July 1, 1941. A. M. ZUCKERMAN 2,248,016

FOLDING MECHANISM

Filed Oct. 25, 1939 4 Sheets-Sheet 1

Fig. 1.

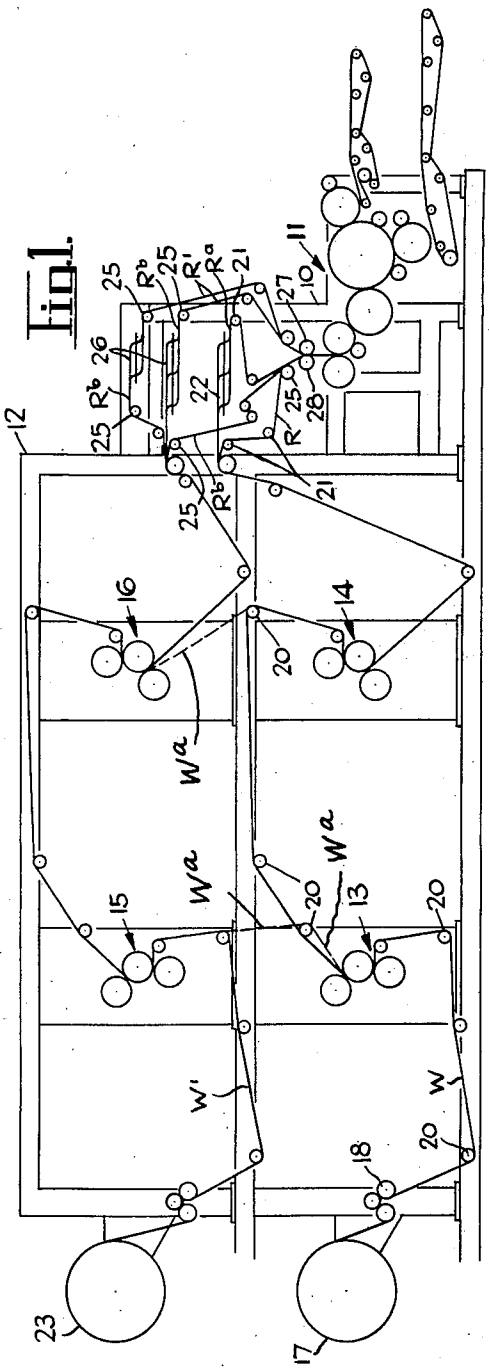
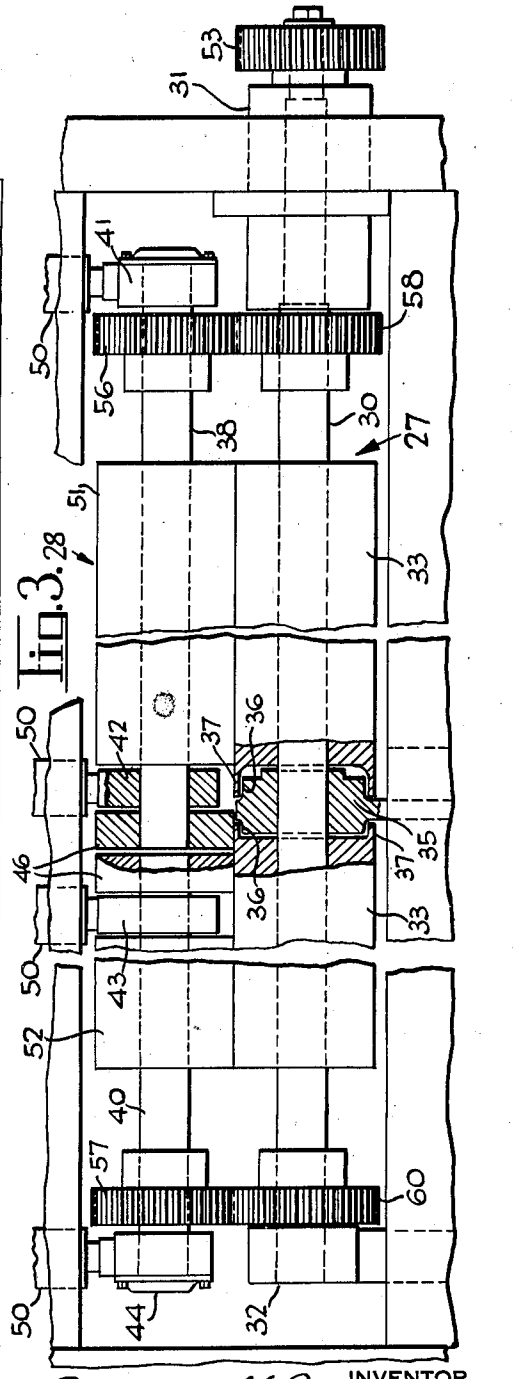



Fig. 3.




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FOLDING MECHANISM

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Fig. 2.

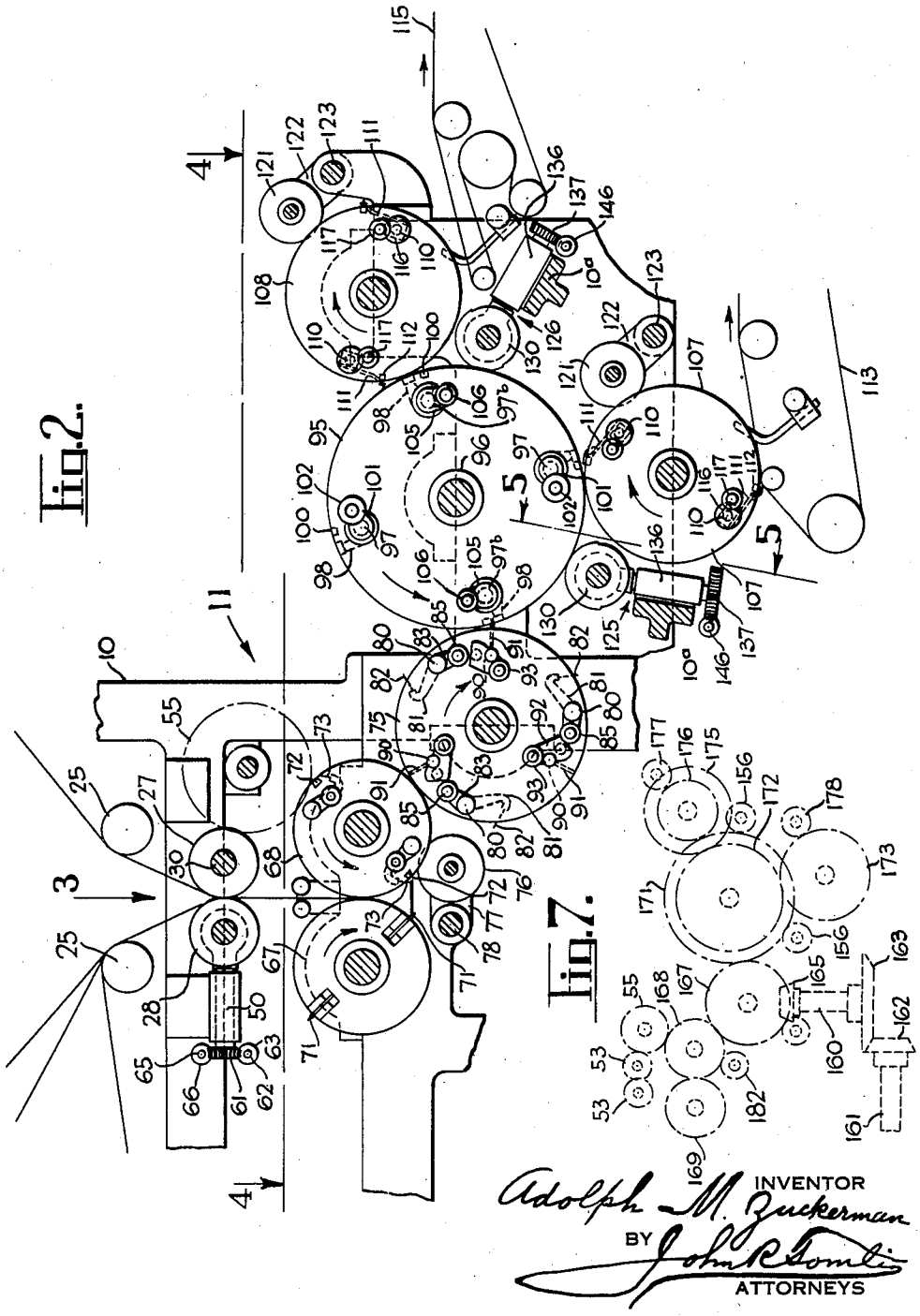


Fig. 7.



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FOLDING MECHANISM

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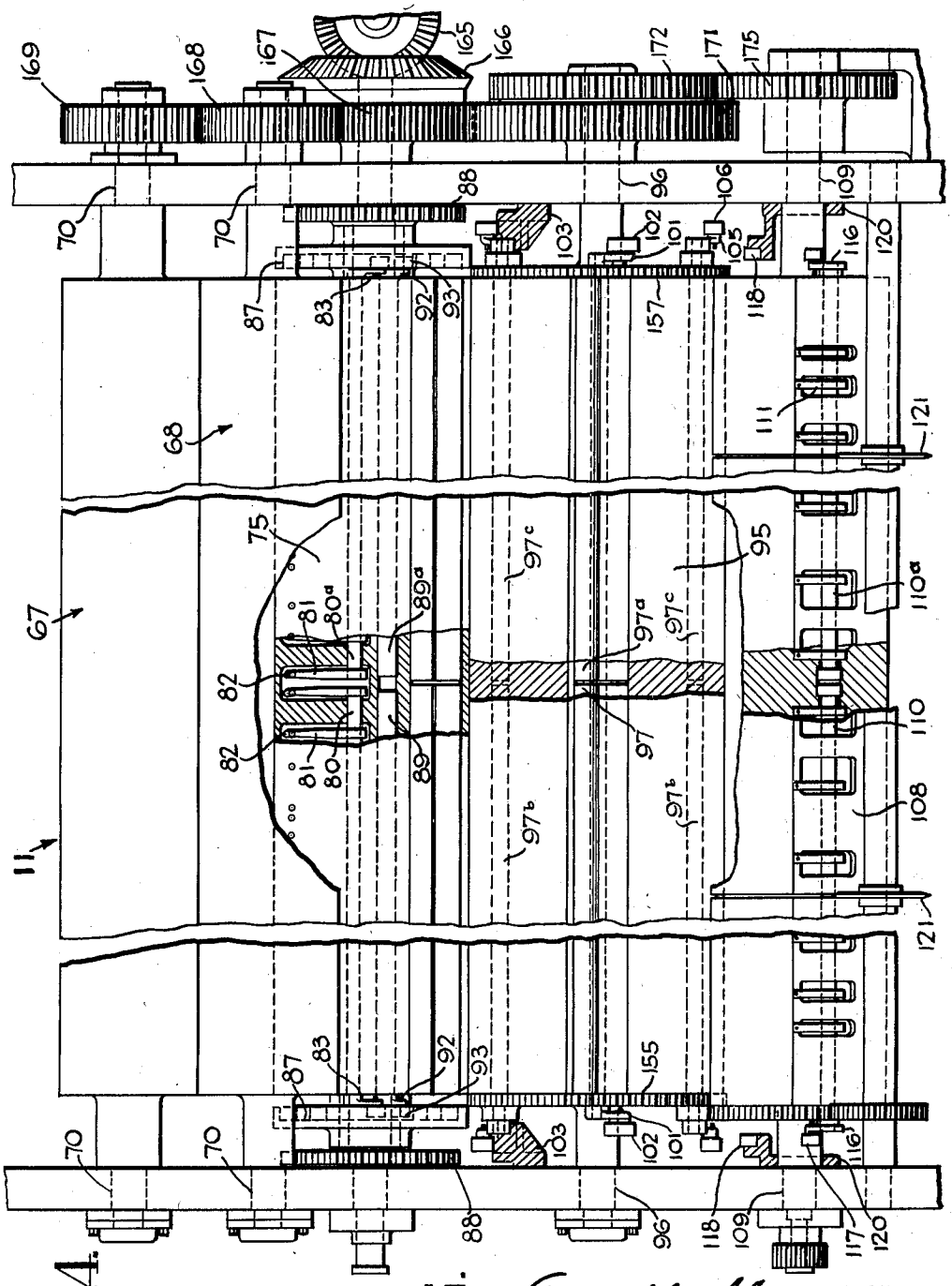



Fig. 4.

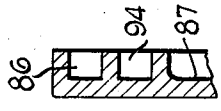



Fig. 6.

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FOLDING MECHANISM

Filed Oct. 25, 1939 4 Sheets-Sheet 4

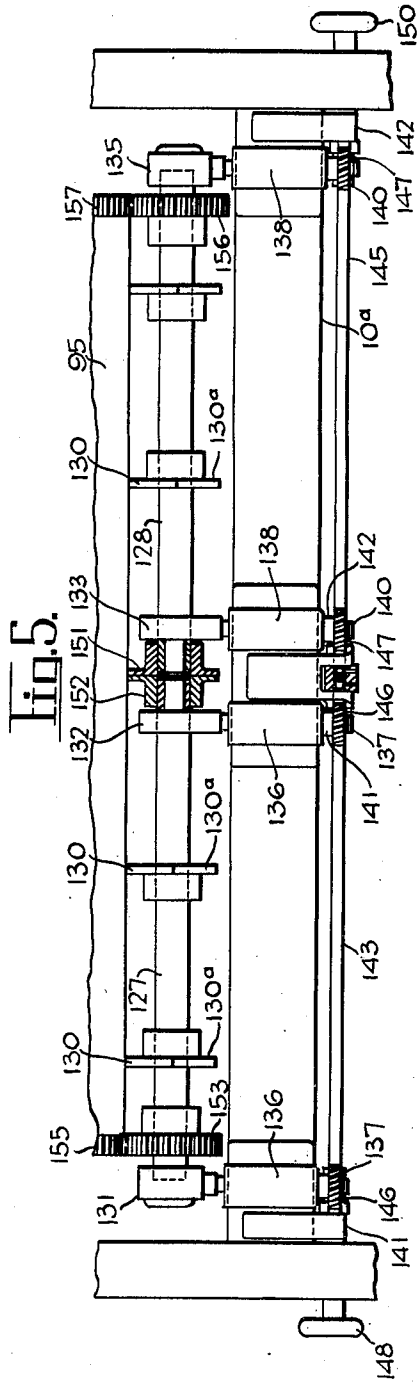



Fig. 5.

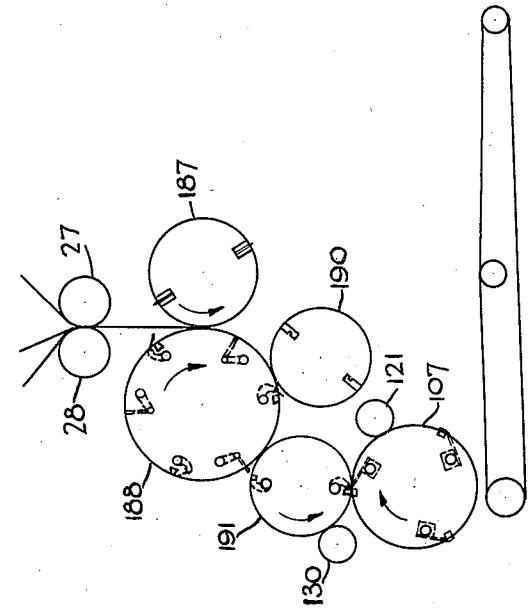



Fig. 9.

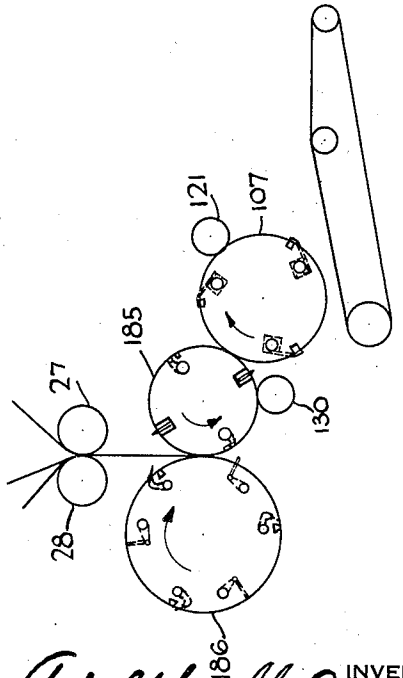



Fig. 8.

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Patented July 1, 1941 2,248,016

# UNITED STATES PATENT OFFICE

2,248,016

## FOLDING MECHANISM

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Application October 25, 1939, Serial No. 301,293

20 Claims. (Cl. 270—64)

This invention relates to folding devices and more particularly to certain improvements in folding and associating mechanism for use in connection with rotary magazine printing machines.

There is a progressively increasing demand for magazine press folders capable of simultaneously producing a plurality of different or diversified products. Known magazine press folders are capable of simultaneously producing different products, but these folders have definite limitations in the degree of difference in the thickness or number of pages of one product with relation to the other products simultaneously produced by the same folder. The diversification of products simultaneously produced by the same folder is rendered possible by constructing and arranging the components and cylinders of the folder so that the web or sheet engaging components operably carried at one end of a cylinder may operate in different phase and independently of similar components operably carried at the opposed end of the same cylinder. By this arrangement, one longitudinal half of the collecting cylinder may operate to collect sheets of the product, and the opposed longitudinal half of the same cylinder may operate non-collect. The thickness of the product thus produced at one end of the cylinder would be twice that produced at the opposed end thereof, and if there were no other operative limitations it would be possible to produce products greatly different in thickness on known folders of this character. However, great difficulty is experienced in feeding the web to folders of this type when there is a difference of more than one or two thicknesses in the webs or ribbons that are led to one end of the nipping rollers and the webs or ribbons that are fed to their opposed end. Again, further difficulty is experienced in properly controlling the webs as they are transferred from one cylinder to the other in the folder.

Obviously, it is possible to use two separate folders or a double folder having two cutting and folding mechanisms, and thereby greatly increase the diversity of the products produced, but either alternative would be much more expensive than the single folder herein disclosed, would occupy considerable more space, and would be more difficult to operate and maintain.

Therefore, an object of this invention is to provide a folder for rotary printing machines capable of feeding greatly different numbers of webs or ribbons to the opposed ends of the same operative component or cylinder of the folder, and the opposed terminals of the component cylinders of the folder being constructed and arranged to operatively receive different numbers of webs or sheets.

Another object of this invention is to provide a rotary folder incorporating means for operably feeding different numbers of webs or sheets to opposed ends of the same operative components or cylinders of the folder, certain of the said cylinders carrying means for transfering sheets from one cylinder to another, and control devices cooperable with a cylinder for controlling the sheets or products as they are transferred from one cylinder to another.

A further object of this invention is to provide a rotary folder capable of operably receiving different numbers of webs or sheets at opposed terminals of the same operative components or cylinders to produce different products at the opposed ends of the same cylinders, and separate deliveries, each cooperable with each end of an operating component or cylinder of the folder to thereby segregate the different products.

A specific object of this invention is to provide a folder for rotary printing machines capable of transferring, collecting and folding different numbers of webs or ribbons at the opposed ends of the same operative components or cylinders of the folder to produce a large number of different products, and nipping or feeding rollers located at the operative entrance of the folder, the nipping rollers being constructed and arranged to uniformly feed greatly differing numbers of webs at their opposed ends.

A more specific object of the invention is to provide a folder for rotary printing machines having operative components or cylinders constructed and arranged to simultaneously cut, transfer, collect and fold different numbers of webs or ribbons at each of their ends, and to deliver different products from each end of an operative component, the folder including cooperating nipping rollers, one of the nipping rollers being divided between its terminals to engage different numbers of webs or ribbons and feed them to cooperable operating components of the folder, and control members cooperating with a cylinder of the folder to control different numbers of webs or ribbons on opposed ends of the said cylinder.

It is also an object of this invention to provide a rotary folder of generally improved construction, whereby the device will be simple, durable and inexpensive in construction, as well as con-

venient, practical, serviceable and efficient in its use.

With the foregoing and other objects in view, which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that various changes in form, proportion, and minor details of construction may be made within the scope of the claims without departing from the spirit or sacrificing any advantage of the invention.

For a complete disclosure of the invention, a detailed description of the improved folder will now be given in connection with the accompanying drawings forming a part of the specification, wherein:

Figure 1 is a diagrammatic elevational view depicting the cooperative association of the improved folder with a four-unit printing machine;

Figure 2 is a fragmental vertical sectional view taken through the improved folder, parts appearing in elevation;

Figure 3 is a fragmental plan view of the improved nipping rollers, parts appearing in section, the view being taken in the direction indicated by the arrow 3 in Figure 2;

Figure 4 is a horizontal sectional view taken through the folder on the line 4—4 of Figure 2, parts being broken away;

Figure 5 is an elevational view depicting the cooperative relation between the improved control or holding rollers and the jaw cylinder, the view being taken in the direction indicated by the arrows 5—5 in Figure 2;

Figure 6 is a fragmental transverse sectional view taken through the collecting cylinder cam;

Figure 7 is a diagrammatic view depicting the folder drive arrangement;

Figure 8 is a diagrammatic elevational view of a modified folder arrangement; and,

Figure 9 is a similar view of a further modification.

Referring to the drawings, in which similar reference characters designate corresponding parts, 10 indicates the frame of the improved folder 11, this frame being secured, as depicted in Figure 1, to the frame 12 of a two color perfecting magazine press arranged to print two colors on each side of each of two webs, or to print four colors on each side of a single web. The press includes two lower printing units 13 and 14 and two superposed printing units 15 and 16. A web W is fed from a feed roll 17 operably supported by the printing machine frame 12. This web W is led from the roll 17 through feed rollers 18 and guide rollers 20 through the unit 13 which prints two colors on one side, then through the unit 14 which prints two colors on the other side, and then towards the folder 11. The web W prior to entering the folder may be slit into any desired number of ribbons, and each ribbon may be led in the same vertical plane directly to the folder, or it may be passed over turner bars to offset it laterally for superposition over any selected ribbon. As depicted in Figure 1, a ribbon R from web W is led over suitable guide rollers 21 to the folder 11, and a similar ribbon $R^a$ is led over turner bars 22 and guide rollers 21 to the folder. A web W' is led from an upper web roll 23 through the units 15 and 16, and then slit into ribbons $R^b$ which lead over guide rolls 25 and turner bars 26 to the folder. Those versed in the art will understand that four colors may be printed on each side of the web W by leading it successively through units 13, 15, 16 and 14 in the order mentioned and thence to the folder, the variations from the previously mentioned lead of the web W being indicated on Figure 1, by dotted lines $W^a$.

The form of press here depicted is merely typical of a type with which the improved folder may be advantageously employed, but, it is to be understood, of course, that other press arrangements incorporating different numbers of units may also be arranged to supply printed webs or ribbons to this improved folder.

The folder is best depicted in Figures 1 to 4, both inclusive, and it incorporates cooperating nipping rollers 27 and 28. The nipping roller 27 is fixed relative to the folder frame 10, and it includes a supporting shaft 30 rotatably mounted in suitable bearings 31 and 32 supported by the folder frame 10. A plurality of roller sections or collars 33 are mounted on the shaft 30, and a bearing 35 is preferably interposed between the roller sections or collars 33 to support the intermediate portion of the shaft 30, the bearing being supported by the folder frame 10, as best seen in Figure 3 of the drawings. The employment of the intermediate bearing 35 is not mandatory, but it is a preferred arrangement and this bearing is preferably reduced, as indicated at 36, at its opposed axial terminals to rotatably receive annular flanges 37 extending inwardly from the roller sections or collars 33. By this arrangement only a relatively small portion of the roller is interrupted by the bearing surface, thus leaving practically the entire peripheral portion of the roller free for engagement with the webs or ribbons.

The nipping roller 28 is preferably of composite construction, and it includes separate shafts 38 and 40 which are rotatably supported in suitable bearing blocks or heads 41, 42, 43, 44. The bearing heads or blocks 42 and 43 are positioned intermediate of the bearings 41 and 44 to rotatably support the inner terminals of the shafts 38 and 40. The shafts 38 and 40 extend inwardly beyond the bearings 42 and 43 to support intermediate roller sections or filling members 46 which are secured to them. The bearing heads 41, 42, 43 and 44 are yieldably supported by the conventional coil spring plunger type support 50 employed generally on folding-off rollers. This type of support, which is well known to those skilled in the art, is shown in Halliwell Patent 1,722,373. The coil spring plunger supports 50 normally urge the shafts 38 and 40 towards the fixed nipping roller 27. Roller sections 51 and 52 are secured to the shafts 38 and 40, the roller sections 51 being interposed between the bearing heads 41 and 42, and the roller sections 52 being interposed between the bearing heads 43 and 44. By this arrangement, the roller sections 46, 51 and 52 are stressed towards the fixed nipping roller 27 to thus pinch or bite webs or ribbons between the peripheral surfaces of the roller sections 33—51 and 33—52 to thus feed the webs or ribbons to other components of the improved folder.

The shaft 30 of the fixed nipping roller 27 has a gear 53 rigidly secured to one terminal thereof which meshes with an idler gear 55 (Figs. 6–7) that is suitably driven from operable components of the folder, as will be hereinafter more fully disclosed. Gears 56 and 57 are rigidly secured to the outer terminals of the shafts 38 and 40, and these gears mesh with similar gears 58 and 60 carried by the fixed rotatable nipping

roller shaft 30. As the shaft 30 is driven through its gear 53, it drives the gears 58 and 60, which, in turn, drive the gears 56 and 57 to thereby rotate the sections of the composite nipping rollers 27 and 28 in unison.

In conformity with well known construction the supports 50 incorporate mechanism for adjusting the composite nipping roller 28 towards and away from the fixed nipping roller 27. This mechanism, as shown in Figure 2, includes operating pinions 61 which are rotatably mounted to operate the conventional mechanism for advancing or retracting the composite nipping roller 28. A shaft 62 carries worms 63 which engage the pinions 61 carried by the supports for the shaft 38, and a similar shaft 65 carries worms 66 which engage the pinions 61 carried by the supports for the shaft 40. The shafts 62 and 65 may be rotated through the usual manipulating knob or head, not shown, to thus rotate the pinions 61 to thereby independently adjust the roller sections 51 and 52 of the composite nipping roller 28 away from or towards the sections 33 of the fixed nipping roller 27. A similar adjusting mechanism is shown in Figure 5, which mechanism will be hereinafter described.

Cutting cylinders 67 and 68 are rotatably supported in suitable bearings 70 carried by the folder frame 10. The cylinder 67 is provided with conventional cutting knives 71 having serrated teeth which extend beyond the periphery of the cylinder and engage cutting slots 72 formed in the peripheral portion of the cylinder 68. As each knife 71 passes the bite portion of the cylinders 67 and 68, it engages the webs, and cuts them into sheets of required length, in conformity with the usual practice. Conventional impaling or transfer pins 73 are swingably supported by the cylinder 68 and operate to transfer the sheets from the cutting cylinder 68 to a collecting cylinder 75. The pins 73 are preferably operated by cams in conformity with the usual practice, and they are timed to engage and release the sheets in order to convey the sheets around the cylinder 68 and deliver them to the collecting cylinder 75. A slitter 76 is rotatably supported by arms 77 pivotally secured to the folder frame 10, as indicated at 78, and this slitter, in conformity with the usual practice, may be swung to or from operable engagement with the cylinder 68. When the slitter 76 is moved to operative engagement with the cylinder 68, it engages the central portion of the web to thereby cut it into separate ribbons.

The collecting cylinder 75 is provided with a plurality of axially alined shafts 80 and 80*a* having fingers 81 extending radially therefrom, and the outer terminal of these fingers carry impaling or collecting pins 82. The outer terminal of each shaft 80 and 80*a* is provided with a radially extending arm 83 having a terminal roller 85 which engages a cam groove 86 formed in a rotatable cam 87. Each cam 87 is driven from any suitable rotatable component of the press through a gear 88. The cam 87 is preferably driven so that it will make three complete revolutions while the collecting cylinder is making two. The alined shafts 80 and 80*a* are similar in construction and arrangement, and their inner terminals terminate at or adjacent the central portion of the collecting cylinder so that each shaft may be operably independent of the other.

Alined shafts 89 and 89*a* are rotatably supported by the cylinder 75, and each shaft carries a plurality of radially extending arms 90 to which conventional tucking blades 91 are operably secured, so that, as the shaft rocks, the tucking blades project beyond the periphery of the cylinder 75 to engage cooperable components to be hereinafter disclosed. An arm 92 extends radially from the outer terminal of each shaft 89 and 89*a* and carries a cam roller 93 which operably engages a cam groove 94 formed in the cam 87, so that the shafts 89 and 89*a* are rocked to operate the tucking blades 91 in predetermined operable relation with components to be hereinafter disclosed. The shafts 89 and 89*a* are similar in construction and operation, and they terminate at their inner terminals preferably at or adjacent the central portion of the collecting cylinder 75 so that each shaft may be operably independent of the other. Inasmuch as the shafts 80 and 89 are operably mounted at one end of the collecting cylinder 75, and the shafts 80*a* and 89*a* are operably mounted at the opposed end of the cylinder by independent cams, it is manifest that the collecting pins 82 at one end of the cylinder may operate to collect sheets while the pins at the other end of the cylinder may simultaneously operate in non-collect phase.

A jaw, folding and transfer cylinder 95 is rotatably mounted in suitable bearings 96 in the folder frame 10. This cylinder is provided with a plurality of alined rockable jaw shafts 97 and 97[a] which carry radially extending folding jaws 98 which are constructed and arranged so that their outer terminals operably engage folding blocks or abutments 100 to receive folded products therebetween, as will be more fully explained hereinafter. The diametrically opposed shafts 97 and the diametrically opposed shafts 97[a] have radially extending arms 101 formed at their outer terminals which carry cam rollers 102 at the outer ends thereof. The cam rollers 102 are relatively and extend a relatively short axial distance beyond the ends of the cylinder to engage cam surfaces formed on fixed cams 103 carried by the folder frame 10. Similar roller arms 105 extend a greater distance from the cylinder and radially from the outer terminals of other diametrically opposed jaw shafts 97[b] and diametrically opposed jaw shafts 97[c] positioned intermediate the shafts 97—97[a]. Each arm 105 carries a relatively small cam roller 106 at its outer terminal to engage separate cam surfaces carried by the fixed cams 103. By this arrangement the jaw shafts 97 and 97[a] are operated by one set of cam surfaces formed on the cams 103, and the jaw shafts 97[b] and 97[c] are operated by a separate set of cam surfaces formed on the cams 103. The cam surfaces formed on the cam 103 are so arranged as to rock the jaw shafts 97—97[a] and 97[b]—97[c], to permit the jaws to receive folded products from the tucking blades 91 operably supported by the collecting cylinder 75.

Delivery cylinders 107 and 108 are rotatably mounted in bearings 109 in the folder frame 10, and each delivery cylinder is provided with alined gripper shafts 110 and 110[a] having grippers 111 extending outwardly or tangentially therefrom. The outer terminals of the grippers 111 cooperate with gripper blocks or surfaces 112 to receive products from the folding jaws 98, and convey the products around the delivery cylinders to delivery belts or conveyors 113 and 115 of conventional construction. The alined

shafts 110 and 110a have their inner terminals located at or adjacent the central portion of the delivery cylinders 107 and 108, so that each shaft is independently operable relative to the other. Cam arms 116 extend radially from the outer terminals of each shaft 110 and 110a, and each arm carries a cam roller 117 at its outer terminal to operably engage a cam surface 118 formed on a fixed cam 120 supported by the folder frame 10. The delivery cylinders 107 and 108 each have cooperating therewith three slitters 121 rotatably supported by arms 122 pivotally supported by the machine frame or brackets, as indicated at 123. These slitters are arranged to be swung to and from engagement with the cylinder surfaces, and, when in operative position, they engage the products and cut them in four sections longitudinally of the cutting cylinders. If, however, the products have been previously slit by the slitter 76, then the central slitter is not employed.

When the folded sheets or products are being conveyed around the jaw or transfer cylinder 95, their leading edges are clamped by the gripper jaws 98 with the said leading edges bent approximately 90° to the body of the products. As the folding jaws 98 release the leading edge of the product it straightens out and is then engaged by the grippers 111 and conveyed around the selected delivery cylinder.

There is an appreciable time interval between the instant the leading edge of the product is released by a jaw 98 and the instant it is engaged by a gripper 111. During this interval the product might tend to move back on the jaw cylinder 95, and, to prevent this, suitable control devices 125 and 126 are provided, such devices being best illustrated in Figures 2 and 5. The control devices 125 and 126 operably engage the jaw cylinder 95 adjacent the bite between the jaw cylinder and each delivery cylinder. Each control device includes axially alined shafts 127 and 128 having control rollers or discs 130 suitably secured thereto and held against rotation relative to each shaft. The shaft 127 is rotatably mounted in bearing heads or blocks 131 and 132, and the shaft 128 is rotatably mounted in bearing blocks or heads 133 and 135. The bearing heads 131 and 132 are adjustably supported in brackets or housings 136, and the adjusting mechanism is operable to move the shaft 127 towards and away from the jaw or transfer cylinder 95 by the rotary movement of worm gears 137. This adjusting mechanism is the conventional construction employed in folding-off rollers, and it is well understood by those skilled in the art, therefore, this mechanism is only generally depicted in these drawings. The bearing heads 133 and 135 are adjustably supported in brackets or housings 138, and the adjusting mechanism is operable to move the shaft 128 towards and away from the jaw or transfer cylinder 95 by the rotary movement of worm gears 140. The brackets or housings 136 and 138 are supported by a transversely extending rail or frame member 10a forming a component of the folder frame 10. Bearing brackets 141 and 142 are supported by the frame rail 10a, and these brackets rotatably support alined shafts 143 and 145. The shaft 143 carries spaced worms 146 which mesh with the worm gears 137, so that rotary movement of the shaft 143 imparts rotation to the worm gears 137 to thus adjustably move the shaft 127 towards or away from the jaw cylinder 95. The shaft 145 supports spaced worms 147 which mesh with the worm gears 140 to effect the adjustment of the shaft 128 towards or away from the jaw cylinder 95. The shafts 143 and 145 are provided with manipulating knobs or handles 148 and 150 to permit the operator to independently adjust one shaft relative to the other to thereby independently effect adjusting movement of the control member supporting shaft 127 relative to the control member supporting shaft 128. The inner bearings 132 and 133 for the shafts 127 and 128 are spaced apart and separate discs or filling-in members 151 and 152 are operably supported by the inner extensions of the shafts 127 and 128. The shaft 127 is provided with a pinion 153 which meshes with a gear 155 carried at one terminal of the jaw cylinder 95, and the shaft 128 has a pinion 156 which meshes with a gear 157 carried at the opposed terminal of the jaw cylinder. By this arrangement, the rotation of the jaw cylinder 95 imparts rotary motion to the control members or discs 130. Each control disc or roller 130 has a portion of its periphery cut away, as indicated at 130a, thus leaving a portion of greater diameter for engagement with the periphery of the jaw cylinder. By this arrangement, the portion of greater diameter of each control disc or roller 130 engages the product during the interval it is being released by the jaws 98 of the jaw cylinder 95 and is being engaged by the grippers 111 of the delivery cylinders, thereby preventing the products from slipping back or moving out of control on the jaw cylinder 95.

The operative components of the folder are driven in operable synchronism by a gear system which includes a vertical drive shaft 160 driven from a horizontal line shaft 161 through a beveled pinion 162 which meshes with a beveled gear 163. The shaft 160 drives the collecting cylinder 75 through meshing bevel gears 165 and 166, and the collecting cylinder, in turn, drives the cutting cylinders 67 and 68 through meshing gears 167, 168 and 169. The idler gear 55 intermeshes with the gear 53 carried by the fixed nipping roller shaft 30 and the gear 168 carried by the shaft of the cutting cylinder 68, to thereby drive the nipping rollers 27 and 28 in synchronism with the operable components of the folder. The shaft of the jaw cylinder 95 has a gear 171 secured thereto which meshes with the gear 167 of the collecting cylinder 75 to thereby drive the jaw cylinder in operable relation to the collecting cylinder, and a gear 172 is also secured to the shaft of the jaw cylinder 95 and meshes with gears 173 and 175 carried by the shafts of the delivery cylinders 107 and 108 to thereby drive these cylinders in operable relation to the jaw cylinder. Any suitable means may be provided for driving the slitters and control rollers, and, as best shown in the diagrammatic Figure 7, the supporting shaft for the upper slitters 121 is driven by a pinion 176, carried by the shaft of the delivery cylinder 108, which meshes with a pinion 177 carried by the supporting shaft of the upper slitters 121. The supporting shafts of the lower slitters 121 is driven through a pinion 178 which meshes with the gear 173. The control rollers or discs 130 of the control devices 125 and 126 are, as stated, driven through pinions 153 and 156 which mesh with the gears 155 and 157 carried at the opposed terminals of the jaw cylinder 95. The slitter discs 76 are driven by a pinion 182 carried by the slitter supporting shaft, and this pinion preferably meshes with the gear 163

or a similar gear located at the opposed terminal of the cutting cylinder **68**.

In operation, any preferred or selected number of webs or ribbons may be fed from the printing press over the turner bars through the nipping rollers to the cutting, collecting, folding and delivery components of the folder. Inasmuch as the nipping rollers are divided, and one of the rollers includes separately adjustable components at each end thereof, it is manifest that any preferred number of webs or ribbons may be led through one side of the cooperating nipping rollers, and a greatly varying number of webs or ribbons may be led through the opposed side of the nipping rollers. After the webs pass through the nipping rollers they are cut by the cutting cylinders **67** and **68**, and the pins **73** carried by the cylinder **68** transfer the cut sheets to the collecting cylinder **75**. The collecting pin carrying shafts **80** and **80***a* and the tucking blade carrying shafts **89** and **89***a* are divided intermediate their terminals, so that products of different thickness and of different condition may be handled at opposed ends of the cylinder. If it is desired to collect at one end of the collecting cylinder **75** and to operate non-collect at the opposed end thereof, then the slitter **76** is moved to operable position to slit the sheets, thus permitting endwise opposed portions of the collecting cylinder to independently handle the slit sheets. The collecting cylinder **75** may then be operated to collect at one end and to run non-collect at the opposed end, but, in each instance, the tucking blades tuck the intermediate portion of the sheets into the jaws of the jaw cylinder **95**, to thus fold the sheets transversely of the direction of the sheet run. The collected sheets are then conveyed around the jaw cylinder to one of the delivery cylinders **107** or **108**, and subsequently delivered to its conveyor. The non-collect sheets are delivered alternatively to the delivery cylinders **107** and **108**, and subsequently to the conveyors **113** and **115**. The control rollers or discs **130** at each end of the jaw cylinder are adjusted through their manipulating knobs **148** and **150** to thus move these control discs or rollers **130** to operably engage the selected number of sheets at each end of the jaw cylinder to permit greatly varying numbers of sheets to be operably carried at each end of this cylinder, and, as hereinbefore explained, the high portion of each control disc or roller **130** engages the products during the interval they are being released by the jaws of the jaw cylinder **95** and engaged by the grippers **111** of the delivery cylinders, thus holding each product against retrograde movement on the jaw cylinder. As the sheets travel around the delivery cylinders **107** and **108**, the slitters **121** for each cylinder may be moved to engagement therewith to slit the sheets into four sections, assuming, of course, the sheets have not been previously slit by the operation of the slitter **76**. In the event that the sheets have been previously slit by the slitter **76**, the intermediate slitter **121** is moved from operable engagement with the cylinders **107** and **108**.

It is now manifest that this device produces a large number of different products, and, for instance in the preferred arrangement, best depicted in Figure 2, it is possible to obtain eight different products. By providing two deliveries, provision is made for separating succeeding cut-offs into two sets, the first set being forwarded to one delivery and the second set being forwarded to the other delivery. In printing such products, the printing cylinders would be arranged to receive four plates around the form cylinder and four plates lengthwise of the cylinder, the plates all being different, thus producing four products through each delivery, or, as stated, a total of eight products which are all different, and these products can vary in thickness over exceedingly wide ranges. For instance, one of a number of possible arrangements resides in a condition where single sheets are cut off and forwarded to the first and second sections considered lengthwise of the collecting cylinder, and three ribbons are simultaneously forwarded to the third and fourth sections lengthwise of the collecting cylinder. The sheets on the first and second sections are run non-collect, while the sheets on the third and fourth sections are run collect. With this arrangement the products going to the first and second sections are delivered alternatively by the lower and upper deliveries **107** and **108**, and the products going to the third and fourth sections are, after being collected, delivered by one of the deliveries.

A modified arrangement is depicted in Figure 8 which includes cooperating nipping rollers **27** and **28** that feed webs or ribbons to a cutting and jaw cylinder **185** which cooperate with a cutting, collecting and folding cylinder **186**. The sheets are conveyed around the cutting and jaw cylinder **185** past control roller **130** to a delivery cylinder **107** which is engaged by slitters **121**. With this simplified arrangement it is possible to produce four different products, two of them having a selected number of pages and formed at one end of the cylinders, and two having a different number of pages and formed at the opposed end of the cylinder.

A further modified arrangement is depicted in Figure 9 which includes cooperating nipping rollers **27—28** that feed webs or ribbons to a cutting cylinder **187** which cooperates with a cutting, collecting and folding cylinder **188**. The web is carried around the cutting, collecting, and folding cylinder **188** past a stapling cylinder **190** to a jaw cylinder **191**, and then past control roller **130** to a delivery cylinder **107**, the delivery cylinder being operably engaged by slitters **121**. With this arrangement, products similar to the arrangement disclosed in Figure 8 are produced, but it incorporates the advantage of a stapling cylinder which cooperates with the collecting cylinder to operate on the products before they reach the jaw cylinder. If desired, this stapling cylinder could be employed with the arrangement disclosed in Figure 2 by installing the stapling cylinder directly over the collecting cylinder **75**.

It will be seen that the single folder herein shown, includes but one cutting mechanism and one folding mechanism. A double folder that would produce the same diversity of products would include two cutting mechanism and two folding mechanism, and also double the number of most of the other parts of the folder herein disclosed.

It is, of course, to be understood that other arrangements incorporating the cardinal features of this invention may be provided, but, in each instance, certain of the cylinders or operating components of the folder are arranged to handle different numbers of sheets or products of different thickness at their opposed ends, and the number of sheets handled at one end of the operating components of the folder may greatly differ from those handled at the opposed end, owing to the fact that the nipping rollers can

feed, if necessary, a single web or ribbon at one end thereof, and a large number of webs or ribbons at the opposed end. Again, as the product at each end of the jaw or folding cylinder is being transferred to the delivery cylinder, the product is controlled during the transfer interval to prevent retrograde movement of the product, and this control is maintained irrespective of the difference in the numbers of sheets carried at one end of the jaw cylinder relative to the number of sheets carried at the opposed end thereof.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, and it will be further understood that each and every novel feature and combination present in or possessed by the mechanism herein disclosed forms a part of the invention included in this application.

Having thus described my invention, what I claim as new and useful is:

1. In a folding mechanism, cooperable rotatable cylinders, separate independently operable components operably supported by separate longitudinal sections of certain of the cylinders to produce different products on the separate sections of the same cylinders, and cooperable nipping rollers for feeding separate webs to the separate sections of the cylinders, one of the nipping rollers having separate longitudinal sections, one section being independently operable relative to the other.

2. In a folding mechanism, cooperable rotatable cylinders, separate independently operable components operably supported by separate longitudinal sections of certain of the cylinders to produce different products on the separate sections of the same cylinders, and cooperable nipping rollers for feeding separate webs to the separate sections of the cylinders, one of the nipping rollers having separate longitudinal sections, one section being independently operable and adjustable relative to the other.

3. In a folding mechanism, cooperable rotatable cylinders, separate independently operable components operably supported by separate longitudinal sections of certain of the cylinders to produce different products on the separate sections of the same cylinders, a fixed rotatable nipping roller, and a composite nipping roller driven in synchronism with the fixed nipping roller, the composite nipping roller having separate longitudinal sections which are independently operable and adjustable relative to each other and to the fixed roller, the composite and fixed nipping rollers cooperating to simultaneously forward different numbers of webs or ribbons at their opposed ends to the said cylinders.

4. In a folding mechanism, cooperable rotatable cylinders, separate independently operable components operably supported by separate longitudinal sections of certain of the cylinders to produre different products on the separate sections of the same cylinders, a fixed rotatable nipping roller having separate rotatable longitudinal sections, a composite nipping roller driven in synchronism with the fixed nipping roller, the composite nipping roller having separate longitudinal sections which are independently operable and adjustable relative to each other, the composite and fixed nipping rollers cooperating to simultaneously forward different numbers of webs or ribbons at their opposed ends to the said cylinders.

5. In a folding mechanism, cooperable rotatable cylinders, separate independently operable components operably supported by separate longitudinal sections of certain of the cylinders to produce different products on the separate sections of the same cylinders, a nipping roller operably supported by a fixed rotatable shaft operably supported in opposed terminal bearings and an intermediate bearing and having separate longitudinal sections, each section being interposed between the intermediate bearing and a terminal bearing, and a composite nipping roller driven in synchronism with the said fixed nipping roller, the composite nipping roller having separate longitudinal sections, separate bearings for supporting each section and the bearings for each section being located at the inner and outer axial terminals of the section, the said inner bearings being spaced apart, filling-in rollers operably supported between the said inner bearings to form components of the composite nipping roller, the separate longitudinal sections of the composite nipping roller being independently operable and adjustable relative to each other, the composite and fixed nipping rollers cooperating to simultaneously forward different numbers of webs or ribbons at their opposed ends to the said cylinders.

6. In a folding mechanism, separate cooperable rotatable cylinders, sheet taking devices operably supported by the cylinders and constructed and arranged so that the sheet taking devices of one cylinder receive products from the sheet taking devices of the other, the sheet taking devices at one end of each cylinder being independently operable relative to the sheet taking devices at the opposed end of the cylinder to engage different products at the opposed ends of the same cylinders, and rotatable control members located externally of the cylinders and operably engaging one cylinder to hold products thereon against retrograde movement when the products are being transferred from the sheet taking devices of the said engaged cylinder to the sheet taking devices of the other cylinder, the control members which operably engage one end of the said cylinder being independently operable relative to the control members which operably engage the opposed end of the same cylinder.

7. In a folding mechanism, separate cooperable rotatable cylinders, sheet taking devices operably supported by the cylinders and constructed and arranged so that the sheet taking devices of one cylinder receive products from the sheet taking devices of the other, the sheet taking devices at one end of each cylinder being independently operable relative to the sheet taking devices at the opposed end of the cylinder to engage different products at the opposed ends of the same cylinders, and rotatable control members located externally of the cylinders and operably engaging one cylinder to hold products thereon against retrograde movement when the products are being transferred from the sheet taking devices of the said engaged cylinder to the sheet taking devices of the other cylinder, the control members which operably engage one end of the said cylinder being independently operable and adjustable relative to the control members which operably engage the opposed end of the same cylinder.

8. In a folding mechanism, separate cooperable rotatable cylinders, sheet taking devices op-

erably supported by the cylinders and constructed and arranged so that the sheet taking devices of one cylinder receive products from the sheet taking devices of the other, the sheet taking devices at one end of each cylinder being independently operable relative to the sheet taking devices at the opposed end of the cylinder to engage different products at the opposed ends of the same cylinders, a composite control device located externally of the cylinders and operably engaging one cylinder to hold products thereon against retrograde movement when the products are being transferred from the sheet taking devices of the said engaged cylinder to the sheet taking devices of the other cylinder, the control device including separate independently supported rotatable shafts, one shaft being positioned adjacent one end of the said engaged cylinder and the other shaft being positioned adjacent the opposed end of the same cylinder, control discs or rollers carried by each shaft to operably engage products carried on the peripheral portion of the said cylinder, and means for independently driving each shaft in synchronism with the said engaged cylinder.

9. In a folding mechanism, separate cooperable rotatable cylinders, sheet taking devices operably supported by the cylinders and constructed and arranged so that the sheet taking devices of one cylinder receive products from the sheet taking devices of the other, the sheet taking devices at one end of each cylinder being independently operable relative to the sheet taking devices at the opposed end of the cylinder to engage different products at the opposed ends of the same cylinders, a control device operably engaging one cylinder to hold products thereon against retrograde movement when the products are being transferred from the sheet taking devices of the said engaged cylinder to the sheet taking devices of the other cylinder, the control devices including separate independently supported rotatable shafts, one shaft being positioned adjacent one end of the said engaged cylinder and the other shaft being positioned adjacent the opposed end of the same cylinder, control discs or rollers carried by each shaft to operably engage products carried on the peripheral portion of the said cylinder, means for independently driving each shaft in synchronism with the said engaged cylinder, and means for independently adjusting each shaft to and from the engaged cylinder so that products of different thickness may be carried at the opposed ends of the said engaged cylinder.

10. In a folding mechanism, cooperable rotatable cylinders, separate independently operable components operably supported by separate longitudinal sections of certain of the cylinders to produce different products on the separate sections of the said cylinders, cooperable nipping rollers for feeding separate webs to the separate sections of the cylinders, one of the nipping rollers having separate longitudinal sections, one section being independently operable relative to the other, sheet taking devices operably supported by a first cylinder and a second cylinder among the said cylinders and constructed and arranged so that the sheet taking devices of the second cylinder receive products from the sheet taking devices of the first cylinder, the sheet taking devices at one end of each cylinder being independently operable relative to the sheet taking devices at the opposed end of the cylinder to engage different products at the opposed ends of the same cylinders, rotatable control members operably engaging the first cylinder to hold products thereon against retrograde movement when the products are being transferred from the sheet taking devices of the first cylinder to the sheet taking devices of the second cylinder, the control members which operably engage one end of the first cylinder being independently operable relative to the control members which operably engage the opposed end of the same cylinder.

11. In a folding mechanism, cooperable rotatable cylinders, separate independently operable components operably supported by the opposed ends of certain of the cylinders to produce different products on the opposed end of the same cylinders, cooperable nipping rollers for feeding webs to the opposed ends of the cylinders, one of the nipping rollers having separate longitudinal sections, one section being independently operable and adjustable relative to the other to feed different number of webs to the opposed ends of the cylinders, sheet taking devices operably supported by a first cylinder and a second cylinder among the said cylinders and constructed and arranged so that the sheet taking devices of the first cylinder deliver products to the sheet taking devices of the second cylinder, the sheet taking devices at one end of each cylinder being independently operable relative to the sheet taking devices at the opposed end of the cylinder to engage different products at the opposed ends of the same cylinder, rotatable control members operably engaging the first cylinder to hold products thereon against retrograde movement when the products are being transferred from the sheet taking devices of the first cylinder to the sheet taking devices of the second cylinder, the control members which operably engage one end of the first cylinder being independently operable and adjustable relative to the control members which operably engage the opposed end of the same cylinder.

12. In a folding mechanism, a folding cylinder, sheet taking devices operably supported by the folding cylinder, the sheet taking devices at one end of the cylinder being independently operable relative to the sheet taking devices at the opposed end of the cylinder to carry different products on the opposed ends of the folding cylinder, means for feeding sheets to the sheet taking devices of the folding cylinder, separate delivery cylinders cooperable with the folding cylinder, sheet taking devices operably supported by each delivery cylinder to receive products from the sheet taking devices of the folding cylinder, the sheet taking devices at one end of each delivery cylinder being independently operable relative to the sheet taking devices at the other end of the same cylinder so that different products may be received at each end of the delivery cylinders from the corresponding end of the folding cylinder, separate sets of rotatable control members located externally of the folding cylinder and operably engaging the folding cylinder adjacent each delivery cylinder, the control members which operably engage one end of the folding cylinder being independently operable relative to the control members which operably engage the opposed end of the folding cylinder to control different products at each end of the folding cylinder as they are being delivered from the sheet taking devices of the folding cylinder to the sheet taking devices of the delivery cylinders.

13. In a folding mechanism, a folding cylinder, sheet taking devices operably supported by the folding cylinder, the sheet taking devices at one

end of the cylinder being independently operable relative to the sheet taking devices at the opposed end of the cylinder to carry different products on the opposed ends of the folding cylinder, means for feeding sheets to the sheet taking devices of the folding cylinder, said means including cooperable nipping rollers, one of the nipping rollers having separate longitudinal sections and one section being independently operable relative to the other to feed different numbers of webs or ribbons at the opposed ends of the cooperable nipping rollers, separate delivery cylinders cooperable with the folding cylinder, sheet taking devices operably supported by each delivery cylinder to receive products from the sheet taking devices of the folding cylinder, the sheet taking devices at one end of each delivery cylinder being independently operable relative to the sheet taking devices at the other end of the same cylinder so that different products may be received at each end of the delivery cylinders from the corresponding end of the folding cylinder, separate sets of rotatable control members operably engaging the folding cylinder adjacent each delivery cylinder, the control members which operably engage one end of the folding cylinder being independently operable relative to the control members which operably engage the opposed end of the folding cylinder to control different products at each end of the folding cylinder as they are being delivered from the sheet taking devices of the folding cylinder to the sheet taking devices of the delivery cylinders.

14. In a folding mechanism, a folding cylinder, sheet taking devices operably supported by the folding cylinder, the sheet taking devices at one end of the cylinder being independently operable relative to the sheet taking devices at the opposed end of the cylinder to carry different products on the opposed ends of the folding cylinder, means for feeding sheets to the sheet taking devices of the folding cylinder, said means including cooperable nipping rollers, one of the nipping rollers having separate longitudinal sections and one section being independently operable relative to the other to feed different numbers of webs or ribbons at the opposed ends of the cooperable nipping rollers, cutting and collecting cylinders constructed and arranged to feed different numbers of sheets to the sheet taking devices of the folding cylinder at the opposed ends thereof, a delivery cylinder cooperable with the folding cylinder, sheet taking devices operably supported by the delivery cylinder to receive products from the sheet taking devices of the folding cylinder, the sheet taking devices at one end of the delivery cylinder being independently operable relative to the sheet taking devices at the other end of the same cylinder so that different products may be received at each end of the delivery cylinder from the corresponding end of the folding cylinder, rotatable control members operably engaging the folding cylinder adjacent the delivery cylinder, the control members which operably engage one end of the folding cylinder being independently operable relative to the control members which operably engage the opposed end thereof to control different products at each end of the folding cylinder as they are being delivered from the sheet taking devices of the folding cylinder to the sheet taking devices of the delivery cylinder.

15. In a folding mechanism, a folding cylinder, sheet taking devices operably supported by the folding cylinder, the sheet taking devices at one end of the cylinder being independently operable relative to the sheet taking devices at the opposed end of the cylinder to carry different products on the opposed ends of the folding cylinder, cooperable nipping rollers, one of the nipping rollers having separate longitudinal sections and one section being independently operable relative to the other to feed different numbers of webs or ribbons at the opposed ends of the cooperable nipping rollers, a collecting cylinder operably engaging the folding cylinder, independently operable sheet taking devices operably supported at the opposed ends of the collecting cylinder to deliver different products at the opposed ends of the collecting cylinder to the sheet taking devices of the folding cylinder, cutting cylinders operably interposed between the collecting cylinder and nipping rollers, sheet taking devices operably supported by the cutting cylinders to convey cut sheets to the sheet taking devices of the collecting cylinder, separate delivery cylinders cooperable with the folding cylinder, sheet taking devices operably supported by each delivery cylinder to receive products from the sheet taking devices of the folding cylinder, the sheet taking devices at one end of each delivery cylinder being independently operable relative to the sheet taking devices at the other end of the same cylinder so that different products may be received at each end of the delivery cylinders from the corresponding end of the folding cylinder, separate sets of rotatable control members operably engaging the folding cylinder adjacent each delivery cylinder, the control members which operably engage one end of the folding cylinder being independently operable relative to the control members which operably engage the opposed end of the folding cylinder to control different products at each end of the folding cylinder as they are being delivered from the sheet taking devices of the folding cylinder to the sheet taking devices of the delivery cylinders.

16. In a folding mechanism, a folding cylinder, sheet taking devices operably supported by the folding cylinder, the sheet taking devices at one end of the cylinder being independently operable relative to the sheet taking devices at the opposed end of the cylinder to carry different products on the opposed ends of the folding cylinder, cooperable nipping rollers, one of the nipping rollers having separate longitudinal sections and one section being independently operable relative to the other to feed different numbers of webs or ribbons at the opposed ends of the cooperable nipping rollers, a collecting cylinder operably engaging the folding cylinder, independently operable sheet taking devices operably supported at the opposed ends of the collecting cylinder to deliver different products at the opposed ends of the collecting cylinder to the sheet taking devices of the folding cylinder, cutting cylinders operably interposed between the collecting cylinder and nipping rollers, sheet taking devices operably supported by the cutting cylinders to convey cut sheets to the sheet taking devices of the collecting cylinder, separate delivery cylinders cooperable with the folding cylinder, sheet taking devices operably supported by each delivery cylinder to receive products from the sheet taking devices of the folding cylinder, the sheet taking devices at one end of each delivery cylinder being independently operable relative to the sheet taking devices at the other end of the same cylinder so that different products may be received at each end of the delivery cylinders from the cor-

responding end of the folding cylinder, separate sets of rotatable control members operably engaging the folding cylinder adjacent each delivery cylinder, the control members which operably engage one end of the folding cylinder being independently operable relative to the control members which operably engage the opposed end of the folding cylinder to control different products at each end of the folding cylinder as they are being delivered from the sheet taking devices of the folding cylinder to the sheet taking devices of the delivery cylinders, a slitter operably engaging a cutting cylinder intermediate the terminals thereof to slit the sheets into separate equal sections, the slitter being movable to and from operable engagement with the said cutting cylinder, and a plurality of slitters operably engaging each delivery cylinder to cut the sheets or products into a plurality of sections, one of the slitters for each delivery cylinder being movable to and from operable engagement with the cylinder so that it may be moved to inoperable position when the slitter which engages the cutting cylinder is in operable position.

17. In a single folder arranged to produce a plurality of different folded products, one of the products consisting of at least three folded sheets, and one of the products consisting of one folded sheet, a pair of coacting nipping rollers at least one of which is divided in its mid section and separably adjustable with respect to its coacting roller, cooperating cutting and folding cylinders arranged to cut and fold products each consisting of one cut sheet carried on their peripheries nearer the other end, a control roller having separately supported individual sections each separately adjustable with relation to the folding cylinder and adapted to control the folded products as they pass between the folding cylinder and the control roller, and a delivery mechanism arranged to receive products from the folding cylinder.

18. In a single folder arranged to produce a plurality of different folded products, one of the products consisting of at least six cut sheets and the other product consisting of two cut sheets, a pair of coacting nipping rollers at least one of which is divided in its mid section and separately adjustable with respect to its coacting roller, cooperating cutting, collecting, and folding cylinders arranged to cut and collect groups of at least three sheets carried on the cylinder peripheries nearer one end and arranged to cut and collect single sheets carried on their peripheries nearer the other end, a control roller having separately supported individual sections each separately adjustable with relation to the folding cylinder and adapted to control folded products as they pass between the folding cylinder and the control roller, and a delivery mechanism arranged to receive products from the folding cylinder.

19. In a single folder arranged to produce a plurality of different folded products, one of the products consisting of sheets cut from at least three webs and folded without being collected and alternatively collected and folded, and one of the products consisting of sheets cut from a single web and folded without being collected and alternatively collected and folded, a pair of coacting nipping rollers at least one of which is divided in its mid section and separately adjustable with respect to its coacting roller, cooperating cutting, collecting and folding cylinders arranged to cut and collect groups of at least three sheets carried on the cylinder peripheries nearer one end and arranged to cut and collect single sheets carried on their peripheries nearer the other end, a control roller having separately supported individual sections each separately adjustable with relation to the folding cylinder and adapted to control folded products as they pass between the folding cylinder and the control roller, and a double delivery mechanism adapted to segregate products received from the folding cylinder.

20. In a single folder arranged to produce a plurality of different assembled, stapled, and folded products, one of the products consisting of at least six cut sheets and the other product consisting of two cut sheets, a pair of coacting nipping rollers at least one of which is divided in its mid section and separately adjustable with respect to its coacting roller, cooperating cutting, collecting, stapling, and folding cylinders arranged to cut and collect groups of at least three sheets carried on the cylinder peripheries nearer one end and arranged to cut single sheets and collect and staple said single sheets carried on the cylinder peripheries nearer the other end, a control roller having separately supported individual sections each separately adjustable with respect to the folding cylinder and adapted to control folded products as they pass between the folding cylinder and the control roller, a delivery mechanism arranged to receive products from the folding cylinder, and a stapling cylinder adapted to insert staples in the groups of sheets before they are folded.

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