March 22, 1949. C. S. MALOTT, JR 2,464,823

FOLDING MACHINE

Filed June 17, 1946 3 Sheets-Sheet 1

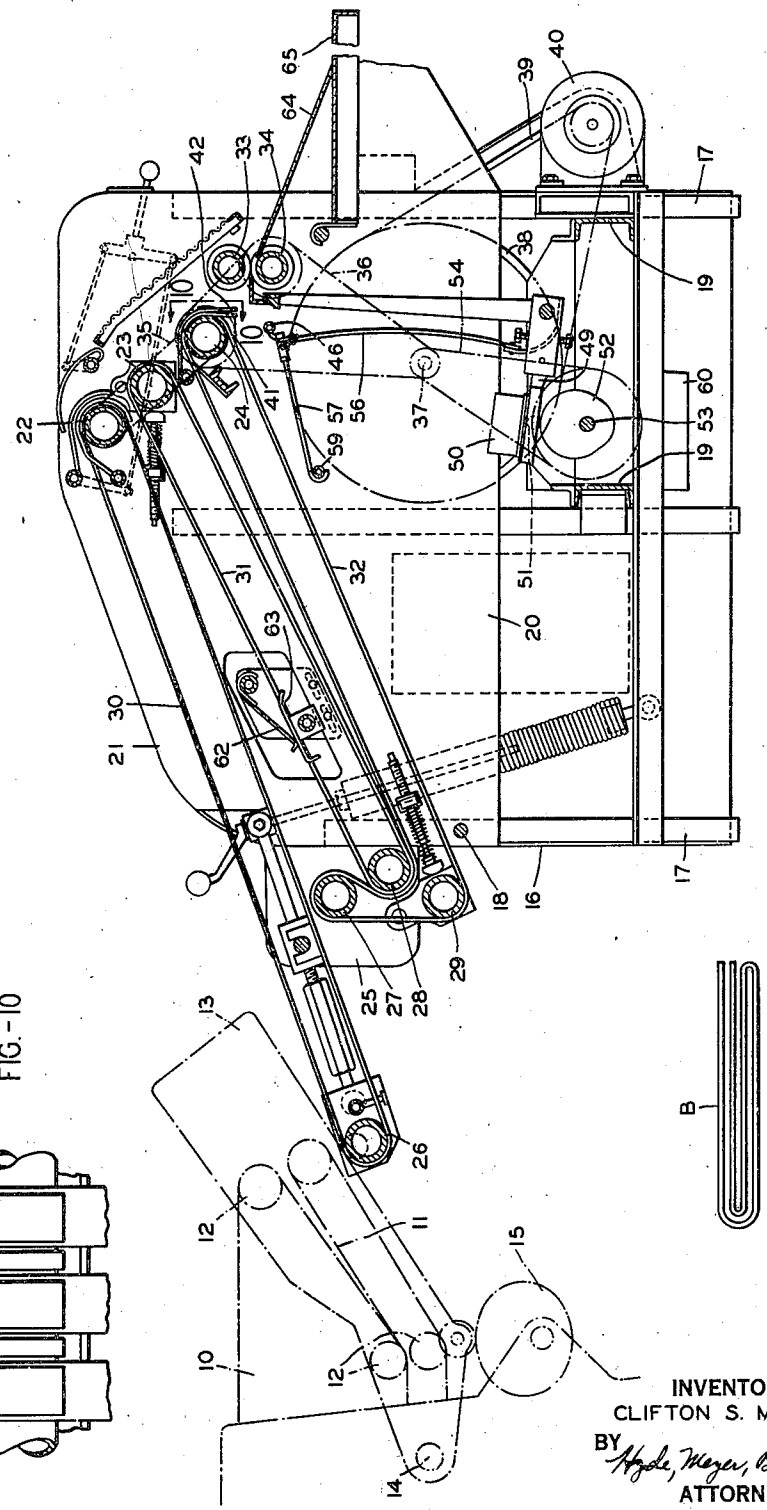


FIG.-1

FIG.-10

FIG.-9

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FOLDING MACHINE

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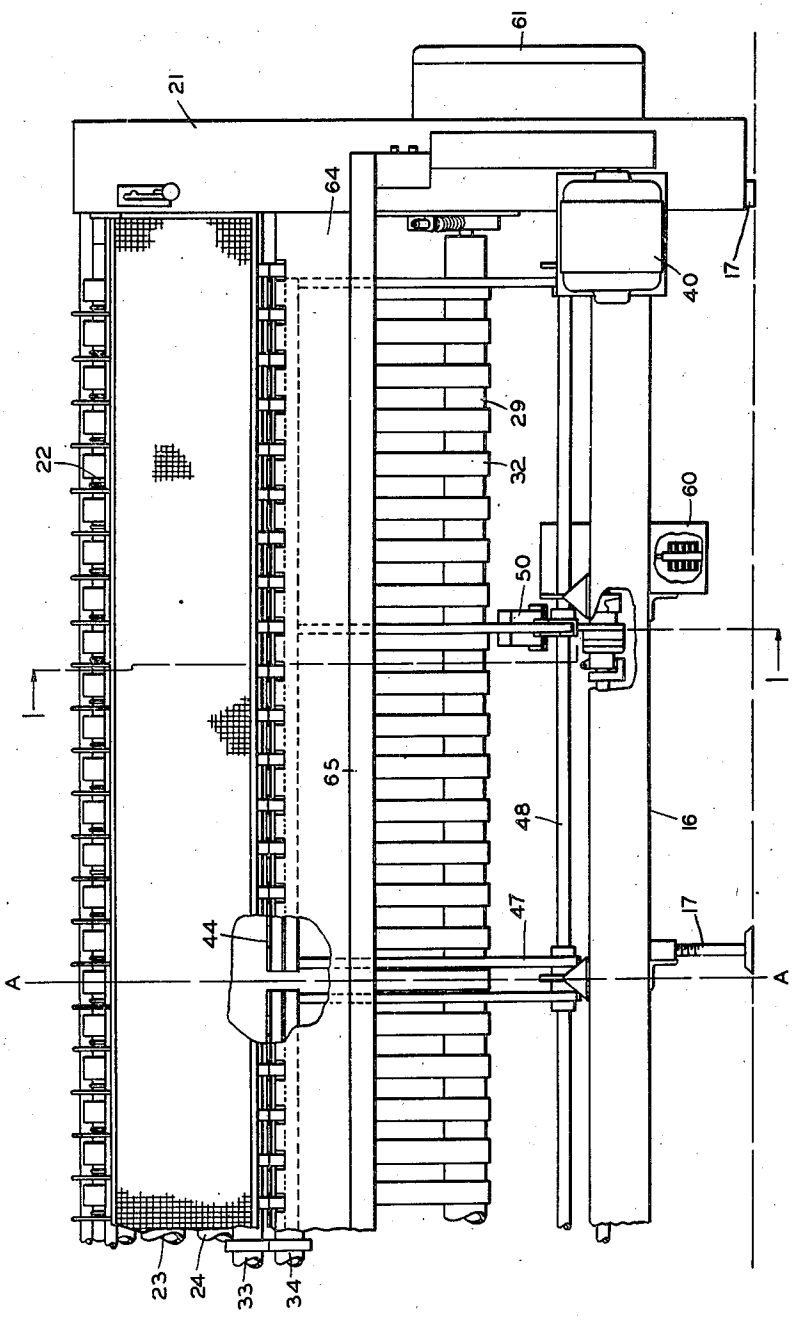


FIG-2

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FOLDING MACHINE

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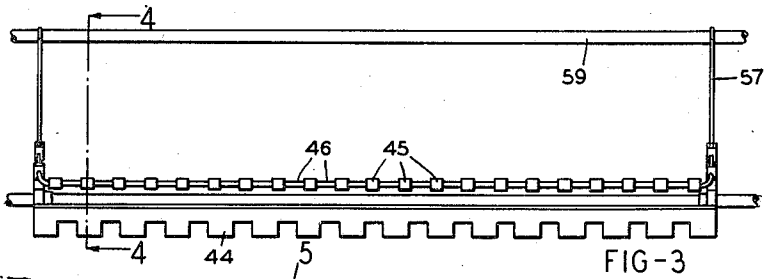
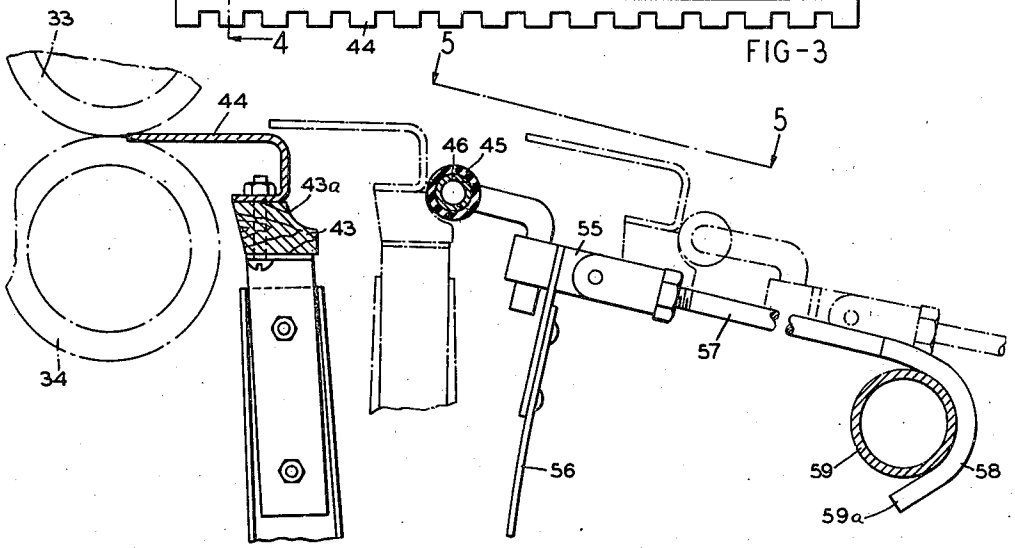


FIG-3



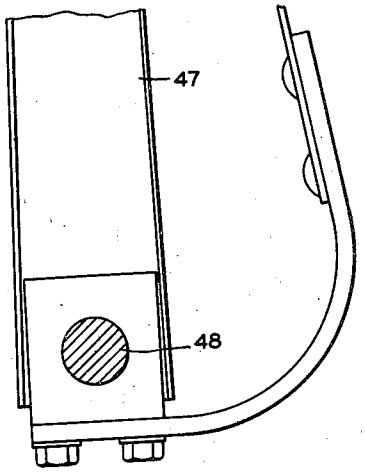


FIG.-4

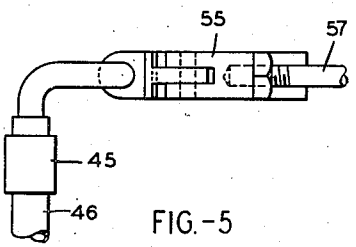


FIG.-5

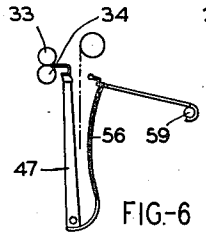


FIG.-6

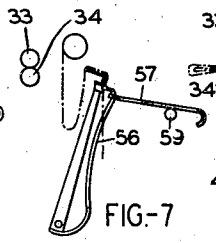


FIG.-7

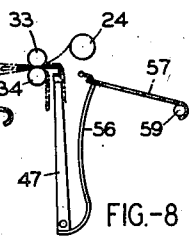


FIG.-8

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UNITED STATES PATENT OFFICE

2,464,823

FOLDING MACHINE

Clifton S. Malott, Jr., Cincinnati, Ohio, assignor to The American Laundry Machinery Company, Cincinnati, Ohio, a corporation of Ohio

Application June 17, 1946, Serial No. 677,366

7 Claims. (Cl. 270—80)

1

This invention relates to folding machines for cross folding flat articles made of textile fabrics, such as sheets, towels, pillowcases and the like. It has to do with those parts of the machine which contribute the folding operations by appropriate draping, laying or arrangement of the article with respect to the blade which introduces it to the folding rolls or other folding devices.

One object of the invention is to generally improve the construction and arrangement of the folding mechanism to reduce or avoid shock, jar and vibration and provide a machine which is quiet in operation and accurate in its selection of the desired folding lines.

Another object is to provide improved means for holding or clamping the work to prevent or avoid disturbing the lay.

Still another object is to provide improved folding mechanism including a vibratory blade or bar over which the article is draped, together with means for clamping the work to it during the draping operation and for releasing it as the folding rolls become effective.

A further object is to provide improved means for yieldingly restraining advance of the trailing end of the work in such manner as to prevent a small article from prematurely slipping off from the feeding roll on its way to the folding mechanism.

Another object is to provide improved folding mechanism in which the leading portion of the article is fed between clamping jaws which close upon it and one of which serves as a supporting bar over which the work is draped, and by means of which it is introduced to the folding devices.

Further objects of the invention in part are obvious and in part will appear more in detail hereinafter.

In the drawings, which represent one suitable embodiment of the invention, Fig. 1 is a longitudinal sectional elevation, on the line 1—1, Fig. 2, looking in the direction of the arrows;

Fig. 2 is an end elevation, the view being taken from the right in Fig. 1;

Fig. 3 is a detail plan view of the work supporting and clamping devices;

Fig. 4 is a detail sectional elevation on a larger scale, on the line 4—4, Fig. 3;

Fig. 5 is a detail plan view, looking in the direction of the arrows, on the line 5—5, Fig. 4;

Figs. 6, 7 and 8 are diagrammatic views corresponding to Fig. 4, and showing the several steps in the draping and folding operation;

Fig. 9 is an end elevation of a folded article; and

Fig. 10 is a detail sectional elevation, taken on the line 10—10, Fig. 1.

While the present folding machine may be arranged and operated as a distinct, self-contained unit, entirely independent of other machines or devices, with the work to be folded fed to the machine by hand, the drawings illustrate it employed in cooperation with a flat work ironer conventionally indicated at 10 and provided with the usual endless work delivery tapes or belts 11 traveling over rolls 12 mounted in arms 13 pivoted to the main frame at 14. These arms are supported by eccentrics 15 which during rest periods, as at lunch time, may be rotatably adjusted, say 180° or so, to lower the arms and move the tapes or aprons away from the hot chest to avoid burning or charring them, all as is customary. When the arms are up, in their normal operating position shown, the tapes deliver the ironed articles to the work-receiving tapes or aprons of the folding machine, now to be described.

2

The folding machine may be of single lane or multiple lane form, and is shown as a multiple lane machine, one lane only of which will be described. The line A—A, Fig. 2, indicates the plane of division between the two lanes. Two streams of articles may be permitted to flow through the machine, one in each lane, articles in each stream being folded independently of those in the other stream, but a wide work piece, such as a bed sheet, will overlap two or more lanes, in which case those lanes work together as a unit, by proper coordination of their controlling, timing and folding devices.

The folding machine shown comprises a suitable frame, marked generally 16, including legs 17, cross rods 18, channels 19, one or more supporting plates 20, and an outer shell or casing 21.

Each lane of the machine is provided with folding mechanism as follows:

In suitable bearings on plates 20 are journalled ribbon rolls 22, 23, 24, and on extensions 25 of said plates, rolls 26, 27, 28, 29 around which travel three sets 30, 31, 32 of endless ribbons or tapes which convey through the machine the articles to be folded therein by any suitable folding devices, such as upper and lower folding rolls 33, 34. Sprockets (not shown) and a system of chains indicated by the dot-dash lines 35, 36, provide coordinated drive for all of the belts from a main driving shaft 37, a sheave 38 on which is connected by belt 39 to the motor 40. Articles ironed in the ironer 10 are delivered by its belts 11 upon the upper stretch of the upper tapes 30, are carried thereby to the right in Fig. 1, are then delivered to the second set of tapes 31 and carried to the left, and are then carried to the right by tapes 32, where they travel between curved resilient pressure members, shown as fingers 41, 42, the free ends of which extend downwardly in alternation with each other (Fig. 10) to apply a light frictional drag on any arti-

cle passing between them, for a purpose which will later appear.

The pressure fingers 41 ,42 terminate just above and in front of the entrance to or bite between the folding rollers 33, 34, into which the article to be folded is advanced by folding means of the same general type shown and described in Letters Patent No. 1,607,407 granted November 16, 1926, to W. F. Mayer, for Sheet folding machine. That is to say, the machine includes a swinging or vibratory member over which the article is draped and which advances it into the bite of the rolls.

Referring to Figs. 3 and 4, the bar 43, made of wood, supports a sheet metal blade 44, both extending crosswise of the machine and lying in such position that the edge of the blade is presented toward the folding rolls. Bar 43 has a concave rear surface to provide a clamping seat 43*a* and serves as a clamping jaw for cooperation with clamping devices, shown as rubber rings or sleeves 45 mounted at intervals upon a clamp rod 46, which serves as the second jaw.

Bar 43 is mounted upon the upper end of three rigid arms 47, mounted upon a pivoted cross rod or shaft 48 and the center one of which is provided with a second arm 49 carrying a counterweight 50 lying above a roller 51 which is actuated by cam 52 on a shaft 53 driven by chain 54 from the main driving shaft 37.

Rod 46 is mounted in blocks 55, one at the upper end of each of two curved leaf springs 56 fastened at their lower ends to the end arms 47. Each of said blocks has pivoted thereto a rod 57 extending rearwardly, away from the folding rollers, and having its rear end provided with a depending hooked end portion 58 engaged over a cross rod 59 and preferably cushioned, as by a short piece of rubber tubing 59*a*, to reduce shock and noise. Springs 56 are of such shape and tension and are so mounted as to always tend to move clamping rod 46 toward its seat in the clamping recess 43*a* of rod 43.

Shaft 53 is rotated intermittently by suitable half revolution clutch mechanism, indicated conventionally at 60 and controlled by timing mechanism or devices, similarly indicated at 61, Fig. 2. The clutch and timing devices may be of any suitable construction and form no part of the invention, and therefore require no detailed description. One suitable clutch mechanism is shown in the Mayer patent above referred to. The timing device may be electrical and include electronic devices such as shown in Letters Patent No. 2,374,779, granted May 1, 1945, to John E. Preston for Sequence timer and measuring control. It is sufficient to say that these devices here include one or more timing contact fingers 62, 63, past or between which the work is carried by one of the sets of tapes, and which therefore are sensitive to the time of passage of the leading and trailing edges of the article, and thus to its length, which contacts so affect or actuate the timer as to cause clutch operation at the proper times to produce the necessary folding operation.

Fig. 9 illustrates an end view of an article B folded in this machine. The fold is what may be termed a half and quarter fold, in the sense that the article is first folded at its quarter point and then at the mid and three-quarter points. The timing mechanism takes care of the production of such folds in the article, regardless of its length, in the manner described in the Preston patent referred to, while the manner of producing the fold is described in the Mayer patent. That is to say, while the folding bar lies in its advance position, at or in the bite of the folding rolls, the leading end of the article is permitted to descend behind it. When about one-quarter of the article has descended, the bar moves back, carrying the article with it and the second and third quarters of the article are draped over and descend as a loop in front of the bar, whereupon it advances and carries the quarter and three-quarter points of the article (superposed now at a fold at the left in Fig. 9) into the bite of the folding rolls. Upon discharge from the rolls the article has received a double transverse fold with its edges coinciding.

Figs. 1, 4 and 6 show the parts in the positions they occupy just after one article, such as a sheet, has been folded and another is advancing into position to be draped and folded.

The clamping jaws 43, 46 are opened or separated from each other, because cam 52 has elevated arm 49 and moved arms 47 to the right in Fig. 1 and to the left in Fig. 4, but the stop hooks 58 have engaged cross rod 59 and restrained full advance of rod 46. But the gap between the jaws is comparatively narrow. Thus, the approaching leading end of the article to be folded emerges from between the pressure fingers 41, 42 and is guided or directed by them into the narrow gap between the clamping jaws in the manner shown in Fig. 6, until approximately one-quarter of the length of the article has passed the folding blade 44. At this particular instant the half revolution clutch mechanism, half revolution operation of which has been initiated by the timing mechanism, causes arm 49 to descend and arms 47 to move to the right in Figs. 4 and 6. Jaw bar 43 almost immediately engages jaw rod 46, so that the work is quickly clamped between the two jaws, the swinging motion of arms 47 continuing until the parts reach the position shown in Fig. 7, rod 57 sliding over rod 59 in the manner shown. Quick clamping, in the manner described, prevents slipping or displacement of the work on the draping or folding bar as it moves away from the folding rollers. Feed of the advancing article by the tapes of course goes on continuously without interruption, and the advancing article now descends in front of the blade 44, in loop form, instead of behind it, as shown in Fig. 7. The half revolution clutch mechanism, including shaft 53 and cam 52, of course is idle while this is going on. Finally, when approximately the three-quarter point of the article reaches a position abreast the edge of the folding blade, the timing mechanism again sets the clutch mechanism into operation, causing arm 49 to rise, tilting arms 47 to the left in Fig. 4, and advancing the article, in its folded and draped condition, into the bite between the folding rolls, which squeeze and compress the folds and make them more or less permanent, as the article passes between them. As arms 47 advance, the stop hooks 58 engage rod 59 and restrain further advance of the jaw rod 46, thus releasing the article from the clamping effect.

Referring particularly to Figs. 1 and 10, pressure fingers 41 are narrow, curved strips of thin resilient material. Although metal may be employed, one suitable material is fabric impregnated with heat-resistant plastic substance, known in the trade as Formica, although other plastic or fabric materials may be employed. These fingers are flexible and resilient, but are

formed to a fixed shape as shown. They lie in recesses between the ribbons and are mounted in a fixed position close to the roll but barely touching it. They are usually about one-half inch wide and of a thickness which brings their outer surfaces in a plane with or just slightly below the outer surfaces of the ribbons. The free ends of said fingers which extend below the roll, as shown, therefore cause them to act as strippers for the work, preventing articles passing through from clinging to and following the roll surface. They also each form one side of a narrow channel, in cooperation with finger 42, for directing the articles downwardly between the folding blade and the clamping mechanism.

The other fingers 42 usually are made of thin metal, such as stainless steel, formed as shown. They are a little wider than fingers 41, and of approximately the width of the ribbons, or a little less. These fingers are mounted freely on a cross rod and are spaced at intervals along the rod to lie on top of the ribbons between the other fingers.

The fact that the fingers 41 lie close to the roll and that fingers 42 lie on top of the ribbons, provides the very shallow or close spacing between the two sets which provides the channel described above, with the weight and pressure of the freely pivoted fingers 42 supplying a light pressure to the articles passing through, particularly the trailing ends thereof, and preventing the rear edge of each article from prematurely dropping downwardly away from roll 24, as it passes over the same. This insures that short articles, particularly, are properly draped into four-fold condition for presentation to the folding rolls.

Folded articles passing through the folding rolls travel down an inclined apron 64 to a suitable support, such as the table 65.

Since the clamping is effected by gradual and resilient approach of two commonly pivoted members, there is no jar or pound. Similarly, upon forward movement, springs 56 flex and cushion the blow, while the rubber sheaths 59*a* reduce sound. The short throw of the blade arms minimizes whip and vibration.

When the clamping bar 46 is held away from bar 43, as in Fig. 4, only a small amount of energy or tension is stored in springs 56, and as the folding blade 44 moves away from the rolls, this spring energy is gradually reduced until, when the clamping jaws come together there is just enough force left to lightly clamp or hold the article. Thus any possible shock on impact of the work clamping members is reduced to a minimum.

For similar reasons the reactive force applied to the clutch and other parts of the half revolution mechanism, during an operating cycle of such mechanism, is also reduced to a minimum, lightening or reducing the clutch load and producing quick and reliable response thereof to a call for its operation.

The construction described insures very accurate draping of the articles upon and between the clamping jaws, regardless of the length of the articles, and insures their introduction into the folding rolls without wrinkles and in such manner as to produce a neat fold with all edges and folds in line with each other. The machine as a whole operates automatically, without any attention by the operator, and shock and jar and wear and tear, as well as sound, are reduced to a minimum. Thus the apparatus is durable and has a long life before adjustments and repairs become necessary.

Further advantages of the invention will be apparent to those skilled in the art.

What I claim is:

1. A folding machine, comprising a frame, cooperating folding rolls mounted thereon into the bite of which work to be folded may be advanced, a support movably mounted upon the frame and carrying an elongated folding bar extending parallel to said rolls and movable back and forth with said support along a path in a direction transverse to bar length and toward and from the bite of said rolls, means for feeding a sheet-form article in a plane parallel with the axes of said rolls and intersecting said path, whereby during advance and retreat of said bar an article is draped upon it and is so delivered to said rolls for folding, and a clamping member movable with said bar and cooperating therewith for clamping the article to the bar while draping it thereon.

2. A folding machine, comprising a frame, cooperating folding rolls mounted thereon into the bite of which work to be folded may be advanced, a support movably mounted upon the frame and carrying an elongated folding bar extending parallel to said rolls and movable back and forth with said support along a path in a direction transverse to bar length and toward and from the bite of said rolls, means for feeding a sheet-form article in a plane parallel with the axes of said rolls and intersecting said path, whereby during advance and retreat of said bar an article is draped upon it and is so delivered to said rolls for folding, and a yielding clamping bar biased toward and movable with the folding bar for clamping the article between said bars while draping it thereon.

3. A folding machine, comprising a frame, cooperating folding rolls mounted thereon into the bite of which work to be folded may be advanced, a support movably mounted upon the frame and carrying an elongated folding bar extending parallel to said rolls and movable back and forth with said support along a path in a direction transverse to bar length and toward and from the bite of said rolls, means for feeding a sheet-form article in a plane parallel with the axes of said rolls and intersecting said path, whereby during advance and retreat of said bar an article is draped upon it and is so delivered to said rolls for folding, and a clamping member movably mounted upon said support and yieldingly biased toward and cooperating with said bar for clamping the article to the bar while draping it thereon.

4. A folding machine, comprising a frame, cooperating folding rolls mounted thereon into the bite of which work to be folded may be advanced, a support movably mounted upon the frame and carrying an elongated folding bar extending parallel to said rolls and movable back and forth with said support along a path in a direction transverse to bar length and toward and from the bite of said rolls, means for feeding a sheet-form article in a plane parallel with the axes of said rolls and intersecting said path, whereby during advance and retreat of said bar an article is draped upon it and is so delivered to said rolls for folding, a clamping member movably mounted upon said support and yieldingly biased toward and cooperating with said bar for clamping the article to the bar while draping it thereon, and operating devices for releasing the clamping member from clamping relation with the bar as

the article to be folded nears the rolls, thereby to release the article for folding.

5. A folding machine, comprising a frame, cooperating folding rolls mounted thereon into the bite of which work to be folded may be advanced, a support movably mounted upon the frame and carrying an elongated folding bar extending parallel to said rolls and movable back and forth with said support along a path in a direction transverse to bar length and toward and from the bite of said rolls, means for feeding a sheet-form article in a plane parallel with the axes of said rolls and intersecting said path, whereby during advance and retreat of said bar an article is draped upon it and is so delivered to said rolls for folding, a clamping member movably mounted upon said support and yieldingly biased toward and cooperating with said bar for clamping the article to the bar while draping it thereon, and operating devices for stopping advance of the clamping member as the advancing folding bar nears the rolls, thereby to release the article for folding.

6. A folding machine, comprising a frame, cooperating folding rolls mounted thereon into the bite of which work to be folded may be advanced, a support movably mounted upon the frame and carrying an elongated folding bar extending parallel to said rolls and movable back and forth with said support along a path in a direction transverse to bar length and toward and from the bite of said rolls, means for feeding a sheet-form article in a plane parallel with the axes of said rolls and intersecting said path, whereby during advance and retreat of said bar an article is draped upon it and is so delivered to said rolls for folding, a clamping member movably mounted upon said support and yieldingly biased toward and cooperating with said bar for clamping the article to the bar while draping it thereon, and means operated by travel of said support for rendering said bias ineffective as the article nears the bite of the rolls.

7. A folding machine, comprising a frame, cooperating folding rolls mounted thereon into the bite of which work to be folded may be advanced by generally horizontal movement, a support movably mounted upon the frame and carrying an elongated folding bar extending parallel to said rolls and movable back and forth with said support along a path in a direction transverse to bar length and toward and from the bite of said rolls, means lying above said path for releasing a sheet-form article for downward motion in a generally vertical plane parallel with the axes of said rolls and intersecting said path, friction means effective upon the article for retarding its downward motion, and a yielding clamping member movable with said folding bar and cooperating therewith for clamping the article to the bar while the latter moves back and forth to drape the article upon it.

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