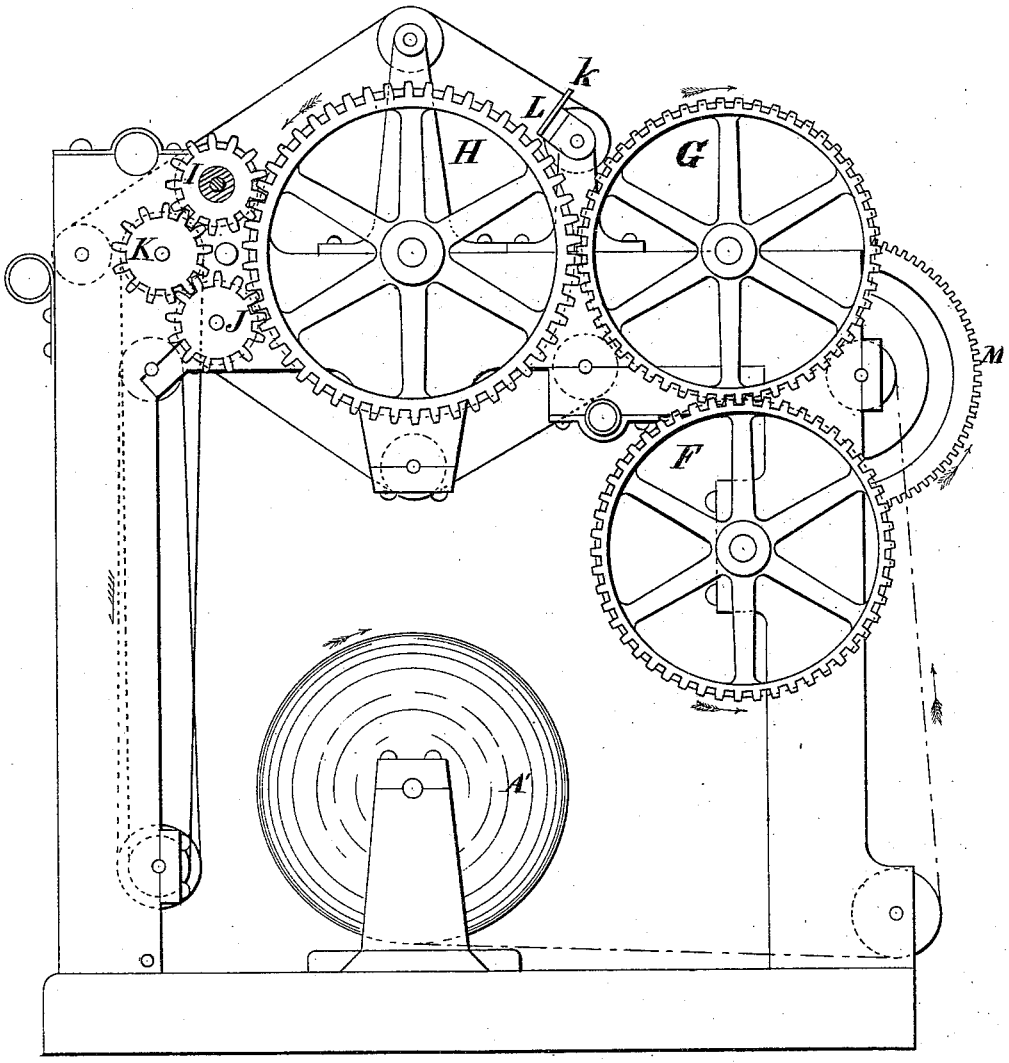
6 Sheets—Sheet 1.

R. M. HOE & S. D. TUCKER.

DELIVERY APPARATUS FOR PRINTING-MACHINES.

No. 192,510. Patented June 26, 1877.

Fig. 1



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6 Sheets—Sheet 2.

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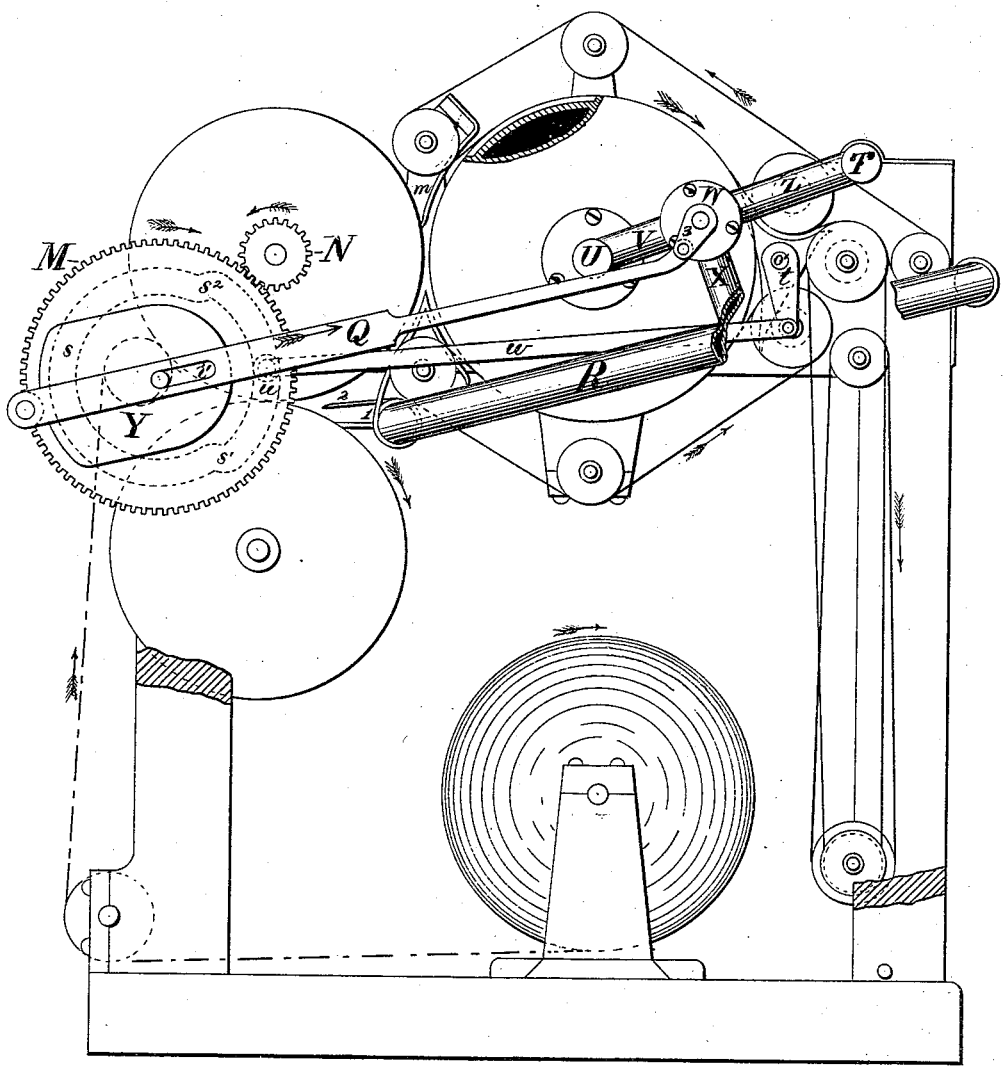
Fig. 2



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6 Sheets—Sheet 3.

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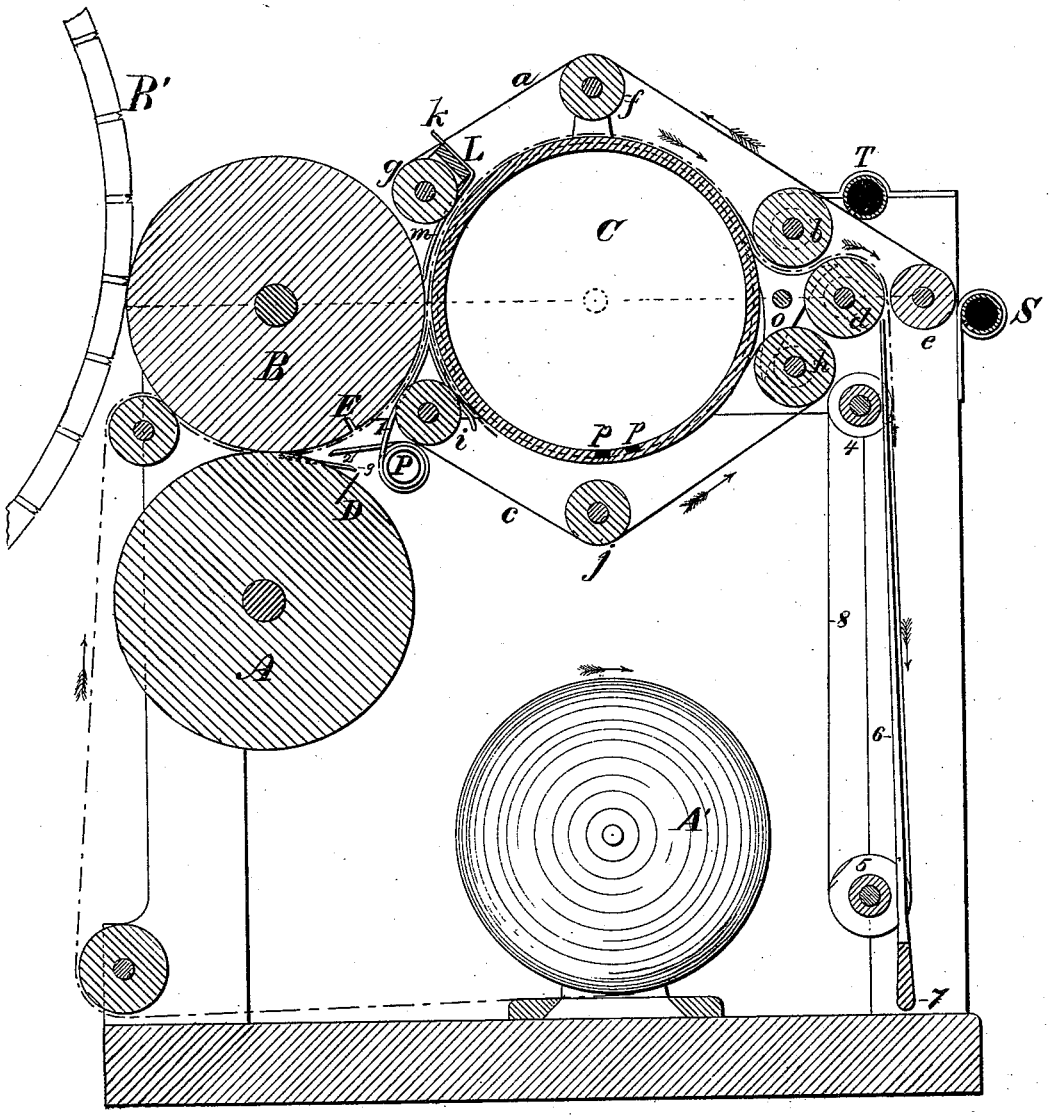
Fig. 3



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DELIVERY APPARATUS FOR PRINTING-MACHINES.

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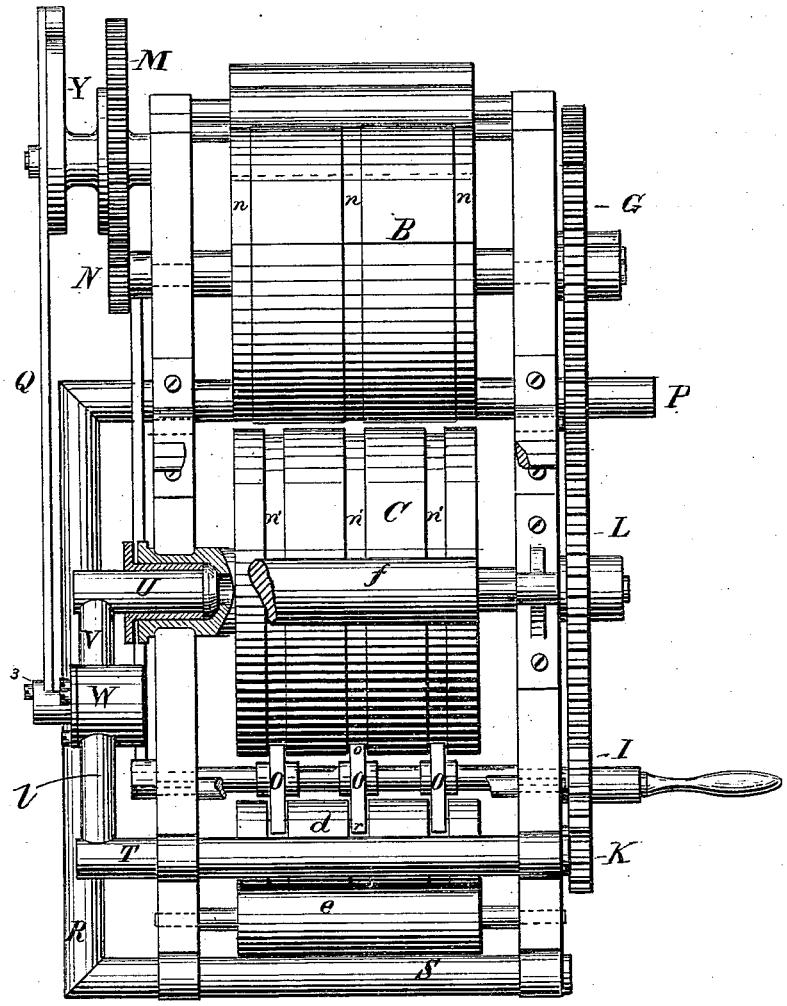
Fig. 4



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DELIVERY APPARATUS FOR PRINTING-MACHINES.

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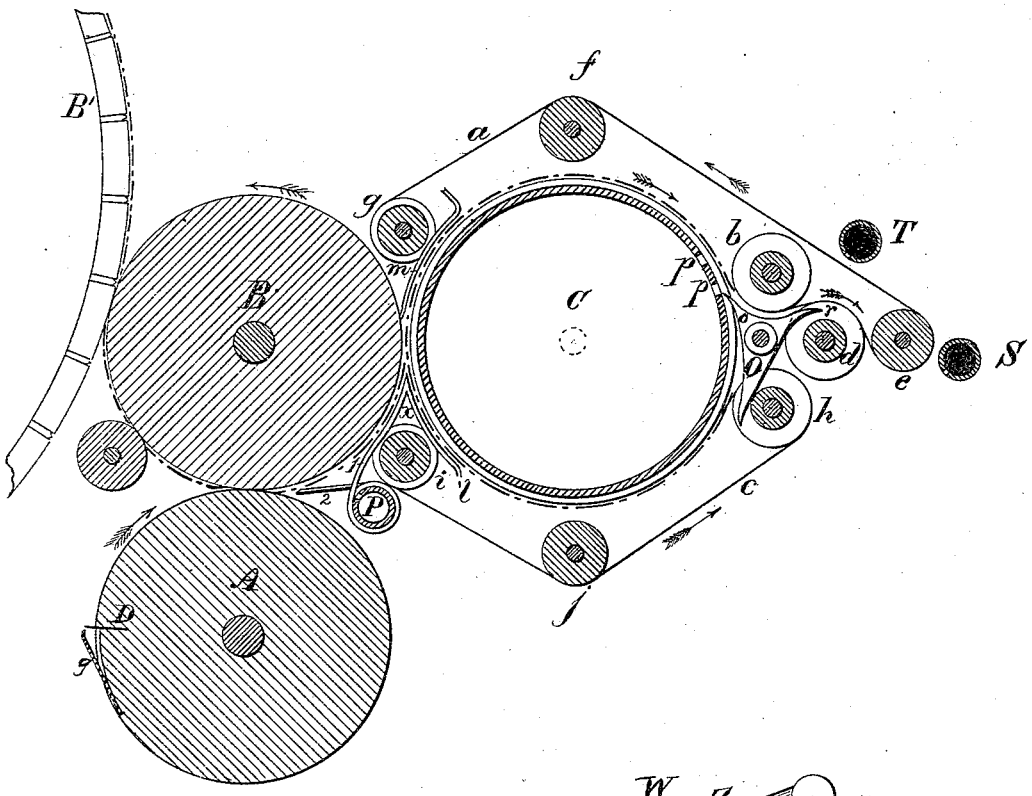
Fig. 5



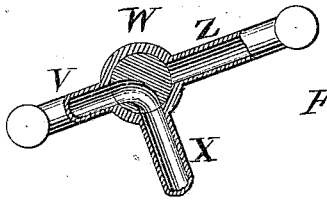


Fig. 6

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6 Sheets—Sheet 6

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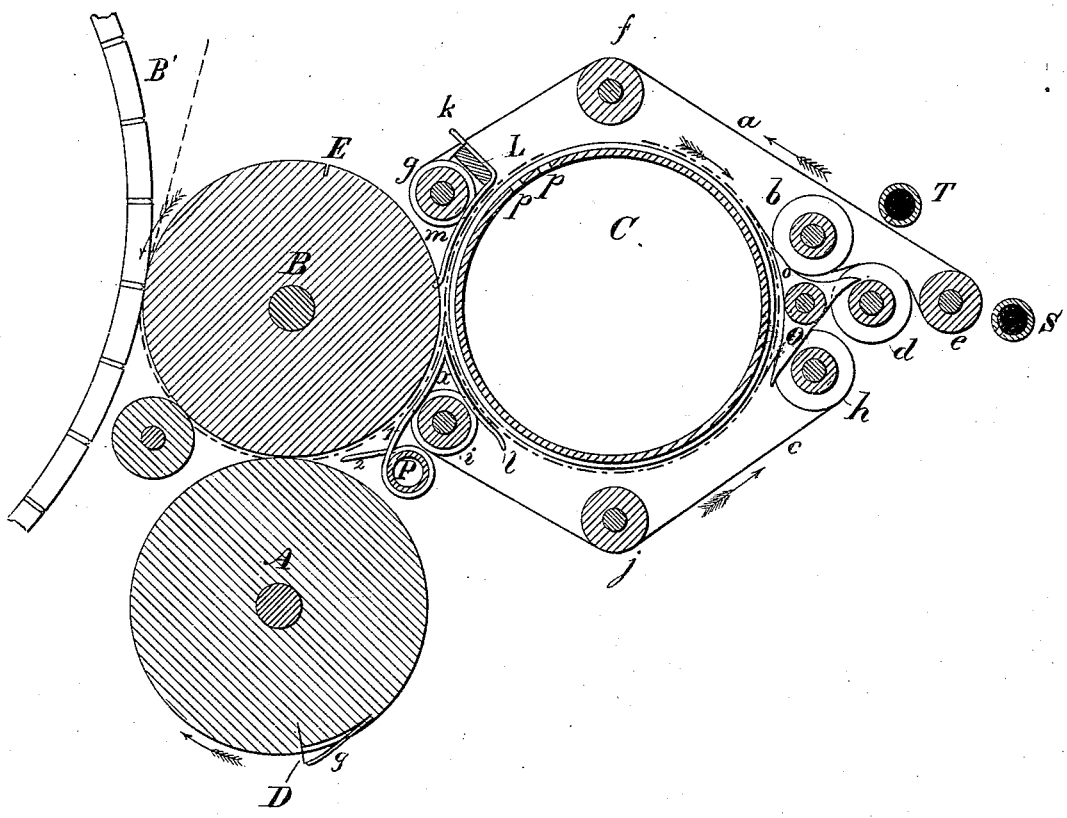
DELIVERY APPARATUS FOR PRINTING-MACHINES

No. 192,510. Patented June 26, 1877.

Fig. 7.



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UNITED STATES PATENT OFFICE.

RICHARD M. HOE AND STEPHEN D. TUCKER, OF NEW YORK, N. Y.

IMPROVEMENT IN DELIVERY APPARATUS FOR PRINTING-MACHINES.

Specification forming part of Letters Patent No. **192,510**, dated June 26, 1877; application filed September 7, 1875.

To all whom it may concern:

Be it known that we, RICHARD M. HOE and STEPHEN D. TUCKER, of the city, county, and State of New York, have invented an Improvement in Delivering Apparatus for Printing-Machines, of which the following is a specification:

In the accompanying drawings, in which like letters represent like parts, Figure 1 is a right-hand side elevation; Fig. 2, a left-hand side elevation, with portions of one cylinder, pipes, and frame partially removed, to more clearly show the devices; Fig. 3, a longitudinal section; Fig. 4, a top view, with the carrying-tapes and tape-guiding frame and rollers removed; Fig. 5, a sectional view of the type, impression, cutting, and gathering cylinders, switch, and guiding-tapes; Fig. 6, a sectional view of the air-pipe cock; and Fig. 7, a longitudinal sectional view, showing the switch in position for directing the sheets around the cylinder.

The use of web perfecting printing-machines of the rotary order, whose product may be many thousand printed sheets per hour, has long been prevented, at least where a high rate of speed was attempted, by reason of the total inadequacy of any known means to deliver the printed sheets as rapidly as such mechanism was capable of producing them.

To accomplish this result, namely, a delivering of the sheets which shall equal the highest speed attainable in printing a web of paper upon both its sides, is the object of this invention; and to that end it consists in a mechanism adapted to operate upon a web of paper, preferably after it has been printed upon both its sides, which, by automatic operations, it severs into sheets equal in length to the surface covered by a single impression of the type-cylinder plus the usual margins, which sheets are directed onto and held upon a revolving carrier until, a suitable number having been accumulated, they are stripped from the revolving carrier and deposited or piled upon the delivery board or table, all of which will be clearly set forth in the following detailed description of the machine.

The elements of the apparatus which have rotative movements are hung in proper journal-bearings in an open frame-work. The male cutting-cylinder A, which carries fixed in its periphery a serrated cutting-blade, D, and the impression-cylinder B, which has a longitudinal slit or recess, E, co-operating with said blade D, are geared together by gear-wheels F and G, and to the revolving carrier C, (which, as illustrated, is a gathering-cylinder,) by means of gear-wheel H, so that said cylinders move with the same velocities. Gear-wheels I, J, and K, meshing into each other, are driven by the gear-wheel H, with which the two former engage and actuate the shafts of the pulleys *b*, *d*, and *h*, upon which are supported the carrying-tapes *a* and *c*. The tapes are thus moved in unison with the periphery of the gathering-cylinder. The endless carrying-tapes *a*, which rest upon the top of the cylinder C, bear on the under side of pulleys *b* and upon the upper side of pulleys *d*, and, passing around pulleys *e*, return over the top surface of pulleys *f*, and around the pulleys *g*. The endless tapes *c* are similarly supported upon pulleys *h*, *i*, and *j*, and bear against the under side of the cylinder C. Both sets of tapes are sustained in proper position or relation to each other by means of guide-bars L, whose fingers *k*, rising upon the opposite sides of the tapes, form ways for them to travel in. The said gathering-cylinder is thus nearly encompassed by the said tapes, whose function it is to sustain the sheets upon the cylinder at the points where they bear upon it. The portion of the periphery of the cylinder C between the pulleys *g* and *i*, which may be termed the sheet-entrance side, is provided with guard-plates or guiding-fingers *l* and *m*. The former, supported upon the pipe P, are bent into an acute angle, with curved sides *x* and 1 coinciding with the arcs of the cylinders B and C, and guide the sheet against the periphery of the cylinder B as it is moved upward to enter between the tapes and the surface of the gathering-cylinder, which latter movement of the sheet is accomplished by means of the guiding-fingers *m*, which are curved to correspond with the periphery of the cylinder C, and are suspended from the bar L. These guiding-fingers *m* will, preferably, extend into shallow grooves or recesses *n* in the cylinder B, which insures their entering behind the sheets.

When the cylinder B, which, like the cylinder C, it is practicable to make up of a number of large pulleys or short cylinders, is so constructed, and its use is limited to a carrier for the female cutting device, the guiding-fingers *m*, which may be arms or bars, can pass into the recesses between said pulleys or short cylinders; and even when a single cylinder is used, and performs the office of an impression-cylinder, as is hereinafter described, the said guides may be continuous plates having toes extending from their edges into the grooves *n*, with which it must be provided at points which will not interfere with the printing form.

The inner arms *x* of the angularly-bent guiding-fingers *l* support the sheets against the cylinder C at the point where the tapes *c* leave them, and direct them upward toward the fingers *m*, as will be hereinafter more fully explained.

At a point of the cylinder C opposite to the sheet-entrance side, and which is termed the sheet-delivering side, the space between the pulleys *b* and *h* is occupied by a switch, O. This switch is of triangular form, and its inner side is curved to conform to the arc of the cylinder C, while its upper side is curved to coincide with the periphery of the pulleys *b*. It may be constructed in several detached parts, as shown in Fig. 4, or made of one continuous piece extending across the face of the cylinder C. In the former construction its horns *o* and *r* are, respectively, made to enter into recesses *n'* in the cylinder C, and between the pulleys *d*, as seen in Figs. 3, 5, and 7, and as will be fully hereinafter described. In the latter construction, toes, projecting from the edges of the switch, will operate in like manner as do the said horns *o* and *r*. This switch is, automatically, at determined intervals of time, shunted into a position to form a guard to direct and hold the sheets upon the cylinder C, as shown in Fig. 7, when its curved inner face will be concentric with the periphery of the said cylinder, or into the position shown in Figs. 3 and 5, where its innermost horns *o* are entered into the grooves *n'* of the cylinder C, and consequently behind the line of travel of the sheets, so that the switch shall act as a guide to direct the sheets off from the cylinder, as will be particularly hereinafter described.

These movements of the switch are accomplished by means of the gear-wheel M, whose inner face has cut in it a cam-groove, *s*, in which runs a friction-roller, *u*, on the end of a rod, *w*. This rod *w* is thus reciprocated, and, being hung to an arm, *t*, fast on shaft *o'*, in which is fixed the switch O, rocks the latter from one to the other of the positions just described at intervals of time governed by the revolutions of the gear-wheel M, which are imparted by the gear-wheel N fast on the shaft of cylinder B. A series of air-pipes, connected with any suitable source of supply or air-blast, as a fan or pump, are disposed about the machine as follows:

The main pipe extends from the air-reservoir or source of supply through the body of the machine, along one side, and across one end, the said sections being marked P R S, the section S being provided with a series of openings on its lower inner side, as in Fig. 3. Another pipe, T, extends across the machine at a point directly over the tape-rollers *d*, and has a series of openings on its lower side, through which a blast of air is directed, for a purpose to be presently explained. Another pipe, U, extends through the hollow shaft of the gathering-cylinder C, and supplies a current of air which is, at proper times, driven through the openings *p p* in its periphery, as hereinafter explained. The pipes T and U, by means of branch pipes V Z, and the pipe R, by a branch, X, are joined to a three-way cock, W, (see Fig. 6,) whose rotating plug has a passage curved so as to present orifices at right angles, which are alternately brought into position to connect pipes X and V, as in Fig. 6, or to connect pipes X and Z in a similar manner by means of an arm, 3, fast on the plug-shaft, and oscillated by a reciprocating rod, Q. This rod Q is maintained in a position the reverse of that shown in Fig. 2, which retains the plug and its orifice in the position and connection shown in Fig. 6 by a spring bearing against a stud on its inner face, which constantly presses the rod in the direction shown by the arrow, Fig. 2. Its movement in a contrary direction is accomplished by a cam, Y, fast on the shaft of gear-wheel M, on the face of which bears a friction-roller in the end of said rod Q. A set of tapes, 8, running over pulleys 4 and 5, guide the sheets before a fly-frame, 6, which is vibrated on its axis 7 at proper intervals to deposit the sheets upon a receiving-table. The construction and operation of these last-named devices, being common and well-known, are not particularly described or shown.

The operation is as follows: Although, for convenience, the web is shown in Figs. 1, 2, and 3 as taken from a reel, A', it is designed to be led from a perfecting printing-press, as is illustrated in Figs. 5 and 7, where it is shown as passing between the second impression-cylinder B and type-cylinder B' into and between the cylinders A and B, where it is divided into sheets, which are directed thence upward between the impression-cylinder B and gathering-cylinder C, around which latter cylinder they will be wound, and from which they will be delivered, as is hereinafter fully described. In printing the web, by causing the female cutting-cylinder to operate as the impression-cylinder, it will be so geared to the type-cylinder that its cutting device shall come in contact with a portion of the type-cylinder which is unoccupied by the printing-surfaces. In passing through the cylinders A and B, which are of a circumference equal

to the length of the matter printed thereon, plus a sufficient space for margins, the web is severed into sheets by means of the cutting devices D and E, with which said cylinders are provided. As the forward end of each sheet emerges from the said cylinders it is thrown or directed upward by flat springs 9 on the cylinder A, or by arms 2, projecting between the peripheries of cylinders A and B, or by a blast of air from the pipe P, or by any other means for throwing its end off from the cylinder A or upward toward the cylinders B and C. The air-blast, which is constantly maintained in the pipe P, passes through proper eduction-orifices, as is seen in Figs. 5 and 7.

The springs 9 are compressed in passing the point of contact of the cylinders A and B, and spring outward so as to follow the periphery of cylinder B for a short distance as the cylinders revolve, and thus press the end of the sheet upward into the range of the blast from the pipe P, which may also be used in connection with it to hold the sheet after the springs have left it. As the end of the sheet comes into contact with the curved faces of the guiding-fingers or guards *l*, their outer arms 1 will direct it upward, and, as it reaches a point on a line with the centers of the cylinders B and C, it meets the guide fingers or bars *m*, which, extending into the grooves *n* in the cylinder B behind said sheet, direct it onto the periphery of the gathering-cylinder C, where it is clamped and retained by the tapes *a*. In passing around this cylinder it is guided downward toward the tapes *c* by the switches O, which at this time are shunted into a position which carries their inner faces a slight distance away from the periphery of the cylinder C, but so as to coincide therewith.

They thus guide the sheet onward in its curved line of travel, and its leading end enters between the tapes *c* and the cylinder C, by which it is griped and carried onward. As it leaves these tapes it meets the rear curved arms *x* of the guides or guards *l*, which direct it upward in its circular course. As it reaches this point its tail will rest on the cylinder C in a position somewhat in advance of that now occupied by the head of the sheet, for a purpose which will be apparent hereinafter. The sheet moving on, when its head approaches the point between and on a line with the centers of the cylinders B and C, and is passing the upper ends of the inner arms *x* of the guides or guards *l*, it will be joined by a second sheet from between the cylinders A and B, which sheet, being delivered as was the first, will be laid upon the said first sheet, so that the front edges or leading ends of the two will coincide or lie one upon the other. The second is thus lapped upon the first as they pass onward together around the gathering-cylinder in the manner explained with reference to the first sheet.

This operation will be repeated as many times as is desirable, or until three or four, or any number, are thus accumulated upon the gathering-cylinder, where they lie, or are piled one upon the other with their ends matched, and their front and rear edges a very slight distance apart, which is caused by a slight excess in size of the gathering-cylinder over that of the cylinders A and B, all of which are geared so as to make equal revolutions; but in practice the cylinders will all be of one size, and the switch-toes will then bear upon the accumulated sheets *n'*, and as the rear ends of the sheets pass under them the sheets will be slightly depressed into the grooves, so that the switch-toes will readily enter under the front edges of the advancing sheets.

When the predetermined number of sheets has been thus accumulated, and the revolutions of the cylinders A and B have equaled the number of sheets thus gathered upon the cylinder C, the pinion on cylinder B will have caused one revolution of the gear-wheel M, which will thereby have thrown or shunted the switch O into the position shown in Fig. 5, by means of the cam *s*, rod *w*, arm *t*, and rock-shaft *o'*. The toes *o* of the switch will thus have been projected into the grooves in the cylinder C, so as to obstruct the path of the moving sheets, while the rear toes *r* will likewise have moved correspondingly in the spaces between the pulleys *d*. As the heads of the sheets meet or engage the switches O, they are peeled or guided off from the cylinder, and directed between the pulleys *b* and the curved upper faces of the switches, being carried by the tapes *a* over the pulleys *d*, from which they descend vertically, guided by the endless tapes 8, so as to extend directly before the fly-frame 6. Just before the tails of these sheets leave the tapes at pulleys *e* the fly-frame 6 will have commenced its forward movement, and at the moment when it presses the sheets forward with it, they, having been entirely released from the said tapes *a*, will be carried down with the fly-frame and deposited in a horizontal position upon the piling-table. Immediately after the rear ends or tails of the pile of sheets have passed off from the cylinder and cleared the switches, they are again moved to their normal position, or that in which they remain while guiding the sheets around the gathering-cylinder, as in Fig. 7. They reach this position in time to guide around the cylinder the head of the sheet which has been delivered onto it from the cylinders A and B, during the same revolution of cylinder C in which the accumulated mass of sheets were stripped off or guided from its surface, the said single sheet following the rear ends of the mass of sheets thus delivered. The movements of the switches are so timed by the cam-slot *s* in the face of gear-wheel M, that they shall be quickly thrown into engagement with the gathering-cylinder by the bend

s^1 of said cam s, and remain in this position while the cam is moving from the bend s^1 to that s^2, which latter quickly throws the switches into their normal position, as explained. The time occupied by the cam moving this distance is nearly equal to that occupied by the gathering-cylinder in making a single revolution. Thus, having directed or guided off a pile or mass of sheets which reach nearly around the gathering-cylinder, they are shunted into a new position before the head or leading end of the succeeding sheet reaches the point occupied by their toes o, which will at such moment be out of the path of travel of said sheet.

This accumulation of any number of sheets piled in succession upon the cylinder, and delivered simultaneously therefrom, may be accomplished by means of the blast-pipes, in which case the switches will be omitted. When the head of the sheet arrives at the point where it leaves the tapes a, the plug of the three-way cock will have been rotated, by reason of the rod Q being released from the operation of the cam Y, and forced by its spring to rock the arm 3 hung upon the plug of the cock, so as to connect the pipes X and Z.

The blast of air maintained in the pipes P, R, and X, will be forced through the orifice in pipe T, Fig. 5, which will direct it upon the liberated end of the sheet, and hold the same in contact with the cylinder C until it enters the tape c, which will conduct it around the cylinder, as before described.

At each revolution of the cylinder, and consequently when the heads of one or more sheets are passing this point, the blast will be maintained and guide them around the cylinder.

When the desired number have been accumulated upon the cylinder, the cam Y will come into operation, it being timed in the machine illustrated to operate at every fourth revolution of the cylinder C, and draw back the rod Q, and thus rotate the plug of the three-way cock, so as to connect the pipes X and V, as in Fig. 6. The air-blast will thus be shut off from the pipe T and directed into the hollow gathering-cylinder C, from whence it will escape through the orifices p p in its shell or case against the forward ends of the sheets, which at this time will have arrived at the point where the tapes a leave the cylinder C. The blast of air will force the ends of the sheets in a body off from the cylinder and direct them between the tapes a and switch O, whence they will be guided between the pulleys d and e. As they emerge from these pulleys a blast from the orifices of pipe S, which, like that from pipe T, is constantly maintained, will force their ends against the vertical tapes S, which, in turn, guide them down before the fly, as before described.

Although the machine illustrated and described is shown adjusted to accumulate four sheets upon the gathering-cylinder, it is to be understood that by slight adjustments of the switch and fly-frame movements any number may be thus accumulated.

By this mechanism a web of paper is received from a printing-press, where it is printed upon both its sides, cut into proper-sized sheets, and said sheets wound in succession upon a cylinder until a mass of them has thus been accumulated, when they are delivered in a body or single package, and piled upon the receiving-table.

While a cylinder has been particularly described as the form given to the means for accumulating and carrying a number of sheets, and at regular intervals discharging them in a mass for simultaneous delivery to the piling-table, the revolving carrier may be otherwise constructed.

By this invention printed sheets produced by a rapidly-working web perfecting printing-press, which cannot be delivered one at a time by a vibrating fly, for the reason that it cannot be vibrated at a speed adequate to the work, are delivered many sheets at a time by a vibrating fly-frame moving at its ordinary speed.

What, therefore, I claim is—

1. The method of delivering sheets of paper by accumulating a number laid one upon another successively on a revolving carrier and then discharging them in a single mass therefrom, substantially as described.

2. A gathering-cylinder or revolving carrier combined with means for directing and retaining many sheets thereon, and means for stripping the accumulated sheets in a single mass therefrom, all substantially as described.

3. The combination of devices for severing a web of paper into sheets with a gathering-cylinder or revolving carrier, devices for directing and retaining many sheets thereon, and means for delivering the accumulated sheets in a single mass therefrom, all substantially as described.

4. The combination of a mechanism for printing a web of paper with a mechanism for severing said web into sheets, a gathering-cylinder or revolving carrier, devices for directing and retaining many sheets thereon, and means for delivering the accumulated sheets in a single mass therefrom, all substantially as described.

5. In combination with a gathering-cylinder or revolving carrier, means for directing and retaining the sheets upon said carrier, and a switch to strip the accumulated sheets from their carrier, all substantially as described.

6. The combination of a gathering-cylinder or revolving carrier, guides for directing and tapes to sustain the sheets upon the carrier, with a switch to strip the accumulated sheets from their carrier, substantially as described.

7. The combination, with a revolving sheet-carrying device, of a switch automatically operated to guide the leading end of a sheet onto and off from said carrying device, substantially as described.

8. The combination of a gathering-cylinder upon which a mass of sheets are accumulated with means for stripping said sheets from the cylinder, and a fly-frame for depositing the same upon the piling-table, all substantially as shown and described.

9. The combination of the guides *l* and *m* with the cylinders B and C, substantially as shown and described.

10. The combination of the guides *l* or *m*, cylinders B and C, and endless tapes *a* and *c*, substantially as shown and described.

11. The combination of the switch with the gathering-cylinder, substantially as shown and described.

12. The combination, with the revolving sheet-carrying device or gathering-cylinder, of the tapes *a* and *c*, the switch O, and guides *l* and *m*, substantially as described.

13. The combination, with the revolving sheet-carrying device, of tapes *a* and *c*, pulleys *b* and *d*, and switch O, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

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STEPHEN D. TUCKER.

Witnesses:
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