Jan. 30, 1962 M. M. POTTER ET AL 3,019,015

PAPER FOLDING MACHINE WITH TYING MEANS

Filed June 20, 1960 4 Sheets-Sheet 1

Fig. 1.

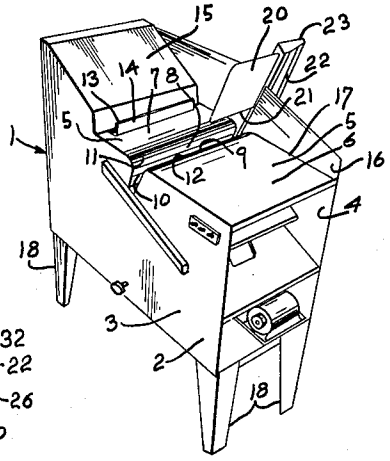


Fig. 7.

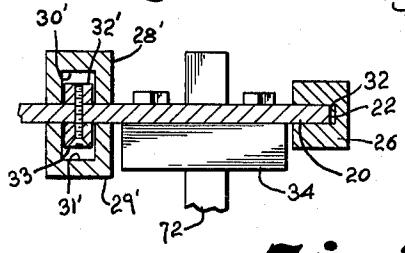
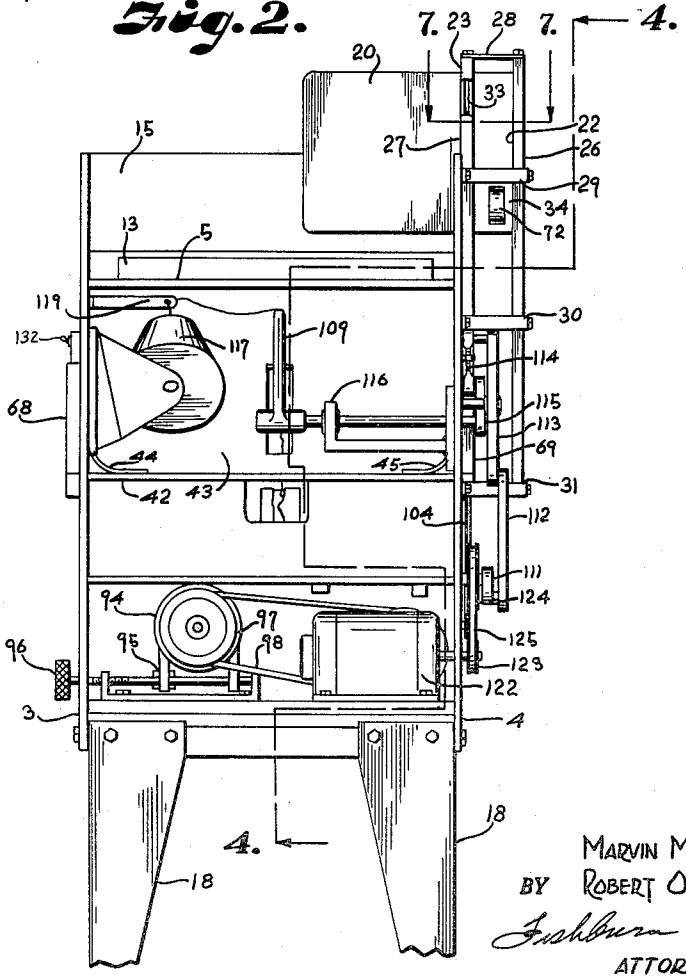


Fig. 2.



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Fig. 3.

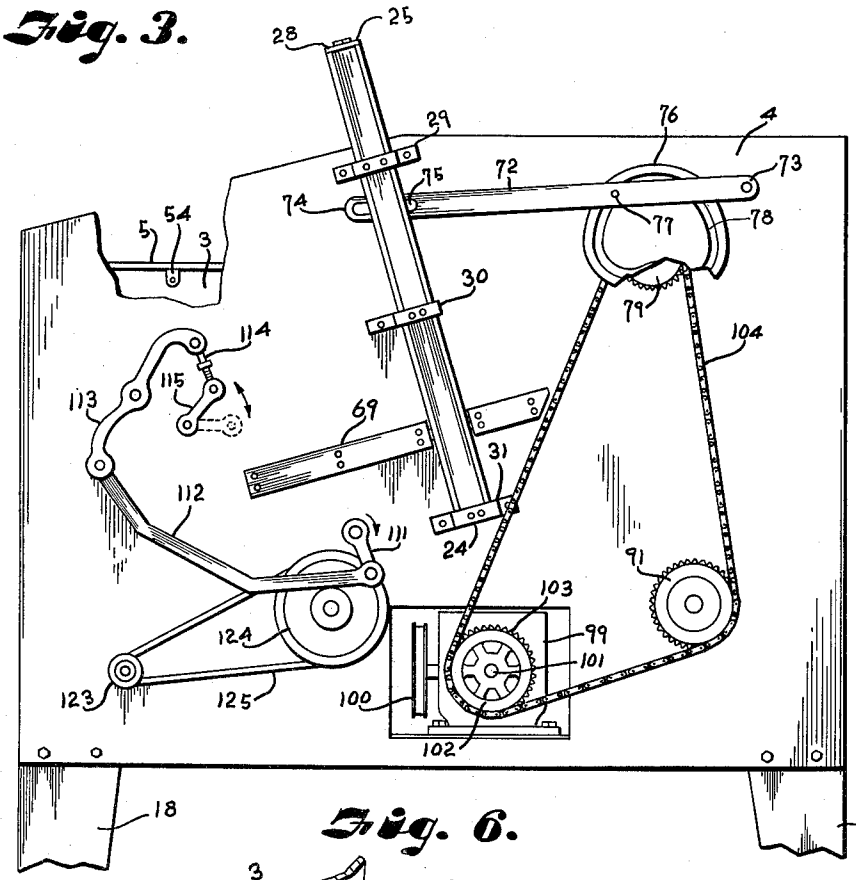
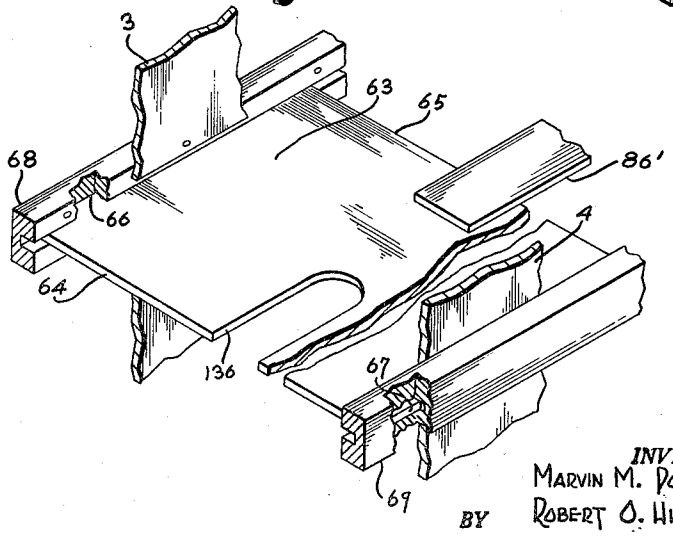


Fig. 6.



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Fig. 4.

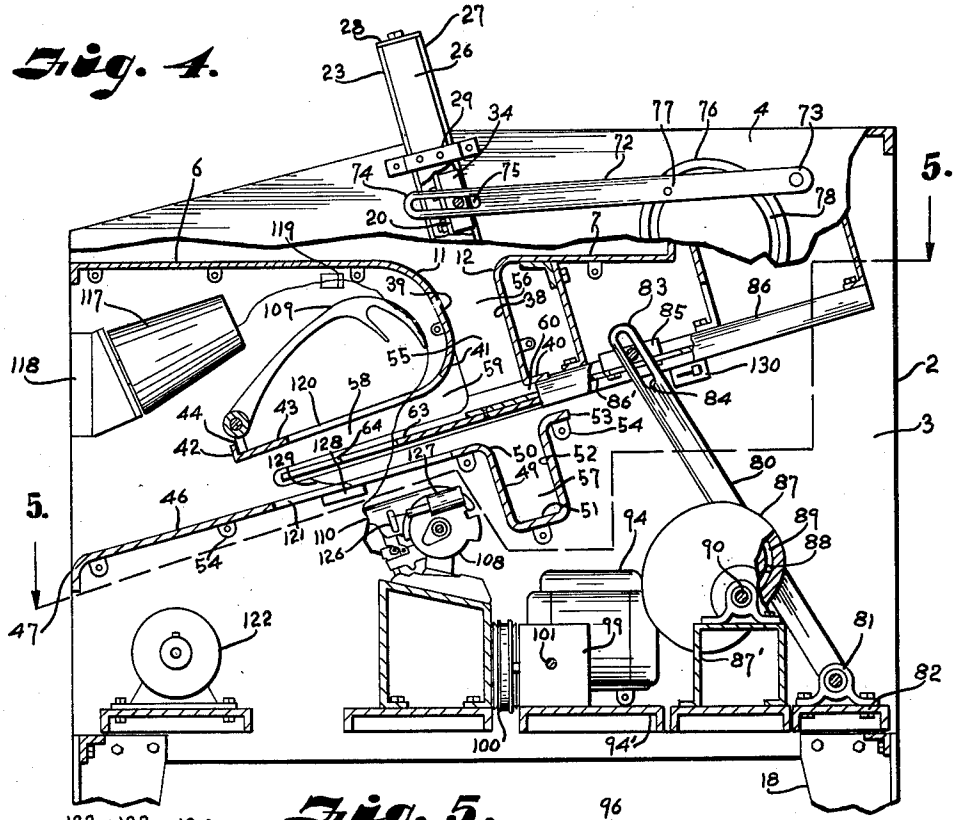
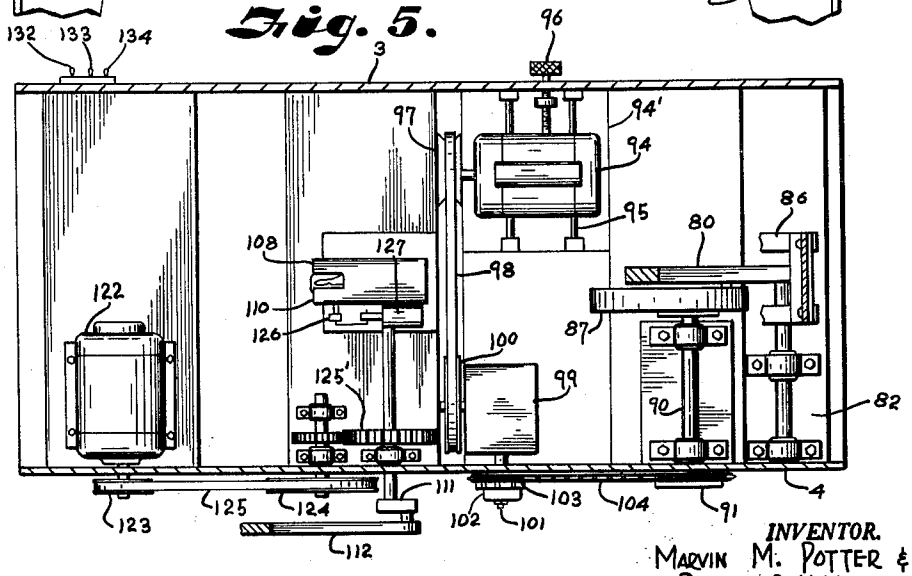


Fig. 5.



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Fig. 8.

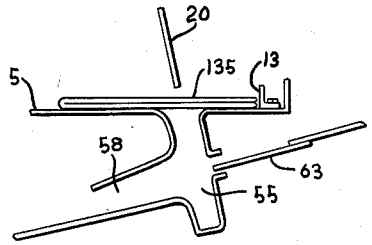


Fig. 9.

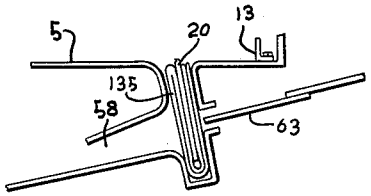


Fig. 10.

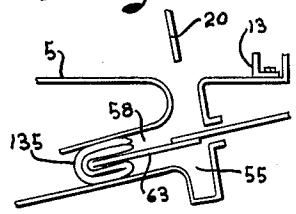


Fig. 12.

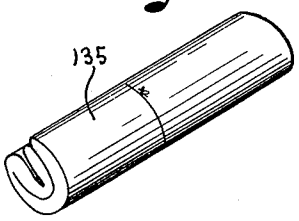
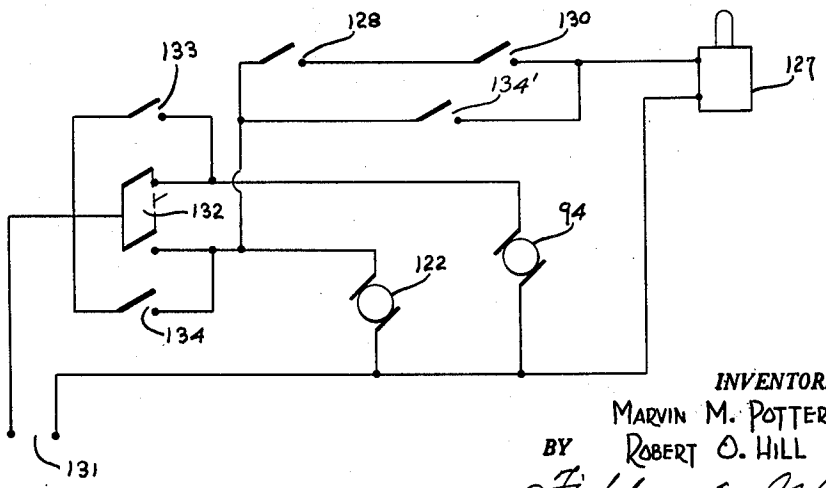


Fig. 11



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United States Patent Office 3,019,015 Patented Jan. 30, 1962

3,019,015
PAPER FOLDING MACHINE WITH TYING MEANS

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Filed June 20, 1960, Ser. No. 37,214
6 Claims. (Cl. 270—84)

This invention relates to folding and tying apparatus and more particularly to machines for folding and tying individual newspapers and the like for home delivery.

The principal objects of the present invention are: to provide an apparatus which automatically makes a double fold in a newspaper and presents the folded newspaper to a string tying apparatus for securing it in the folded or bundled form; to provide such an apparatus having a pair of folding blades adapted to reciprocate on intersecting paths into a receiving compartment wherein a newspaper is rapidly double folded; to provide such a device wherein the folding blades reciprocate continuously to accept newspapers fed thereto; to provide such a machine which is variable in operating speed to suit the convenience of the person or device feeding newspapers therein; to provide such a device in which the tying apparatus is automatically actuated by the delivery of a folded newspaper thereto; to provide such a machine in which a subsequent newspaper moving toward the exit effects the discharge of a prior folded and tied newspaper; to provide such a device in which an overrunning safety clutch reduces the likelihood of injury to an operator and prevents damage to the device in case of jamming; and to provide such a machine which is simple to build, economical to operate and rugged in use.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a perspective view of a newspaper folding and tying apparatus constructed according to this invention.

FIG. 2 is an end view of the folding and tying apparatus showing the newspaper exit.

FIG. 3 is a view of the apparatus in side elevation with parts broken away.

FIG. 4 is a sectional view of the apparatus taken on the lines 4—4, FIG. 2.

FIG. 5 is a sectional view taken on the line 5—5, FIG. 4.

FIG. 6 is a perspective view of the horizontal folding blade supported by guides.

FIG. 7 is a sectional view taken on the line 7—7, FIG. 2, showing details of the vertical folding blade guides.

FIG. 8 is a diagrammatic view showing a newspaper in position for folding.

FIG. 9 is a diagrammatic view showing the newspaper at the completion of the first fold.

FIG. 10 is a diagrammatic view showing the newspaper at the completion of the second fold.

FIG. 11 is a diagrammatic view of the electrical circuit of the apparatus.

FIG. 12 is a perspective view of the bundled and tied newspaper ready for home delivery.

Referring more in detail to the drawings:

1 designates generally an example of the folding and tying apparatus contemplated by this invention. A rigid supporting frame 2 has vertical side portions or walls 3 and 4 fabricated of sheet material or plate and a planar, elongated, horizontally disposed top portion 5 which may also be fabricated of sheet material or plate and constitutes a newspaper or foldable material supporting surface. The top portion or surface 5 is divided into two sections 6 and 7 having opposed edges 8 and 9 spaced from each other forming a transverse slot or opening 10 therebetween. The opposed edges 8 and 9 are curved downwardly forming convex surfaces 11 and 12 at the mouth of the slot 10.

A newspaper stop 13 is comprised of an elongated angle member having a vertically disposed leg 14 parallel to and laterally spaced from the slot 10, and adjustably secured to the section 7 to accommodate various newspaper sizes. The frame 2 includes an inclined surface 15 which slopes downwardly toward the newspaper stop 13. The surface 15 acts both as a cover for a portion of the folding mechanism described hereinafter and as a member tending to cause a newspaper to slide downwardly into folding position in case it falls thereon. A back stop 16 rising vertically adjacent the side edge 17 of the top portion 5 cooperates with the newspaper stop 13 to locate a newspaper in correct position on the top portion 5. Legs 18 are located at each corner of the supporting frame 2 and are of a length sufficient to bring the top portion 5 to a convenient working level.

A first folding blade 20 is substantially rectangular in shape and has a horizontal folding edge 21 and a vertical edge 22. A substantially vertically disposed elongated guide member 23 is secured to the side portion 4 and supports the folding blade 20. The guide member 23, in the example shown, slopes from the vertical for a purpose described hereinafter. The guide member 23 extends upwardly from a point 24 (FIG. 3) through the plane of the top portion 5 to a point 25 thereabove. The guide member 23 is comprised of opposed elongated members 26 and 27 held in spaced relation by means of brackets 28, 29, 30 and 31, the brackets 29, 30, and 31 also securing the guide member 23 to the side portion or wall 4. The elongated member 26 has a groove 32 cut therein in which the vertical edge 22 of the blade 20 rides. The elongated member 27 is composed of two separated sections 28′ and 29′ which contain opposed grooves 30′ and 31′ in which runners 32′ and 33 are slidably held. The runners 32′ and 33 are secured to opposite sides of the folding blade 20. A yoke 34 positioned between the inside surfaces of the elongated members 26 and 27 is secured to the blade 20 adjacent the vertical edge 22.

The guide member 23 supports the blade 20 in a plane aligning with the transverse slot 10 and permits substantially vertical movement of the blade 20 into the slot 10 from a position wherein the horizontal edge 21 of the blade 20 is spaced from the plane of the top portion 5.

The convex surfaces 11 and 12, in the example shown, are extensions of the sections 6 and 7 and extend downwardly into the apparatus forming parallel walls 38 and 39 respectively. The wall 38 terminates in a lip 40 bent outwardly from the wall 39 and secured to the side portions or walls 3 and 4. The wall 39 at the lower portion thereof curves outwardly from the wall 38 forming a convex surface 41 and terminates in a lip 42 spaced from the convex surface 41 by the wall portion 43. The wall portion 43, the lip 42, and the convex surface 41 are not secured to the side portions or walls 3 and 4, but are permitted to flex in cantilever fashion approximately about the convex surface 41. Strip springs 44 and 45 are secured respectively to the side portions or walls 3 and 4 and urge the wall portion 43 downwardly.

A sheet material member 46 extends laterally between the side portions or walls 3 and 4 and longitudinally beneath the wall portion 43. The member 46 begins in a strengthening lip portion 47, extends substantially horizontally rearwardly of the machine and spaced from the wall portion 43 to a point in alignment with the wall 39 where it bends downwardly forming a wall 49 which is in the plane of the wall 39. A convex surface 50 is

formed as the member 46 bends downwardly into the wall 49. The member 46 subsequently extends substantially horizontally forming a wall 51 and then upwardly in the plane of the wall 38 forming a wall 52. The wall 52 terminates in a lip 53 secured to the side portions or walls 3 and 4, for example, by brackets 54 which are illustrated as used throughout the apparatus to retain sheet metal members in place; however, other fastening means such as welding are also satisfactory.

As best shown in FIG. 4, the walls 39, 38, 49, 51 and 52 form an elongated receiving compartment 55 aligned with the path of movement of the blade 20 and having an upper end 56 which is open by virtue of the transverse slot 10, and a lower end 57 which is closed by virtue of the wall 51. The wall portion 43 and the member 46 form a horizontally disposed duct 58 which intersects the receiving compartment 55 intermediate the ends 56 and 57 thereof. The spacing of the walls 38, 39, 49 and 51 and 52 of the receiving compartment 55 form aligned openings 59 and 60 therein permitting unobstructed passage into and through the duct 58.

A second folding blade 63 having a forward or leading edge 64, a rear edge 65, and parallel side edges 66 and 67 is maintained substantially horizontal by elongated and opposed guide members 68 and 69. The guide members 68 and 69 are respectively secured to the side portions or walls 3 and 4 and intersect the plane of the folding blade 20. The guide members 68 and 69 support the blade 63 by the parallel side edges 66 and 67 thereof and in a plane aligning with the duct 58, permitting substantially horizontal movement of the blade 63 in the duct 58.

A first lever arm 72 is pivotally mounted at one end 73 thereof to the supporting frame 2 adjacent the outside of the wall 4. The other end 74 of the lever arm 72 contains a slot 75 running longitudinally of the arm and in which the yoke 34 is slidably secured. A first cam 76 is rotatably mounted adjacent the wall 4 between the ends 73 and 74 of the arm 72. A cam follower 77 is secured to the arm 72 intermediate the ends 73 and 74 thereof and is adapted to cause reciprocal pivoting of said arm in response to the rotation of the cam 76 by riding in the cam track 78. The cam track 78 has approximately 90° of "dwell" at maximum radius, that is, 90° of rotation in which the cam follower is a constant distance from the center of rotation, causing a pause in the travel of the blade 20 for newspaper insertion thereunder. A sprocket wheel 79 is fixed to the cam 76 in a position coincident with the center of rotation thereof (FIG. 3).

A second lever arm 80 is pivotally connected at one end 81 thereof to a cross member 82 secured to the supporting frame 2. The other end 83 of the arm 80 has a slot 84 therein similar to the slot 75 in the lever arm 72 and which slidably retains a yoke 85 similar to the yoke 34 noted above. The yoke 85 is secured to a rod 86' which is in turn secured to the rear edge 65 of the blade 63 whereby movement of the yoke 85 effects movement of the blade 63 in the guide members 68 and 69. A guide 86 is aligned with the path of movement of the rod 86' to provide support therein. A second cam 87, similar to the cam 76 is rotatably mounted on a support member 87' between the ends 81 and 83 of the arm 80. A cam follower 88 is secured on the arm 80 and rides in the track 89 of the cam 87 whereby rotation of the cam 87 causes reciprocal pivotal movement of the arm 80. The cam 87 is carried upon a shaft 90 which extends through the side portion or wall 4 and has secured to the end thereof a sprocket wheel 91. A substantially constant speed motor 94 is mounted on a cross member 94' of the frame 2. The motor 94 is secured on a sliding mount 95 which is adjustable transversely of the frame 2 by means of screw 96. A variable V-belt pulley 97 such as those commonly known as "Reeves Drive" is fixed to the shaft of the motor 94 and changes the effective pulley radius in response to rotation of the adjusting screw 96, altering the driving speed of the V-belt 98.

A right angle speed reducer 99 is driven through a pulley 100 rotated by the V-belt 98. The output shaft 101 of the speed reducer 99 has fixed thereto a slip clutch 102 of the type commonly known as a "Morse Torque Limiter." A sprocket wheel 103 which carries a drive chain 104 is driven through the clutch 102. The chain 104 also meshes with the sprocket wheel 91 and the sprocket wheel 79 whereby the cams 76 and 87 are driven in synchronization by the motor 94 and at a speed determined by the setting of the adjusting screw 96. The rotation of the cams 76 and 87 effect alternate pivotal reciprocation of the blades 20 and 63 toward the receiving compartment 55 but in respective directions substantially normal to each other.

A bundle tyer 108 of the well known type first disclosed by Saxtan et al. in United States Patent No. 1,105,703, is comprised of a needle 109 and a knotter mechanisum 110. The knotter mechanism 110 pivots the needle 109 downwardly during the tying operation by means of crank 111, link 112, pivot arm 113, adjustable link 114 and arm 115 (FIG. 3). A bracket 116 pivotally mounts the needle 109 (FIG. 2). A string package 117 is secured on the frame 2 by means of a bracket 118 and supplies string through a guide 119 to the needle 109 and the knotter mechanism 110 in the well known manner described by the above cited Patent No. 1,105,703.

When pivoting downwardly to effect the tying operation, the needle 109 passes through a slot 120 in the wall portion 43 and an aligned slot 121 in the member 46 before it contacts the knotter mechanism 110. A motor 122 provides operating power for the knotter mechanism 110 through pulleys 123 and 124, drive belt 125 and gearing 125'. The bundle tyer 108 is actuated into performing a tying cycle by pivoting a lever 126 by means of a solenoid actuator 127.

A normally off switch 128 is secured adjacent the downstream end of the duct 58 and carries a lever arm 129 adapted to actuate the switch in response to a folded newspaper in the duct 58. A second normally off switch 130 is secured adjacent the path of movement of the arm 80 and is adapted to actuate in response to the rearward movement of arm 80. The switches 128 and 130 are connected in series to the solenoid actuator 127 and a power source 131 (FIG. 12). A master toggle switch 132 is secured to the side portion or wall 3 and is of the double pole, single throw type. The switch 132 controls the flow of electricity to the bundle tyer and controls therefor and to the drive motor 94. Auxiliary switches 133, 134 and 134' may be provided to permit energizing the motor 94 without actuating the bundle tyer and controls or to permit individual actuation of the bundle tyer and controls without energizing the motor 94. The switches 133, 134 and 134' will normally be used only for maintenance and adjustment purposes.

To fold and tie newspapers with this invention, a newspaper 135 is placed on the top portion 5 against the newspaper stop 13 and back stop 16. The blade 20 moves downwardly folding the newspaper 135 and depositing it in the receiving compartment 55. The blade 20 retracts upwardly and the blade 63 travels horizontally into the duct 58 folding the newspaper 135 a second time (FIGS. 8, 9 and 10). On the return or retracting stroke of the blade 63, the switch 130 is actuated, completing the circuit through switch 128 which was closed by the presence of the newspaper in the duct 58. This actuates the solenoid 127 which causes the bundle tyer 108 to pivot the needle 109 downwardly into the knotter mechanism 110, tying a piece of string around the newspaper 135, severing the trailing string and forming a self supporting bundle. During the tying cycle the next newspaper is placed in position on the top portion 5 and the subsequent presence thereof of the next newspaper in the duct 58 ejects the preceding newspaper 135.

As illustrated, the duct **58** is slightly inclined from the horizontal in order that the newspapers will tend to slide outwardly from the apparatus on the member **46**. Since it is desirable that the blade **63** contact the newspaper **135** in a direction normal thereto, the blade **20** is inclined at a similar angle from the vertical. It is noted, however, that the blades **20** and **63** could be effectively used in other angular positions if desired.

For more rapid output rate a slot **136** may be cut in the forward edge **64** of the blade **63** to permit the needle **109** to begin its descent before the blade **63** is completely retracted.

With manual feeding of newspapers into the apparatus approximately 50 cycles per minute is the optimum rate due to reflex limitations of the operator, however, with automatic feeding devices the apparatus may be cycled at a higher rate.

It is to be understood that while we have illustrated and described one form of our invention it is not to be limited to the specific form or arrangement of parts herein described and shown except insofar as such limitations are included in the claims.

What we claim and desire to secure by Letters Patent is:

1. A folding machine comprising in combination, a rigid frame including a foldable material support, a first folding means, means adapted to guide said first folding means along a path intersecting said material support to produce a fold in the foldable material, a second folding means, means adapted to guide said second folding means along a path intersecting the path of said first folding means to produce a second fold in the foldable material, and string tying means positioned adjacent the path of said second folding means and actuated by said second folding means for tying a string around the folded foldable material.

2. A folding machine comprising, a rigid frame including a foldable material supporting portion, said portion having an opening therein, a first folding means, a guide member supporting said first folding means and adapted to permit movement of said first folding means into said opening from a position spaced from said material supporting portion, a receiving compartment aligned with the path of movement of said first folding means and having opposite ends, said opening providing access into said compartment at one of said ends, a duct intersecting said compartment intermediate said compartment ends, said compartment opening into said duct whereby unobstructed passage is permitted into said duct; a second folding means, a guide member supporting said second folding means and adapted to permit movement of said second blade into said duct, means to cause said first and second folding means to alternately reciprocate whereby foldable material placed on said top portion is double folded by said folding means, and string tying means for tying a string around the folded material and actuated by said second blade reciprocating means whereby a self supporting bundle is formed.

3. A machine for folding newspapers comprising, a rigid frame including a newspaper supporting portion, said portion having a slot therein, a first folding blade, a guide member supporting said first blade and adapted to permit longitudinal movement of said first blade into said slot from a position spaced from said newspaper supporting portion, a receiving compartment aligned with the path of movement of said first blade, said compartment having opposite ends, said slot forming an access opening into said compartment at one of said ends, a duct intersecting said compartment intermediate said compartment ends, said compartment having an opening therein permitting passage into said duct; a second folding blade, a guide member supporting said second blade and adapted to permit longitudinal movement of said second blade into said duct, means to cause said first and second blades to alternately reciprocate whereby a newspaper placed on said newspaper supporting portion is double folded by said blades, string tying means adjacent said duct, said string tying means being adapted for actuation by said second blade reciprocating means whereby a self-supporting bundle is formed.

4. In combination with a bundle typing apparatus; a rigid frame having a newspaper supporting top portion, said top portion having a transverse slot therein, a first folding blade, a guide member supporting said folding blade, said guide member being adapted to permit movement of said first blade into said slot from a position spaced from said slot, an elongated receiving compartment aligned with the path of movement of said first blade and having opposite ends, said slot forming an access opening into said compartment at one of said ends, a duct having walls intersecting said compartment intermediate said compartment ends, said compartment having at least one opening therein permitting unobstructed passage through said duct, a second folding blade, a guide for said second blade adapted to permit longitudinal movement of said second blade into said duct, said bundle tying apparatus being operatively secured adjacent said duct, and means to cause the said first and second blades to alternately reciprocate into said compartment, said latter named means being adapted to actuate said bundle tying apparatus whereby a newspaper placed on said top portion is double folded by said blades and tied by said bundle tying apparatus.

5. A machine for folding and tying newspapers comprising a rigid supporting frame having vertical side portions and a planar, elongated, horizontally disposed sheet material, newspaper supporting top portion, said top portion being divided into two sections having opposed edges spaced from each other forming a transverse slot therebetween, a first folding blade having a horizontal edge and a vertical edge, a substantially vertically disposed elongated guide member secured to one of said side portions and extending through the plane of said top portion, said vertically disposed guide member supporting said first blade by said vertical edge and in a plane aligning with said slot, said vertically disposed guide member being adapted to permit substantially vertical movement of said first blade into said slot from a position wherein said horizontal edge is spaced from said top portion, an elongated receiving compartment aligned with the path of movement of said first blade and having an upper and a lower end, said slot forming an access opening into said compartment at said upper end, a substantially horizontally disposed duct having an open exit and having upper and lower walls intersecting said compartment intermediate said compartment ends, said compartment having aligned openings therein permitting unobstructed passage through said duct, a second folding blade having forward, rear and parallel side edges, substantially horizontally disposed, elongated and opposed guide members secured respectively to said side portions and extending through the plane of said first blade, said horizontally disposed guide members supporting said second blade by said parallel side edges and in a plane aligning with said duct, said horizontally disposed guide members being adapted to permit substantially horizontal movement of said second blade in said duct, a first arm pivotally connected at one end thereof to one of said side portions, the other end of said first arm having a slot therein, a yoke secured to said first blade, said yoke being retained in said first arm slot for movement therewith, a first rotatable cam positioned between the ends of said first arm, a cam follower on said first arm adapted to cause movement of said first arm in response to the rotation of said first cam, a second arm pivotally connected at one end thereof to said frame, the other end of said second arm having a slot therein, a yoke retained in said second arm slot for movement therewith, a slot secured to said yoke, said slot being fixed

to said second blade at said rear edge, a second rotatable cam positioned between the ends of said second arm, a cam follower on said second arm adapted to cause movement of said second arm in response to the rotation of said second cam, means for rotating said first and second cams in synchronization to cause said first and second blades to alternately reciprocate toward said compartment, and a bundle tyer positioned adjacent said exit and cooperating with said blades whereby a newspaper placed on said top portion is double folded and tied.

6. A machine for folding and tying newspapers comprising a rigid supporting frame having vertical side portions and a planar, elongated, horizontally disposed newspaper supporting top portion, said top portion being divided into two sections having opposed edges spaced from each other forming a transverse slot therebetween, a first folding blade having a horizontal edge and a vertical edge, a substantially vertically disposed elongated guide member secured to one of asid side portions and extending through the plane of said top portion, said vertically disposed guide member supporting said first blade by said vertical edge and in a plane aligning with said slot, said vertically disposed guide member being adapted to permit substantially vertical movement of said first blade intc said slot from a position wherein said horizontal edge is spaced above said top portion, an elongated receiving compartment aligning with the path of movement of said first blade and having an upper and a lower end, said slot forming an access opening into said compartment at said upper end, a substantially horizontally disposed duct having an open exit and having upper and lower walls intersecting said compartment intermediate said compartment ends, said compartment having aligned openings therein permitting unobstructed passage through said duct, a second folding blade having forward, rear and parallel side edges, substantially horizontally disposed, elongated and opposed guide members secured respectively to said side portions and extending through the plane of said first blade, said horizontally disposed guide members supporting said second blade by said parallel side edges and in a plane aligning with said duct for longitudinal movement of said second blade in said duct, a first arm pivotally connected to one end thereof to one of said side portions, the other end of said first arm having a slot therein, a yoke secured to said first blade, said yoke being retained in said first arm slot for movement therewith, a first rotatable cam positioned between the ends of said first arm, a cam follower on said first arm engaging with said first cam adapted to cause movement of said first arm in response to the rotation of said first cam, a second arm pivotally connected at one end thereof to said frame, the other end of said second arm having a slot therein, a yoke retained in said second arm slot for movement therewith, a rod secured to said yoke, said rod being fixed to said second blade at said rear edge, a second rotatable cam positioned between the ends of said second arm, a cam follower on said second arm engaging with said second cam and adapted to cause movement of said second arm in response to the rotation of said second cam, means for rotating said cams in synchronization to cause said blades to alternately reciprocate into said compartment, a bundle tyer having a knotter mechanism and a needle automatically cooperating with said knotter mechanism, means pivotally mounting said needle on said frame adjacent said duct exit near the upper wall of said duct, aligned slots formed in the upper and lower walls of said duct arranged to permit said needle to periodically extend through said duct, means positioning said knotter mechanism adjacent the lower wall of said duct and aligned with the path of movement of said needle, a slot formed in said second blade and opening into said forward edge thereof, said second blade slot aligning with said duct slots when said second blade is in the extended position, a solenoid actuator for said tyer, a first normally off switch secured adjacent said duct exit and adapted to actuate in response to the presence of a folded newspaper in said duct, a second normally off switch secured adjacent the path of movement of said second arm and adapted to actuate in response to the rearward movement of said second arm, said first and second switches being electrically connected in series to said solenoid actuator and a power source whereby a newspaper placed on said top portion is double folded and tied and subsequently ejected by a following newspaper.

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