

S. D. TUCKER.
Sheet-Delivering Apparatus for Printing-Machines.
No. 214,066. Patented April 8, 1879.

Fig. 1.

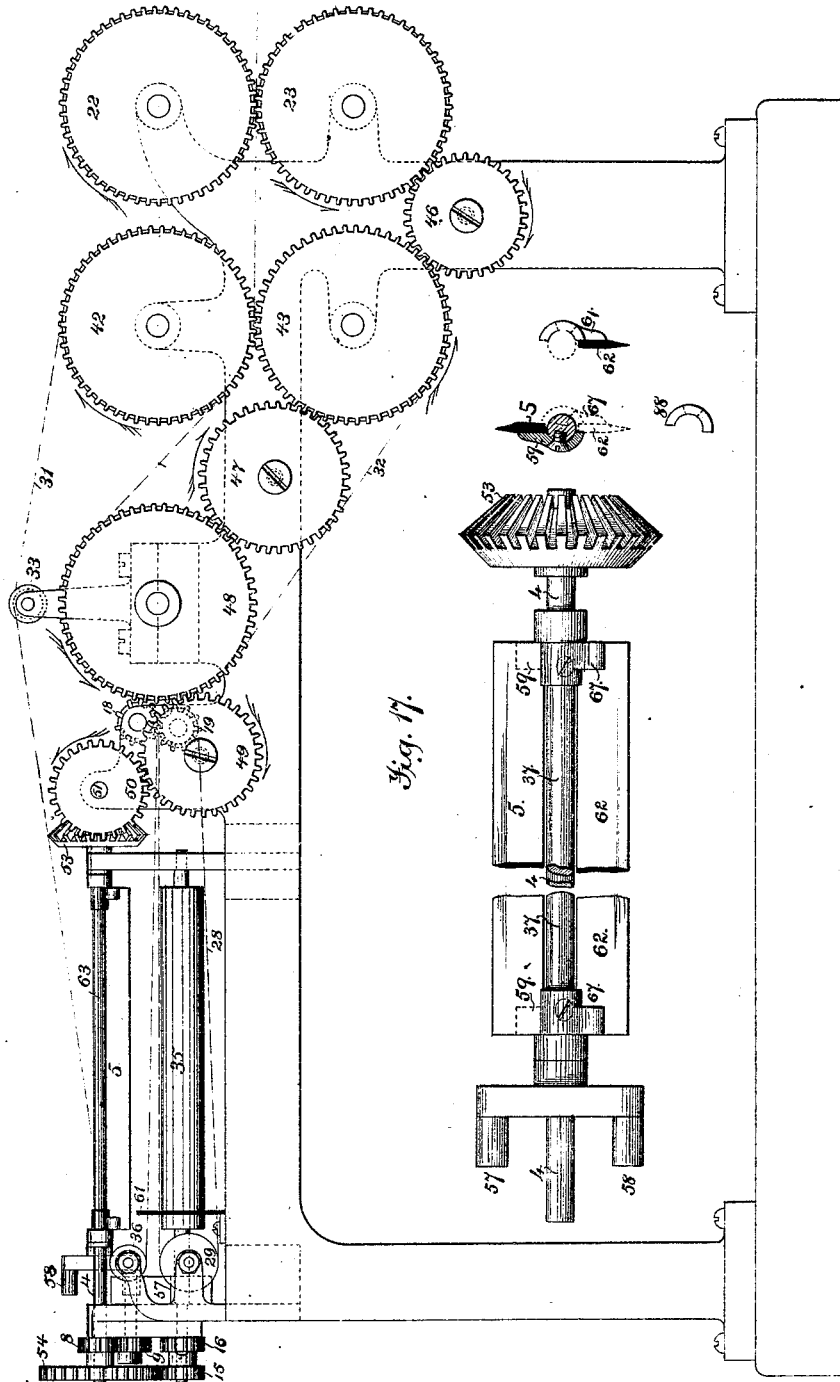


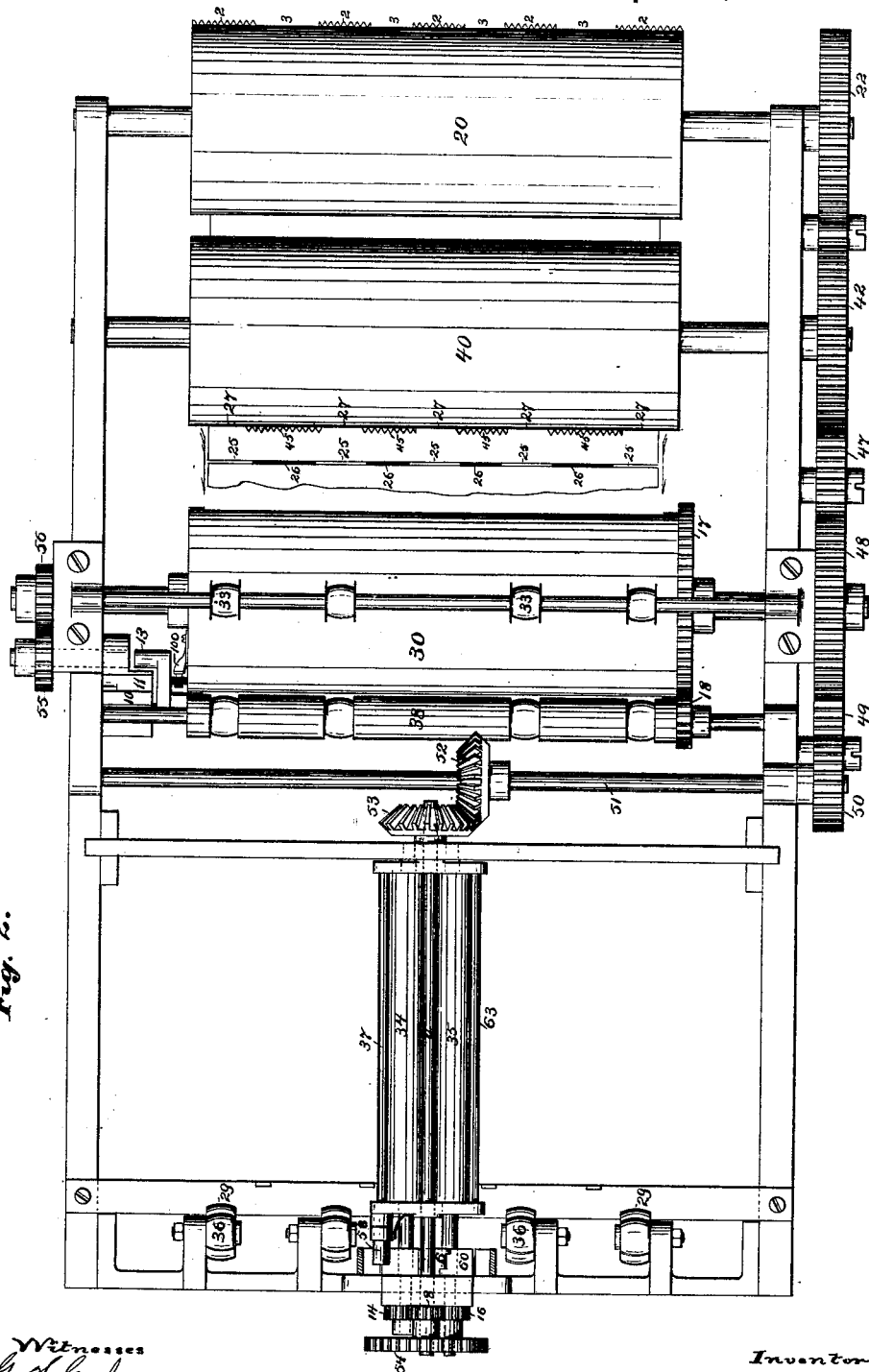
Fig. 17.

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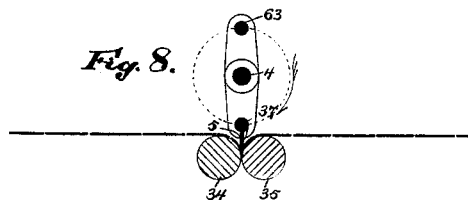
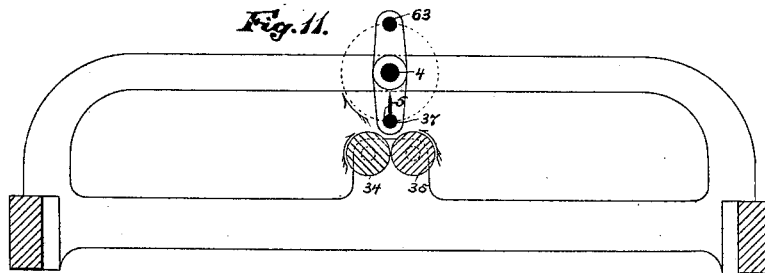
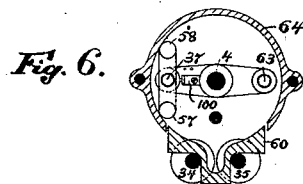
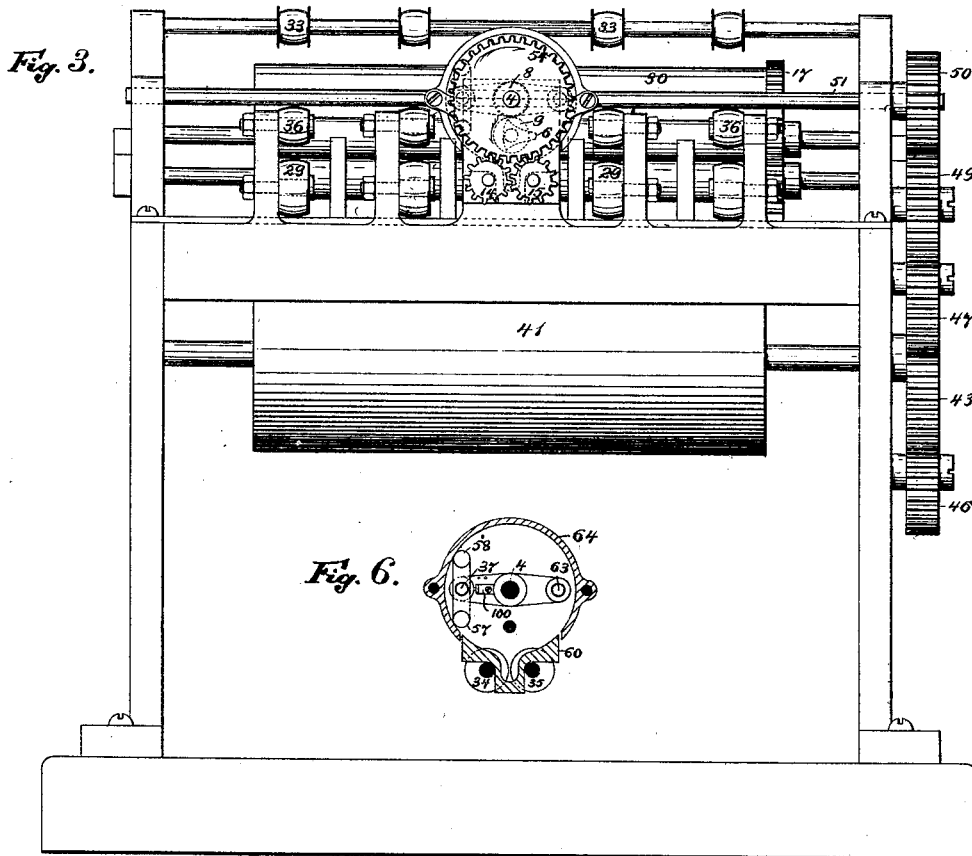
Fig. 2.



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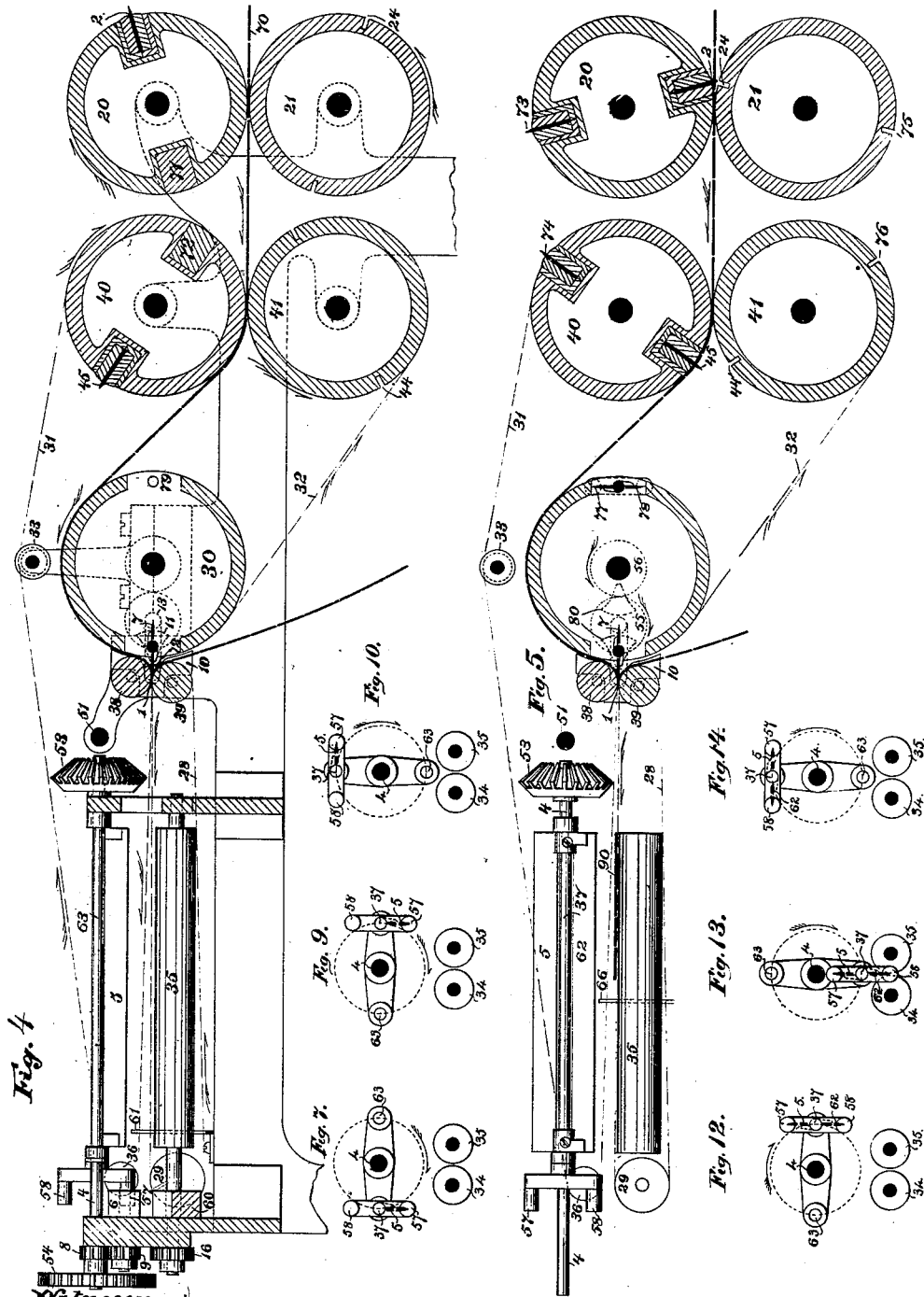
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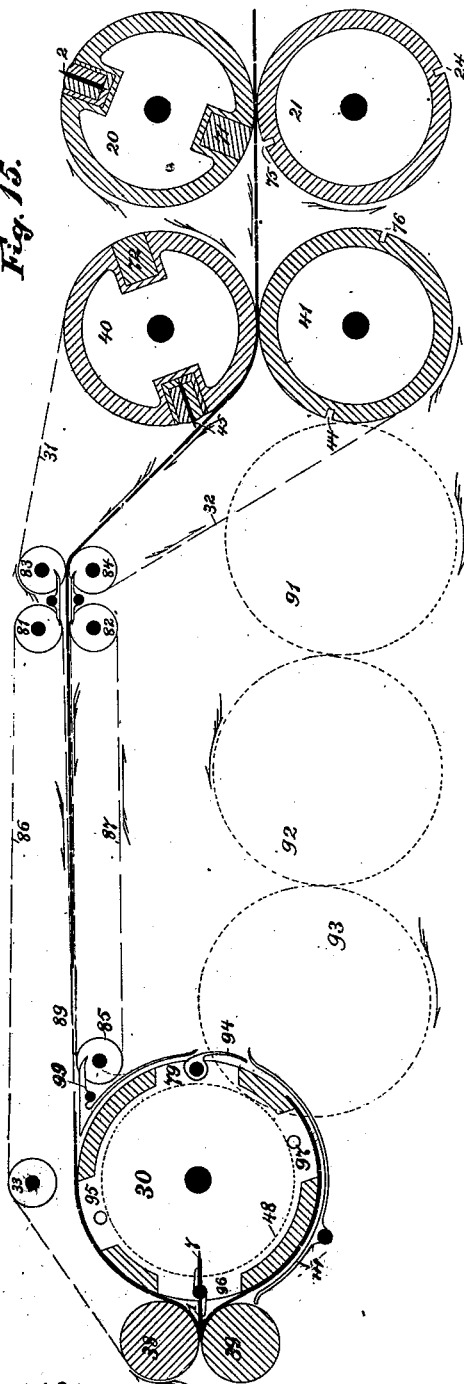
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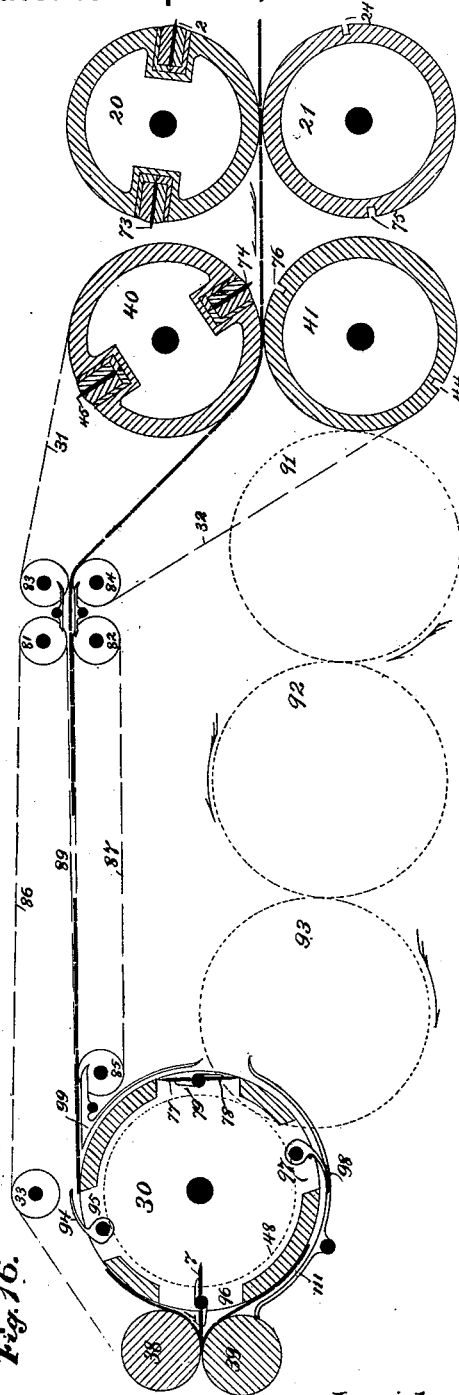
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Fig. 15.



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Fig. 16.



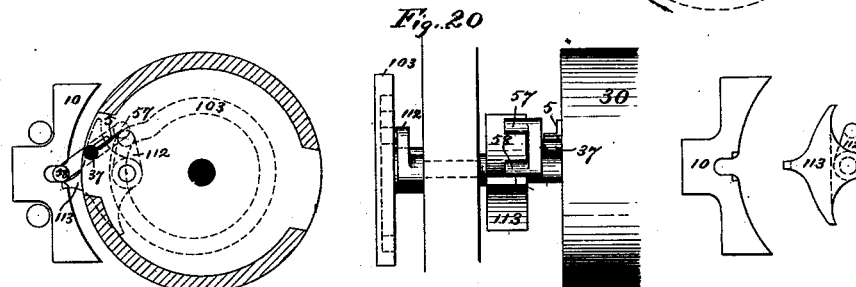
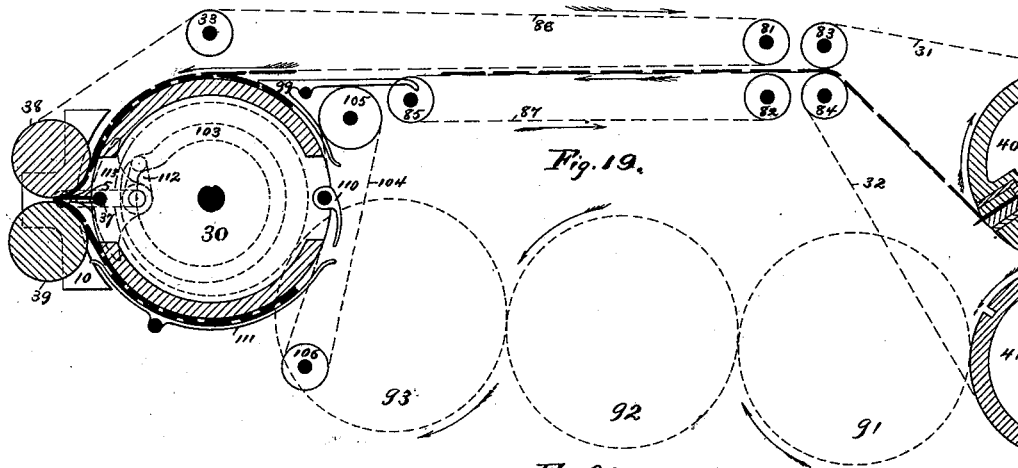
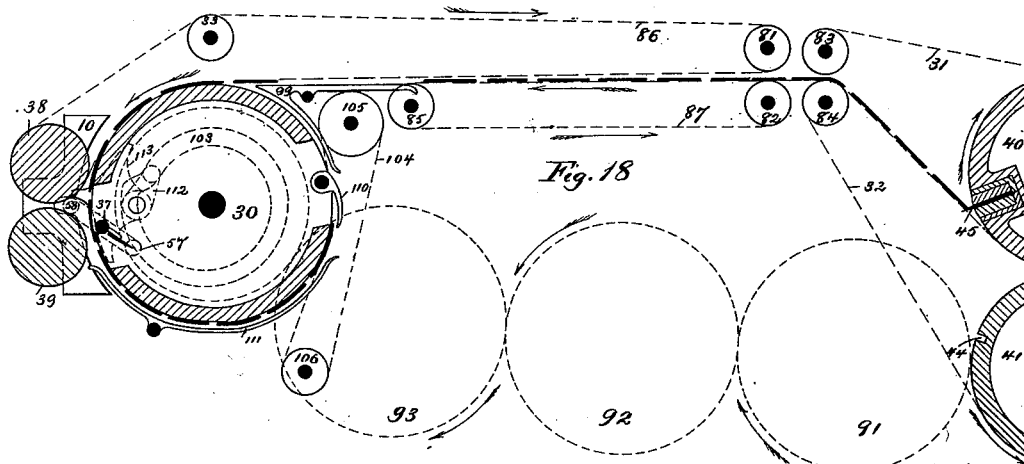
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No. 214,066.

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UNITED STATES PATENT OFFICE.

STEPHEN D. TUCKER, OF NEW YORK, N. Y.

IMPROVEMENT IN SHEET-DELIVERING APPARATUS FOR PRINTING-MACHINES.

Specification forming part of Letters Patent No. **214,066**, dated April 8, 1879; application filed May 22, 1878.

To all whom it may concern:

Be it known that I, STEPHEN D. TUCKER, of the city, county, and State of New York, have invented an Improvement in Sheet-Delivering Mechanism for Printing-Machines; and I hereby declare the following to be a full, clear, and exact description of my invention, reference being had to the accompanying drawings, forming a part of this specification.

In said drawings, Figure 1 illustrates, in side elevation, an apparatus whereby a web is cut into sheets, which are delivered in a folded condition. Fig. 2 is a plan view thereof, the tapes being omitted to more clearly show the parts underlying them; Fig. 3, an end elevation; Fig. 4, a longitudinal section, partly in elevation; and Fig. 5, a similar view, showing the apparatus as adapted for cutting and folding half or small sized sheets. Fig. 6 illustrates a folding-blade guard. Figs. 7, 8, 9, 10, and 11 illustrate the operation of the secondary folding mechanism, and Figs. 12, 13, 14 illustrate the operation of the same when adjusted for folding half or small sized sheets. Figs. 15 and 16 show fast-running tapes interposed between the delivering apparatus and cutting mechanism. Fig. 17 is an enlarged view illustrating the construction of the rotary folder, having two blades, one of which is removable. Figs. 18, 19, and 20 show a modified form of the means of actuating the single folding-blade, whereby the carrier may be adapted to collect and fold two sheets.

The present improvements relates to web-printing machines, which, as is well understood, are provided with mechanisms for printing the web, with cutting mechanisms for dividing the same into sheets, and with a delivering apparatus for disposing of the said sheets.

As commonly constructed, this cutting mechanism consists of a pair of cylinders provided, respectively, with a cutting-knife and a cutting-slot, which co-operating devices sever the web into sheets. This knife is either constructed so as to completely divide the web, or has slight portions of its edge removed, so as to nearly divide the web, yet leave it attached at several points, which are so slight as to be easily broken.

In order to carry the sheets or partially-severed web away from the cutting-cylinders, conducting-tapes, wide enough to properly support and carry the same, are provided, and, as it is obvious that these tapes cannot pass around the cutting-cylinders, for the reason that they would be destroyed by the action of the knife, or if its removed portions were made wide enough to accommodate suitable tapes the intact portions of the web would be so strong as to prevent its being readily torn apart, a pair of receiving-rollers are hung in front of the cutting-cylinders, from which the conducting-tapes are stretched to the delivering apparatus.

One part of the present invention relates to the combination of broad sheet-conducting tapes with the cutting mechanism, which is constructed to accommodate them, it consisting of two pairs or sets of cutting-cylinders, one cylinder of each set carrying a series of short cutting-knives, and the other a corresponding cutting-slot, the said cutting-knives being so arranged that the set carried by one cylinder will sever that portion of a web which is not severed by the knives of the other cylinder, whereby the web passing through the first cutting-cylinders receives incisions which but partially sever it transversely, and in passing through the second cutting-cylinders has its uncut portions severed by incisions which unite with the preceding ones and completely divide the web and form a detached sheet. This construction admits the passage of wide conducting-tapes around the cutting-cylinders, which tapes occupy circumferential positions thereon, which coincide with the spaces between the short cutting-knives, and thus the web may be carried into and out of the cutting mechanism, and be completely severed into sheets in passing through the same, which sheets will be conducted to the delivering apparatus.

The invention also comprehends the combination, with a primary rotating folding mechanism, provided with a folding-blade operating at each revolution of its carrier, of a secondary folding mechanism having a constantly-revolving carrier, the single folding-blade supported by which is caused to make a semi-rotation at each revolution of said carrier, and

to be projected into operative relation with its co-operating folding-rollers at each second revolution of its said carrier.

A revolving-carrier supporting a rotating folder having two blades, one of which is removable, is also embraced in this invention.

Another part of this invention is found in the guard for preventing the accidental or ill-timed movement of the rock arm or arms, whereby a folding-blade is projected without and drawn within the peripheral line of its revolving carrier when the same is a drum or cylinder, as in the primary folding mechanism, or making a like movement with respect to the circular path of travel which its revolving carrier has when constructed in the form of a frame-work, as in the secondary folding mechanism.

The invention further consists in the interposition of sheet-accelerating tapes between the delivering mechanism and the conducting-tapes leading from the two pairs of cutting-cylinders.

Various combinations of the aforesaid mechanisms with each other and with coacting devices are also included in the invention, as will be more specifically hereinafter set forth.

The cutting mechanism consists of two sets or pairs of cutting-cylinders, 20 21 and 40 41, the members 20 40, or male cutting-cylinders, whereof are furnished with cutting-knives 2 45, while the female cylinders 20 41 have grooves or slots 24 44, into which said knives work.

The cutting-knives 21 in the cylinder 20 are a series of short knives, as is best seen in Fig. 2, which provide spaces or non-cutting surfaces 3, whereby the transverse incisions 25 25 are made through the web.

The cutting-knives 45 in the cylinder 40 are a like series of short blades, leaving the spaces or non-cutting surfaces 27, whereby the transverse incisions 26 are made through the web. These knives 2 and 45 are so disposed that the incisions made in succession by them will completely sever the web transversely, the knives operating to partially sever it, thus leaving united by uncut portions of sufficient strength to carry it through the cylinders 40 41, and the knives 45 completing the severance by incisions which, uniting with those made by the blades 2, complete the severance, and thus divide the web into sheets.

The cutting-knives might of course be continuous plates having portions removed so as to provide the spaces 3 27 and cutting or operative portions 2 45. This construction of cutting-cylinders thus provides the means for completely dividing the web, and also permits the use of sets of wide sheet-conducting tapes, such as are adapted to and are necessary in a fast-running web-machine, which tapes may rest upon each cylinder at the points unoccupied by the cutting-knives, and connect with the delivering mechanism and delivering apparatus. Such tapes 31 32 are shown as stretched around the cylinders 40 41, (which may have slight

grooves to receive them,) from whence they lead to the delivering apparatus, their operation being to carry the severed sheets, as well as the end of the web, outward from the cylinders 40 41. These tapes may lead direct to any well-known form of delivering apparatus, such as a folding mechanism of the types illustrated and described in United States Patents Nos. 171,196, 186,384, 191,494, 196,502, or to any other rotating or vibrating folding apparatus; or they may conduct the sheets to a gathering, collecting, or accumulating apparatus, such as that shown in United States Patents Nos. 131,217, 192,510, 192,954, 193,056, 196,502, or to any other sheet-delivering mechanism. These tapes are herein shown as arranged with a rotating sheet-folding mechanism, with which they may directly connect, as in Figs. 1 to 5, or to accelerating-tapes interposed between them and said folding mechanism, as in Figs. 15 and 16.

In the first-named arrangement a primary and a secondary folding mechanism are shown, each of which will be particularly hereinafter described.

The tapes 31 are stretched from the cutting-cylinder 40 over the folding-blade carrier 30, under the upper folding-roller, 38, of the primary folding mechanism, pass out over the folding-rollers 34 35 of the secondary folding mechanism, and return over pulleys 36 33 to the cylinder 40. These tapes might, however, return over the roller 38 and pulleys 33, and another set lead therefrom to the pulleys 36, or fixed rods or other conductors might be substituted for these latter tapes. The tapes 32 are stretched from the cutting-cylinder 41 around the carrier 30 and return to said cylinder. These tapes 31 32 form conductors, which carry the sheets from the cutting-cylinders onto the carrier 30, by the mechanisms of which they are folded through the rollers 38 39, as will be described, and a set of tapes, 28, are stretched from the lower folding-roller, 39, to the pulleys 29, whereby the folded sheets, emerging from the rollers 38 39, are carried out over the folding-rollers 34 35 of the secondary folding mechanism, as will more fully hereinafter appear.

The two sets of cutting-cylinders 20 21 and 40 41 are provided with toothed wheels, as 22 23 42 43 46, whereby they are revolved in unison, and motion imparted to them by suitable gearing connecting with the printing-machine is transmitted, through the toothed wheels 47 48, to the rotating folding-blade carrier 30, and thence, by means of toothed wheels 49 50, a shaft, 51, and miter-wheels 52 53, to the shaft 4 of the rotating folding-blade carrier of the secondary folding mechanism. The folding-rollers 38 39 are geared together by wheels 18 19, the former of which gears with the wheel 17, fast on one end of the carrier 30, and the folding-rollers 34 35 are geared together by toothed wheels 14 16, which are driven from the toothed wheel 54 on the shaft 4 by an outside pinion, 15, on the shaft of roller 35.

The primary folding mechanism consists of the rotating folding-blades 1 and 7, which are supported on a shaft hung in the heads of the carrier 30, which folding-blades co-operate with folding-rollers 38 39. The folding-blade shaft is rotated by means of a stationary cam, 10, and a flying cam, 11. This latter cam is fast upon a short shaft journaled in the side frame, which is rotated by a pinion, 55, from a pinion, 56, of equal size, fast on the shaft of carrier 30, and is thus caused to make equal turns with said carrier and to move its working-surfaces into such relative positions with the working-surfaces of the stationary cam 10 as to provide a pathway between them, which will guide one or the other of the rock-arms 12 13, fast on one end of the folding-blade shaft, outward and inward, and thus cause one or the other of the folding-blades 1 7 (which are cut away so as to pass the tapes 32) to be projected without the peripheral line of the carrier 30, between the folding-rollers 38 39, and returned within the said carrier, whereby a sheet of paper overlying said blade will be doubled between the said folding-rollers, and be nipped thereby and folded, which construction and operation are set forth at length in the aforesaid Patents Nos. 171,196 and 191,494.

The secondary folding mechanism, Figs. 1 to 5, consists of a rotating folding-blade, 5, fixed upon a shaft, 37, which is supported in arms hung on a shaft, 4, which blade co-operates with the folding-rollers 34 35.

The shaft 4, the supporting-arms of the folding-blade shaft 37, with or without the counterbalancing-shaft 63, constitute an open framework or revolving carrier for the rotating folding-blade 5, which carrier is caused to make double the number of revolutions of the revolving carrier 30 by means of the toothed wheel 50, whose size is one-half that of the wheel 48, its driver. The folding-blade 5 is rotated by means of rock-arms 57 58 on its shaft 37, which are actuated by means of a stationary cam, 60, and a flying cam, 6, Figs. 3 and 4, the latter being rotated by the pinions 8 9, which operation is substantially the same as that described with reference to the folding-blades 1 7.

The operation of the mechanism, as thus far described, is as follows: The web 70 is led directly from the printing mechanism and entered between the cutting-cylinders. In passing through the cylinders 20 21, the knives 22 cut the transverse incisions 25 25, (see Fig. 2,) which thus leave the web intact between said incisions, whereby it retains sufficient strength to be drawn onward through the cylinders 40 41, passing through which the knives 45 45 cut transverse incisions 26 26, which, intersecting with the incisions 25 25, complete the severance of the web, whose leading end is thus converted into a sheet. The sheet thus formed is conducted between the tapes 31 32, passes over the carrier 30, and down before the folding-rollers 38 39, between which it is

doubled by the operation of the folding-blade 1, which is projected at the proper time by means of the stationary and flying cams 10 11, as in Fig. 4. These rollers 38 39 nip the doubled edge of the sheet and propel it through them, and it emerges into and is carried by the tapes 31 28 in a once-folded condition out over the folding-rollers 34 35 of the secondary folding mechanism, through which it is to be doubled upon a line at right angles to that of its first fold. The sheets thus severed from the web 70 are successively doubled through the rollers 38 39, and delivered by the tapes 31 28 out over the folding-rollers 34 35 and against a gage or stop, 61, in position to be doubled by the folding-blade 5 through the rollers 34 35, and thus be a second time folded. As before stated, the revolving carrier supporting this folding-blade 5 makes two revolutions to each one of the carrier 30, and as the flying cam 6 operates the rock-arms 57 58, and thus rotates the single folding-blade 5, it follows that said folding-blade will make a semi-rotation at each revolution of its carrier. Thus, while the carrier 30 is making its first half-revolution, the carrier supporting the folding-blade 5 will make a full revolution, and the said folding-blade 5 a half-revolution; and since its rock-arm 58 will at that time be actuated by the stationary and flying cams it also follows that the semi-rotation imparted to the single folding-blade will turn the same inwardly or toward the shaft 4 of its revolving carrier. (See Fig. 11.) The said blade will thus pass the folding-rollers 34 35 without projecting toward them, and will leave the path of travel of the incoming sheet unobstructed, whereby the tapes 31 28 may properly conduct the same into position to be folded by the second revolution of the carrier, when the arm 57 of the folding-blade 5 being foremost, as in Figs. 9 and 10, will be actuated by the stationary and flying cams, and said blade projected, as in Fig. 8, thus carrying the sheet into the nip of the rollers 34 35 and folding it a second time. At the next revolution of the carrier of the blade 5, said blade will, standing as in Fig. 7, be turned as in Fig. 11 while passing the rollers 34 35, at which time a new sheet will be fed over the rollers 34 35, which sheet will be doubled into the nip of the said rollers by the succeeding rotation of said carrier, when its blade 5 will enter said rollers, as in Fig. 8.

This mechanism, which, as thus far described, is supposed to have been severing the web into full sized sheets, may be adapted to the production and folding of half-sized sheets, as follows, (see Figs. 5, 12, 13, and 14:) The cutting-cylinders 20 40 are provided with cutting-knife sockets at points of its surface opposite to those occupied by the knives 2 45, which, temporarily filled by blocks 71 72, may receive cutting-knives 73 74, and the cylinders 21 41 be supplied with co-operating cutting-slots 75 76. The knives 73 74 will correspond in struct-

ure with the knives 2 45, and the cutting-cylinders be thus adapted to sever the web into small or half sized sheets.

It is apparent that the cylinder 41 may support the cutting-knives 45, and the cylinder 40 have the cutting-slot 44, and thus operate with the cylinders 20 21 to sever the web into large sheets; also, that in cutting the web into small sheets each of the cylinders 20 21 40 41 may carry a set of cutting-knives and have corresponding cutting-slots.

It is likewise apparent that instead of constructing the carrier supporting the cutting-knives in the form of a cylinder, as 20 40, as hereinbefore described, said carrier may be a frame-work or supporting-arms turning upon a suitable axis, as may also the cylinder 40, when it is not desired to have said carriers support tapes; and, furthermore, that the cutting slot or slots for these blades may be in one cylinder, properly timed and situated.

The carrier 30 will also have a second double folding blade, 77 78, hung in its recess 79, and the flying cam 11 will be exchanged for a double flying cam, 80, whereby a folding-blade will be projected between the folding-rollers 38 39 at each half-revolution of the carrier 30, and each half-sheet delivered onto or before it or past the rollers 38 39 will be folded, which operation is fully described in the United States Patent No. 191,494.

It is apparent, however, that the double flying cam might be used continuously in the machine, since when but one folding-blade is used the cam will effect nothing when its point is turned outward at the opening 79, unless the folding-blade 77 78 is in place, as in Fig. 5.

The secondary carrier, which might be a cylinder, as is the carrier 30, will then have a second single folding-blade, as 62, fixed upon the shaft 37, and a sheet-stop, 66, will be introduced at or near the middle of the folding-rollers 34 35.

The single folding-blade 5 and its shaft 37 may be made removable, so as to be exchanged for a shaft carrying a double folding-blade, in the same manner as the blades 77 78, and their shafts are removed and replaced; but, in order to reduce the cost of construction of the parts, and to facilitate the operation of adjusting the machine to the manipulation of small-sized or half sheets, I have adapted a second folding-blade, as 62, to be attached to and removed from the shaft 37, as shown in Fig. 17.

Each of the blades 5 62 is provided with brackets, as 59 59 or 67 67, the half-hubs of which embrace the shaft 37, to which they are fastened by screws passing through them and entering the said shaft. These half-hubs are so constructed that when two blades are adjusted in place the ends of the half-hubs attached to one blade will bear against the other blade, as in Fig. 17, and thus brace the two blades firmly in place and prevent their twisting upon the shaft 37. When the blade 67 is

removed a half-hub, 88, may be secured on the shaft 37 to aid in supporting the blade 5.

The mechanisms will then operate as follows: The web will be severed by the knives 2 73 and 45 74 on lines which will divide it into small sheets, or such as are one-half the size of the sheets produced by the knives 2 45, which sheets will be delivered and successively folded by the primary folding mechanism. Thus the first sheet arriving before the folding-rollers 38 39 will be doubled into their nip by the blade 1, as in Fig. 5, and, passing out over the folding-rollers 34 35, will be doubled through the same by the secondary folding mechanism.

The next sheet will be doubled into the nip of the rollers 38 39 by the blade 77, and the succeeding one by the blade 7, the following one by the blade 78, the next by the blade 1, and so on, as explained in said Patent No. 191,494.

Supposing the sheets of the secondary folding mechanism to be in the position shown in the drawings, the first sheet, as 90, fed over the rollers 34 35, as in Fig. 5, will be folded by the folding-blade 62, which, being foremost, as in Fig. 12, will be rotated to project between said rollers and double said sheet into their nip, as in Fig. 13. As the succeeding sheet is fed out over said rollers 34 35, it will be folded by the blade 5, which is then foremost, as in Fig. 14, its operation being the same as that of the blade 62. Thus the blades 5 62 will alternately operate at the rollers 34 35 to fold successive sheets, as is fully set forth in the afore-said Patents Nos. 171,196 and 191,494.

In folding-machines which are provided with folding-blades supported in a revolving carrier, and adapted to be partially rotated at a given point or points of their circular path of travel by means of rock-arms, which project at one or both sides of their carrier, it has been found by experience that said rock-arms, although held in position by the spring-catch 100, as described in Patent 171,196, may be accidentally displaced, thus projecting, or partially projecting, the folding-blade, and causing the mechanisms to be either forced out of time, disrupted, or broken, so as to require stoppage and repair. To prevent this result, a guard, as 64, is provided, (see Fig. 6,) whose internal face forms an arc corresponding with the circular path described by the rock arm or arms, as 57 58, by which said blade or blades are operated. This guard is provided with one or more openings at the point or points where the blade or blades are to be projected to perform the folding operation.

As has been stated, the tapes conducting the sheets out from the cutting-cylinders may deliver the sheets to accelerated tapes, which, in turn, conduct them to the delivering mechanism; and, though it is obvious that these accelerating-tapes may lead the sheets to any of the delivering mechanisms hereinbefore referred to, they are illustrated in Figs. 15, 16, 18, and 19 as being connected with a primary

rotating folding mechanism, which, as shown in Figs. 15 and 16, is substantially like that shown in Figs. 4 and 5.

The tapes 31 and 32 are shown as returning over a pair of rollers or sets of pulleys, 83 84, adjacent to which are receiving rollers or pulleys 81 82. The accelerating-tapes 86 lead from the receiving-roller 81, pass over the rotating carrier 30, and return over the folding-roller 38 and pulleys 33, while the accelerating-tapes 87 lead from the receiving-roller 82 and return over pulleys 85. These tapes will be driven by the folding-roller 38, which is driven by gearing, as in Fig. 2, and by the pulleys 81 82, whose shafts will be geared together. The pulleys 85 and 83 84 might also be provided with gear-wheels, so as to be positively driven. Short conductors bridge the space between the pulleys 81 83 and 82 84, and a similar device or guard, 99, is placed between the pulleys 85 and surface of the carrier 30.

The toothed wheel 48 on the shaft of the revolving carrier is of the same size as the toothed wheel 43, from which it is driven by a train of wheels, 91 92 93, and thus runs turn for turn with the cutting-cylinders.

As this carrier is of greater diameter than said cutting-cylinders, it follows that its surface-speed is greater than theirs, and therefore that the tapes 86 87 will be moved at a greater speed than the tapes 31 32 are driven, and hence that the sheets, when nipped by said tapes 86 87, will have their speed accelerated. This increased speed of the tapes 86 87 may, of course, be imparted by other mechanism than that shown, and in some instances where the carrier 30 does not act as a sheet-carrier these conducting-tapes will be driven by mechanisms independent of said carrier.

The end of the web will be carried by the tapes 31 32 and entered between the tapes 86 87, which latter are slightly separated to allow them to slip over the same until it is severed to form a sheet by the knives of cylinder 40, which sheet will take up the motion of the tapes 86 87 at the moment when its rear end is released by the rollers 83 84, and its speed be so accelerated as to form the space 89 between the sheets, whereby the sheets are separated a distance apart, and one sheet is prevented from interfering with another in the operation of delivering them. This is requisite when the delivering apparatus is a gathering or accumulating mechanism, as shown in Patents 192,170, 192,510, 193,056, 196,502, to provide for the movements of the switches; and likewise, when said apparatus is a rotating folding mechanism provided with grippers 94, as here illustrated, to provide space for the action of said grippers.

Each sheet conducted to the carrier 30 is seized by the grippers 94, carried partially around said carrier, released by the grippers, and doubled through the rollers 38 39 by one of the folding-blades 1 7, its leading end being protected from drooping by a guard, 111,

as is set forth in the Patents Nos. 171,196 and 191,494.

In order, however, to adapt this apparatus to the manipulation of both full and half sized sheets, as before explained with reference to its arrangement as in Figs. 1 to 5, the revolving carrier must be supplied with four recesses, as 79 95 96 97, the recesses 95 97 whereof are provided with bearings, in which shafts carrying grippers may be hung, and the recess 79 in like manner adapted to receive either a shaft with grippers or one bearing a double folding-blade, as 77 78. The stationary and flying cams 10 11, arranged as hereinbefore described, will operate both folding-blades, and cams adapted to operate the grippers at proper times will be supplied, so as to be properly adjusted, which interchanging, adjusting, and operating of said devices are set forth with particularity in the Patent No. 197,694.

With the cutting-knives 2 45 and 73 74 adjusted in the cylinders 20 40, the double folding-blades 1 7 and 77 78 arranged in the recesses 96 79, and grippers 94 98 arranged in the recesses 95 97, the web will be severed into half-sheets, each of which will be separated a distance apart by the tapes 86 87, as at 89. One sheet will be seized and carried onward by the grippers 98, be released therefrom and doubled into the nip of the folding-rollers 38 39 by the folding-blade 1, as in Fig. 16. The next sheet will be seized by the grippers 94 and doubled by the blade 77; the next be seized by the grippers 98 and doubled by the blade 7; the next seized by the grippers 94 and doubled by the blade 78, and so on; and when these sheets leave the said rollers 33 39, they may be delivered to the secondary folding mechanism for further folding, as hereinbefore described.

A revolving carrier supporting a single rotary folding-blade, which is projected at every second revolution of said carrier to co-operate with folding-rollers, as in the secondary folding mechanism herein described, is admirably adapted, when such carrier is constructed as a cylinder upon which sheets may be supported, to be supplied with mechanisms whereby it may operate to collect two sheets and fold them as one. In this operation one sheet will be taken onto the periphery of the cylinder during that revolution of it when its single folding-blade is inoperative, and receive a second sheet at its second revolution when the folding-blade is operative, whereby two sheets will be collected and folded as one product. This modification of it is shown in Figs. 18, 19, 20, wherein the various devices which are constructed and operate as do like devices in the preceding figures of the drawings are similarly marked. Thus the cylindrical carrier 30, which is slightly larger, and runs turn for turn with the cutting-cylinders, is shown as supplied with a single folding-blade, 5, hung on a shaft, 37, which is provided with rock-arms 57 58, and also as provided with grippers 110. This carrier is par-

tially spanned by the guards 99 and tapes 86, as before described, and by the guards 111 and tapes 104, the latter leading from pulleys 106 to pulleys 103, and driven by a spur-wheel, as 17, on the shaft of said carrier.

The grippers 110 are operated by a properly-shaped cam, as in Patent No. 191,494, so as to open and release the sheets just an instant before the tapes 104 are reached, and to close to seize the same at the upper side of the carrier.

As in the structure of the secondary folding mechanism this folding-blade 5 makes a semi-rotation at each revolution of its carrier, whereby it is projected inwardly at its first revolution to inoperatively pass the folding-rollers 38 39, and is projected outwardly to co-operate with the same at the second revolution of said carrier.

The means for accomplishing this movement of the folding-blade are, however, modified, as follows: A suitably-shaped cam, 113, Fig. 20, is hung on a short shaft in the side frame and provided with a rock-arm, 112, the stud or friction-roller of which runs in the groove of the cam-wheel 103, fast upon the shaft of the carrier, which cam 113 co-operates with a stationary cam, as 10, and is rocked to impart a semi-rotation to the blade 5 and its shaft at each revolution of its carrier 30, as follows: As the carrier revolves and the blade-shaft it supports approaches the cam 113, said cam will be rocked into the position shown in Fig. 20, so as to intercept the stud or roller on the forward rock-arm of the folding-blade shaft, and cause the same to follow the curved pathway provided between said cam 113 and the stationary cam 10, thus rocking the said cam outward, as is shown in Fig. 19. When this position of the parts is reached the cam will be rocked over the friction-roller and into the position shown in Fig. 18, whereupon the said roller will follow the curved pathway and rock the said arm inward.

The shaft 37 of the blade 5 will thus have been partially rotated, and the said blade 5 caused to make a semi-rotation, and it will thereby be projected inwardly, as in Figs. 18, 20, and thereby pass the rollers 38 39, or be projected outwardly to enter between the same, as in Fig. 19, according as its arm 57 or 58 is foremost, as will be readily understood.

The point of the cam 113 is partially cut away, and the stationary cam 10 is in like manner recessed, so that the one cam will fit into the other, as in Fig. 20, and form continuous pathways for guiding the studs or rollers on the rock-arms of the folding-blade in and out of the central depression of said cam 10.

In the operation of this modified form of the apparatus, as the first sheet is received, it is seized by the grippers and carried around with the carrier 30. The arm 58 then being foremost will be operated upon by the cam 113, and cause the shaft 37 and the blade 5 it carries to make a semi-rotation; but as the said blade points toward the arm 57 it will

then be projected inwardly and not affect the position of the said sheet. This sheet will thus be carried around with the carrier 30, which receives at its next revolution a second sheet upon the first.

The grippers 110 are opened just before the tapes 104 are reached, thus releasing this first sheet, which will be carried onward into the nip of said tapes by its own momentum, and said grippers close to seize its leading edge, together with that of the next incoming sheet, as the latter is laid upon it, which two sheets thus associated together are carried onward and released by the grippers just before the tapes 104 are again reached, as in Fig. 19, during which second revolution of the carrier the cam 113 is rocked in like manner as before; but now, since the rock-arm 57, toward which the blade 5 points, is foremost, it follows that as said arm is rocked by the cams 113 and 10 said blade will be projected to double the two sheets then released by the grippers between the rollers 38 39, and be withdrawn into the carrier to repeat the operation. The third and fourth sheets and succeeding pairs will be manipulated in like manner. This folding mechanism may be made to fold successive sheets by constructing its folding-blade 5 as is shown in Fig. 17, and providing a second blade, as 62, which is adapted, as therein shown, to be attached to the shaft 37, or its single folding-blade and shaft might be removed and exchanged for a shaft carrying a double folding-blade, as has been herein described with reference to the primary folding mechanism.

The following is not claimed: A revolving carrier adapted to receive sheets upon its surface, and provided with means for collecting two or more sheets thereon, with a single folding-blade rotated continuously during or partially rotated at each revolution of said carrier, and with means for causing said blade to be projected between folding-rollers at each second or other repeated revolution of said carrier, which invention being broadly claimed in my application filed September 16, 1878, the subject-matter herein claimed is limited to the specific mechanisms shown and described.

I also disclaim the following subject-matter, the same being embraced in an application filed by me March 14, 1879: the combination, with a single pair of folding-rollers, of a revolving carrier, a single folding-blade, as 5, supported thereby, and mechanisms for projecting said blade between said rollers at each second revolution of the carrier.

What is claimed is—

1. The combination of sets of wide-sheet-conducting tapes, as 31 32, with a cutting mechanism consisting of co-operating cylinders, two of which are provided with short cutting-knives, whereby the web is completely severed and a non-operative space is provided, which admits the passage of said tapes around the cylinders 40 41, substantially as described.

2. The combination, with a primary rotating folding mechanism provided with a folding-blade operating at each revolution of its carrier, of a secondary folding mechanism provided with a folding-blade operating at each second revolution of its carrier, all substantially as described.

3. A revolving carrier provided with a rotating folder having two blades, as 5 62, one of which blades is removable, so that said folder will operate at each revolution of its carrier or at each second revolution thereof, as is desired, substantially as described.

4. The combination, with the primary rotating carrier 30, of a secondary rotating carrier provided with a rotating folder having two blades, as 5 62, one of which blades is removable, so that said folder will operate at each revolution of its carrier, or at each second revolution thereof, as is desired, substantially as described.

5. In combination with a revolving carrier,

a folding-blade shaft having an actuating rock-arm supported by said carrier, and the cam 60, the guard 64, substantially as described.

6. The combination, with the cutting-cylinders 20 21 40 41 and sheet-conducting tapes leading from the latter, of the sheet-accelerating tapes 86 87, substantially as described.

7. The combination, with a single pair of folding-rollers, of a revolving carrier supporting a single folding-blade, as 5, and provided with mechanisms operating to impart a semi-rotation to said single blade at each revolution and project the same between said rollers at each second revolution of the carrier, all substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

STEPHEN D. TUCKER.

Witnesses:

SAML. S. MOTLEY,

CHAS. W. CARPENTER.