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Fig. 1

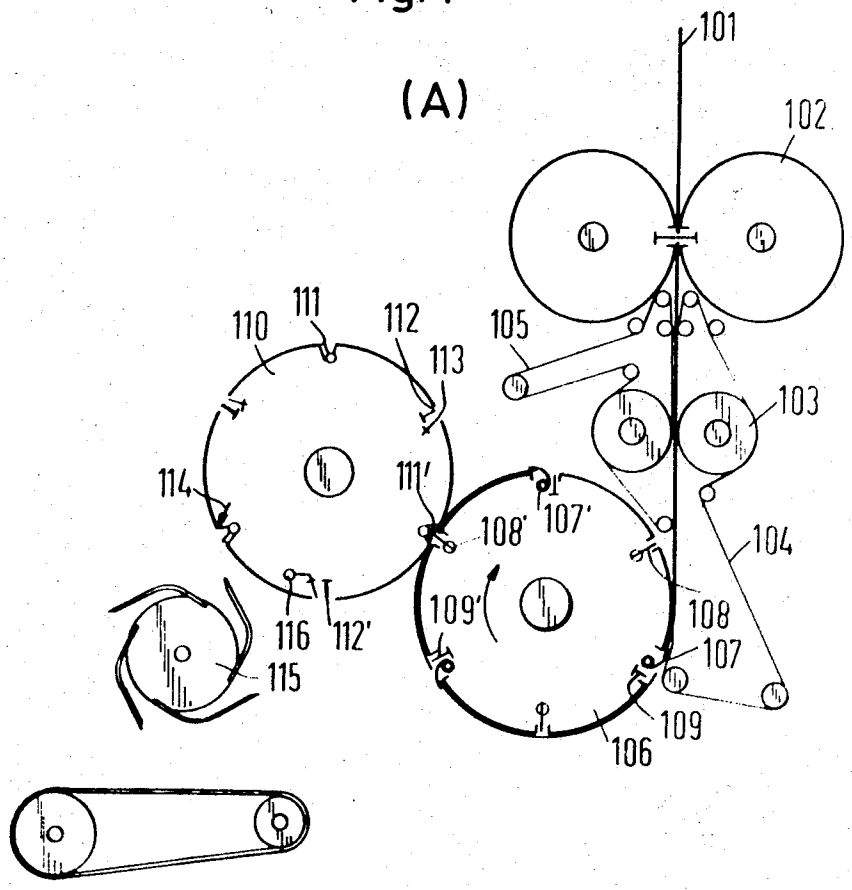
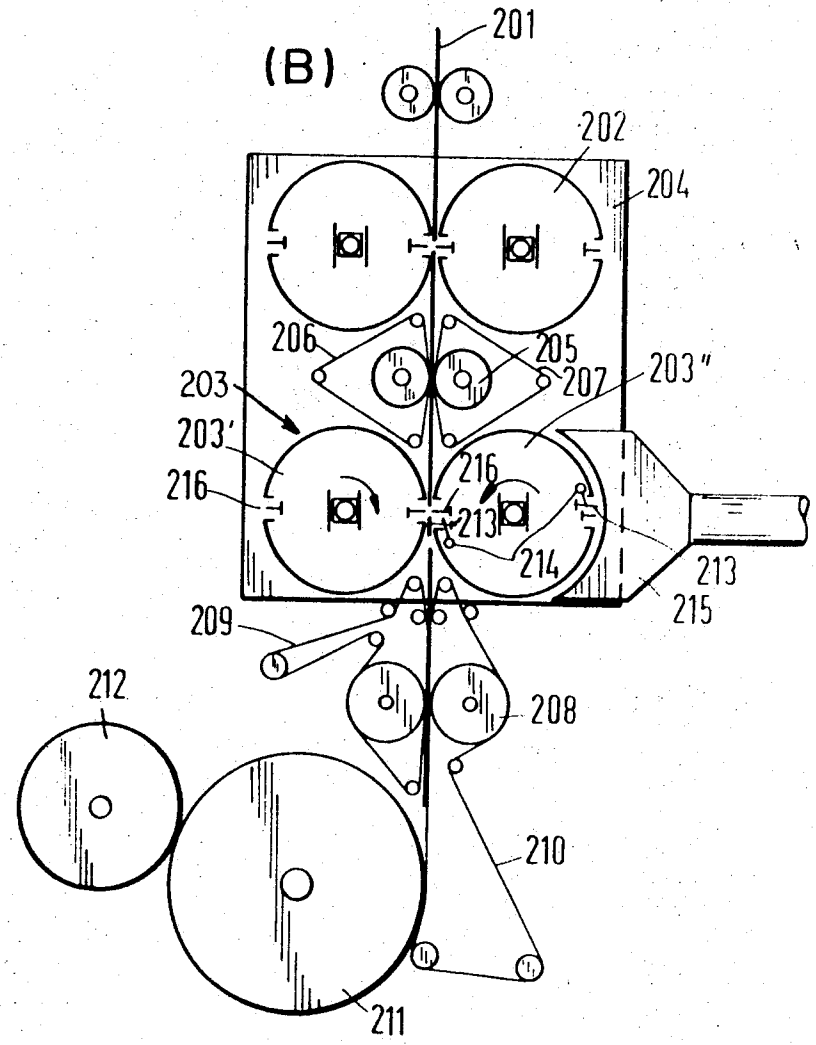


Fig. 2


(B)
201
202
204
206
205
207
203"
203
203'
216
216
213
214
213
215
209
212
208
210
211

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Fig. 3

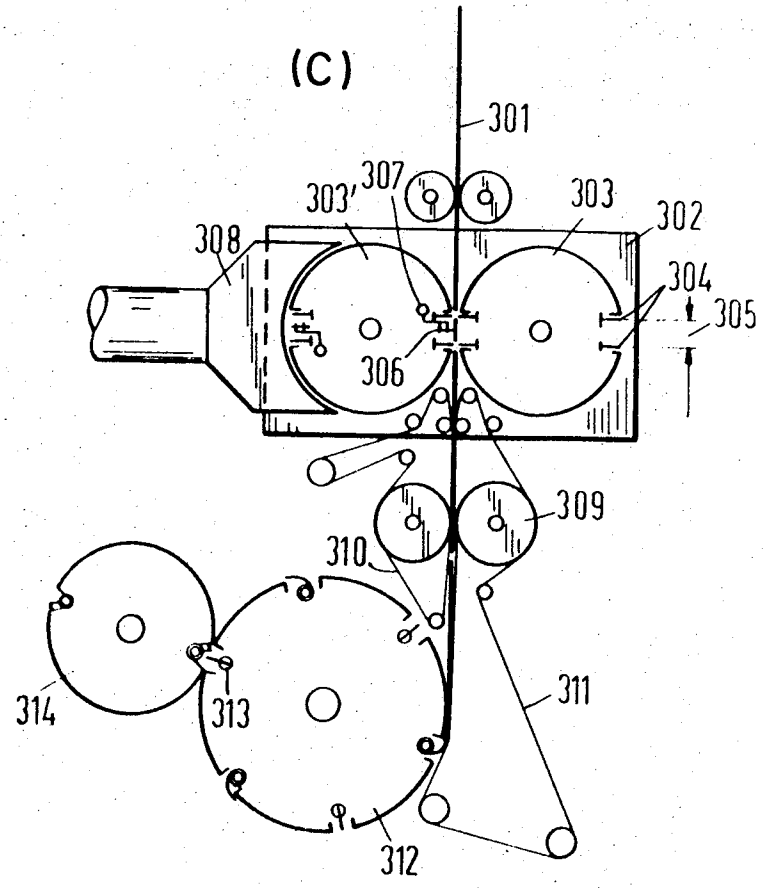
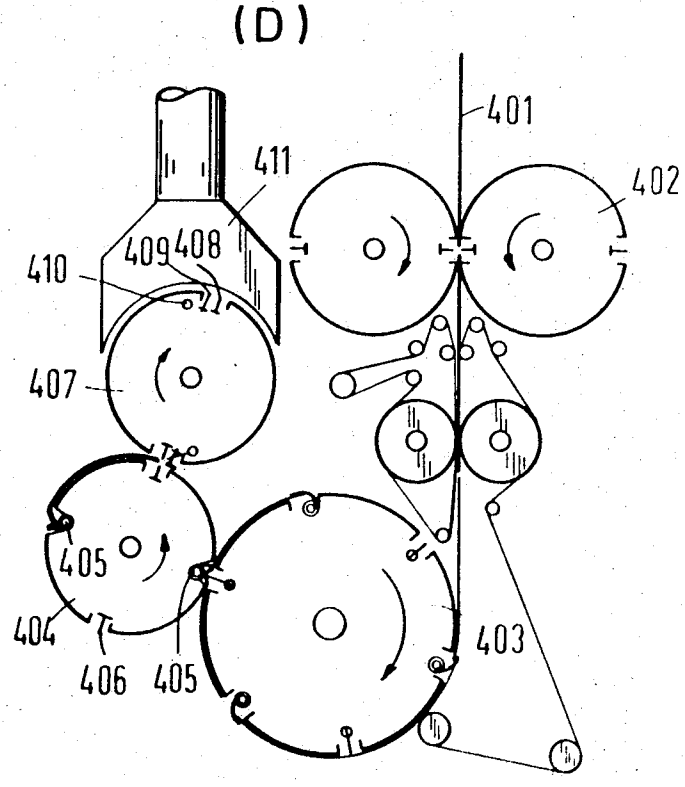


Fig. 4



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3,544,454

METHOD AND APPARATUS FOR THE PRODUCTION OF TRIMMED AND FOLDED COPIES

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Int. Cl. B41f *13/56;* B65h *45/16;* B23d *25/12*
U.S. Cl. 270—21 15 Claims

ABSTRACT OF THE DISCLOSURE

The apparatus takes a plurality of ribbons as paper or the like that is fed together as an assembly of ribbons, cross cuts the ribbons to form a product of assembled sheets that are folded intermediate their leading and rear edges to form, for example, a book or periodical. A pair of cutting cylinders cross cuts the continuously fed ribbons, endless belts running side by side transfer the product to a cylinder that has grippers that grip the leading edge of the product and it is rotated against a folding and cutting cylinder where a blade on the gripping cylinder folds the product intermediate its ends into a jaw on the folding and cutting cylinder. Knives on cooperating cylinders trim the edge of the folded product opposite to the fold line. A modification is two pair of cutting cylinders that cross cut the ribbons to form the cut leading and rear edge of the product of assembled sheets which lead to a gripping-and-fold-blade cylinder which cooperates with a folding jaw cylinder to fold the product intermediate its ends. A third form of apparatus is a pair of cutting cylinders that have closely spaced apart knives that cut a narrow cross strip out of the assembled ribbons led therebetween and the product is led to a gripper-and-folding blade cylinder that cooperates with a folding-jaw cylinder to fold the product. A fourth form is like the firstly described form of the apparatus with the addition of a cutting cylinder cooperating with a folding-jaw cylinder that has scissor knives cooperating with scissor knives on the additional cutting cylinder to trim the edge of the folded product opposite to the fold line.

BACKGROUND OF THE INVENTION

The present invention relates to a method of producing trimmed copies and to a cutting-and-folding apparatus for carrying out the method, particularly in reel-fed rotary printing presses used for printing periodicals and provided with longitudinal and cross cutting devices for clean cut.

Folding apparatus used for scissors cut in combination with sheet-feeding means operating by means of grippers are used predominantly where the folded copy does not require subsequent trimming in a three-knife trimmer. Hitherto, a subsequent trimming of the copies has been necessary whenever copies trimmed to bleed are wanted, that is to say pictures extending to the edge of the copy. In order to produce products of this kind, the blank white strip of paper or the like between two successive pages on the running web, in the zone of which strip the cut is made, has to be removed. This is usually done by trimming the folded copies in a three-knife trimmer.

SUMMARY OF THE INVENTION

It is the object of the invention to produce products trimmed to bleed in the folding apparatus of reel fed rotary printing presses and thus to dispense with the subsequent trimming operation.

According to the invention this is achieved in that the paper ribbons obtained by slitting the paper webs, are edged on both sides in known manner by additionel cutting devices, an additional cross-cutting device being used for trimming the leading and/or rear edges of the layers of product obtained by cross-cutting the ribbons.

A number of ways of carrying out this method are proposed.

In a first solution according to Proposal A, a folding-jaw cylinder, which is also of a tripartite construction, is associated with a 3/2-gripper-and-folding blade cylinder of a cutting and folding apparatus provided in a reel-fed rotary printing press. In addition, each of the two cylinders is provided with three scissor knives which co-operate in pairs to produce a shear cut. These sets of knives are so positioned as to cut off from the rear edge of the layer of product passing through the gap between the two cylinders a narrow strip having a width corresponding to that of the blank zone. In addition, the 3/2-folding-jaw cylinder contains, at positions immediately beyond the knives, controlled sets of pins by which the strips of trimming cut off are engaged and conveyed to a collecting box provided below the cylinder. The trimmings stripped off the pins by controlled ejectors, are continuously withdrawn by suction from the collecting box. The two cross-cutting cylinders provided above the 3/2 gripper-and-folding-blade cylinder are adjusted so that the leading edge of the layer of sheets is trimmed to bleed. Controlled ejectors, by which the copy is delivered to the fan are provided beyond each folding jaw, since the knives effecting the shear cut project from the periphery of the cylinder and thus prevent the provision of guides on the folding-jaw cylinder, and since the knives would otherwise have to be interrupted.

In a second construction according to Proposal B, an ordinary folding set, comprising a 3/2-gripper-and-folding-blade cylinder and a 2/2 folding-jaw cylinder, cooperates with two pairs of cutting cylinders provided above the 3/2-cylinder. Each pair of cutting cylinders is mounted in a slide, the slides being vertically adjustable relatively to each other and to a set of feed rollers provided below the lower pair of cutting cylinders. The distance between the cutting cylinders can be adjusted so that either the two cutting mechanisms cut simultaneously, or the lower cutting mechanism cuts chronologically before the upper cutting mechanism. A pair of feed rollers is inserted between the pairs of cutting cylinders the circumferential speed of which corresponds substantially to the speed of the paper, the feed rollers ensuring reliable conveyance of the paper ribbons and/or the layer of sheets cut off, through the sets of cutting cylinders. The paper ribbons are adjusted in the direction of web travel, so that the upper cutting mechanism cuts the lagging part of the layer of sheets already to bleed, that is at the edge of the pictures. The lower pair of cutting cylinders serves for cutting the leading edge, so that the strips of trimming are obtained at that point. For this reason, pin and controlled ejectors leading with respect to the knives are provided in one of the two lower cutting cylinders. As the cylinder continues to rotate, strips of trimming cut off the leading edge of the copy are stripped off the pins into a bonnet from which they are continuously withdrawn by suction.

According to Proposal C a third solution consists in that in folding apparatus of the construction hereinbefore described, a pair of cutting cylinders comprising two cutting devices of double-knife construction staggered through an angle of 180°, or three cutting devices staggered through an angle of 120° are provided. The double knives, which may consist of two knives reciprocally adjustable in the peripheral direction of the cylinder, are used for

cutting off the strips of trimming between two cut lengths. In this construction also holding means, for example pins, and strippers are provided by which the strips of trimming are conveyed to and stripped off in a collecting box.

According to the invention the object can also be achieved by Proposal D as follows: Folding apparatus comprising a pair of cutting cylinders, a 3/2 gripper-and-folding-blade cylinder and a 2/2 folding-jaw cylinder is provided with an additional cutting cylinder, the knives of which co-operate with additional knives inserted in the folding-jaw cylinder, to cut off the over- or underfolded strips provided on the folded product. The strips of trimming are, again, engage by pins mounted in the additional cutting cylinder, and conveyed to a collecting box provided with suction means.

In order to obtain periodicals trimmed to bleed also at the top and at the bottom of the copy, the slitting device by which the paper web is usually cut up into ribbons corresponding to the height of a page contains slitters by means of which the individual ribbons are cut on both sides. The slitters are reciprocally adjustable in order to enable the width of the strips to be varied. The strips may then be drawn-off by suction and conveyed to a bundling press. The individual ribbons then run in known manner over magazine turner bars to one of the cross-cutting and folding mechanisms hereinbefore described.

Owing to fact that the inner sheets project slightly during the folding operation, the edges of the products produced by one of the cross-cutting-and-folding devices hereinbefore described are not as smooth and straight as those of products trimmed in a three-knife cutter externally of the printing press after the folding operation. When, however, a shear cut is used in the folding apparatus, the first named folded products will meet the requirements in many cases. In cases of this kind, cutting-and-folding apparatus according to the invention afford substantial advantages, since they enable copies trimmed to bleed to be produced for which a three-knife trimmer provided externally of the folding apparatus has hitherto been indispensable. The products leaving the folding apparatus are ready for sale, so that a saving in machinery and personnel is obtained and the production time is reduced.

Constructions according to the invention are hereinafter described by way of example with reference to the accompanying drawings but it is clearly to be understood that the invention is by no means restricted to the details of this embodiment.

FIG. 1 is a diagram of cutting-and-folding apparatus according to Proposal A;

FIG. 2 is a diagram of cutting-and-folding apparatus according to Proposal B;

FIG. 3 is a diagram of cutting-and-folding apparatus according to Proposal C; and

FIG. 4 is a diagram of cutting-and-folding apparatus according to Proposal D.

FIG. 1 shows cutting-and-folding apparatus according to Proposal A. In a cutting mechanism **102**, the paper ribbons **101** are cut into layers of sheets which are engaged by a set of feed rollers **103** and passed by belts **104** and **105** to a 3/2 gripper-and-folding-blade cylinder **106**, which is provided with grippers **107**, folding blades **108**, and scissor knives **109**. The leading edges of the incoming layers of sheets gripped by the grippers **107** come to rest on the surface area of the 3/2 gripper-and-folding-blade cylinder **106**. As the cylinder **106** continues to rotate, the layers of sheets picked up move to a position corresponding to the positions of the gripper **107'**, the folding blade **108'** and the knife **109'**. In this position, the 3/2 gripper-and-folding-blade cylinder **106** is in the folding position opposite to the 3/2 folding-jaw cylinder **110**, carrying scissor knives **112** and pins **113** as well as the three folding jaws **111**.

The knives **112** and the pins **113** are provided at a substantially mid-position between the folding jaws **111**. In the folding position, which corresponds to the position of the grippers **107'**, the layers of sheets are pushed by the controlled folding blades **108'** into the folding jaw **111'**. When the folding-jaw cylinder **110** has completed about one sixth of a revolution, the knife **109'** and the knife **112'** of the 3/2 folding-jaw cylinder **110** carry out the cutting operation, so that a narrow strip of the width of the unprinted zone is cut off the rear edge of the layers of sheets. These strips are picked up by the pins **113**, provided immediately beyond the knives **112**, and are held in position until they reach a collecting box (not shown) provided below the cylinder **110**, where they are stripped off the pins **113** by controlled ejectors **116** and continuously removed by suction. The folded copy is guided to a fan **115** by ejectors **114** provided beyond the folding jaws **111**.

In the cutting-and-folding apparatus according to Proposal B illustrated in FIG. 2, the paper ribbons **201** are cut in a first set of cutting cylinders **202** of a cutting mechanism **204**, comprising two sets of cutting cylinders **202** and **203**, into layers of sheets which are fed by a set of feed rollers **205** rotating at a speed corresponding substantially to the speed of the paper, and by belts **206** and **207** to the second set of cutting cylinders **203**, by which a narrow strip of a width corresponding to that of the blank area is cut off simultaneously with, or chronologically prior to operation of the set of cutting cylinders **202**. The axial distance between the two sets of cutting cylinders corresponds to the length to which the layers of sheets are cut.

The layer of sheets arriving from the second set of cutting cylinders **203** is fed by a set of feed rollers **208** and belts **209** and **210** to a 3/2 gripper-and-folding-blade cylinder **211** by which the layers of sheets are folded away in known manner on the 2/2 folding-jaw cylinder **212** and removed in normal manner.

The set of cutting cylinders **203** consists of the cutting cylinders **203'** and **203''**. The cutting cylinder **203''** carries pins **213** which are positioned ahead to knives **216** and controlled ejectors **214**. The strips cut off are picked up by the pins **213** and held in position until the cutting cylinder **203''** has completed about half a revolution and has reached the zone of a bonnet **215** where the cut-off strip is stripped off the pins **213** by the ejector **214** and then continuously withdrawn from the bonnet **215** by suction.

The width of the cut-off strip can be adjusted. For this purpose, each pair of cutting cylinders **202** and **203** is mounted in a slide, the two slides being vertically adjustable to each other and to a set of feed rolls **208** provided below the lower pair of cutting cylinders **203**.

FIG. 3 shows cutting-and-folding apparatus according to Proposal C. The paper ribbons are cut into layers of sheets by a cutting mechanism **302** comprising a pair of cutting cylinders **303** and **303'**. Each cylinder **303** and **303'** carries on its periphery two double knives **304** which are so positioned as not only to cut up the lengths of paper **301** passing through but, in addition to cut off a narrow strip the width of which corresponds to the distance **305** between the individual cutting edges of the double knives **304**, that is to say to the width of the blank area. The distance **305** may be adjusted by inserting spacer plates or by any other means. Pins **306** and ejectors **307** are provided between the pairs of knives **304**. The strips cut off are picked up by the pins **306**. The cutting cylinder **303'** having completed about half a revolution the strips cut off having been stripped off by the ejectors **307** are ejected into a bonnet **308** from which they are continuously withdrawn by suction.

The layers of sheets is gripped by a set of feed rolls **409** and is transferred by belts **310** and **311** to a 3/2 gripper-and-folding-blade cylinder **312**, the folding blades **313** folding the layers of sheets away into the folding jaws of the 2/2 folding-jaw-cylinders **314** by which the copies are passed on in known manner.

In the cutting-and-folding apparatus according to Pro-

posal D illustrated in FIG. 4, the paper ribbons **401** are cut into layers of sheets in an ordinary cutting mechanism **402**. The layers of sheets are transferred in known manner to a 3/2 gripper-and-folding-blade cylinder **403** and folded away in a 2/2 folding-jaw cylinder **404** which, in addition to carrying two folding jaws **405**, is provided with knives **406** displaced through an angle of about 90° relatively to the folding jaws **405**. When the folding-jaw cylinder **404** has completed a quarter of a revolution, the leading and/or rear edges of the layers of sheets resting on the surface area of the folding-jaw cylinder **404** reach the central line formed by the folding-jaw cylinder **404** and a further cutting cylinder **407** provided above it. The cutting cylinder **407** is also provided with two knives **408** staggered through an angle of 180° and co-operating with the knives **406** of the folding-jaw cylinder **404**. As the knives **406** and **408** pass through the central line, they cut the top and/or bottom folding strips off the folded product, the top and/or bottom folding strips being held in position by the pins **409** until they have reached the zone of the ejector bonnet **411** when the cutting cylinder **407** has completed about half a revolution. The sheets are stripped off the pins **409** by the ejectors **410** in the ejector bonnet **411** and then continuously withdrawn by suction air from the bonnet **411**.

The copies are removed in known manner.

Having thus fully disclosed our invention, what we claim is:

1. Cutting and folding apparatus for assembled continous ribbons of paper that have been edged on both sides, comprising, in combination,

cutting cylinder means between which the continuous ribbons of paper are led for cross cutting of the assembled lengths thereof,

a gripper-and-folding-blade cylinder receiving and gripping the leading edge of the assembled cut lengths of paper for further transfer thereby, and

a folding-jaw cylinder cooperating with said gripper-and-folding-blade cylinder and on which said assembled cut lengths of paper are transferred to and folded intermediate their length and parallel to their leading and trailing cross cut edges, said folding-jaw cylinder having ejector means cooperating therewith for ejecting said folded assembled cut lengths of paper transferred thereto,

said gripper-and-folding-blade cylinder and said folding-jaw cylinder have cooperating scissor knives thereon positioned for cutting the trailing edge of said assembled cut lengths of paper being transferred to said fold-jaw cylinder.

2. Cutting and folding apparatus according to claim **1** wherein said gripper-and-folding-blade cylinder and said folding-jaw cylinder are both 3/2 cylinders.

3. Cutting and folding apparatus for assembled continuous ribbons of paper that have been edged on both sides, comprising, in combination,

a first pair of cutting cylinders between which the continuous ribbons of paper are led,

a second pair of cutting cylinders positioned beyond said first pair of cutting cylinders in the direction of leed of said assembled continuous ribbons of paper,

a gripper-and-folding-blade cylinder receiving and gripping the leading edge of the assembled cut lengths of paper for further transfer thereby, and

a folding-jaw cylinder cooperating with said gripper-and-folding-blade cylinder and on which said assembled cut lengths of paper are transferred to and folded intermediate their length and parallel to their leading and trailing cross cut edges, said folding jaw-cylinder having ejector means for cooperating therewith for ejecting said folded assembled cut lengths of paper transferred thereto.

4. Cutting and folding apparatus according to claim **3** wherein the gripper-and-folding-blade cylinder is a 3/2 gripper-and-folding-blade cylinder and the folding-jaw cylinder is a 2/2 folding-jaw cylinder.

5. Cutting and folding apparatus according to claim **3** in which one of said second pair of cutting cylinders has pin means and controlled ejector means positioned in advance of and adjacent the cutting knives thereon in the direction of rotation of the cutting cylinder for impalling the cut strips and ejecting the same from the pins.

6. Cutting and folding apparatus for assembled continuous ribbons of paper that have been edged on both sides, comprising, in combination:

cutting cylinder means between which the continuous ribbons of paper are led for cross cutting of the assembled lengths thereof,

each of said cutting cylinders having cutting mechanisms of double-knife construction for cutting off cross strips of trimming between two cut lengths from the assembled continuous ribbons of paper,

a gripper-and-folding-blade cylinder receiving and gripping the leading edge of the assembled cut lengths of cross trimmed paper for further transfer thereby,

a folding-jaw cylinder cooperating with said gripper-and-folding-blade cylinder and on which said assembled cut lengths of paper are transferred to and folded intermediate their length and parallel to their leading and trailing cross cut edges,

said folding jaw-cylinder having ejector means for cooperating therewith for ejecting said folded assembled cut lengths of paper transferred thereto.

7. Cutting and folding apparatus according to claim **6** wherein the gripper-and-folding-blade cylinder is a 3/2 gripper-and-folding-blade cylinder and the folding-jaw cylinder is a 2/2 folding-jaw cylinder

8. Cutting and folding apparatus according to claim **6** in which one of said cutting cylinders has pin means and controlled ejector means positioned between each pair of double-knives on the cylinder for impalling the cut strips and ejecting the same from the pins, and transfer means for receiving and carrying away said ejected cut strips.

9. Cutting and folding apparatus for assembled continuous ribbons of paper that have been edged on both sides, comprising, in combination:

cutting cylinder means between which the continuous ribbons of paper are led for cross cutting of the assembled lengths thereof,

a gripper-and-folding-blade cylinder receiving and gripping the leading edge of the assembled cut lengths of paper for further transfer thereby,

a folding-jaw cylinder cooperating with said gripper-and-folding-blade cylinder and on which said assembled cut lengths of paper are transferred to and folded intermediate their length and parallel to their leading and trailing cross cut edges,

said folding jaw-cylinder having cutting-knives thereon and ejector means for cooperating therewith for ejecting the folded assembled cut lengths of paper transferred thereto, and

an additional cutting cylinder means whose cutting knives cooperate with said cutting knives on the folding-jaw cylinder to cut off the over or under-folded strips on the folded product.

10. Cutting and folding apparatus according to claim **9** wherein the gripper-and-folding-blade cylinder is a 3/2 gripper-and-folding-blade cylinder and the folding-jaw cylinder is a 2/2 folding-jaw cylinder.

11. Cutting and folding apparatus according to claim **9** in which the additional cutting cylinder has pins for engaging the cut-off strips and ejector means for removal of the cut-off strips therefrom adjacent said knives thereon and a conveyor means adjacent said additional cutting cylinder for conveying away said cut-off strips.

12. A method of producing uninterruptedly trimmed

and folded copies of paper or the like, comprising, feeding assembled continuous ribbons of the paper that have been edged on both sides,

cross cutting the fed assembled lengths of ribbons to form an essembled product of sheets,

gripping the leading edge of the assembled product and transferring it to a folding position,

folding the assembled product intermediate its leading and rear edges, and

cross trimming the leading and rear edges of the folded product.

13. A method of producing uninterruptedly trimmed and folded copies of paper or the like, comprising:

feeding assembled continuous ribbons of the paper that have been edged on both sides,

cross cutting the fed assembled length of ribbons to form an assembled product of sheets,

further cross cutting the leading edge of said assembled product of sheets,

gripping the leading edge of said product and transferring it to a folding position, and

folding said transferred product intermediate its ends.

14. A method of producing uninterruptedly trimmed and folded copies of paper or the like, comprising, feeding assembled continuous ribbons of the paper that have been edged on both sides,

cross cutting the fed assembled continuous ribbons at two relatively closely spaced positions thereby removing a strip from the ribbons and trimming a

leading and rear edge of adjacent assembled products of sheets,

gripping the leading edge of the leading product of assembled sheets and transferring it to a folding position and folding said transferred product intermediate its ends.

15. A method of producing uninterruptedly trimmed and folded copies of paper or the like, comprising:

feeding assembled continuous ribbons of the paper that have been edged on both sides,

cross cutting the fed assembled lengths of ribbons to form an assembled product of sheets,

gripping the leading edge of the assembled product and transferring it to a folding position,

folding the assembled product intermediate its leading and rear edges and moving the folded product to another position and cross trimming the edges of the product opposite said line of fold thereof.

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