76 and is rigid in relation to roller 39. Shaft 75 has secured to its outer end an arm 78 against the outer end of which bears one end of spring 79 having its other end secured to and engaging a member 80 secured to the roller 39. The arm 78 has a cam roller 75b journaled on a pin 75c in its outer end which roller is held by spring 79 in engagement with a cylindrical cam 81 similar to the cam 69 and similarly held in bearing 41 by set screw 82.

The roller 39 also has a shallow recess 39° extending longitudinally of its surface and parallel to an element thereof, through which projects a plate or bar 83 having a rigid outer edge extending parallel to the surface of the roller 39. Bar 83 is disposed about 60 degrees from the bar 72.

The conical roller 42 also has a recess 42° extending longitudinally of its surface throughout a considerable extent thereof at one side of which is disposed a plate or bar 84 projecting radially outward slightly past the periphery of said roller. A shaft 85 is journaled in roller 42 and has secured thereto a plate-like arm 86 extending parallel to plate 84. Shaft 85 has secured thereto by universal joint a shaft 87 journaled in a gear 88 meshing with gear 77 and revolving rigid with roller 42. The shaft 87 has an arm 89 secured to its outer end carrying a pin on which is journaled a cam roller 90, which cam roller is held against a stationary cylindrical cam 91 similar to the cam 69 and held in the bearing 43 in a similar manner by the set screw 92. A spring 93 carried in roller 42 bears at one end against arm 89 and at its other end against a member 94 in the roller 42, thus holding arm 89 and roller 90 toward cam 91.

The rollers and gears described will be driven through shaft 28, which will have power applied thereto by any suitable means such as a pulley or motor (not shown) connected to one end thereof. Shaft 28 has a gear 95 secured thereto which meshes with gear 26. Gear 26 as shown in Fig. 2 comprises a spur gear at its outer side and a bevel gear 26° at its inner side. Bevel gear 26° meshes with gear 63 already referred to, the ratio between said gears being two to one. The gear 76 is rigid on shaft 27 with the gear 63, which gear 76 meshes with gear 77 and gear 77 in turn meshes with gear 88 as clearly shown in Fig. 2, gears 76, 77 and 88 being of the same size. Rollers 36, 39 and 42 are thus driven at the same speed and at substantially twice the speed of roller 33.

The apparatus so far described constitutes the folding means for folding the napkins into quarter fold and then folding over each side along the line radial to one corner of the quarter fold to bring the napkin into the well-known cornucopia shape shown in Fig. 22. The operation of the folding mechanism is as follows:

As already stated, the sheet S is folded lengthwise into two-ply thickness as it passes through the rollers 23. Said sheet then passes downwardly over the roller 30 which is at one side of the point of tangency of rollers 27 and 33. As the sheet is carried down between rollers 27 and 33, it is engaged by plates 46 on roller 27 and by plates 50 and 47 carried on roller 33. The napkin is then crimped or bent about the
edge of the knife 45 as shown in Fig. 4. This knife having a very sharp edge, the material is severed as shown in Fig. 5. As the rollers 27 and 33 come to the position shown in Fig. 4, the cam roller 54 rolls up on the high part 66 of cam 56 and arms 51 and 49 are swung so that plate or bar 50 moves away from surface 38 and occupies a position shown in Fig. 4. Just after the material is severed as shown in Fig. 5, roller 54 drops down off the portion 56 of cam 56 and spring 52 swings arms 51 and 49 so that plate 50 moves toward surface 38. It will be seen from Fig. 5 that the rear plate 46 together with plate 50 form or pinch a loop, small fold, or bight Sb in the material, as the ends of these plates overlap. As rollers 27 and 33 continue their rotation in opposite directions, the plates 46 and knife 33 move away from plates 47 and 50 and plate 50 snaps back against surface 38, thus gripping the bight Sb against surface 38 as shown in Fig. 6. The advancing edge of the sheet of material is thus gripped by the plate 50 throughout the length of the roller 33 and the material is carried around on the surface of said roller. As there are two of the shafts 48 and plates 50, the material will thus be severed at each half revolution of roller 33 as described and each plate 50 will carry the advancing edge of a piece of severed material which piece forms the napkin. While the napkins might be of various dimensions, it has been the common practice to make the same square so that a piece of material carried around on roller 33 is twice as long as it is wide, due to the fact that the material and consequently the napkin, has been folded lengthwise. The roller 33 continues to revolve and the plate 58 which is midway between the plates 50 moves in between the plate 59 and the arm or plate 61 on conical roller 36. The plates 59 and 61 are quite short in length. The diameter of the conical roller 36 at its large end is substantially half the diameter of roller 33, or slightly more than half of said diameter, and as roller 36 is driven at twice the revolution of the roller 33, the peripheral speed of the rollers adjacent the large end of roller 36 is substantially the same. The peripheral or surface speed of roller 36, of course, decreases toward its smaller end and it is of course, necessary to have a short length of plates 59 and 61 so that these plates may be disposed where the peripheral speed of both rollers is substantially the same. As rollers 33 and 36 revolve and plate 58 approaches plate 59, cam roller 67 has moved up on the high part 66 of cam 69 and plate or arm 61 has been moved away from plate 59 against the resistance of the spring 65 so that plate 58 can project between plates 59 and 61 and form a small fold or bight Sb in the material or napkin. As rollers 33 and 36 continue their rotation in opposite directions as shown by the arrows in Figs. 7, 8 and 9, plate 58 moves away from plates 59 and 61 and roller 67 drops off of the high part 69 of cam 69. Spring 65 then snaps arm or plate 61 towards plate 59 and the small fold or bight Sb is pinched or gripped between arm 61 and plate 59 as shown in Fig. 8. The material or napkin is thus carried around the roller 36 and as the bight Sb is formed along a median line of the napkin, the same will be folded into a quarter fold on roller 36 and said quarter fold will be carried around recess 36 with its folded edge as shown in Fig. 10. It will be noted, as shown in Fig. 7, that when cam roller 67 drops down off of the high part 69 of cam 69, to permit arm 61 to grip the bight Sb of the napkin, that roller 54 on arm 51 on the roller 33 rides up on the high part 56 of cam 56, thus moving plate 50 away from surface 38 and releasing the advancing edge of the napkin, which napkin is designated as S1. The napkin is thus free to be carried away from roller 33 by the gripping means on roller 36.

Roller 36, as stated, carries the napkin S1 thereabout, as shown in Fig. 10 and plate 71 on said roller passes in between plates 72 and arm or plate 74 on roller 39 as shown in Fig. 10. Since the peripheral speed of the rollers 36 and 39 is the same, at all corresponding points on their surfaces, the plates 71, 72 and arm 74 can extend quite a long distance longitudinally of said rollers. As plate 71 approaches plate 72, the roller 70 has passed on to the high part 81 of cam 81 and arm 78 has thus moved arm 74 away from plate 72 so that plate 71 can enter between plates 72 and 74 and plate 72, as it so enters, forms a bight Sb in the napkin S1 as shown in Fig. 10. Just after said bight is formed, plate 71 moves away from plate 72, on account of the opposite rotation of the rollers 36 and 39, cam roller 80 drops off of the high part 81 of cam 81 and spring 79 snaps the arm 74 back against plate 72, thus pinching and gripping the bight Sb against plate 72. The napkin S1 is now carried away from roller 36 by the roller 39. As the napkin is thus gripped by arm 74 and plate 72, the cam roller 67 rides up on the high part 69 of cam 69 and arm or plate 61 is moved away from plate 59 thus releasing the napkin at the bight or fold Sb so that the napkin is free to be carried about roller 39. This is clearly shown in Fig. 10. It will be understood that the napkin S1 is disposed on the surface of the roller 36 at one corner adjacent the small end of said roller and the napkin is engaged by plates 71 and 72 along a line radial with said corner of the napkin such as the line S4 as shown in Fig. 20. As plate 71 is disposed 100.
substantially 60 degrees from the plate 61, the angle between line $S_1$ and the edge $S_9$ of the napkin $S_1$ is substantially 60 degrees or slightly less. The napkin, therefore, as it is carried around roller 39 is folded substantially into the shape shown in Fig. 21.

The roller 39 now revolves in the direction of the arrow shown in Fig. 10 and the napkin is carried around the surface thereof.

Plate 88 on roller 39 now follows in the rear of plate 72 and comes between plates 84 and 85 on the roller 42 as shown in Fig. 12.

As plate 84 approaches the plate 82 the cam roller 90 has moved up on the high part $91^a$ of cam 91 and arm 85 has been moved away from the plate 84. Plate 83 now enters between plates 84 and 85 and forms a small fold or bite $S_d$ in the napkin. As plates 83 and 84 separate in the continued rotation of roller 42 and 43, cam 90 drops off the high part $91^a$ of a cam 91 and arm 85 springs back against plate 84 and grips bite $S_d$ of the napkin and carries the napkin around roller 42. Just as arm 85 grips bite $S_d$, roller 80 rolls up on the high part $81^a$ of cam 81, moving arm 74 away from plate 72 and releasing the napkin from roller 39.

The napkin is disposed on roller 39 with its corner $S_2$ (Figs. 20, 21) toward the pointed end of the roller and plates 84 and 83 extend along an element of the rollers toward the points thereof and the napkin $S_1$ is gripped by plate 84 and arm 85 along the line $S_9$ as shown in Fig. 20. The napkin is now carried around roller 42 and folded as shown in Fig. 22. It will be noted that the folded over side portions of the quarter fold napkin which are indicated as $S_8^a$ and $S_9^a$ in Fig. 20, are folded in opposite directions and on opposite sides of the central zone portion $S_8^a$ at the center of the quarter fold napkin. The napkin has thus been folded into the so called V-shaped form as shown in Fig. 22. The napkin so folded is now carried around on the roller 42. The means for receiving and stacking the napkins and folding over the end portions $S_9^a$ thereof, will now be described.

Roller 42 has journaled therein and extending lengthwise thereof, a shaft 97, which shaft carries a plate 98 forming a part of the peripheral surface of the roller 42. Plate 98 swings about shaft 97 and is tapered towards its free end, the end of said plate fitting against a small shoulder 42$. An arm 98$ extends from plate 98 and shaft 97 at one end of roller 42 carrying in its outer end a cam roller 99 journaled on a pin 100 in the end of said arm. Cam roller 99 is adapted to move over a stationary cam 101 and arm 99$ is urged in the direction to hold roller 99 against cam 101 by a spring 102 contacting said arm at one end and a plate 103 at its other end, which plate is secured to roller 42. A trough or magazine 104 is provided for the folded napkins, said magazine having an end guide plate 104$ at its receiving end disposed substantially below the outer side of the roller 42 and having its upper free end curved toward said roller.

The guide plate 104 has a triangular opening 105$ therethrough shaped to accommodate the passage therethrough of a stacker plate 105 carried on a reciprocating bar 106 guided in apertures in upstanding members 107 of the frame member 107, which frame member 107 will be secured to the frame 20. The stacker bar 106 has an upstanding pin 106$ disposed in a slot in one arm of a bell crank lever 106$ fulcrumed on frame 20, the other arm of which is engaged and moved by a pin or roller 108 carried on gear 77 (see Fig. 13). Said stacker will be retracted or moved in the opposite direction by tensile spring 109 secured at one end to one of the members thereof and at its other end by a pin projecting from stacker bar 106. The stacker plate 105 comprises a triangular portion 105$ fixed relatively to stacker bar 106 and a hinged portion 105b, the portion 105b being of trapezoidal shape, as shown in Fig. 19. The magazine 104 has a plate 104$ disposed a short distance from end plate 104$ and as shown in Fig. 19, the plate 104 has a downwardly extending portion 104c, the lower edge of which is inclined to the horizontal. It will be noted that the bottom 104c of magazine 104 is inclined to the horizontal, making an angle therewith which is substantially the same as the angle between the lines $S_8^a$ and $S_9^a$ shown in Fig. 20. A narrow plate 104$ projects upwardly from the bottom 104c in substantially the same plane as Fig. 20. The projection 104d of magazine 104 and as shown in Fig. 19 the adjacent edges of plate 104$ and the projection 104d converge toward the higher side of the magazine or bottom 104$ thereof, the angle between said edges being substantially the same as the angle between lines $S_8^a$ and $S_9^a$ as shown in Fig. 20. The stacker plate 105 is adapted to move between the adjacent edges of projection 104d and plate 104$ and to have a small amount of clearance between said edges. A plate 110 extends into one side of the magazine and has its inner vertical edge disposed substantially in line with the vertical end of stacker plate 105. The plate 110 extends outwardly from the inner end of plate 110 as shown in Fig. 17. Plate 110 is carried on the resilient bar 110$ secured to a block 112 at one side of magazine 104.

In operation as roller 42 revolves in the direction of the arrow shown in Fig. 13, the cam roller 99 will ride up on the high part of cam 101 as shown in Fig. 15 just as the advancing end of the folded napkin $S_9$ curves over the outside surface of roller 42. Cam
104 thus swings arm 96 and plate 98 is swung outwardly away from the surface of roller 42. Just previous to this cam roller 90 rides up on the high part 91 of cam 91 and arm 55 is swung away from plate 84 releasing the forward edge of the folded napkin S'. The napkin is thus released and pushed away from the roller by plate 98. The roller 42 is running at high speed and the napkin has considerable momentum. The napkin is thus projected downward substantially tangent to the roller 42 and is delivered substantially against the forward plate 104 of magazine 104 as indicated by the dotted line position of the folded napkin S' in Fig. 13. As the napkin is thus delivered into the magazine 104 it occupies substantially the position shown in Fig. 19. The stacker 105 is now moved forwardly and engages the part of the folded napkin in the central zone thereof as shown in Fig. 19, which zone is comprised between the lines S10 and S14 and as shown in Fig. 20, the sides of the stacker being parallel and some distance from the lines S10 and S14 but the vertical edge of the stacker being substantially in line with the line S11. As the stacker pushes the napkin into the magazine, it is pushed past the plate 104 and the projection 104b. The edges of the napkin bend and flip past these edges. As the napkin is pushed past the plate 110, however, the pointed portion S10 outside of the line S11 as shown in Fig. 20, is folded back as shown in Figs. 15 to 18 and is disposed in the rear of the hinged portion 105b of the stacker plate 105. The vertical edge of the napkin, however, which is now substantially along the line S11 as shown in Fig. 20, is pushed past the inner edge of plate 110, it being noted that plate 110 is pushed out laterally as shown in Fig. 15 by engagement of the end of portion 105b of the said stacker with the curved plate 110b. Portion 105b engages and pushes out the portion 110a with a cam like action. It may be stated that portion 105b cannot move rearwardly past the position shown in Figs. 15, 16 and 18, but can swing forwardly from said position as shown in Fig. 17. After the stacker has thus pushed the napkin back of plates 104a, 104b and back of the inner edge of plate 110, it is retracted. The napkin is kept from moving outwardly by the edges of projection 104 and plate 104 as well as by the edge of plate 110. As the stacker plate 105 is retracted, the portion 105b which has moved behind the inner edge of the plate 110 swings about its pivot and withdraws as shown in Fig. 17. Plate 110 moves inwardly due to the resiliency of its plate 110b and the triangular end S15 of the napkin is folded inwardly into the position shown in Fig. 18. The next napkin pushed into the magazine will engage the flap Sf and said flaps will thus be folded over toward the inside of the napkin, the napkin being stacked in magazine 104 and pushed against the follower plate or weight 113 which is pushed back as the napkins accumulate. It will be seen that there will be a force tending to push the outermost napkins longitudinally of magazine 104 against plates 104a and 104b due to the resiliency in the stack of napkins. The napkins have now been folded into the form indicated in Fig. 23 and are stacked in the magazine 104 from which they can be removed and packed into the desired containers for shipment.

From the above description it is seen that applicant has provided a comparatively simple, highly efficient and rapidly operating apparatus for folding the napkins. The device operates with great rapidity and delivers the completely folded napkins at the rate of substantially four hundred (400) per minute. The machine operates continuously, using a continuous web of paper. This paper is usually thin white crepe paper now commonly used for paper napkins. The device has been demonstrated in actual practice and found to be very successful and efficient.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts of the apparatus as well as in the steps and sequence of steps in the method, without departing from the scope of applicant's invention, which, generally stated, consists in a method and apparatus capable of carrying out the objects above set forth in the novel parts and combinations of parts of the apparatus and novel steps and sequence of steps in the method, defined in the appended claims.

What is claimed is:
1. A machine for folding a paper napkin or similar article having in combination, means for folding a strip of material lengthwise, means for severing the strip when folded into pieces of desired length, revolvable means for engaging each of said pieces along a line substantially midway of its length, progressing and folding the same, and revolvable means for subsequently engaging said napkin along a diagonal line and folding the same along said line.
2. A machine for folding a paper napkin or similar article having in combination, means for folding a strip of material lengthwise, means for severing the strip when folded into pieces of desired length, revolvable means for engaging each of said pieces along a line substantially midway of its length and folding the same along said line, and a plurality of revolvable means for suc-
cessively engaging said pieces along lines inclined to its edges and folding the same along said lines.

3. A folding apparatus for sheet material having in combination, a roller, means on said roller for engaging a piece of material and carrying it about said roller and means for forming a bight in said material along an intermediate diagonal line, gripping said bight and progressing said material to fold the same along said line.

4. A folding apparatus for sheet material having in combination, a roller over which a sheet of material is carried and means for engaging the material on said roller, forming a bight on an intermediate diagonal line therein, gripping said bight and progressing said material away from said roller to fold the same along said line.

5. A folding apparatus for sheet material having in combination, a member about which a sheet of material is carried, means on said member for gripping said material and advancing the same, a member adjacent to said member having means for gripping said material along an intermediate diagonal line thereon and carrying the same away from said first mentioned member and means for releasing said first mentioned means to permit said material to be so carried.

6. A folding apparatus having in combination a cylindrical roller, a conical roller having its surface substantially tangent to said roller, means on said rollers for forming a bight in a sheet of material carried on said cylindrical roller, including a means for gripping said bight and carrying said material thereby about said conical roller to fold the same.

7. A folding apparatus having in combination a cylindrical roller, a plurality of conical rollers adjacent said cylindrical roller, said rollers being arranged with their axis substantially in one plane and the adjacent rollers being tangent to each other, means for carrying a sheet of material about said cylindrical roller and means on said conical rollers for successively gripping said sheet of material and carrying it about each of said rollers to fold the same.

8. A method of folding a sheet of material which comprises progressing said sheet on a smooth surface, forming a bight in said sheet along an intermediate diagonal line thereof, and advancing said sheet away from said surface by means of said bight to fold the same on said line.

9. A method of folding a piece of sheet material which consists in progressing said sheet on a smooth surface, forming a bight in said material along an intermediate diagonal line, gripping said bight and progressing said material away from said surface to fold the same on said line and advancing the folded sheet along another surface form-
of material into a four-ply quarter fold, means for folding substantially triangular side portions of said quarter fold onto the central portion thereof, and means for folding inwardly the portion of the quarter fold beyond said side portions.

16. A folding apparatus having in combination, means for folding a rectangular sheet into a four-ply quarter fold, means for folding said quarter fold along diagonal lines from one corner thereof to form a folded figure of trapezium shape, and means for folding over one corner of said trapezium shaped figure on a diagonal line extending between two adjacent corners to form a folded figure of triangular shape.

17. A folding apparatus having in combination, means for folding a rectangular figure into a four-ply quarter fold, means for folding over two edges of said quarter fold along lines extending toward a corner of said quarter fold to form flaps, a receptacle having a triangular opening therethrough, and means for pressing said figure through said triangular opening to fold the opposite corner from said first mentioned corner over said flaps.

18. A folding apparatus having in combination, a member having a surface on which a folded sheet is carried, means on said member for pushing said sheet away from said member, a receiving chamber having a triangular shaped opening leading thereto, and means for catching said sheet as discharged from said first mentioned means and pushing the same through the opening in said chamber to bend inwardly portions of said sheet not conforming to the shape of said opening, whereupon as a successive sheet is pushed through said opening, the first sheet will be folded on the line of bend thereof.

In testimony whereof I affix my signature.

AARON GROFF.