

Aug. 12, 1958

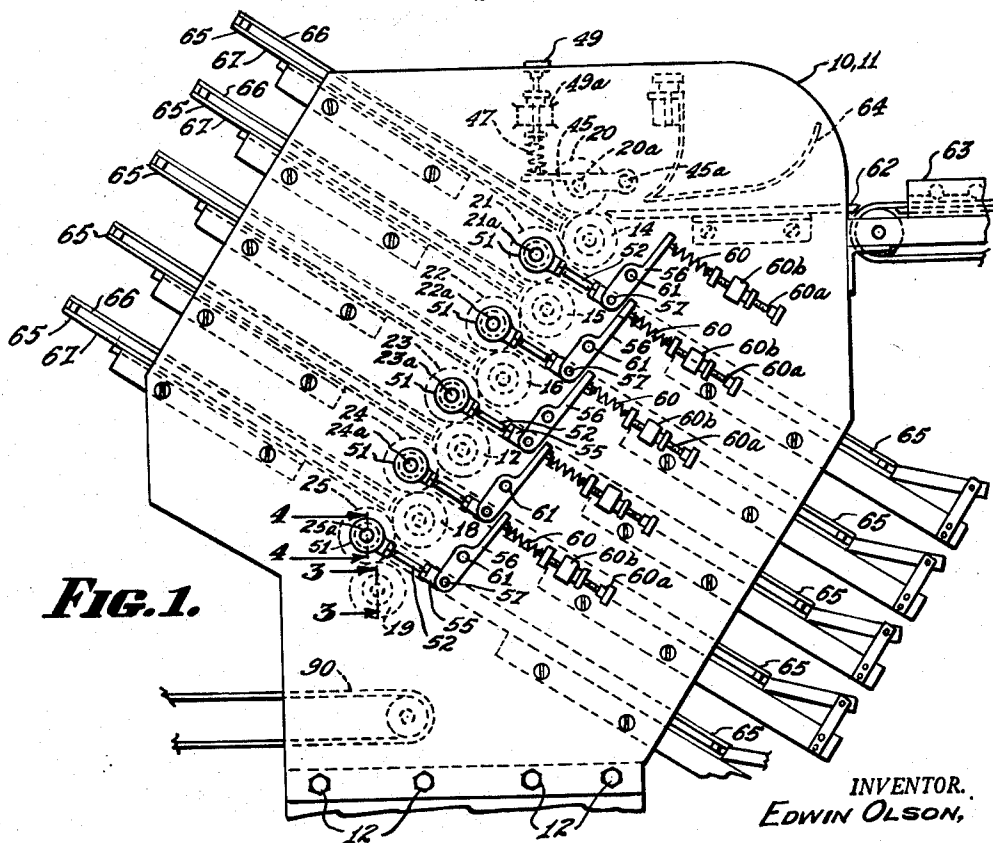
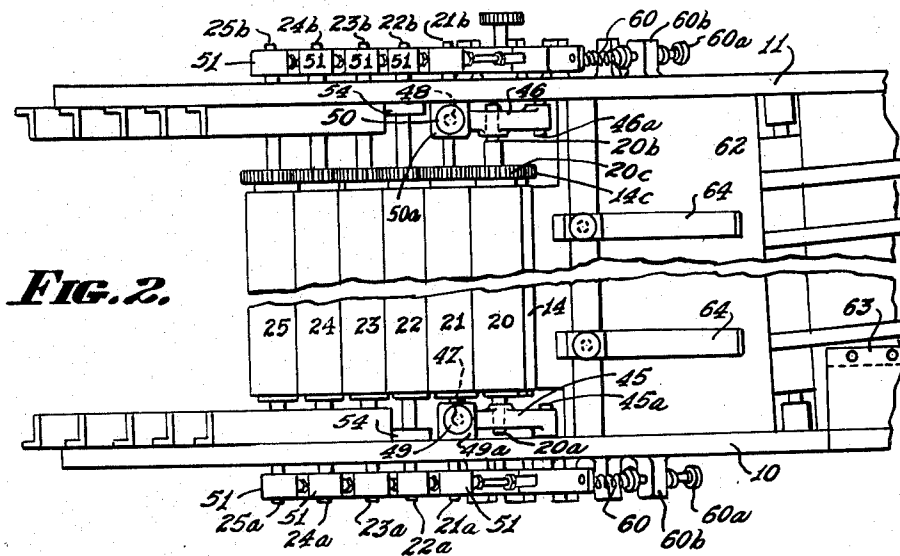
E. OLSON

2,847,209

BUCKLE TYPE FOLDING MACHINE

Filed Feb. 28, 1955

3 Sheets-Sheet 1



INVENTOR.
EDWIN OLSON,

BY

Allen Allen

ATTORNEYS.

Aug. 12, 1958

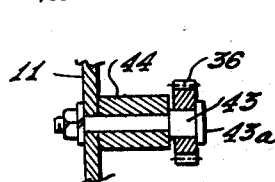
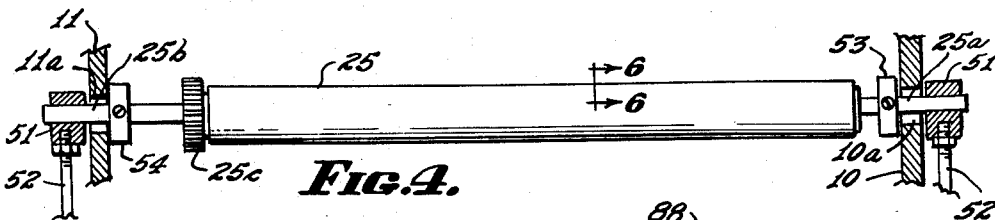
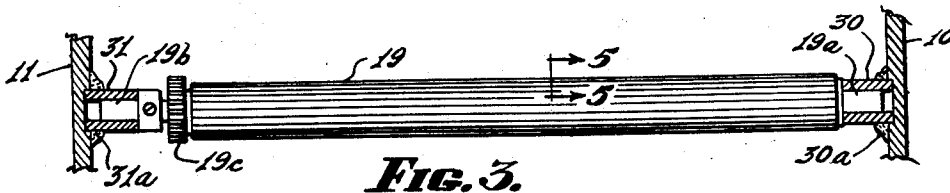
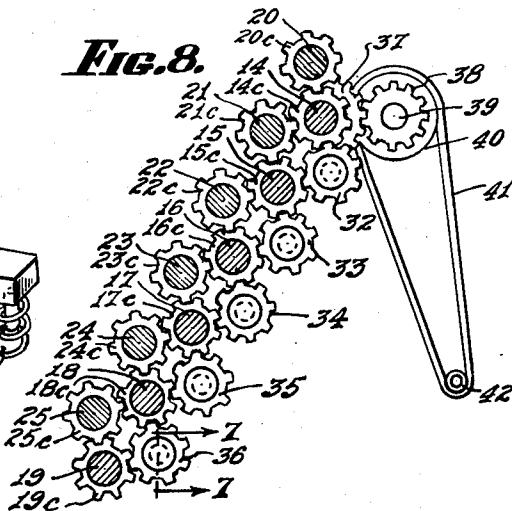
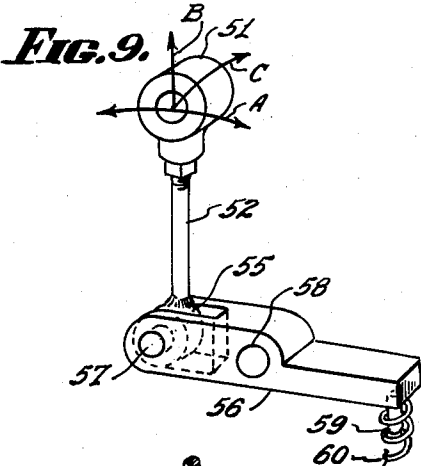
E. OLSON

2,847,209

BUCKLE TYPE FOLDING MACHINE

Filed Feb. 28, 1955

3 Sheets-Sheet 2



INVENTOR.
EDWIN OLSON,
BY *Allen Allen*

ATTORNEYS.

Aug. 12, 1958

E. OLSON

2,847,209

BUCKLE TYPE FOLDING MACHINE

Filed Feb. 28, 1955

3 Sheets-Sheet 3

FIG. 11.

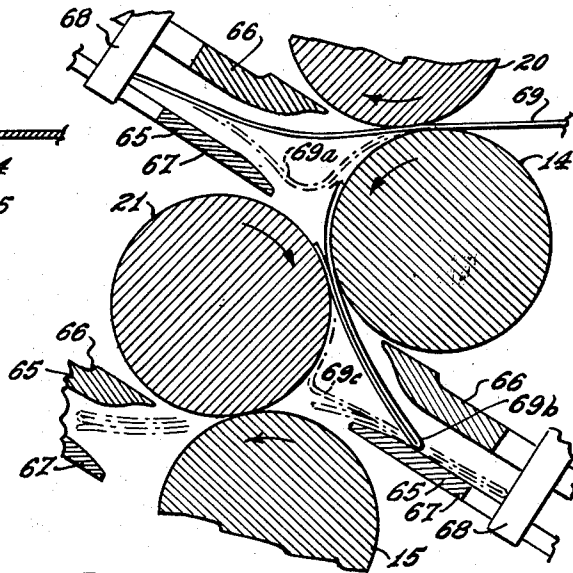
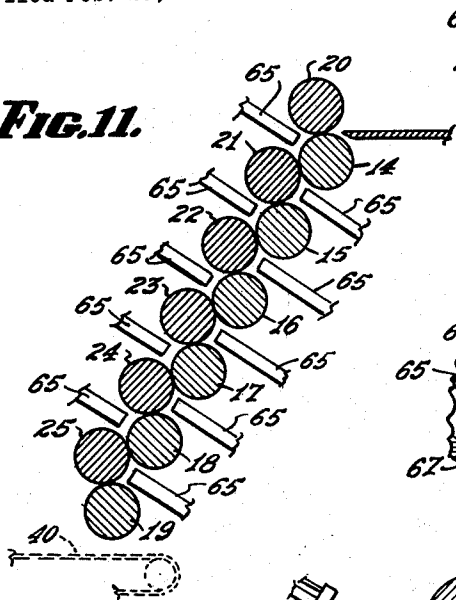


FIG. 12.

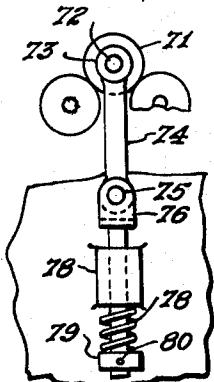


FIG. 13.

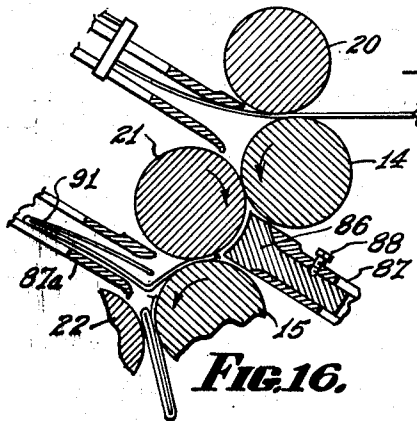


FIG. 14.

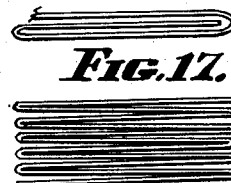


FIG. 15.

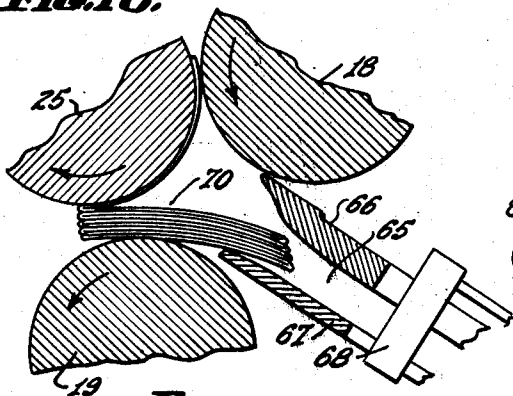


FIG. 16.

FIG. 17.

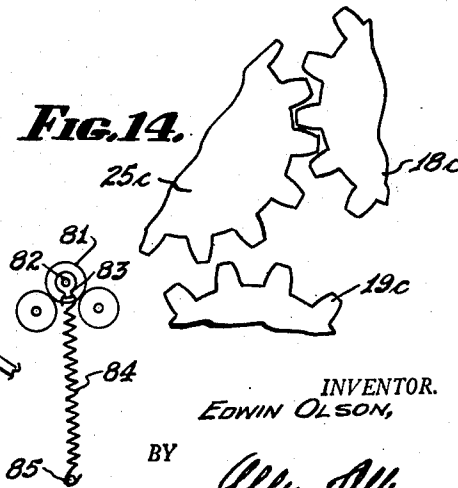


FIG. 18.

INVENTOR.
EDWIN OLSON,

BY

Allen Allen

ATTORNEYS.

1

2,847,209

BUCKLE TYPE FOLDING MACHINE

Edwin Olson, Cleveland, Ohio, assignor to Russel Ernest Baum, Inc., Philadelphia, Pa., a corporation of Pennsylvania

Application February 28, 1955, Serial No. 490,957

1 Claim. (Cl. 270—68)

This invention relates to paper folding machines of the type in which paper is folded by a buckling operation.

The invention has especial reference to an improved mounting of the feeding and folding rolls and to the driving means thereof.

As well known in the art, it has heretofore been considered impractical to provide a folding machine of the buckle type which was capable of imparting a large number of parallel folds to a workpiece. With respect to buckle type folding machines the industry has therefore resigned itself to machines so constructed as to be limited to imparting only about four parallel folds, more or less, depending on various factors well known to those skilled in the art.

One reason for the limited nature of the machines heretofore developed resides in the manner in which the various feeding and folding rolls were mounted in the machines. In general, the rolls have heretofore been mounted in a resilient arrangement whereby they were permitted to separate slightly from each other as workpieces passed therebetween. However, because of the mountings and arrangements heretofore employed the degree or amount of resiliency was of a limited or restricted nature and when a large number of folds were attempted various difficulties were encountered. The workpieces jammed in the machine or were torn, improperly folded or otherwise disheveled.

Some degree of success, directed toward the problem of imparting a larger number of folds, has been achieved by the obvious expedient of arranging at least two of the conventional machines in series, the rolls of the second machine being set at increased distances. Arrangements of this nature, however, have proven generally unsatisfactory, are unduly expensive and require means for transferring the work pieces from machine to machine, a troublesome and objectional feature. Another objection to such an arrangement has been the relatively large amount of floor space required, two machines plus an intervening conveyor requiring approximately three times the space occupied by a single machine.

It is an object of this invention therefore, to provide an improved folding machine of the buckle type whereby the number of folds imparted to a workpiece may be substantially increased beyond the number of folds heretofore considered practical to impart in a single machine of the buckle type.

Another object of the invention is to provide an improved mounting arrangement for the feeding and folding rolls whereby certain of the rolls are fixedly (but rotatably) mounted in the frame and other coating rolls are resiliently (also rotatably) mounted in a new and novel manner whereby the resiliently mounted rolls may freely separate or be displaced from the fixedly mounted rolls in full conformance with the thickness of work pieces passing therebetween.

Still another object is to provide a novel arrangement

2

comprising a series of fixedly mounted work rolls and a series of independently and resiliently mounted work rolls in combination with driving means comprising a train of gears so arranged as to positively impart driving motion at all times regardless of displacement of the resiliently mounted rolls as a work piece passes through the machine.

Other objects of the invention and the features of novelty will be apparent from the following description taken in connection with the accompanying drawings of which:

Figure 1 is a side elevational view showing a folding machine constructed in accordance with a preferred embodiment of the invention.

Figure 2 is a plan view of Figure 1, but with certain parts removed to facilitate illustration of novel features of the invention.

Figure 3 is an enlarged fragmentary sectional view taken along the line 3—3 of Figure 1, and showing in detail the journaled mounting of certain work rolls.

Figure 4 is an enlarged fragmentary sectional view taken along the line 4—4 of Figure 1 and showing in detail certain features of an improved mounting employed with certain other work rolls of the machine of Figure 1.

Figure 5 is an enlarged fragmentary sectional view taken along the line 5—5 of Figure 3.

Figure 6 is a similar view taken along the line 6—6 of Figure 4.

Figure 7 is an enlarged sectional view taken along the line 7—7 of Figure 8 and illustrating a stud or suitable mounting for various idler gears preferably employed.

Figure 8 is a diagrammatic sectional view illustrating a train of gears in accordance with the invention.

Figure 9 is a fragmentary perspective view showing a lever having a pivotally affixed link comprising a bearing member.

Figure 10 is a fragmentary perspective view showing the pivoted end of the link of Figure 9.

Figure 11 is a diagrammatic sectional view illustrating arrangement of the various feeding and folding rolls and the arrangement of folding plates or pockets therewith.

Figure 12 is an enlarged sectional view through the initial feeding and folding rolls of the preferred embodiment, the view also showing detailed fragments of the folding pockets and illustrating the buckling and folding of the paper as it is advanced between the rolls.

Figure 13 is a view similar to Figure 12 but showing the folding of the paper and the resulting displacement of a work roll as the final folds are imparted to the paper.

Figure 14 is a semi-diagrammatic view illustrating the relative positions occupied by their driving gears when the rolls are in the position of Figure 13.

Figure 15 is a diagrammatic view illustrating an "accordion" folded work piece or pamphlet.

Figure 16 is a fragmentary sectional view showing a deflector mounted in one of the folding pockets.

Figure 17 is a view illustrating the "over and over" type of fold produced by use of the deflectors of Figure 15.

Figure 18 is a side view showing an alternative arrangement or modification which may be substituted for the lever and link of Figure 9.

Figure 19 is a side view showing a further alternative mounting for a work roll.

Referring to Figures 1 and 2 of the drawings, a preferred embodiment of the invention comprises frame members herein shown as side plates 10 and 11. These side plates are affixed as by bolts or screws 12 to other supporting frame members such as indicated at 13, which form no part of this invention and serve merely to sup-

port the plates 10 and 11, as will be apparent to those skilled in the art and which, for purpose of this disclosure, need not be herein shown and described in detail.

As shown, the plates 10 and 11 provide suitable and convenient means for supporting the various work rolls which are pertinent to the invention. Still referring to Figures 1 and 2, these work rolls comprise a plurality of rolls which, for convenience of this disclosure, may be divided into two groups. Thus one group will be referred to as fixedly mounted work rolls and the other group will be referred to as resiliently mounted work rolls.

The fixedly mounted work rolls as indicated in Figures 1, 3 and 11 comprise the rolls 14, 15, 16, 17, 18 and 19, while the resiliently mounted work rolls comprise the rolls indicated at 20, 21, 22, 23, 24 and 25.

Referring now to Figure 3, which is a sectional view through the work roll 19, a preferred mounting which is common to all of the various fixedly mounted rolls is shown. Thus, the roll 19 is provided with a spindle 19a on the right and a spindle 19b on the left. The spindles 19a and 19b are respectively journaled in suitable bearing members 30 and 31 which members are fixedly mounted in the side plates 10 and 11 by welding as indicated at 30a and 31a, or by any other suitable means as will be apparent to those skilled in art. It is to be now understood that all of the various fixedly mounted rolls are mounted as just described, these rolls being provided with spindles which are journaled in fixedly mounted bearings. Thus, while these rolls are free to rotate, when driven as will next be described, the rolls cannot shift from their normal operating positions as shown.

For purpose of driving the various fixedly mounted rolls each of the rolls is provided with a spur gear fixed thereon. Thus, as in Figure 3, the roll 19 is furnished with a gear 19c. Referring now to Figure 8, which is a semi-diagrammatic view of the driving arrangement, the positions of the fixedly mounted work rolls 14 through 19 are indicated by those numerals and the spur gear carried by each of these rolls is indicated by an appended letter "c." Thus, in Figure 8 the rolls 14 through 19 have spur gears respectively indicated at 14c through 19c.

Still referring to Figure 8, the fixedly mounted rolls 14 through 19 are positively driven simultaneously and at identical speeds by means of idler gears indicated at 32, 33, 34, 35 and 36, which idlers are arranged as shown to mesh with and transmit motion between the successive gears 14c through 19c. The train of gears just described assures proper and positive rotation of the fixedly mounted rolls 14 through 19 at all times, the rolls rotating at identical speeds. The required driving power may be applied as convenient to any gear of the train 14c through 19c. However, as shown, the roll 14 is provided with a gear 37 (Fig. 8) driven by a gear 38 which is mounted on a shaft 39 having pulley 40 in turn driven by a belt 41 running over a drive pulley 42 which as will be understood may be powered by any desirable means such as an electric motor or the like, not shown. As will be clear, other arrangements for driving the rolls may readily be devised without departing from the scope of the invention.

The idler gears 32 through 36 may be mounted in any convenient manner and various mountings thereof may be readily devised without departing from the scope of the appended claims. However, referring briefly to Figure 7, the idler gear 36 is journaled upon a stud 43 which stud is provided with a spacing sleeve 44 and has a head 43a to retain the gear in operative relation, as will be apparent from inspection of the drawing.

While not pertinent to the invention it may, however, be now pointed out that the positive driving arrangement for the various lower work rolls as just described, provides a convenient means for driving other appurtenances of the machine, such as a feeding device (not shown) or a conveyor such as indicated at 90 (Fig. 1), for disposing of the folded work pieces.

Thus, any gear of the train driving the rolls 14 through 19 may be readily engaged and employed as a driving means, it being understood that suitable power transmitting members (not shown) would be employed.

Referring to Figures 1 and 2, the roll 20 which serves only as an initial feed roll, is resiliently mounted or spring pressed into contact with the roll 14, the roll 20 having a spindle 20a and a spindle 20b respectively journaled in bearing members 45 and 46, each of which at one end is pivotally and respectively mounted as at 45a and 46a on the side plates 10 and 11. At their other ends the members 45 and 46 are engaged by compression springs 47 and 48 to thus urge the roll 20 into contact with roll 14, the compression of the springs being adjustable by means of adjusting screws 49 and 50 threaded in lugs 49a and 50a of the side plates. For driving purposes the roll 20 is provided with a gear 20c which meshes with the gear 14c of the roll 14 (Fig. 8).

One of the novel features of the invention resides in the resilient mountings provided for the rolls 21 through 25, the detailed construction and mountings of these rolls being identical. Referring briefly to Figure 4, the detailed construction of one of these rolls is clearly illustrated. As therein shown the roll 25 has spindles 25a and 25b which extend outwardly through enlarged perforations 10a and 11a of the side plates 10 and 11, the perforations providing ample clearance to permit some displacement of the roll from its normal position as shown. The spindles 25a and 25b are journaled in bearings 51, 51, which bearings are affixed to rods 52, 52 in accordance with an arrangement which will later be described in detail. As shown in Figure 4 the roll 25 is provided with a gear 25c for purposes of driving the roll. To restrain undue axial movement of the roll thrust bearings or collars 53 and 54 may be employed as shown, the collars being affixed to the spindles and arranged to abut one of the side plates 10 or 11 if the roll tends to move sidewise from its normal operating position between the side plates. Other arrangements for this purpose may readily be devised by those skilled in the art without departing from the scope of the invention.

Referring briefly to the driving diagram of Figure 8 the rolls 21 through 25 are indicated by the numerals 21, through 25, the drive gears of the rolls being respectively indicated at 21c through 25c. It may be noted that each of the gears 21c through 25c is engaged by two other gears. Thus for example, the gear 21c is engaged by the gears 14c and 15c, while the gear 22c is engaged by the gears 15c and 16c.

As previously stated, the detailed construction and the mounting of the resilient rolls 21 through 25 is identical. Referring now to Figures 1 and 2, the rolls 21 through 25 are thus provided with spindles 21a through 25a on the one side and spindles 21b through 25b on the other side, all of these various spindles being journaled in identical bearing members 51.

Referring now to Figures 9 and 10, each of the bearing members 51 is affixed in any desired manner to a rod or arm 52 at the lower end of which is affixed a second bearing member 55. The assembly of these members 51, 52 and 55 may for convenience, be termed a link or an arm, the arm being pivotally attached to a lever 56 by means of a pin 57 passing through one end of the lever 56 and the bearing 55. The lever 56 is perforated as at 58 for the purpose of fulcrumed mounting and has a downwardly depending pin 59 for retaining a compression spring 60 as will presently be clear.

As best seen in Figure 1 where a plurality of the levers 56 appear, the levers are mounted by means of suitable fulcrum pins or studs 61, the levers being urged by compression springs 60 to the positions shown whereby each of the work rolls 21 through 25 is thus resiliently urged into contact with a pair of the fixedly mounted work rolls.

Adjustment of the springs 60 may be provided by means of adjusting screws 60a threaded in lugs 60b of the frame.

It may be pointed out with reference to Figure 9 that by virtue of the arrangement of parts as shown the bearing members 51 and the rolls journaled therein may pivot or oscillate about the axis of the pin 57 in a path as indicated by the double headed arrow A. Also due to the fulcrumed mounting of the levers 56 the movement may be as indicated by the arrow B, this movement resulting in compression of the springs 60 as the levers 56 rock upon their fulcrums. It is to be noted that the rolls 21 through 25 are thus resiliently mounted and with compression of the springs 60, may move in any direction, such as indicated at C, which results from a combination of movements in the directions A and B.

Referring to Figures 1 and 2, the work pieces or flat unfolded sheets of paper may be fed into the machine manually or by any conventional feeding device or the like not herein shown and forming no part of this invention. While entering the machine however, the sheets pass over a suitable or conventional feed board indicated at 62, a side guide 63 and hold down guides 64, 64 being provided as well known in the art.

The unfolded sheet thus fed into the machine is engaged between the lower fixedly mounted roll 14 and the upper resiliently mounted roll 20, these rolls coacting as feed rolls to initially drive the sheet forward as will be obvious. Referring briefly also to Figure 11, the numerals 65 indicate a plurality of folding pockets or buckling plates which as well known in the art are positioned in relation to the various work rolls as shown diagrammatically in that figure. The various folding plates 65 are constructed as well known to those skilled in the art and are deemed to require only brief description for purpose of this disclosure. Thus referring to Figures 1 and 12, the buckling plates 65 each comprise a pair of spaced plates 66 and 67 having an abutment member 68 mounted therebetween. As well known in the art the abutment 68 may be adjustably mounted so as to accommodate various folded widths, the details of said adjustable mounting being no part of the present invention and deemed to require no detailed disclosure for purposes of this specification.

As best seen in Figure 12 the work piece 69 is driven forward by the rolls 20 and 14 until the leading edge of the sheet strikes the abutment 68. Thereupon the sheet commences to buckle as at 69a, whereafter the work rolls 14 and 21 serve as folding rolls and grasp the buckled portion of the sheet to impart a definite fold 69b as the sheet is engaged between the rolls. Thereupon the rolls 14 and 21 function as feed rolls to drive the folded edge 69b into a second buckling plate 65 until the leading folded edge 69b strikes the abutment 68 of that buckling plate. Thereupon the sheet again commences to buckle as at 69c and the rolls 21 and 15 engage the buckled portion 69c to impart a second fold or crease to the sheet. These rolls then function as feed rolls driving the sheet thus folded into a succeeding one of the buckling plates 65. Thus the feeding, buckling and folding operations continue as the work piece is driven between the various work rolls until, as in Figure 13 the work piece emerges between the rolls 19 and 25. As herein shown the work piece now comprises a large number of parallel folds.

During the various folding operations the work piece becomes progressively thicker as will be obvious. The resilient mountings of the upper work rolls permit movement of these rolls in an oscillating fashion away from or toward the coacting lower work rolls as necessary to accommodate passage of the work pieces therebetween. Thus referring to Figure 13, the resiliently mounted roll 25 is displaced from its normal position in contact with the roll 19 by the many thicknesses of the folded pad 70. It is to be noted, however, that the roll 25 is displaced from its normal coacting position with respect

to the roll 18 by only the single thickness of the trailing portion of the work piece. Thus, as illustrated in Figure 14, the gear 25c of the roll 25 is displaced to a position where it is fully out of mesh with the gear 19c of roll 19. It is to be observed, however, that the gear 25c remains in proper driving relation with the gear 18c of the roll 18 so that the roll 25 is smoothly and properly driven. With reference to Figure 13 it is to be pointed out that for purpose of illustration the thickness of the folded pad 70 is highly exaggerated in proportion to actual sizes of the parts and that, therefore, the relative displacement of the roll 25, and of the gear 25c (of Figure 14) is also exaggerated. Nevertheless it will be clear that proper and positive driving engagement of the gears is maintained by virtue of the resilient oscillating mounting of the roll 25, the roll shifting from side to side alternately displaced from the rolls 18 and 25 in an oscillating fashion as the work pieces pass between the rolls.

It may here be mentioned that limited successful operation of the machine may be possible to obtain without use of the idler gears as heretofore disclosed, but that for dependable high speed operation the idler gears are preferred.

Referring briefly to Figure 18 an alternative arrangement providing a resilient and oscillating mounting for a work roll is shown. As here shown the roll 71 having a spindle 72 is journaled in a bearing element 73 comprising a link 74 which is pivotally mounted as at 75 to an element 76 slidably and resiliently carried in a lug or bearing 77 of the frame, the resilient means comprising a compression spring 78 arranged as shown to abut the lug 77 and a collar 79 fixed as by a pin 80 to the slidable element 76. It will be understood that a similar arrangement of parts is required for mounting the opposite spindle of the roll (not shown).

A further alternative arrangement providing a resilient and oscillating mounting is illustrated in Figure 19. As here shown the roll 81 is journaled in a bearing 82 having a lug 83 to which a spring 84 is affixed, the spring being anchored at its lower end by means of a stud or the like 85 mounted in the frame. While this arrangement would permit oscillation of the roll 81 as required I prefer the mountings heretofore disclosed for dependable and accurate performance of the machine.

Referring to Figures 5 and 6 the surfaces of the fixedly mounted rolls such as the roll 19 here indicated, may preferably comprise a knurled or fluted surface as indicated at 87 while the surfaces of the resiliently mounted rolls such as the roll 25 may comprise a semi-resilient sleeve or the like indicated at 88, the surfaces of the rolls forming no novel part of the invention.

As well known in the art, the conventional buckling plates as herein employed may readily be provided with deflecting devices such as often employed to alter the normal course, or path of travel, of the work pieces passing through the machine. Referring briefly to Figure 16, a deflecting device 86 is shown as mounted in a buckling plate 87 and being removably retained therein by means of a set screw or the like 88. Thus the once folded work piece indicated at 91 has been deflected from entry into the buckling plate 87 and diverted into the succeeding buckling plate 87a. As well known in the art and deemed to require but brief mention for purposes of the present disclosure, the employment of similar deflecting devices on alternate buckling plates results in an "over and over" type of fold as illustrated in Figure 17. It is one of the advantages of the improved construction that a larger number of folds of this character may, if desired, be imparted to the work pieces. As well known in the art and deemed to require but brief description herein, the "over and over" type of fold may be employed in conjunction with a pasting operation whereby booklets are inexpensively produced. In this type of operation a glue wheel or the like is employed

to apply a strip of adhesive centrally of the work piece as it enters the machine. Upon emerging from the machine the folded work piece is next folded transversely upon the line of the adhesive whereafter the edges of the work piece adjacent to the line of adhesive are trimmed, the resulting product being a booklet all as well known in the art. It is to be pointed out, however, that by virtue of the improved machine, booklets of this type having a substantially increased number of pages may be relatively inexpensively produced.

From the foregoing disclosure it will now be clear that the invention provides an improved arrangement of parts whereby as the various folding operations are performed the work pieces passing through the machine are engaged and driven forward by successive pairs of feeding and folding rolls, the arrangement being such that each succeeding pair of rolls engaging the work pieces comprises a fixedly mounted roll and a coacting resiliently mounted roll whereby as a work piece is folded and becomes progressively thicker, the rolls may separate in conformance with the thickness of the folded pad, the finally folded work piece thus emerging from the machine in properly folded condition as required.

Thus the invention provides an improved folding machine of the buckle type whereby a substantially increased number of folds may be imparted to the work pieces.

It is to be understood that the appended claim is not to be limited to the precise number of rolls and buckling plates herein shown and described. Other variations from the disclosure herein are also possible without departing from the spirit of the invention and it is therefore, to be understood that the detailed disclosure is for

the purpose merely of illustrating the invention and is not to be construed as a limitation upon the scope of the invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

In a paper folding machine comprising a frame mounting coacting work rolls and buckling pockets, a series of folding rolls disposed in rectilinear spaced relation and fixedly journaled in said frame, a series of pressure rolls disposed opposite to the spaces between the said folding rolls, each pressure roll comprising a resilient journaled mounting urging the roll toward adjacent successive folding rolls while being yieldable therefrom in all directions to accommodate the folds of paper passing through the machine, a drive gear mounted on each of said folding rolls, a drive gear mounted on each of said pressure rolls and engaging successive gears comprising the said series of folding rolls, and supplementary driving means comprising an idler gear disposed between and engaging each successive pair of the said folding rolls drive gears.

References Cited in the file of this patent

UNITED STATES PATENTS

1,770,312	Kleinschmit	July 8, 1930
2,699,331	McGarvey et al.	Jan. 11, 1955
2,707,914	Harrold	May 10, 1955

FOREIGN PATENTS

263,860	Great Britain	July 7, 1927
441,557	Great Britain	Jan. 22, 1936