8 Sheets—Sheet 1.

S. D. TUCKER.

Sheet-Reversing Apparatus for Printing-Machines.

No. 214,065. Patented April 8, 1879.

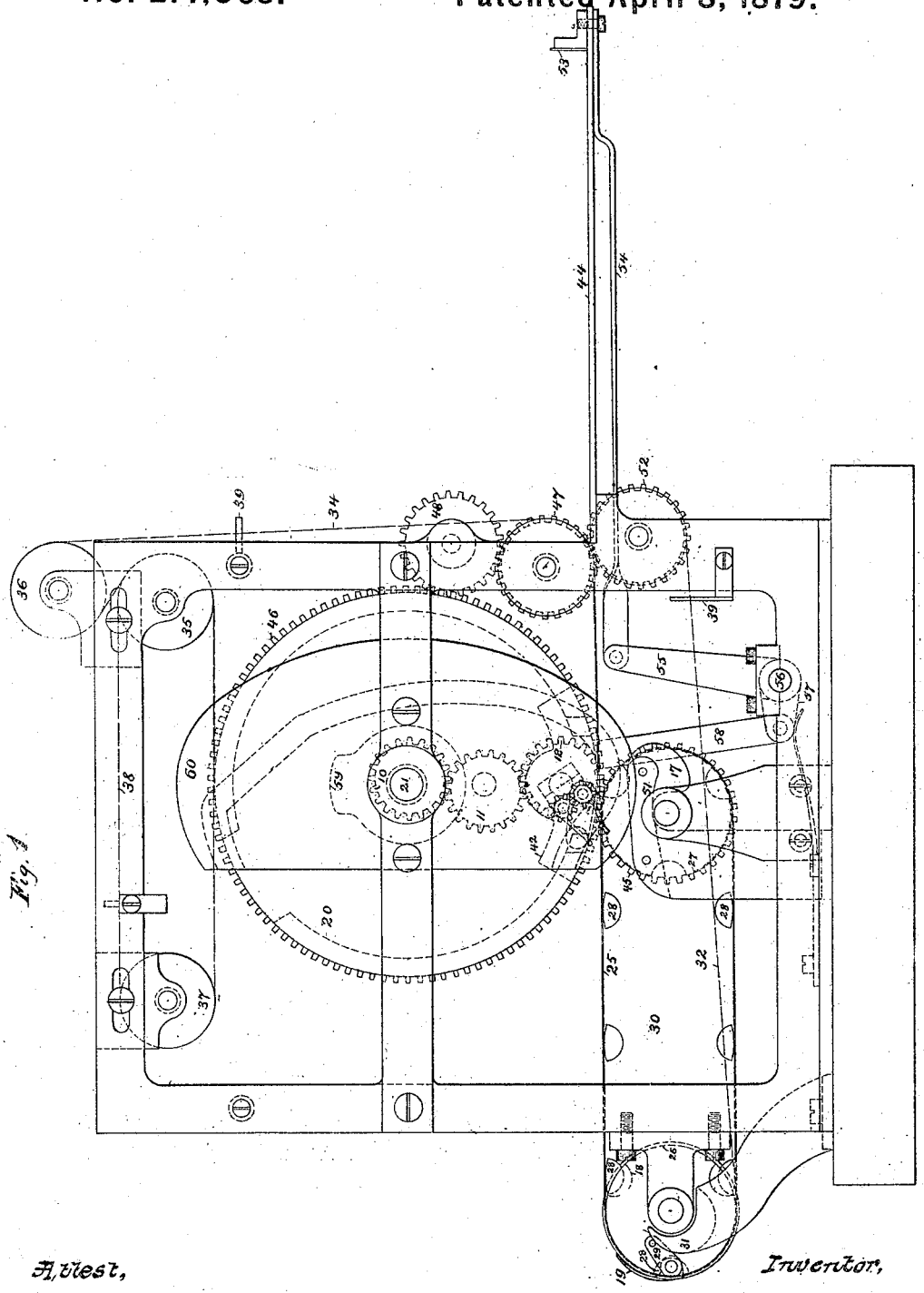

Fig. 1

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by Munn & Philipp.

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8 Sheets—Sheet 2.

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Fig. 9.

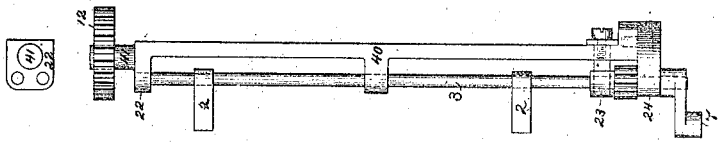


Fig. 10.

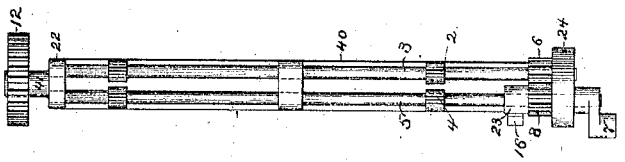


Fig. 11.

Fig. 12.

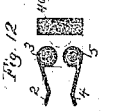
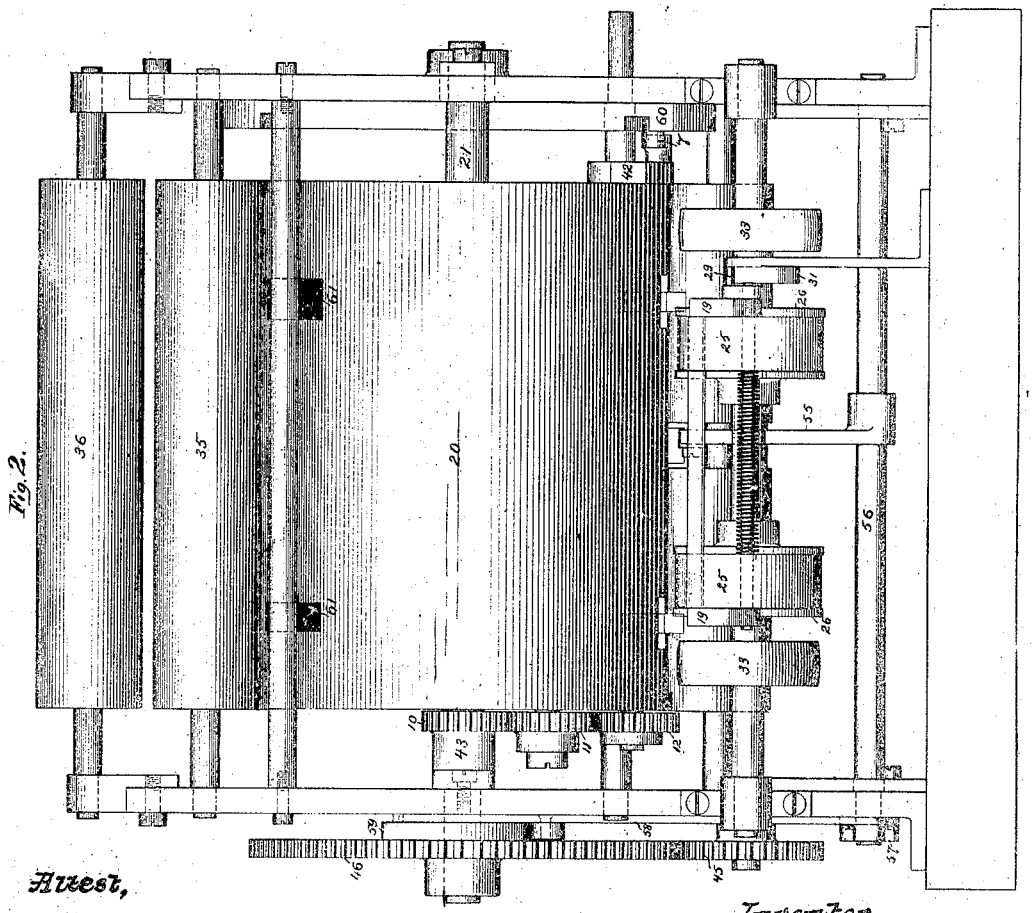


Fig. 2.



Witnesses,
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8 Sheets—Sheet 3.

S. D. TUCKER.

Sheet-Reversing Apparatus for Printing-Machines.

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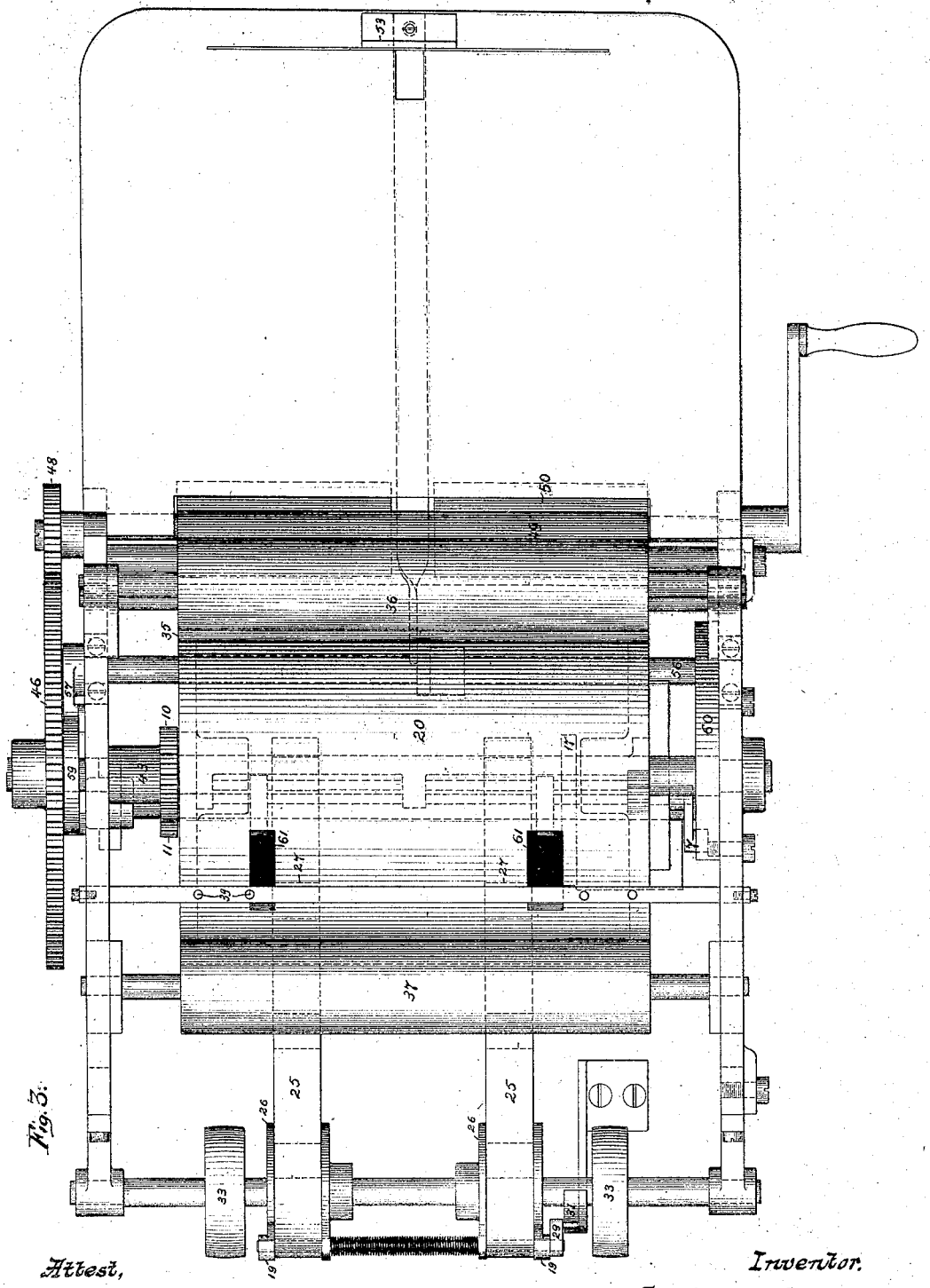

Fig. 3.

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8 Sheets—Sheet 4.

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Sheet-Reversing Apparatus for Printing-Machines.

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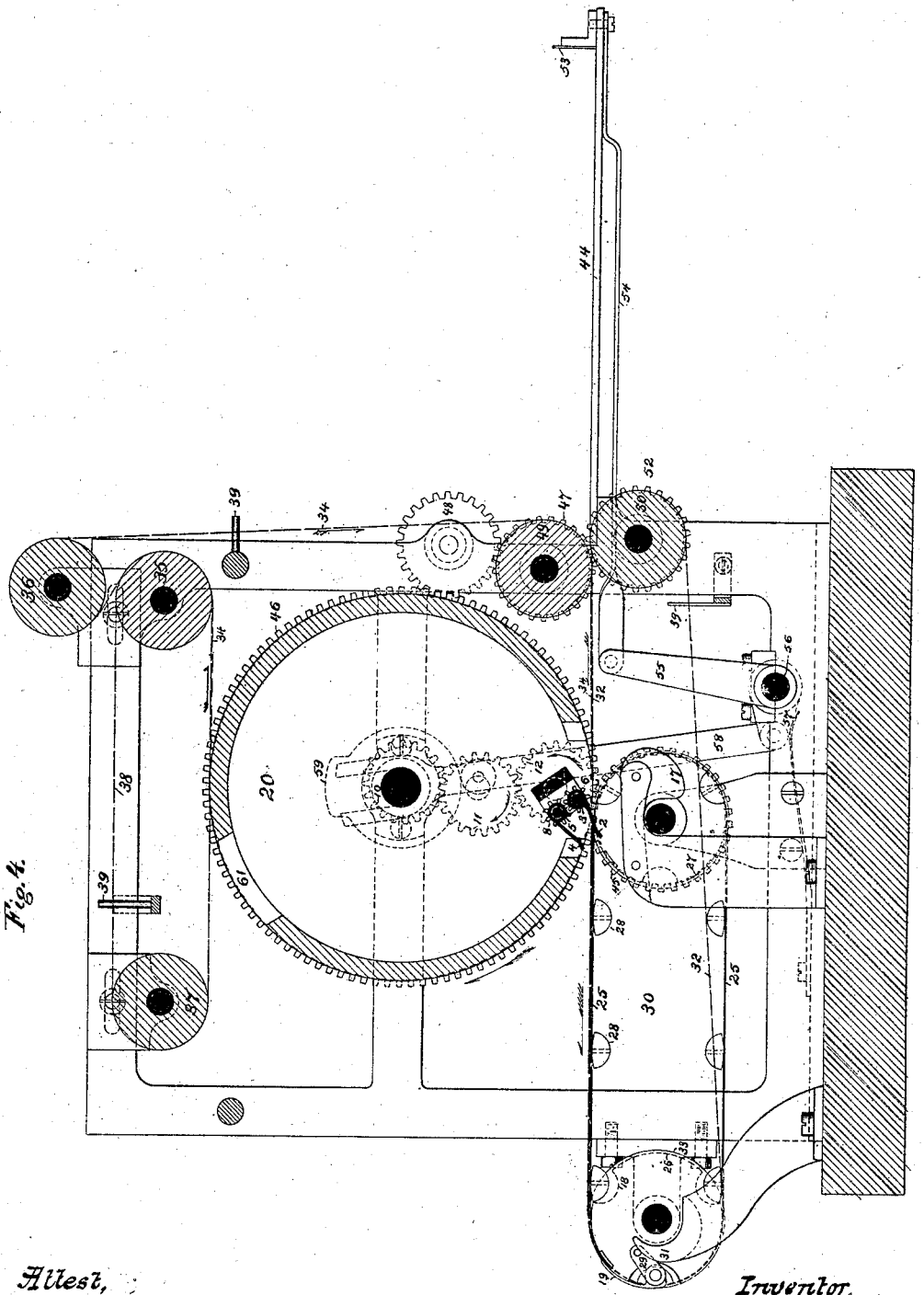

Fig. 4.

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8 Sheets—Sheet 5

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Fig. 5.

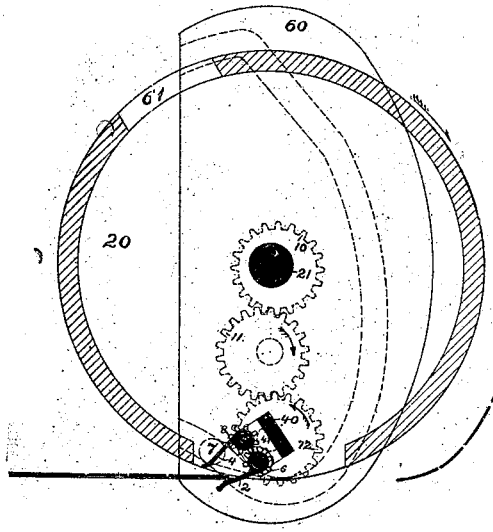


Fig. 6.

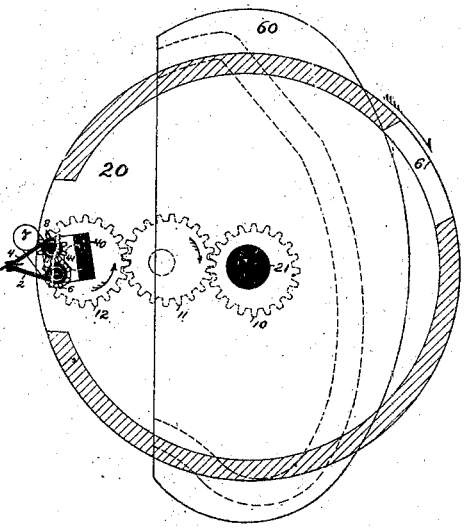


Fig. 7.

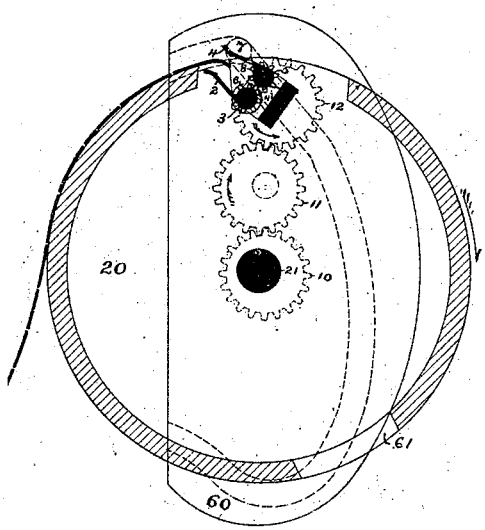
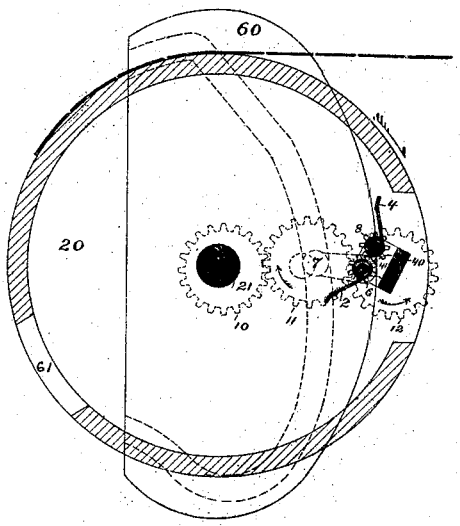


Fig. 8.



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8 Sheets—Sheet 6.

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Sheet-Reversing Apparatus for Printing-Machines.

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Fig. 13.

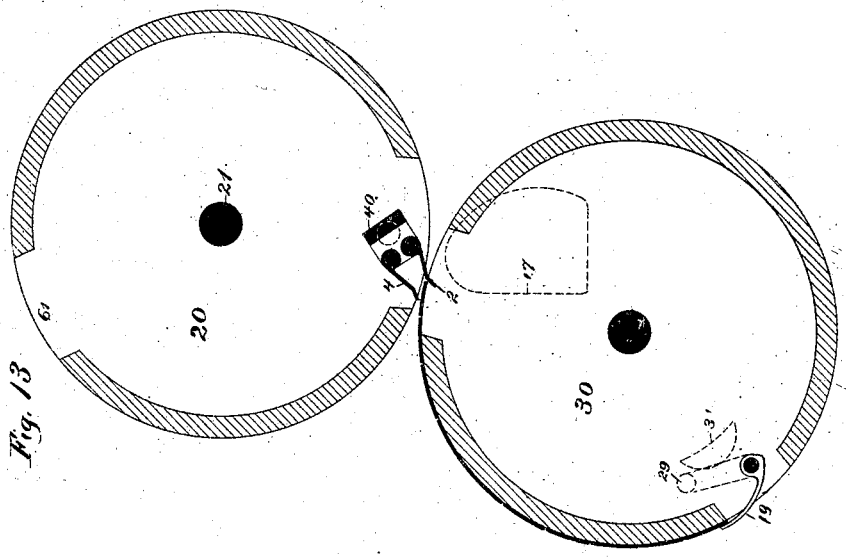
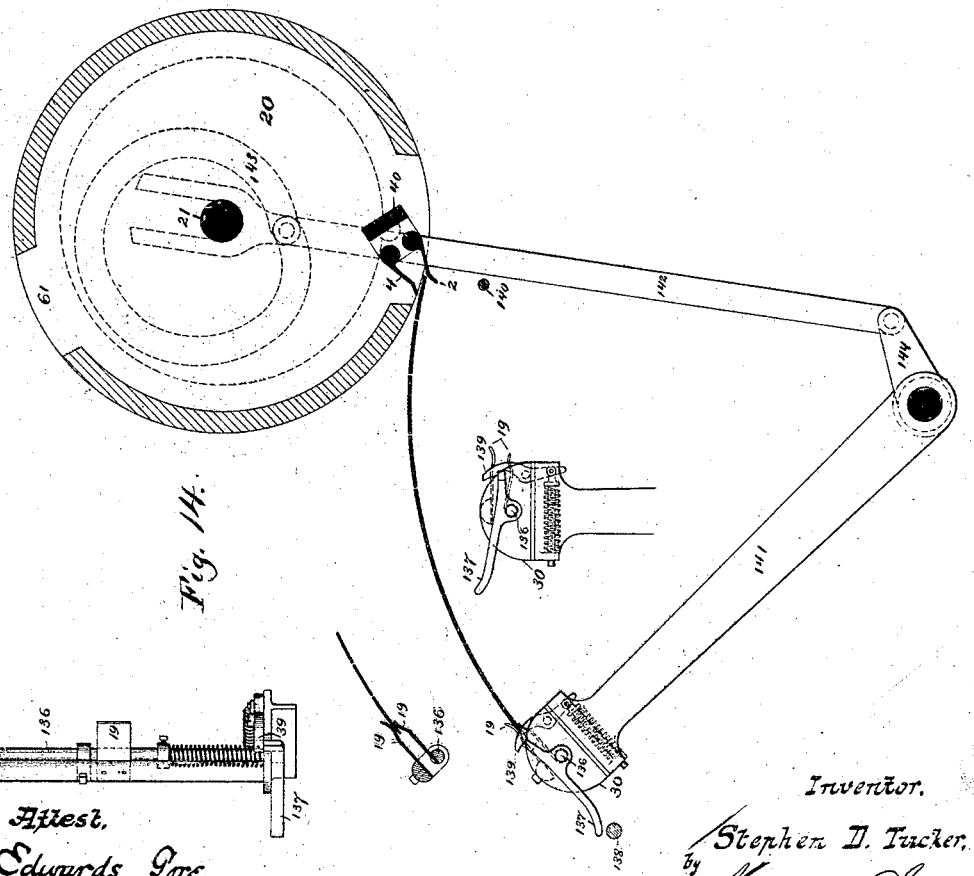


Fig. 14.



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8 Sheets—Sheet 7.

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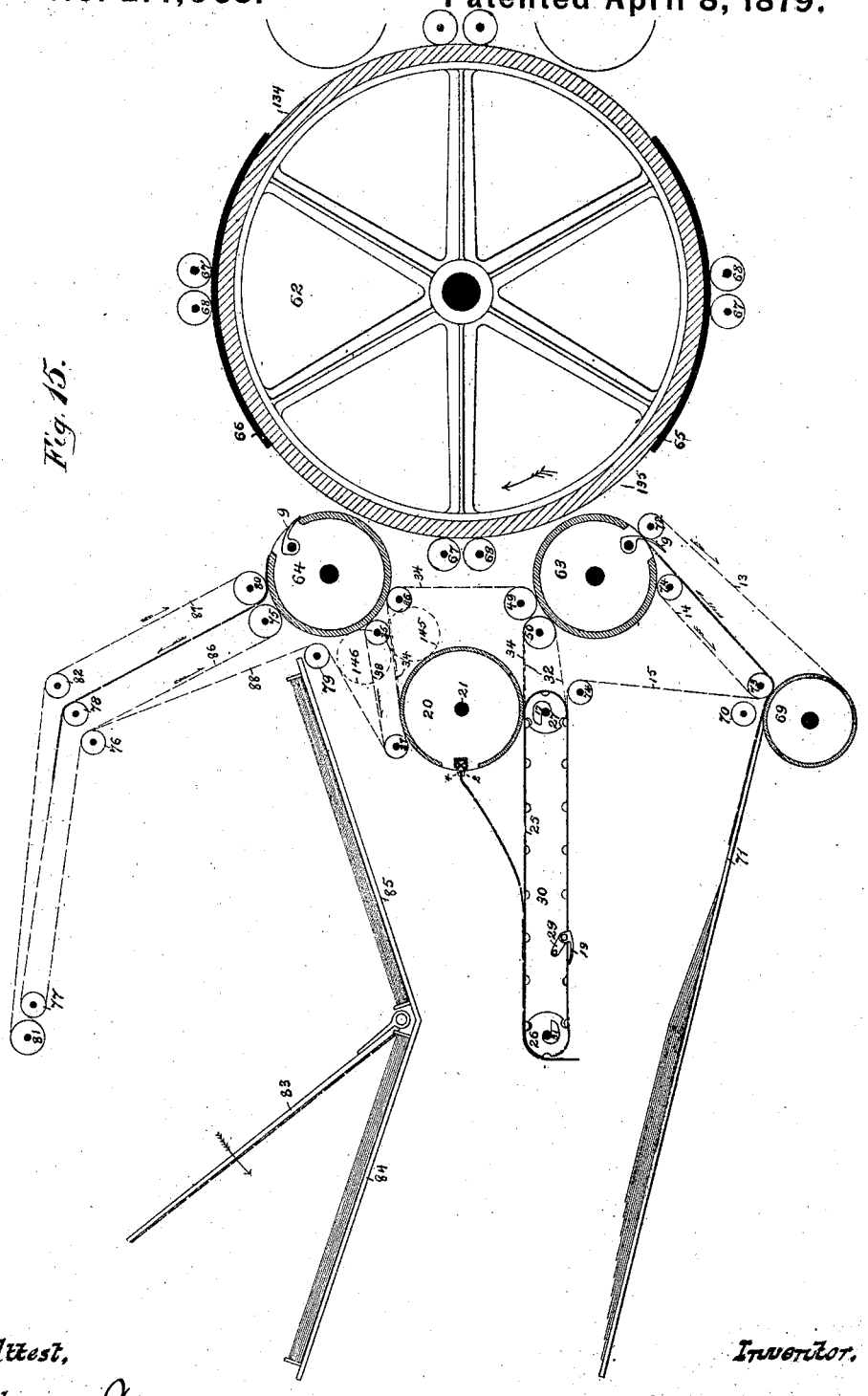
Sheet-Reversing Apparatus for Printing-Machines.

No. 214,065. Patented April 8, 1879.

Fig. 15.



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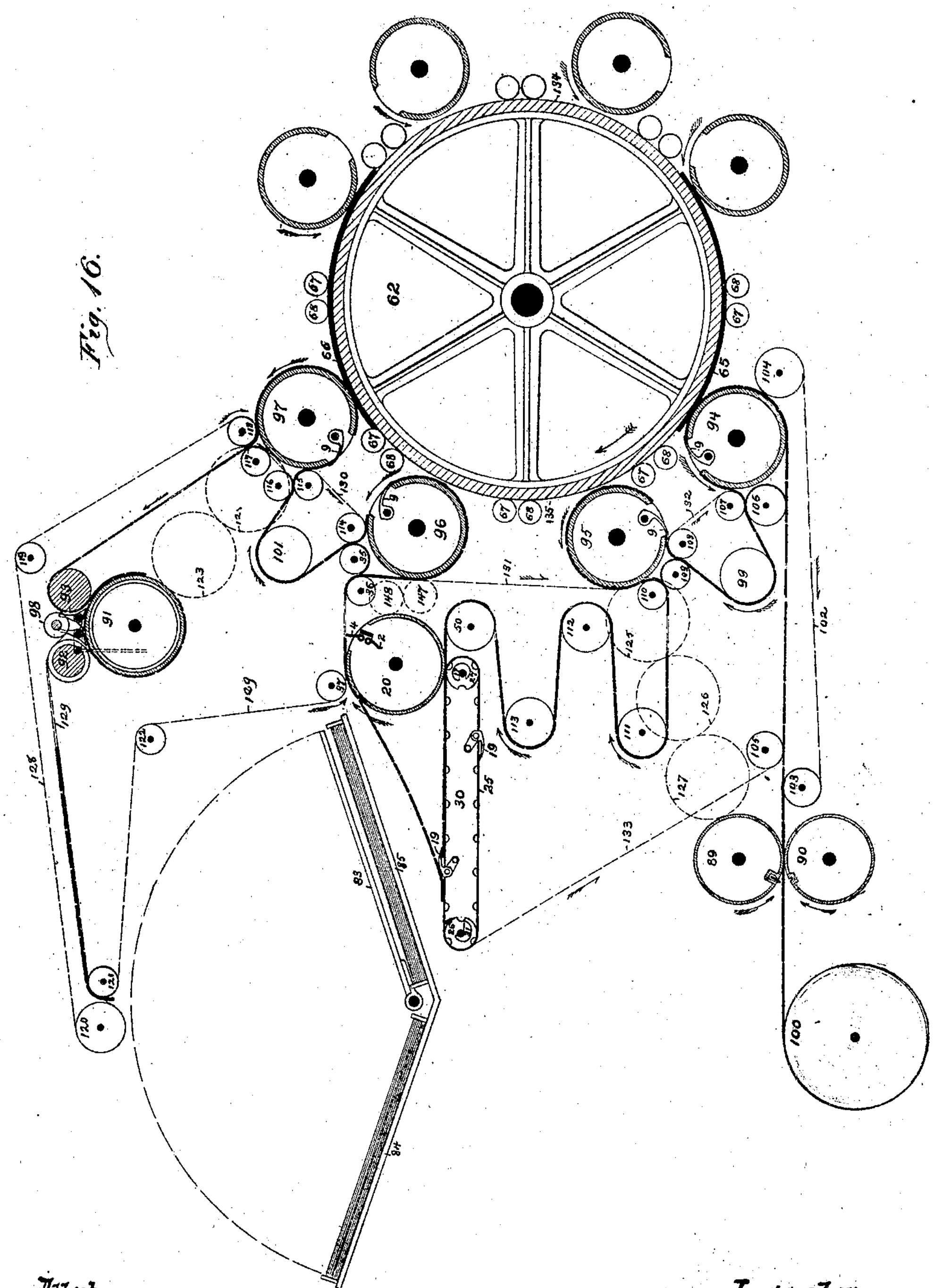
Sheet-Reversing Apparatus for Printing-Machines.

No. 214,065. Patented April 8, 1879.

Fig. 16.



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Attys.

UNITED STATES PATENT OFFICE.

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

IMPROVEMENT IN SHEET-REVERSING APPARATUS FOR PRINTING-MACHINES.

Specification forming part of Letters Patent No. **214,065**, dated April 8, 1879; application filed October 14, 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 certain new and useful Improvements in Sheet-Reversing Apparatus for Printing-Machines; and I do hereby declare the following specification, when taken in connection with the accompanying drawings, to be a full, clear, and exact description of the apparatus, sufficient to enable those skilled in the art to make and use the same.

In said drawings, Figure 1 represents a side elevation, Fig. 2 a rear-end elevation, Fig. 3 a plan view, and Fig. 4 a longitudinal sectional elevation, of the apparatus provided with a feeding device and such sheet-conducting tapes as are necessary to exemplify the mode of its operation. Figs. 5, 6, 7, and 8 are diagrams, illustrating the twin fingers and their actuating mechanisms in different positions of their operation in manipulating a sheet. Fig. 9 shows, in a plan view and end elevations, the twin fingers and their mountings removed from the cylinder 20. Fig. 10 is a front elevation of the same; and Figs. 11 and 12 are sectional views, illustrating the twin fingers in closed and open positions. Figs. 13 and 14 illustrate modified forms of the sheet-carrier which co-operates with the reversing-cylinder. Fig. 15 illustrates the combination of my sheet-reversing apparatus with a printing-machine adapted to receive and perfect sheets; and Fig. 16 illustrates the combination of said sheet-reversing apparatus with a printing-machine provided with mechanisms whereby a web is cut into sheets and said sheets perfected.

This invention relates to that class of mechanisms known as "sheet-reversing apparatuses," which are adapted to operate in conjunction with the impression cylinder or cylinders of a printing-machine, and, receiving a sheet printed on one side by the latter, reverse the same and return it to the printing-machine, to be printed upon its opposite side, thus enabling the sheets to be perfected without leaving the machine, which sheets may then be piled, folded, or undergo hand manipulation; and the invention consists in an improved construction of the mechanisms constituting the sheet-reversing apparatus and combinations thereof, as will be more specifically hereinafter pointed out and distinctly claimed.

The principal mechanism of this apparatus is a reversing-cylinder, 20, which is provided with twin fingers 2 4, whereby a sheet fed beneath it is seized by the tail end, carried over, and delivered from the top of said cylinder, thus having its direction of travel reversed, and its tail end rendered its leading end. With this reversing-cylinder is combined a sheet-conducting carrier, 30, provided with gripers 19, whereby sheets fed into the apparatus are seized by their heads, conducted out from under the reversing-cylinder 20 into such position that their tail ends may be seized by the twin fingers 2 4 and carried over the top of the cylinder 30, the gripers 19 being opened at the proper time to release them.

When provided with suitable mechanism for feeding sheets to and delivering them from it, this apparatus will, by its manipulation thereof, cause each sheet to be reversed, so that its rear or tail end becomes the leading end, whereby, when combined with a printing-machine having an impression cylinder or cylinders, a sheet which has been printed upon one side thereby may be reversed and be printed upon the opposite side in passing once through the machinery.

In order that the reversing apparatus may be more readily understood, the structure of its parts and their operation will first be described, and then its operation in connection with printing mechanisms explained.

To aid such description, the reversing apparatus is exemplified in Figs. 1 to 4 as supplied with an intermittingly-reciprocating feeding mechanism, whereby sheets are fed to it at such intervals of time that they shall be properly manipulated, which feeding mechanism will, in practice, be supplanted by one connected directly with the printing-machine and automatically operated by it, as will fully hereinafter appear.

The reversing-cylinder 20 is mounted upon a shaft, 21, and caused to revolve by means of a toothed wheel, 46, shown in these illustrations as driven by means of an intermediate pinion, 48, from a toothed wheel, 47, on the shaft of one of a pair of feeding-rollers, 49 50, which are

driven in unison by toothed wheels 47 52. Its twin fingers 2 4 project, respectively, from rocking shafts 3 5, which are geared together by pinions 6 8, and journaled in a differentially-rotating frame, 40, both shafts turning at one end in a projection, 22, while their opposite ends have their bearings in the circular head 24 of the frame 40, the shaft 5 projecting through and being provided with a rock-arm, 7, on its outer end. The end of this rock-arm 7 runs in the groove of a stationary cam, 60, which is fixed to the side frame, and is thereby rocked at proper intervals to vibrate the shafts 3 5, and open and close the twin fingers 2 4. A spring, 16, is screwed on the frame 40, the point of which, when the fingers are closed, drops into a notch in a disk, 23, on the shaft 5, and thus keeps them firmly together when the end of the rock-arm 7 is free from the groove in the cam 60.

The rotating frame 40 is journaled at a point near the periphery of the cylinder 20 by means of a short stud, 41, projecting from it at one end, and its circular head 24 at the opposite end, the head 24 having its bearing in a suitably-recessed bracket, 42, (see Fig. 2,) fixed to the opposite end of said cylinder. The stud 41 carries a toothed wheel, 12, fastened eccentrically upon its outer end, which wheel is actuated as the cylinder 20 revolves by means of an intermediate wheel, 11, set eccentrically and moving loosely upon a stud in the cylinder end, which is driven by a stationary toothed wheel, 10, that is fixed to a sleeve, 43, projecting from the side frame, and embraces the shaft 21 of the cylinder 20 in such a manner that said wheel 10 stands eccentrically with respect to said shaft 21. These wheels 10 11 12 are all of the same size, and constitute a train of eccentric gearing, by the operation of which, as the cylinder 20 is revolved, the frame 40 is rotated with a differential movement that causes the axis or shafts of the twin fingers to stand at such appropriate angles with respect to the periphery of said cylinder as will cause the twin fingers attached to them to take the most favorable position to seize the tail end of the sheet, carry it up, reverse its direction of travel, and deliver it to the receiving-tapes at the top of the cylinder by an easy motion that will not tear paper of the poorest quality or disarrange the register of the sheet. Thus, the frame 40 is so turned that the shafts 3 5 of the twin fingers are caused to stand at the angle shown in Fig. 5 at the time when the sheet is about being seized, and then said frame rotates with a constantly-decreasing motion until the position shown in Fig. 6 is reached, during which time the rear end of the sheet seized by the twin fingers is being raised, then increases its speed gradually until the position Fig. 7 is reached, when the sheet is released, and thereafter further increases its speed until the position Fig. 8 is reached, from which time until the position Fig. 5 is passed and that of Fig. 6 again reached, its motion is constantly decreasing, which relative differential speeds of its rotation result from the fact that while the sheet is within the control of the twin fingers the shortest radius of the driving-wheel 10 is in gear with the longer radius of the intermediate 11, the shortest radius of which is at the same time in gear with the longest radius of the wheel 12, and at other times the longest radius of the driving-wheel 10 is geared in like manner with the intermediate 11, the longest radius of which is at the same time in gear with the shortest radius of the wheel 12.

The groove of the cam 60 is so shaped that, together with the rotation of the cylinder 20 and the rotative movement of the frame 40, it shall cause the twin fingers, then rocked wide open, to stand on opposite sides of the tail of the sheet as they follow its forward movement, and when the position Fig. 5 is reached to quickly close upon and seize the same, in which position they are held by the spring 16.

The sheet-conducting carrier 30 (shown in Sheets 1 to 4) consists of endless belts 25, of metal, leather, or other suitable material, which run over pulleys 27 26, (see Fig. 3,) said pulleys having curved recesses 18, into which similar-shaped teeth 28, fastened to the inner surface of the belts, enter, which said pulleys and belts are driven with uniform speed and in unison with the cylinder 20 through a pinion, 45, fast on the shaft of pulley 27, and meshing with the toothed wheel 46. These belts each carry a griper, 19, on a spring-seated shaft, which has its bearings in one set or pair of the teeth 18, as in Figs. 3, 4. This griper-shaft is vibrated, to open and close said gripers at the point of reception of the sheet, by means of a rock-arm, 29, and a stationary cam, 17, properly supported by a bracket, 51, and to open and release the sheet by means of a similar stationary cam, 31, with which said rock-arm 29 engages.

The apparatus is provided with sets of sheet-carrying tapes, as follows: A set, 32, run from the lower feeding-roller, 50, to the pulleys 33 on the shaft of wheels 26. Another set, 34, run from the upper feeding-roller, 49, around the cylinder 20, under a roller, 35, and return over a roller, 36; and a set, 38, run from the roller 37 to and return over a roller, 35. These several tapes are kept in place by suitable guides, as 39, and serve to direct the sheets into and out of the apparatus, as will presently appear.

The feeding device consists of a table, 44, over a portion of the rear end of which a gage, 53, is caused to reciprocate by being attached to the end of a rod, 54, the opposite of which rod is connected to an arm, 55, fixed on a rock-shaft, 56. This shaft is operated by a cam, 59, on the cylinder-shaft, which engages a stud on a rod, 58, one end of which rod embraces the shaft 21, and the other end is connected to the arm 57 on the rock-shaft 56.

The operation of the apparatus thus arranged is as follows: A sheet laid upon the table 44 against the gage 53 will be, at the

proper time of the revolution of the cylinder 20, carried into the nip of the feeding-rollers 49 50, which, aided by the tapes 32 34, will deliver its leading end to the gripers 19 of the sheet-conducting carrier 30, which gripers are opened to receive and closed to seize said leading end as it passes onto said carrier by means of the griper-cam 17, in which movement the gripers enter recesses 61, cut in the periphery of the cylinder 20. The sheet thus seized and held upon the endless carrier 30 is carried outward thereby, the said carrier 30, cylinder 20, and the tapes 32 34 moving in unison with the sheet, and the cylinder 20 during this movement making that part of its revolution which carries it and the mechanisms it supports from the position of Fig. 7 to that of Fig. 5.

When the tail end of the moving sheet is closely approaching the point at which the cylinder 20 runs in contact with the endless carrier 30, the twin fingers 2 4 will, while standing open, as in Fig. 8, be brought up behind the sheet, and, following the tail end thereof as it passes under said cylinder, will close quickly together and seize the same by means of the rotation of their frame 40 and the action upon them of the cam 60, the gripers 19 of the sheet-conducting carrier 30 being simultaneously opened by the cam 31 to release the head of the sheet. The tail end of the sheet thus held by the twin fingers will be lifted thereby, as in Fig. 6, said fingers while thus acting being held closed by their spring 16, and swung so as to gradually turn rearward as they move upward and forward with the cylinder, whereby they make no abrupt bend in the sheet and slowly change its direction of travel. When these twin fingers have carried the tail of the sheet (now its leading end) into the nip of the tapes 38, their rock-arm 7 will enter the high part of the groove in the cam 60 and quickly open said twin fingers to release the sheet, which, now traveling in the reverse direction to that in which it was received by the reversing-cylinder, will be conducted by the tapes 38 34 and delivered thereby. While the tail end of said sheet is being carried by the twin fingers to the point at which they release it, the sheet-conducting carrier 30 will have so far revolved as to bring its gripers to the point for receiving sheets, and a second sheet will have been fed inward in proper time for its head to be seized and the sheet carried outward by them, and the twin fingers will be brought in proper time into a position for embracing and be caused to close upon and seize the tail end of said sheet, and repeat the reversing operation just described.

The sheet-conducting carrier 30 might be constructed in the form of a rotating cylinder, as in Fig. 13, which cylinder is therein marked 30, while its gripers 19 and their opening-cams 17 and 31 correspond with the like devices of the carrier 30 shown in the preceding figures. This cylinder 30 will, of course, be geared to run with the proper surface-speed relative to that of the reversing-cylinder 20, and the cams 17 31 will be fixed to the frame-work so as to properly engage the rock-arm of the griper-shaft.

The sheet-conducting carrier 30 might also be a rocking frame carrying the gripers 19. This is illustrated in Fig. 14, where the carrier 30 is supported at the ends of vibrating arms 141, to which timely movements are imparted by a rock-arm, 144, by means of a connecting-rod, 142, and a cam, 143, fixed to the shaft 21 of the reversing-cylinder 20.

The gripers in this modification consist of fixed and movable jaws. The lower jaws, which are the movable ones, project from a spring-seated shaft, 136, which is rocked to open said lower jaws by means of a lever, 137, the tail of which, striking a stop-pin, 138, when the carrier 30 is rocked to its rearmost position, is depressed until its forward end is engaged by a spring-seated catch-lever, 139, which locks the said jaws open, as seen in one of the detail views. As this carrier 30 is rocked to its foremost position to meet the head of the sheet, the tail of the catch-lever 139 strikes another stop-pin, 140, whereby the lever 137 is released and the gripers are closed upon said sheet, as shown in one of the detail views.

The operation of a reversing apparatus thus constructed is to receive a sheet and deliver the same with its direction of travel reversed. It is therefore, as will be readily apparent, adapted to operate in connection with a printing mechanism, whereby sheets printed upon one side and directed to it will be reversed and returned to the printing-machine in proper position to be printed upon the opposite side.

In Fig. 15 is shown so much of a rotary or type-revolving printing-machine as is necessary for the purpose of exhibiting the arrangement and operation of this reversing apparatus in connection therewith.

The principal elements of such a printing-machine are a rotating type-cylinder, 62, the periphery of which is constructed so as to support printing-surfaces, as forms of movable types or stereotype-plates 65 66, and to provide between such printing-surfaces curved inking surfaces or tables 134 135. Said cylinder is also furnished with an appropriate number of inking mechanisms, (the form-rollers 67 68 only of which are shown,) which are automatically moved to and from the periphery of the cylinder and ride over the inking-surfaces 134 and 135 in distributing the ink, and in contact with the printing-surfaces 65 66 to properly ink the same.

A number of impression-cylinders, as 63 64, having sheet-controlling gripers 9, are set in stationary bearings about the type-cylinder 62, being geared so as to revolve in unison therewith and roll in contact with the type-surfaces, and escape the inking-surfaces of said cylinder. Such printing-machines are also supplied with mechanisms for feeding sheets

to its impression-cylinders and delivering them therefrom, all of which is fully illustrated and specifically described in the United States Patent No. 5,199, granted to Richard M. Hoe, July 24, 1847.

As here shown, the type-cylinder 62 of such a printing-machine is provided with an inside form, 65, an outside form, 66, intervening inking-surfaces 134 135, inking apparatuses 67 68, two impression-cylinders, 63 64, and suitable feeding and delivering tapes, with which is combined my improved reversing apparatus.

The reversing-cylinder 20 is of the same size and runs turn for turn with the impression-cylinders, from one of which, 64, it is driven by the intermediate wheels, 145 146, it being understood that the impression-cylinders are geared with the cylinder 62, and so as to run with a like surface-speed. An ordinary feed-table, 71, feeding drop-roller 70, and a double-acting fly, 83, with piling-tables 84 85, are also illustrated. This type-cylinder 62 may be provided with a duplication of these mechanisms on the opposite side, as is indicated by the outlines of impression-cylinders corresponding with 63 and 64.

The sheet-conducting tapes, whose bearing pulleys or rollers are to be understood as provided with driving gear-wheels wherever the same are necessary to drive said tapes, are arranged as follows: A set, 13, run from the feeding-cylinder 69, return over pulleys 72; a set, 14, running from pulleys 73, are returned over pulleys 74, except the margin-tapes 15, which run from pulleys 73, around the impression-cylinder 63, under pulleys 49, over pulleys 50, and return around the endless carrier 30, over roller 74; a set, 32, run from the pulleys 50, over pulleys on the shaft of the wheels 26, as hereinbefore described; a set, 34, run from the pulleys 49, around the reversing-cylinder 20, under pulleys 35, and return over pulleys 36, as hereinbefore described; a set, 38, run from the pulleys 37 to and return over pulleys 35, as hereinbefore described, but in this arrangement of them the margin-tapes 88 run from the pulleys 37 over pulleys 36, around the impression-cylinder 64, under pulleys 80, over roller 78, around roller 77, over roller 76, and return over roller 79; a set, 86, run from pulleys 75 over rollers 78, around roller 77, and return over roller 76; and a set, 87, run from pulleys 80 over rollers 78 and 77, around roller 81, and return over roller 82.

The operation of the mechanisms thus combined is as follows: A sheet laid in position will be fed into the tapes 13 14 by the operation of the drop-roller 70, and be thereby conducted to the impression-cylinder 63, the grippers 9 of which will seize its leading front end. In passing around this cylinder the sheet will be pressed onto the form 65, and have its inside surface printed, and when released by the grippers 9 it will be stripped off from the cylinder 63 by the margin-tapes 15 and carried into the tapes 32 34, by which it will be conducted to the reversing apparatus and manipulated, as hereinbefore described. When said sheet has been reversed its tail end, now become its leading end, is delivered to the tapes 38 34, which conduct it to the impression-cylinder 64, where it is seized by the gripers 9, and has its unprinted surface rolled in contact with the outside form 66, which is then passing said impression-cylinder. After having thus been printed or perfected it is released from the gripers 9, stripped off said cylinder by the margin-tapes 88, and carried into the tapes 86 87, which convey it to the rollers 81 77, between which it depends until it is swept by the vibrating fly 83 down onto the piling-table. During this operation of the reversing apparatus upon the first sheet, the impression-cylinder 63 will make an idle revolution while the inking-surface 134 is passing it, and when said impression-cylinder is pressing the second sheet upon the outside form, 66, the first sheet, then reversed, will be approaching the impression-cylinder 64, around which it will be carried in time to be pressed thereby into contact with the outside form, 66, as it passes said cylinder. Thus each form prints as it passes an impression-cylinder, and each sheet fed into the machine is perfected, and as each alternate sheet receives its inside impression first it follows that every other sheet delivered to the fly-frame will have its sides reversed; but as said fly-frame piles alternate sheets in opposite directions it also follows that, as illustrated, the sheets piled on the table 84 will have their insides uppermost, and those piled on the table 85 will have their outsides uppermost. If the forms 65 and 66 are duplicates, as in the case of half-sheets or supplements, the sheets will require to be cut in two.

The printing apparatus with which my reversing apparatus is combined, as shown in Fig. 16, is of the same general character as that last described, having a similar type-cylinder, 62, surrounded on one side by four impression-cylinders, 94 95 96 97, which are driven at a corresponding surface-speed by being geared thereto, and provided with proper inking apparatuses 67 68. It is, however, provided with cutting-cylinders 89 90, geared together and driven by a train of wheels, 125 126 127, from a toothed wheel on the impression-cylinder 95, whereby a web of paper may be automatically cut into sheets, and with a gathering-cylinder, 91, provided with a toothed wheel, whereby it is driven through a train of wheels, 123 124, from a toothed wheel on the impression-cylinder 97, which gathering-cylinder is provided with means whereby it collects successive sheets delivered to it with the same printed side uppermost and properly delivers them. In this arrangement the reversing-cylinder is driven turn for turn with the impression-cylinders by being geared through wheels 147 148 to one of them, 96.

The several tapes are driven in proper directions and time by suitable spur-wheels on the pulley-shafts, and run as follows: A set, 102, run from pulleys 103, in contact with im-

pression-cylinder 94, and return around pulleys 104. A set, 133, run from pulleys 105, around pulleys 106, except the margin-tapes of the set, which pass on around the impression-cylinder 94, under the pulleys 107, and then rejoin the remainder of the tapes, 133. They then all pass together around the roller 99 and over the pulleys 108, the margin-tapes passing around the impression-cylinder 95, under the pulleys 110, and there again rejoin the remainder of the set. They then all pass around rollers 111, 112, 113, and 50, thence over pulleys on the shaft of wheels 26 of the endless carrier 30, and return to pulleys 105. A set, 132, run around pulleys 107, roller 99, and pulleys 108. A set, 131, pass over pulleys 110, rollers 111, 112, 113, and 50, run partially around the reversing-cylinder 20, and return over pulleys 36. A set, 129, run under pulleys 37, over pulleys 36, around pulleys 35, except the margin-tapes, which pass around the impression-cylinder 96, under pulleys 114, and there rejoin the remainder of the set. They then all pass around roller 101, over pulleys 116 117, except the margin-tapes, which pass over pulleys 115, around impression-cylinder 97, under pulleys 118, where they rejoin the remainder of the set, and all pass over roller 93, around gathering-cylinder 91, over pulleys 92, around roller 121, and return over roller 122. A set, 130, run from pulleys 114, and around roller 101 and pulleys 115; and a set, 128, run from the pulleys 118, over roller 93, under pulleys 98, over pulleys 92, around roller 120, and return over roller 119; all of which mechanisms may be duplicated on the opposite side of the cylinder 62, as is indicated by the impression-cylinders there represented.

The cutting-cylinders run turn for turn with the impression-cylinders from which they are driven; but they are of a less diameter; hence the tapes 102 133 travel faster than the paper is supplied by the cutting-cylinders. These latter do not cut the sheets entirely free from the web, but leave them joined at several points. The distance from the impression-cylinder to the pulleys 103 105 is such that when the leading end of a sheet reaches the impression-cylinder the partially-made cut has already entered between the tapes 102 133. As soon as a sheet is caught in the nip of the tapes and impression-cylinder it partakes of their speed, and is torn loose from the web and separated a certain distance from it. The sheets thus have a space between them, which is utilized for the operation of the gripers 9 and switches of the gathering-cylinder 91.

The gathering-cylinder 91 and the mechanisms with which it is supplied are fully illustrated and described in United States Patent No. 192,954, July 10, 1877.

The operation of the mechanisms combined as illustrated in Fig. 16 is as follows: The web of paper from the roll 100 is passed between the cutting-cylinders 89 90 and entered between the tapes 133 102. Its leading portion is partially severed by the cutters of the cylinders 89 90 to form a sheet, which sheet is conducted to the gripers 9 of the impression-cylinder 94, and is torn from the web. This sheet, we will suppose, is passed, and this cylinder 94 at the time when the inking-surface 135 is passing. Said sheet will thus pass around the said cylinder without being printed, and when released from the gripers 9 the margin-tapes 133 will strip it from the cylinder 94 and conduct it around the roller 99, from which it is directed to the gripers 9 of the cylinder 95. Now, the second sheet directed to the gripers 9 of the cylinder 94 closely follows the first, and will meet the printing-surface 65 and be printed on its inside, and the course of the first sheet around the roller 99 is of such length that said sheet is delivered to the cylinder 95 in proper time to meet the form 65 and be printed on its inside by it. Thus the first and second sheets will be printed nearly simultaneously upon their inside surfaces. As the third and fourth sheets are conducted into the machine they are manipulated precisely as were the first and second, except that the impressions are made by the outside form, 66, and that the third sheet is passed around the cylinder 94, and the second sheet, already printed, is passed around the cylinder 95 while the inking-surface 134 is passing; hence it follows that all the sheets are printed upon one side in passing the cylinders 94 95, and that they form sets of twos, each alternate set receiving their inside impressions and the other set their outside impressions.

As the sheets are released by the gripers 9 of the cylinder 95 they are stripped off the same by the margin-tapes 133, and pass into the elongated passage formed by the tapes 133 131, pulleys 110, and rollers 111, 112, 113, and 50, which regulates the time at which they must meet the reversing-cylinder, so that when they are reversed and conducted to the impression-cylinders 96 97 they will be met and printed on their second sides by the forms opposite to the one that printed their first side.

The sheets are manipulated by the reversing apparatus in the same manner as hereinbefore described, and are conducted to the impression-cylinders 96 97, by which they receive their second impressions, or are printed upon their white surfaces, in an order and by means operating precisely as described with respect to their first impression. Thus perfected, they are delivered in succession to the tapes 128 129, which convey them to the gathering-cylinder 91, upon which each successive two sheets of a kind or alternate sets of two sheets which arrive with their insides or outsides uppermost are collected together and delivered as a single body, and are conducted between the pulleys 120 121, and piled by the fly 83 upon one or the other piling-tables 84 85, all the sheets receiving their last impression upon their inside being piled upon one table, and

those receiving their last impression upon their outside being piled upon the other table.

What is claimed is—

1. A sheet-reversing apparatus consisting of a sheet-conducting carrier provided with gripers, whereby the sheet is moved outward by its head, and a reversing-cylinder provided with twin fingers, whereby the moving sheet is seized by its tail end, carried onto said cylinder, and reversed, all substantially as described.

2. The combination, with the sheet-conducting carrier 30 and cylinder 20, of the twin fingers 2 4, their frame 40, and the eccentric toothed wheels 10 11 12, substantially as described.

3. The combination, with the sheet-conducting carrier 30 and cylinder 20, of the twin fingers 2 4, rotating frame 40, geared rocking shafts 3 5, rock-arm 7, and stationary cam 60, substantially as described.

4. The combination, with the sheet-conducting carrier 30 and cylinder 20, of the twin fingers 2 4, frame 40, eccentric wheels 10 11 12, geared rocking shafts 3 5, rock-arm 7, and stationary cam 60, substantially as described.

5. The combination, with the cylinder 20, of the twin fingers 2 4, rotating frame 40, and eccentric toothed wheels 10 11 12, substantially as described.

6. The combination, with the cylinder 20, of the twin fingers 2 4, rotating frame 40, eccentric toothed wheels 10 11 12, geared rocking shafts 3 5, rock-arm 7, and stationary cam 60, substantially as described.

7. The combination, with the reversing-cylinder 20 and sheet-conducting carrier 30, of the tapes 32 and 38 34, substantially as described.

8. The combination, with the reversing-cylinder 20, and sheet-conducting carrier 30, of a rotating type-cylinder and two impression-cylinders, as 95 96, substantially as described.

9. The combination, with the reversing-cylinder 20 and sheet-conducting carrier 30, of a rotating type-cylinder, four impression-cylinders, and a cutting apparatus, 89 90, substantially as described.

10. The combination, with the reversing-cylinder 20 and sheet-conducting carrier 30, of a rotating type-cylinder, four impression-cylinders, cutting-cylinders 80 90, a gathering-cylinder, and a fly-frame, 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:
H. T. MUNSON,
GEO. H. GRAHAM.