United States Patent

Surbrook

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[54] PRINTING PRESS FOLDERS

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[52] **U.S. Cl.** **270/76**

[51] **Int. Cl.** **B65h 45/16**

[58] **Field of Search** 270/76, 77, 65, 49, 50, 63, 270/64, 70, 71, 72, 73, 74, 75

[56] **References Cited**

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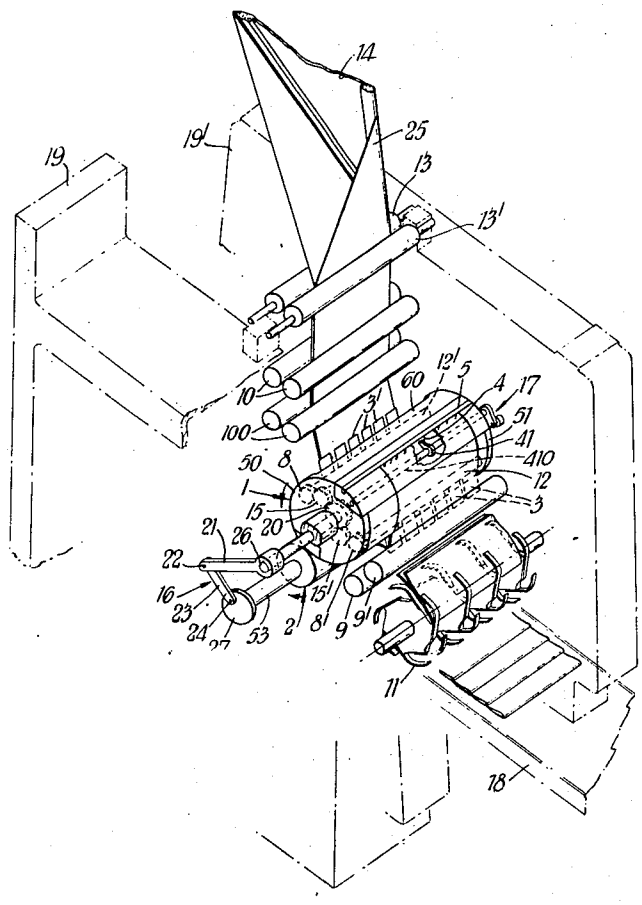
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Attorney—William P. Keegan

[57] **ABSTRACT**

A flying tucker folder in which the tucker blades are carried by a shaft rotatably mounted on a folding drum which shaft is rotated by a sun and planetary gear arrangement, the sun gear being given an oscillatory motion to control the movement of the tucker blades into the nip of the folding rollers.

7 Claims, 5 Drawing Figures



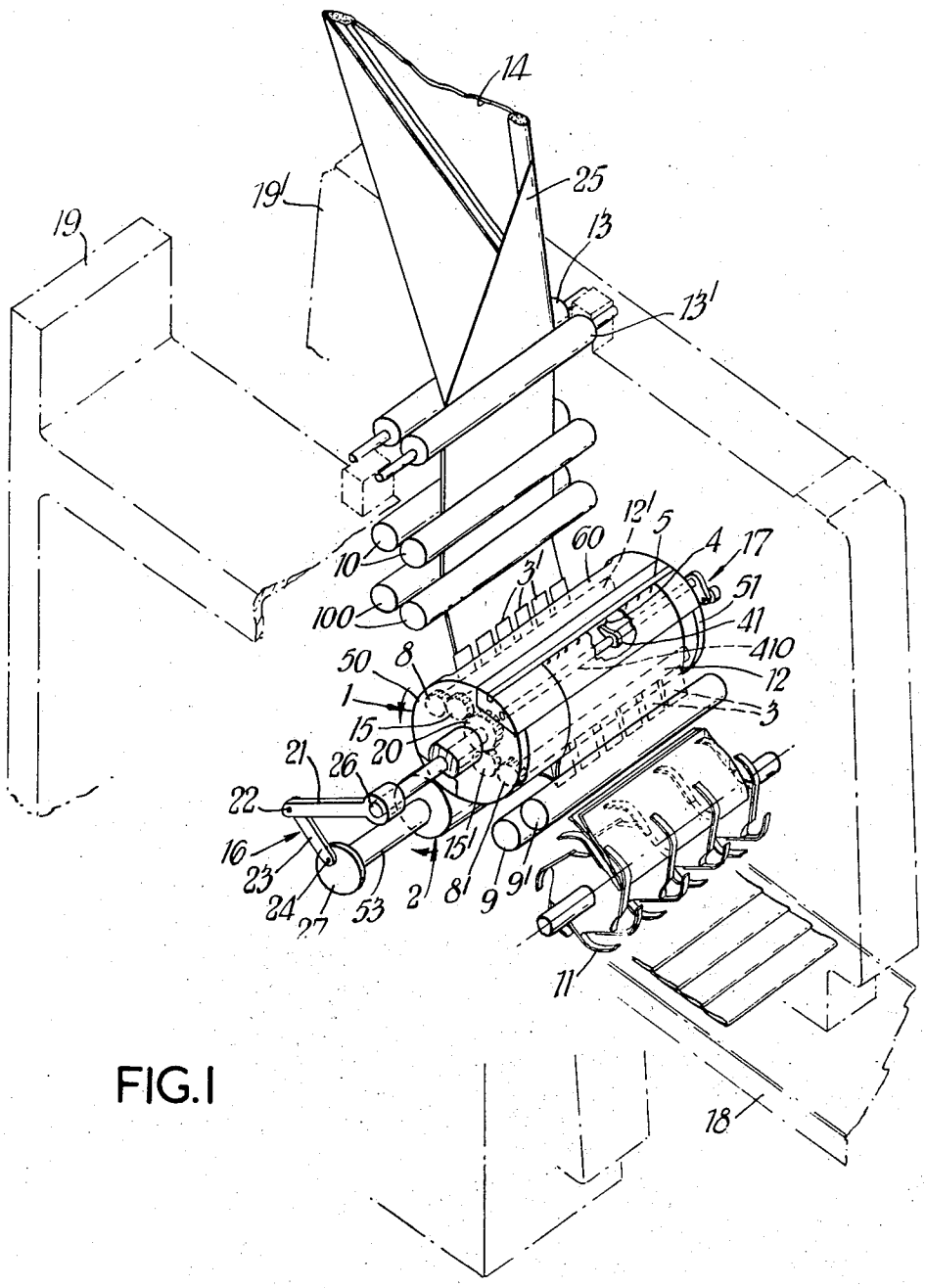
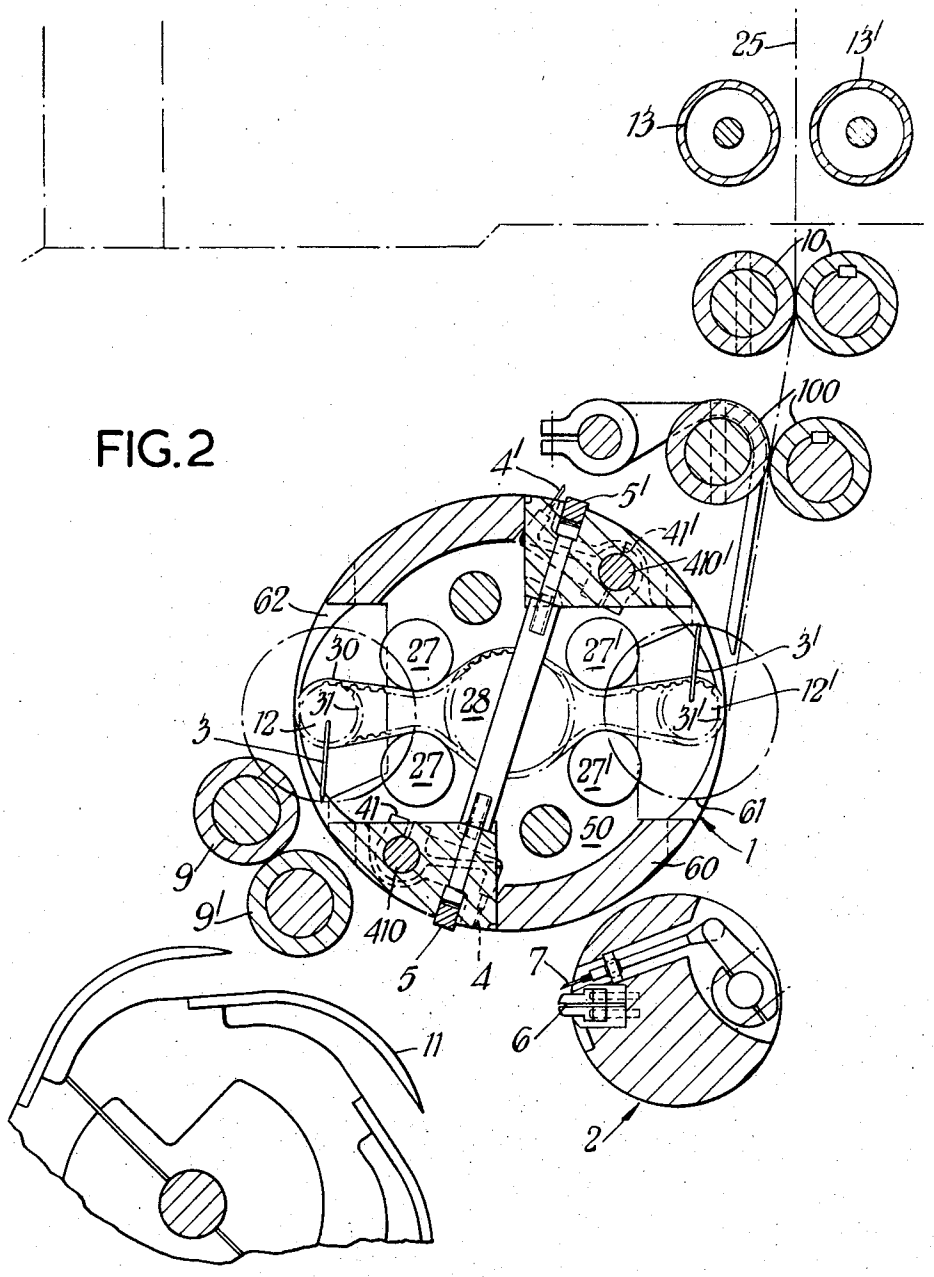

14
19'
25
19
13
13'
12'
5
60
4
17
10
3'
51
100
41
410
50
8
12
1
3
15
20
21
26
22
16
15'
23
8'
9
9'
24
27
53
2
11
18

FIG.1

FIG. 2


25
13'
13
10
100
4'
5'
41'
410'
62
30
27
27'
3'
31
28
31'
12'
3
12
27
27'
41
50
61
1
9
60
9'
410
5
4
7
6
11
2

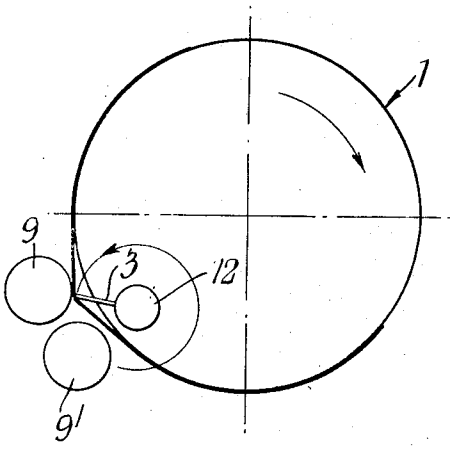


FIG.3

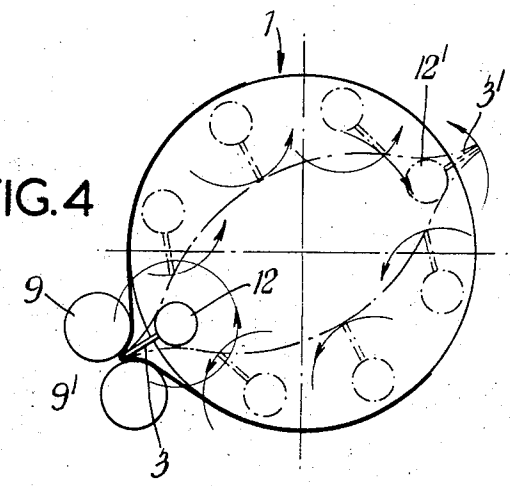


FIG.4

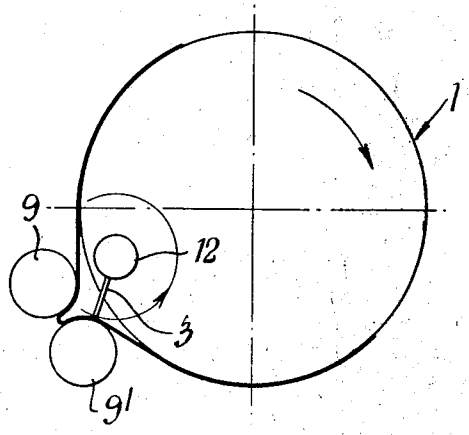


FIG.5

PRINTING PRESS FOLDERS

The present invention relates to a folder for a web fed printing press and particularly to a so called flying tucker folder, operating at high press speeds.

An object of the present invention is to provide a flying tucker folder with a quarter fold attachment facility.

A typical flying tucker folder with the facility of quarter folding comprises basically a folding drum rotatably supported in side frames, a pair of folding rollers adjacent the folding drum, a cutting cylinder also adjacent the folding drum, and spaced away from the folding drum, a pair of feed in rolls receiving the web from the former plate.

Within the folder drum there are contained two tucker blades each carried by a planet gear meshing with idler gears which in turn mesh with a stationary sun wheel. The planet gears are carried on bearings within the folding drum.

The axles of the folding rollers, the cutting cylinder, and the infeed rollers are all carried in the folder side frames.

In operation on a half folder setting the printed web passes down the former plate to pass between prefold rollers and infeed rollers, thereby positively folding the web, and then between the cutting cylinder and the folding drum, where severence of the web into sheets is effected. The leading edge of the severed web is impaled on pins in a known way and is carried round the folding drum for approximately half the periphery of the drum, when one of the tucker blades projects from the folding drum to press the sheet into the nip of the folding rollers, which nip the sheet, fold it and eject it rearwardly to a delivery creel.

The path described by the tips of the tucker blades is important as it is essential that the sheet on the folder drum should be smoothly pressed into the nip of the folding rollers and not just thrust in by a swift jab motion. At high press speeds, e.g. 30,000 sheets per hour upwards, sheet misses can result from such jabbing action.

In the known arrangement the tips of the tucker blades each follow a substantially triangular path, the sides of which triangle are concave, and thus each blade projects from the folder drum three times for each rotation of the folding drum.

When the folder is half folding, one of these projections is actually used to tuck the sheets into the folding rollers at approximately 6.o'clock (in clock notation), one projection occurs at 2.o'clock and is an idle motion, and the third projection which occurs at approximately 10.o'clock also is an idle motion.

At the point of projection, the tip of the tucker blade first appears above the surface of the folder drum at an angle acute to the direction of web feed, then as projection proceeds, the tip of the blade projects further from the surface of the folding drum, and at the same time its angle increases until it is normal to the nip of the folding cylinders at which point the blade is at its maximum point of projection. The blade then goes "over centre" as rotation of the folder drum continues and follows a mirror image of its entry path.

When a quarter fold facility is provided, it is known to "rock" the folder so that delivery of the sheet is effected at approximately 8.o'clock. In such a position

the tucker blade projections will take place at 12, 4 and 8.o'clock, but this means that the 4.o'clock projection will contact the web and hence it is customary to provide a bypass roller to keep the web away from the folding drum. Such bypass rollers however do tend to "-bag" the web.

An object of the present invention is to reduce the number of each tucker blade projections in a given rotation of the folder drum to two, without loss of efficiency of the folder, such reduction in the number of projections making it possible to eliminate the bypass roller, when the quarter fold facility is fitted.

In the accompanying drawings which show examples of the flying tucker folder according to the present invention;

FIG. 1 is a somewhat schematic view of one example of the folder, with one side frame broken away to show the folder mechanism.

FIG. 2 is a side elevation of a second example of folder, and

FIG. 3, 4 and 5 are diagrammatic side elevations showing different positions of a tucker blade in its cycle, respectively, the blade about to push a signature into the nip of folding rollers, the tucker blade pushing the signature into the nip; and the withdrawal of the tucker blade as the signature is pulled into the nip of the folding rollers.

In the example of folder shown in FIG. 1, two spaced apart side frames **19**, **19**^{1} are located adjacent a former plate **14** of a web fed printing press, which is not shown. Two pairs of feed in rollers **10**, **100** are provided, the shafts of which are carried by the side frames **19**, **19**^{1}, below the prefold rollers **13**, **13**^{1} to receive the web **25** and to complete the fold imparted by the former plate **14** and prefold rollers **13**, **13**^{1}.

A printed web **25** from the printing press passes down the former plate **14** and is fed through pre-fold rollers **13**, **13**^{1} which can be adjusted relatively to each other to accommodate different numbers of webs which may be passed through the printing press. From the feed in rollers **10**, **100** the web enters the nip of a folding drum generally designated **1** and a cutting cylinder, which is generally designated **2**. Both the folding drum **1** and the cutting cylinder **2** are supported in the side frames **19**, **19**^{1}, by their shafts, respectively **26** and **53**. The folding drum can rotate freely on its shaft, that is, it is not driven by its shaft as hereafter described.

The cutting cylinder **2** is of known type and requires no further description, other than it is for example half the diameter of the folding drum **1**, (the ratio of the diameter of the folding drum to that of the cutting drum may be three to two) and imparts a cutting action to the web **25** at least once in each revolution, that is, at least once for each half revolution of the folding drum.

The folding drum **1** carries in its end plates **50**, **51** two tucker shafts **12**, **12**^{1} having secured thereto respectively a plurality of tucker blades **3**, **3**^{1}, each of which tucker blades is projected only twice from the folding drum per cycle, that is, for one complete revolution of the folding drum. Each shaft, **12**, **12**^{1} carries respectively a planet gear **8**, **8**^{1} driven by a sun gear **20** through idler gears **15**, **15**^{1}. The sun gear **20** is secured to the shaft **26** of the folding drum **1**. The sun gear **20** has linkage, generally designated **16**, associated

therewith to oscillate the sun gear **20**, thereby to impart to each tucker blade **3**, **3¹**, at each projection cycle a lead in and lead out path substantially following the contours of a pair of folding rollers **9**, **9¹**, thereby feeding a sheet severed from the web as hereafter described, from the folder drum **1** smoothly into the nip of the folding rollers **9**, **9¹**. The folding rollers may be adjustable relatively to each other to accommodate different thicknesses of signature.

Known adjusting means, not shown, are used to adjust the nip between the folding rollers **9**, **9¹**, which adjusting means support the spindles of the folding rollers and are themselves supported by the folder side frames.

From the folding rollers **9**, **9¹**, the folded sheets are passed to a conventional quarter folder not shown or fed to a known type of half fold delivery creel **11**, supported by the folder side frames.

Referring now particularly to the folding drum **1**, this comprises a cylindrical shell **60** with the end plates **50**, **51**, carrying journals **26** supported in bearings in the side frames of the folder.

The cylindrical shell **60** is provided with two diametrically opposed axial apertures **61**, **62**, through which can protrude the tucker blades **3**, **3¹**.

Each tucker blade **3**, **3¹**, is carried respectively on an axle **12**, **12¹** supported in bearings in the end plates **50**, **51** of the cylindrical shell. Each aperture **61**, **62**, is large enough to allow uninterrupted rotation of the tucker blades **3**, **3¹**; each tucker blade **3**, **3¹** is of such length that for a part of its rotation it extends above the surface of the shell **60** and each blade, on its alternate projection, projects into the nip of the folding rollers **9**, **9¹**, when each tucker blade is at that point of projection from the folding drum **1**.

As already mentioned the folding rollers **9**, **9¹**, may be adjusted relatively to each other, to accommodate different thicknesses of paper and also differing number of sheets.

Two sets of picking pins **4**, **4¹**, of known type are carried on pin holders **41**, **41¹** which pin holders are clamped on shafts, respectively **410**, **410¹** carried by the cylinder end plates. The picking pins are each operated in known manner through a cam and follower generally designated **17**, which rock the picker pin shaft **410**, and associated holders **41**, so that the picking pins project above the cylinder shell surface, thereby to penetrate and to retain sheets, severed from the web, on the folding drum **1**. An identical cam and follower is provided for controlling the shaft **410¹** and pins **4¹**.

Each set of pins **4**, **4¹**, is located at approximately 90° to one of the apertures **61**, **62** in the cylindrical shell, and is so positioned that it does not encroach on the rotary movements of the tucker blades **3**, **3¹**, associated with these apertures.

The folding drum **1** is driven by the cutting cylinder **2** by means of a gear wheel, not shown, which is secured to one end plate of the folding drum **1**, and this, meshing with a gear, not shown, on the cutting cylinder **2**, acts as a driven gear to the driving gear on the cutting cylinder **2**. The folding drum **1** rotates on its shaft **26**, being driven by the gear secured to it; the cutting cylinder **2** rotates with its shaft **53**. The gears are in a **1:2** ratio, or maybe in a 2:3 ratio, depending on the diameter ratio relationship of the folding drum and the cutting cylinder.

One end of each tucker blade axle **12**, **12¹** has secured thereto a planet gear **8**, **8¹**, respectively, meshing with idler gears **15**, **15¹** which themselves mesh with the sun gear **20**.

The relationship between the sun and planet wheels and the rotation of the folding drum **1** causes each of the tucker blade tips to follow a substantially elliptical path, protruding through an aperture at the "apex" of each ellipse. The path of the tucker blade tips is indicated in dash lines in FIG. **4**, with different positions of the tucker blades dotted in.

To provide the required tip path for the tucker blades **3**, **3¹**, the sun gear **20** is oscillated by means of an arm **21** which is secured at one end to the shaft **26** which supports the folding drum **1** and which also carries the sun gear **20**, and pivotally secured at the other end by a coupling pin **22** to one end of a second arm **23**, the other end of which is secured, by an eccentric pin **24**, on an eccentric **27**, secured to one of the journals **53** of the cutting cylinder **2** which extends through the side frame **19** of the folder. Rotation of the eccentric **27** imparts an oscillatory motion to the shaft, through the second arm **23** and first arm **21**, thereby oscillating the sun gear **20**.

In operation, the printed web **25** passes through the pre-fold rollers **13**, **13¹** and the pairs of feed-in rollers **10** and **100** and is impaled by the picking pins **4** or **4¹** which are protruding from the surface of the folding drum **1**, and carries the web round with the rotation of the folding drum.

On the completion of a half revolution of the folding drum **1** a cutting cylinder blade **6**, shown in FIG. **2**, cooperates with an anvil **5** or **5¹** on the folding drum **1** and severs the web **25** to form the tail end of a sheet. Substantially at the same time the next set of picker pins **4¹** or **4** impales the leading edge of the web **25** to follow up the second half of the first revolution of the folding drum **1**.

Referring to FIG. **3**, as the first half of the revolution of the folding drum **1** and complete revolution of the cutting cylinder **2** is taking place, the sun gear **20** is oscillated clockwise (FIG. **3**) by the linkage **16** so that as the tucker blade **3**, adjacent the folding rollers **9**, **9¹**, approaches its aperture **62**, its tip is pointing at the folding roller **9¹** so that it is substantially radial thereto.

As the folder drum **1** continues to rotate, the tucker blade **3** increases its angle until it is substantially tangential to the two folding rollers **9**, **9¹** and in its fully extended position, that is, it is extended to its maximum projection above the surface of the folding drum, as shown in FIG. **4**. At this point the lower crank driving the oscillating sun gear **20** is at 90° to its bottom dead center position.

The path followed by the tucker blade tip as it protrudes from the aperture **62** is arcuate, due to the double action of the sun gear **20** and the idler gears **15**, **15¹** and pinion **8**, **8¹** and the imposed oscillatory motion on the sun gear **20**.

As the tucker blade **3** projects from the aperture **62**, so it pushes and lifts the web **25** from the face of the folding drum **1** and as the picker pins **4¹** at the leading edge of the web **25** retract by known means, so the web **25** is pushed into the nip of the folding rollers **9**, **9¹**.

The now nipped web is then pulled rearwardly by the folding rollers **9**, **9¹** from the folding drum **1** and delivered to a delivery creel **11** to be delivered to the

delivery table 18 with a half fold or delivered to a quarter fold attachment, now shown.

As the folder drum 1 continues to rotate, the tucker blade 3 goes "over centre" and follows a mirror image path as the sun gear 20 is oscillated in the opposite direction as the second arm 23 is at the mid point between top and bottom dead center of the crank 24, 27. This arcuate movement thus clears the tucker blade tip of the surface of the second folding roller 9.

At a position diametrically opposite to that of the folding rollers 9, 9^1 the other tucker blade 3^1 makes an identical movement, but this is an ineffective movement, having no effect on the web.

The relative positions of the cutting cylinder 2 and folding rollers 9, 9^1 are such that a common line drawn through a radius of the cutting cylinder 2 and the folding drum 1, and a tangent common to the folding rollers 9, 9^1 passing through a radius of the folding drum forms an angle of approximately 90°.

The tucker blade 3 pushes the sheet severed from the web 25 at a point which is half the sheet length into the nip of the folding rollers 9, 9^1, and, by the known mechanism the picker pins 4^1 are withdrawn from the web.

As the folding drum 1 continues to rotate past its half revolution so the leading edge of the next portion of the web is speared by the picker pins 4 and fed round the folding drum 1 for the cutting of the next sheet. Thus one complete revolution of the folding drum 1 produces two complete sheets.

It will be understood that there can be a plurality of superposed webs fed into the folder, and these superposed webs are cut into superposed sheets as hereinbefore described, forming, for example a newspaper or a magazine, which may be in collect form.

In a modified example of folder shown in FIG. 2 the tucker blades are driven by a different mechanism. Like references are used for parts identical with those of the previous example.

As in the previous example the journals at one end of the folder drum 1 and the cutting cylinder 2 extend through one side frame 19 of the folder and have secured thereto a driving gear, not shown, on the cutting cylinder 2 and a driven gear, not shown, on the folder drum 1.

The oscillating mechanism 16 is attached to the journal of the cutting cylinder 2 as hereinbefore described. However in place of the sun gear 20 there is provided a timing belt pulley 28.

As in the previous example, the movement of the second arm 23 driven by the shaft of the cutting cylinder 2, oscillates the upper arm 21 and hence oscillates the timing belt pulley 28 within the folder drum 1.

Rotatably mounted on the end plate 50, to either side of the toothed pulley 28 and intermediate the tucker blade axles 12, 12^1 are two pairs of idler pulleys 27, 27^1. Each of the tucker blade axles 12, 12^1 has secured at the ends adjacent the toothed pulley 28, a toothed pulley wheel 31, 31^1, respectively.

An endless belt 30, with a toothed inner face, passes round the tucker blade pulleys 31, 31^1 and the toothed wheel 28, and the pair of idler pulleys 27, 27^1 tighten the belt 30 to ensure positive oscillatory drive being imparted from the toothed pulley 28.

In place of the endless belt, a chain may be employed.

The operation of these examples is identical in principle to that previously described.

I claim:

1. A flying tucker folder mechanism for a web fed printing press having a former plate for initially folding the web in a lengthwise direction, feed in rollers for feeding the web into the folder mechanism and a cutting cylinder for severing the lengthwise folded web into sections, said folder mechanism comprising a pair folding rollers, and a folding cylinder adjacent said folding rollers, said folding cylinder including a pair of shafts rotatably mounted opposite each other near the periphery of said folding cylinder, a plurality of tucker blades secured to each shaft of the pair of shafts, a planet gear means connected to each shaft, sun gear means about which each of the planet gears rotate, and means for oscillating said sun gear means to vary the rotational movement in each rotational cycle of movement of the tucker blade shafts whereby in any one rotation of the folder drum each set of tucker blades will project from the surface of the folding drum twice, one such projection following substantially the dual curvature of the nip of the folding rollers for the purpose for pushing a severed web carried by the folding drum into the nip of the folding rollers.

2. A flying tucker folder according to claim 1 wherein the planet gear means is a toothed pulley, and the sun gear means is a timing belt pulley, and a timing belt meshing with the toothed pulleys and the timing belt pulley whereby rotation of the folding drum imparts rotational drive to the tucker blade shafts and the oscillating means imparts to the tucker blade shafts a decrease or increase in rotational speed.

3. A flying tucker folder according to claim 1 wherein the oscillatory mechanism imparts additive and subtractive speeds of rotation to the tucker blade shafts whereby the tips of the tucker blades will follow a substantially elliptical path of travel in a half revolution of the folding drum.

4. A flying tucker folder according to claim 1 and including a shaft about which the folding cylinder rotates and on which the sun gear is mounted, and wherein the oscillating means is provided to oscillate said shaft about which the folding drum rotates, such oscillation oscillating the sun gear in the same or opposite direction of rotation of the folding drum to impart to the tucker blade shafts a decrease or increase in rotational speed.

5. A flying tucker folder according to claim 4 wherein oscillation of the shaft is effected by a crank mechanism associated with the cutting cylinder.

6. A flying tucker folder according to claim 5 wherein the shaft of the cutting cylinder has secured thereto a crank with links pivotally interconnecting the crank with the shaft on which the folding drum rotates whereby rotation of the crank will impart oscillatory motion to the shaft on which the folding drum rotates.

7. A flying tucker folder according to claim 6 wherein the folding drum comprises an apertured cylinder provided with end plates, one of which end plates has secured thereto a gear wheel meshing with a gear wheel secured to the shaft of the cutting cylinder to obtain transmission and synchronism of drive between folding drum and cutting cylinder.

* * * * *