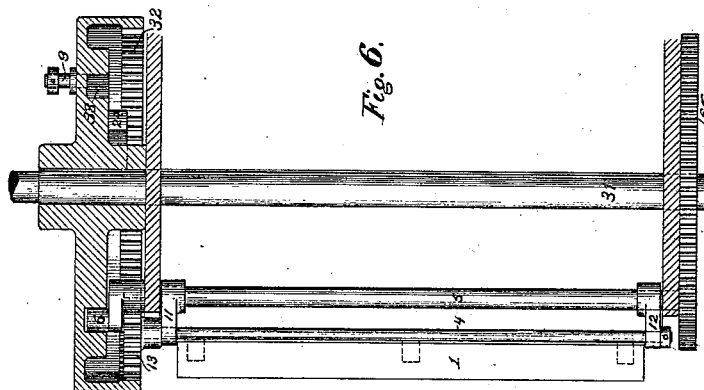
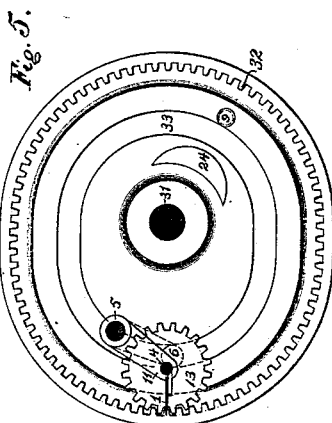
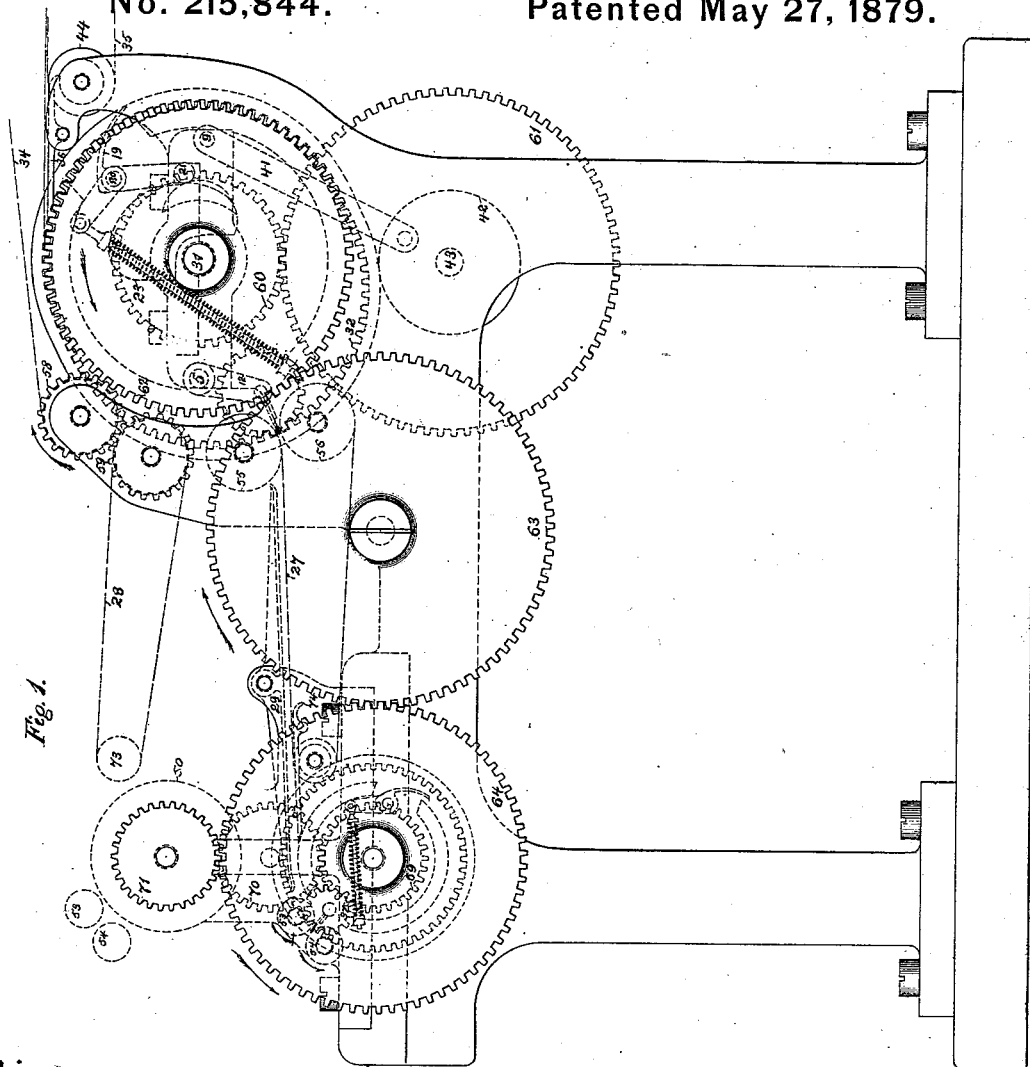


S. D. TUCKER.
Sheet-Delivering Apparatus for Printing-Machines.
No. 215,844.
Patented May 27, 1879.



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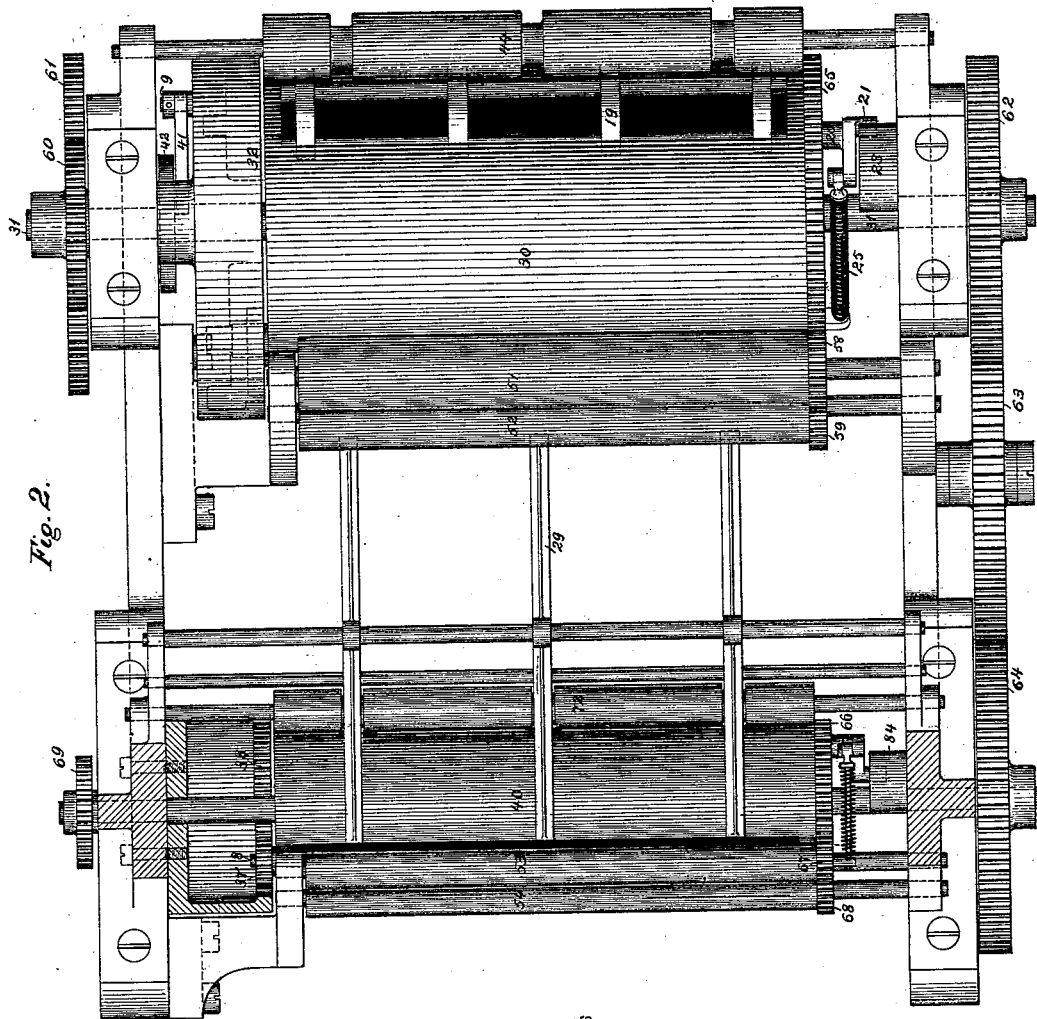
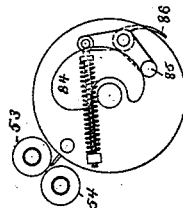


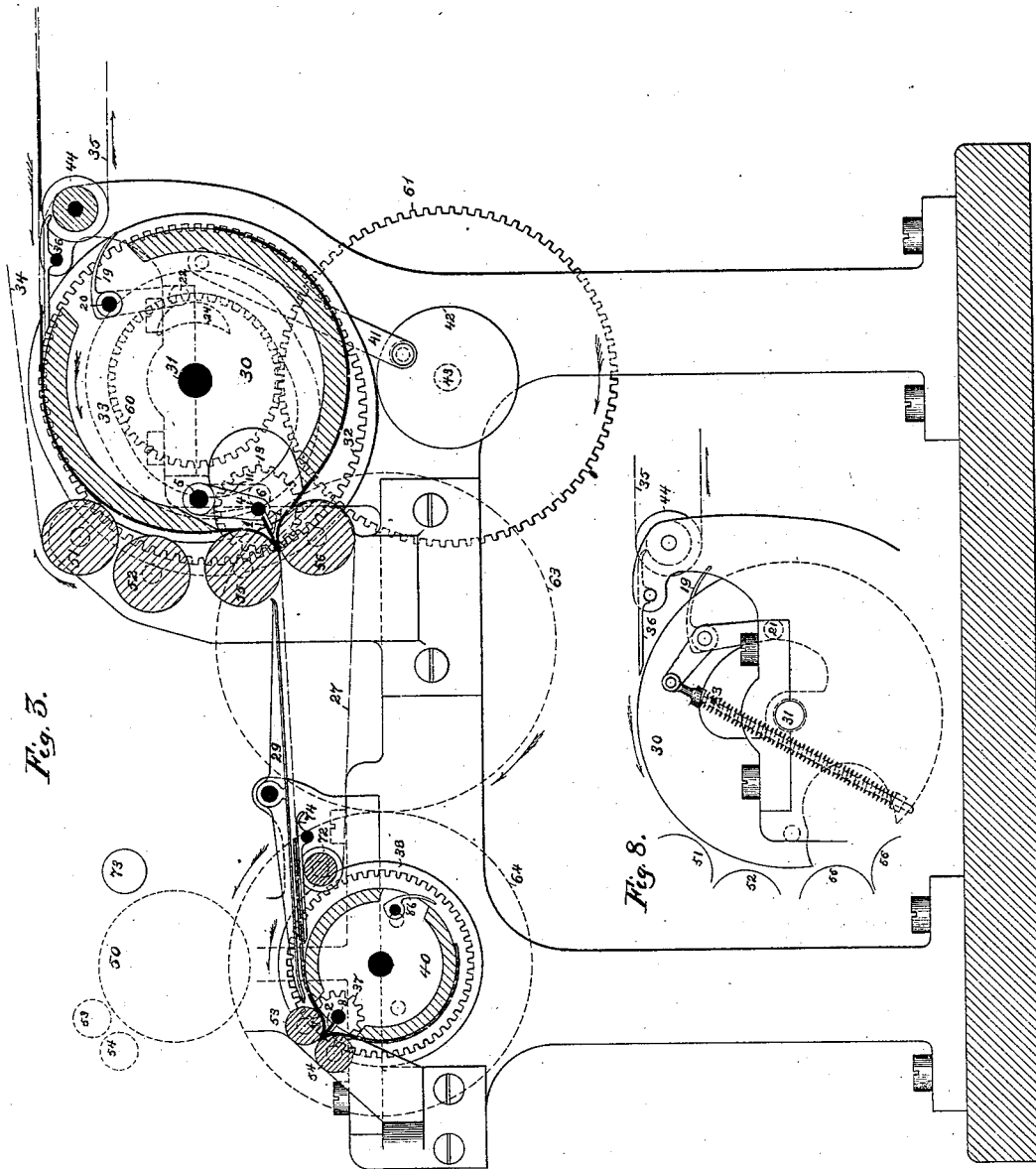
Fig. 2.



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Fig. 7.

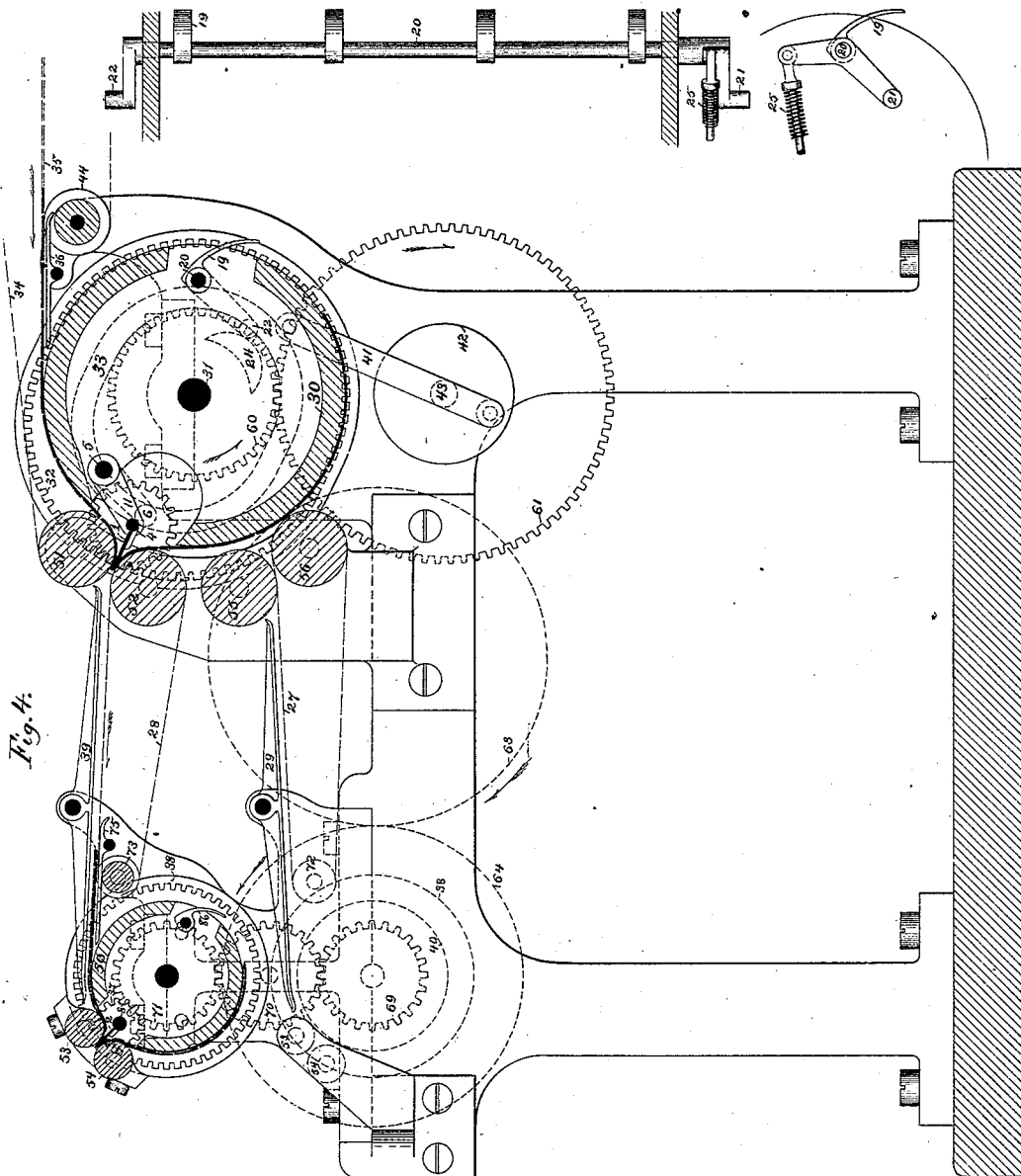


Fig. 4.

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Fig. 9.

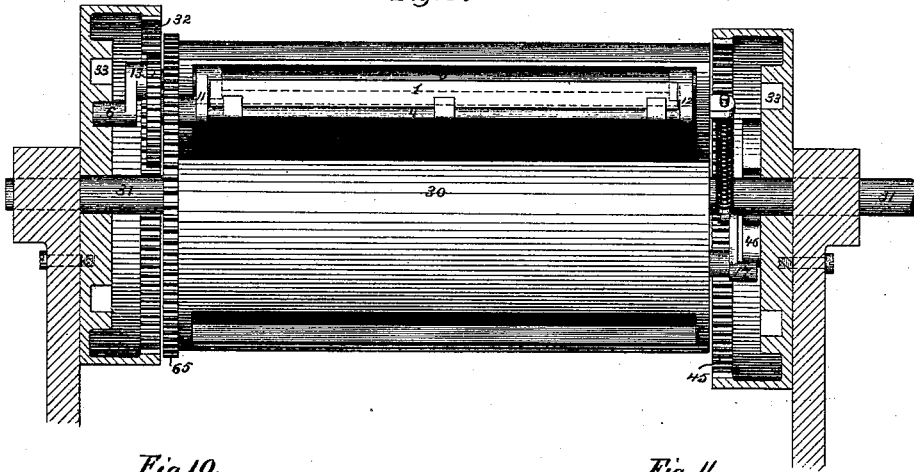


Fig. 10.

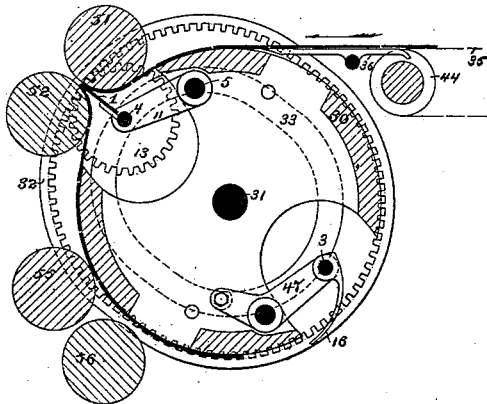


Fig. 11.

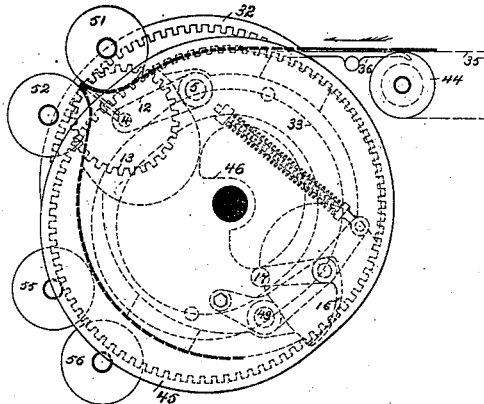


Fig. 12.

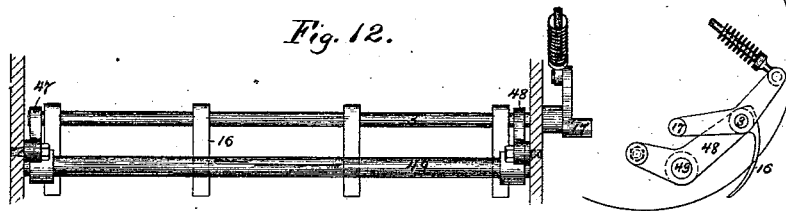
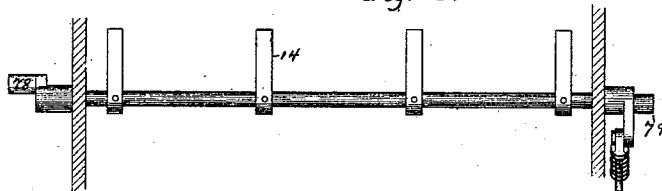


Fig. 16.



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Fig. 13.

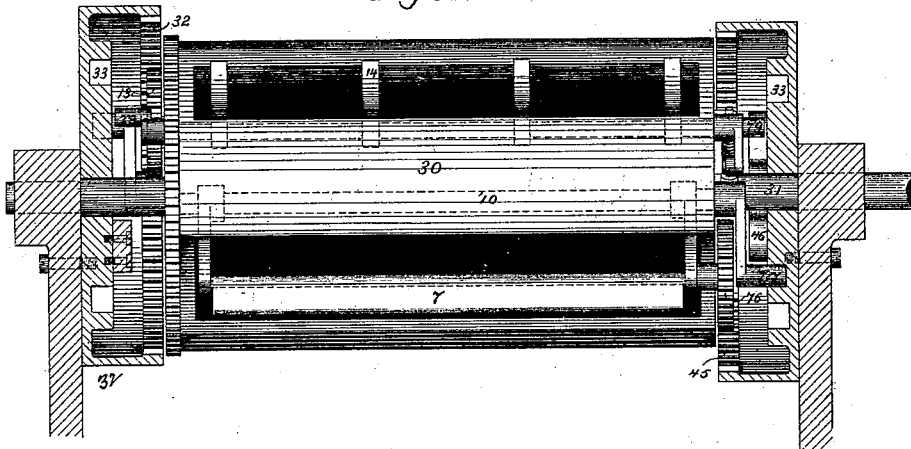


Fig. 14.

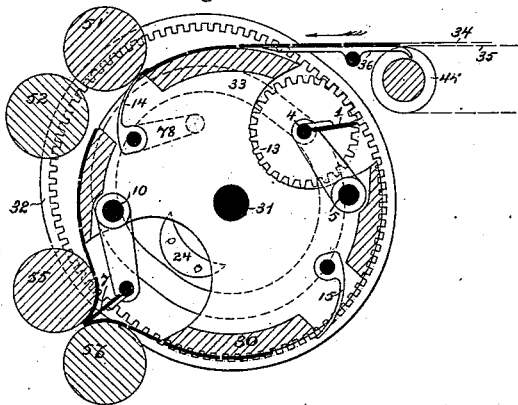


Fig. 15.

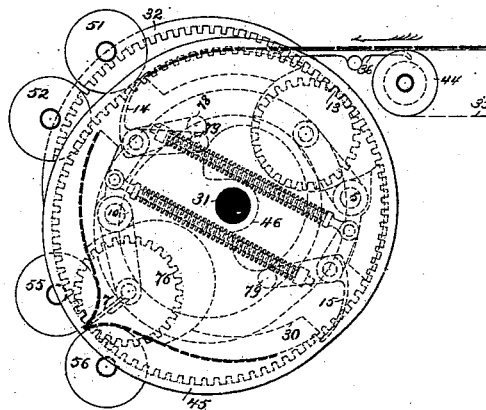


Fig. 18.

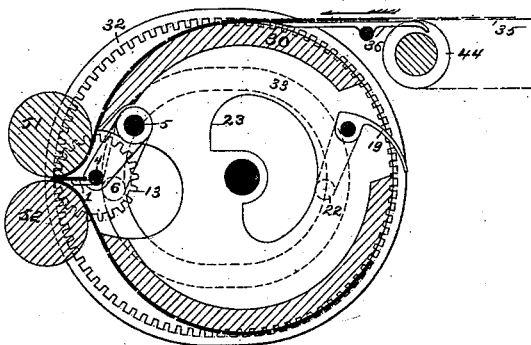
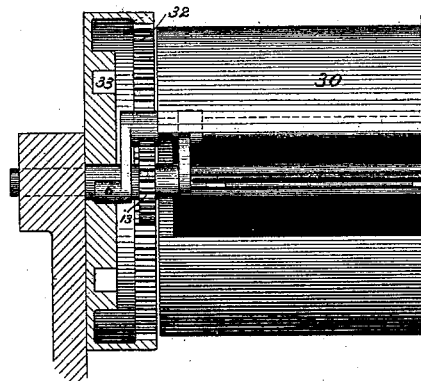


Fig. 17.



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Fig. 20.

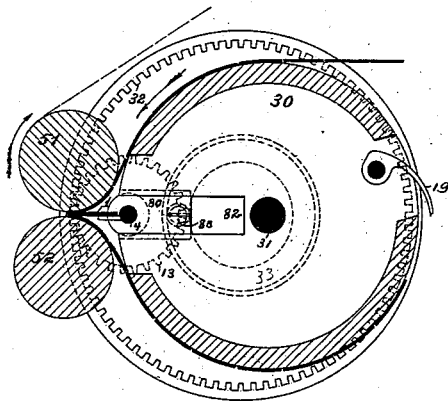


Fig. 21.

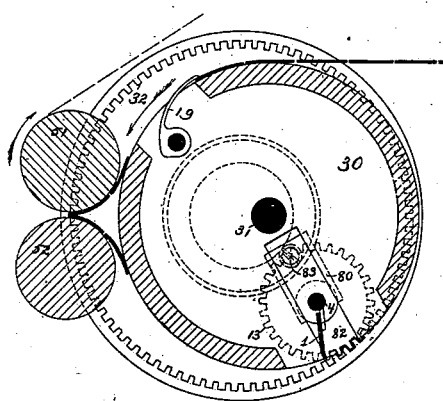


Fig. 19.

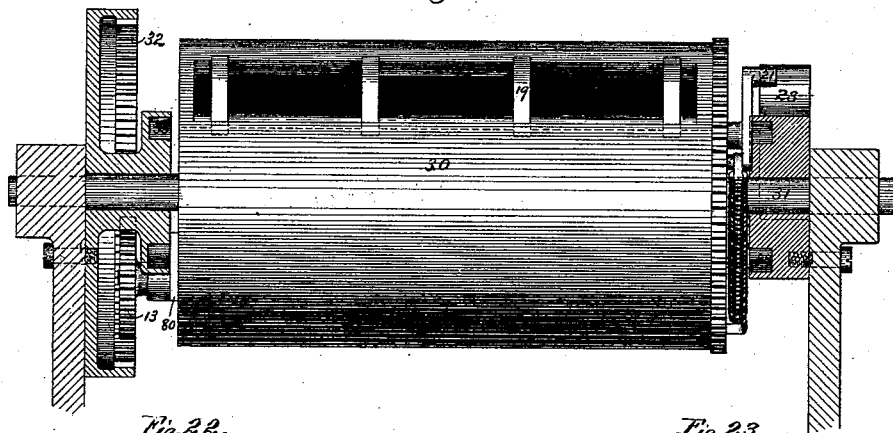


Fig. 22.

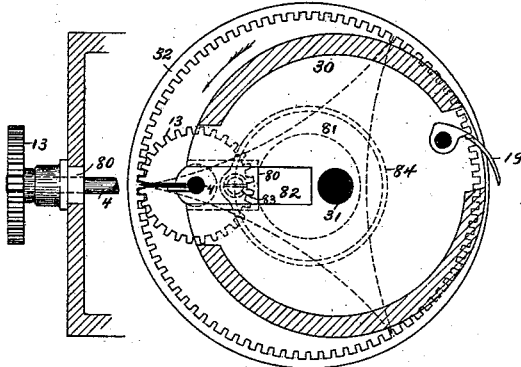
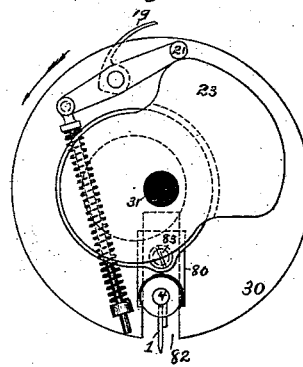


Fig. 23.



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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. **215,844**, dated May 27, 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-Delivering Apparatus for Printing-Machines; and I do hereby declare the following specification, when taken in connection with the accompanying drawings, to be such a full, clear, and exact description thereof as is sufficient to enable others skilled in the art to make and use the same.

In said drawings, Figure 1 is a side elevation. Fig. 2 is a plan view of my improved apparatus, Figs. 3 and 4 being longitudinal elevations, partly in section, illustrating its mechanisms in two positions of their operation. Fig. 5 is an inside elevation of the annular wheel, cam, and other gearing for operating the rotating folding-blade; and Fig. 6, a sectional plan view, showing said gearing, the folding-blade, and the heads of the cylinder supporting the same, while Fig. 7 shows, in plan and end views, the structure of the grippers, and Fig. 8, by a diagram, the mode of operating the same. Figs. 9 to 15 illustrate a modification of the apparatus, wherein stationary folding-blade-actuating mechanisms are provided at opposite ends of the carrying-cylinder, the construction of which mechanisms is such that two single folding-blades, supported by said cylinder, may alternately operate with independent pairs of stationary rollers in folding half-sheets, or whereby one of said folding-blades may be removed and the other operate at one of the pairs of rollers in folding whole sheets. Fig. 9 is a front elevation, partly in section, of this modification, showing the mechanisms adjusted so that but one folding-blade is in operation, Figs. 10 and 11 being diagrams illustrating the folding operation, and Fig. 12 plan and end views of the grippers then in action. Fig. 13 is a front elevation, partly in section, of this modification, showing the mechanisms adjusted so that both folding-blades are operating, Figs. 14 and 15 being diagrams illustrating the positions of the mechanisms at opposite ends of the cylinder during the folding operation; and Fig. 16 shows plan and end views of the auxiliary gripper-motion then in action. A further modification of the apparatus is shown in Figs. 17

and 18, which illustrate, in part, sectional elevations, the operation of the folding-blade-actuating mechanisms when the same are stationary, and arranged to cause the folding-blade to operate with a single pair of stationary rollers at each revolution of the cylinder. Figs. 19 to 22 illustrate a further modification of the apparatus, wherein the cam which projects the folding-blade shaft is in the form of an eccentric, Fig. 19 being a front elevation, partly in section, of the cylinder and blade actuating mechanisms, Figs. 20 21 diagrams illustrating their operation, and Fig. 22 a diagram illustrating a modified form of the eccentric, while Fig. 23 is a diagram illustrating the gripper-motion.

This sheet-delivering apparatus is designed to be attached to a web-perfecting printing-machine, from which it will be so driven that its mechanisms will co-operate with those of the printing-machine, and sheets printed by the latter will be conducted to the former, and therefrom in a folded condition.

The mode of connecting this apparatus to the printing-machine is like that shown and described in United States Patent No. 191,494, May 29, 1877. Any other feeding mechanism may, however, be employed which will deliver successive sheets properly separated onto the cylinder 30.

The present invention relates to that class of sheet-delivering apparatus which contain folding mechanisms, in which a folding-blade is supported in a revolving carrier, upon the surface of which each sheet to be folded rests while it is being carried into a proper position, with respect to stationary folding-rollers, to be acted upon by the folding-blade, and which said blade is caused to rotate many times within the carrier during each single revolution of the same, but is protruded beyond the peripheral line thereof only at the time when the folding operation is to be performed, and then at the point occupied by said folding-rollers.

The invention embodies improved mechanisms for accomplishing said operation, which mechanisms are a cam for projecting the folding-blade, its shaft, and driving-pinion outward from and withdrawing the same toward the center of the revolving carrier at a proper

time to cause said blade to co-operate with stationary folding-rollers, and an annular wheel for imparting the rotary movements to the folding-blade, which annular wheel is of such form that that portion of it in which the driving-pinion on the blade-shaft runs when the folding-blade approaches, enters, and recedes from the folding-rollers is protruded toward said rollers, and stands in an eccentric position with respect to the periphery of the revolving carrier. It is thus adapted to retain the pinion in gear with it at all degrees of the movement of said pinion, blade-shaft, and folding-blade outward from and inward toward the center of said carrier.

The invention includes other mechanisms co-operating with those before recited, devices for moving the blade-shaft-projecting cam and annular wheel, and various combinations of the parts, all of which will be more fully explained and claimed.

In order that the invention may be more readily understood, the structure and operation of the main apparatus, as illustrated in Figs. 1 to 8, will first be described, and then its modifications explained.

The revolving carrier 30, which supports a rotating folding-blade, 1, and upon which the sheets are conducted and rest when doubled by said folding-blade into the nip of one or the other of pairs 51 52 and 55 56 of stationary folding-rollers, which are journaled in the frame in the rear of said carrier, is preferably constructed in the form of a cylinder, the periphery of which is slotted at proper points to permit the passage of the folding-blade 1 and the grippers 19. This cylinder 30 is mounted upon a shaft, 31, which carries at one end a toothed wheel, 62, that imparts motion to other parts of the apparatus, and which may be the wheel through which motion is received from the printing-machine.

The folding-rollers are rotated in unison with the cylinder by means of pinions, as 58 59, gearing the pairs of folding-rollers together, and driven by a toothed wheel, 65, fixed on one end of the cylinder 30, (which wheel, obscured in Fig. 1 by the wheel 62, is fully shown in Fig. 2.)

The rotating folding-blade 1 projects from a shaft, 4, which is attached by means of arms 11 12 to a rock-shaft, 5, that turns in bearings in the heads of the cylinder 30. The folding-blade shaft projects beyond one head of the cylinder 30, and carries on that end a driving-pinion, 13, that gears with an annular wheel, 32. This annular wheel, as illustrated in the main apparatus, is oblong in form, and has the center of the cylinder 30 for one of its foci, whereby that portion of it which is extended toward the stationary folding-rollers stands in an eccentric position with respect to the cylinder 30, and will be hereinafter referred to as the eccentric portion of said annular wheel.

This annular wheel has connected with it a cam, 33, the groove of which is concentric

with the perimeter of said wheel, in the groove of which cam runs the rock-arm 6, which is fast on the end of the folding-blade rock-shaft 5. As the cylinder 30 revolves, this cam 33 so rocks the shaft 5 that the pinion 13 is kept constantly in gear with and rotated by the annular wheel 32, and while following the eccentric portion thereof the blade is protruded beyond the periphery of the cylinder, entered between, and withdrawn from, the stationary folding-rollers.

The annular wheel 32 is hung on the shaft 31, so as to oscillate thereon, whereby its eccentric portion is caused to travel back and forth from and to the folding-rollers 55 56 and 51 52. This movement of the annular wheel 32, which carries with it the cam 33, is accomplished by a crank-rod, 41, that is connected with a wrist-pin, 9, on said wheel, and to a similar pin on a crank-disk, 42. This disk is fast on a short shaft, 43, that carries on its outer end a toothed wheel, 61, which is geared with a pinion, 60, on one end of the cylinder-shaft 31. This pinion 60 is but one-half the size of the wheel 61, and consequently causes said annular wheel and the cam, 33, it carries to move in the proper direction and a suitable distance at each second revolution of the cylinder 30.

The cylinder is furnished with grippers 19, the shaft 20 of which has its bearing in the heads of the cylinder, beyond which it protrudes, it being furnished at one end with a rock-arm, 21, that engages with the main griper-cam 23 (see Figs. 1, 2, and 7) when the grippers are to be opened to receive and seize a sheet, and at the other end with a rock-arm, 22, that engages with an auxiliary griper-cam, 24, which is fast upon the inner face of the cam 33, and opens the grippers to release the sheet. These grippers are closed by means of a spring-seated rod, 25, connected with a rock-arm on their shaft, as is common.

The sheet-conducting tapes 34 35 connect with the cutting-cylinders of the printing-machine, the set 34 running over the cylinder 30 and returning around the folding-roller 51, and the set 35 running over a roller, 44, set near the periphery of the cylinder, while the space between the cylinder 30 and roller 44 is spanned by guards 36, that enter grooves in the roller.

The operation is as follows: A sheet conducted onto the revolving carrier 30 by the tapes 34 35 and guards 36 will be seized by the grippers 19, which are then opened by the main griper-cam 23 and carried around upon the surface of said cylinder. As the sheet is thus being carried by the cylinder, the pinion 60 will so rotate the wheel 61 that the crank-rod 41 will impart a slowly-oscillating movement to the annular wheel 32 toward the folding-rollers 55 56, causing the central point of the eccentric portion of the annular wheel 32 to arrive at said rollers, remain there during the folding operation, and while the crank-rod 41 is passing its center, as shown in Fig. 3. Dur-

ing this revolution of the cylinder the rock-arm 6 will, following the groove of cam 33, cause the shaft 5 to be so rocked that it projects the blade-shaft 4 and pinion 13 outward and inward, thus forcing said pinion to remain in gear with the annular wheel 32, and be so actuated thereby as to rotate the blade into and out of the rollers 55 56, whereby the sheet is doubled into the nip of said rollers, it being folded in passing through the same. As this folding-blade 1 performs its folding operation, the grippers 19 are opened to release the sheet by contact of their rock-arm 21 with the main gripper-cam 23. As the continued revolution of the cylinder brings its grippers 19 into position to seize a second sheet, the crank-rod 41 will oscillate the annular wheel 32 and cam 33 toward the folding-rollers 51 52, at which the eccentric position of said annular wheel 32 will arrive and remain while the crank-rod is passing its other center, as in Fig. 4, during which time the rotating folding-blade, projected and withdrawn as before described, will, coacting with the said folding-rollers, fold or double the second sheet between them, the auxiliary gripper-cam acting to release the sheet in proper time, which, by the oscillating movement of the annular wheel 32 and cam 33, has been brought into the proper position to thus act. The folding-blade 1 is thus caused to fold the sheets alternately into the folding-rollers 55 56 and 51 52. The folded sheets emerging from the rollers 55 56 and 51 52 may be delivered directly to a piling apparatus, or be carried by tapes to folding-machines of either the vibrating or rotating type, and arranged to fold the same one or more times on lines parallel with their first fold, at right angles thereto, or both.

This apparatus is shown as provided with two such folding-machines, whose carrying-cylinders 40 50 are arranged one above the other, and geared together so as to revolve in unison by toothed wheels 69 70 71. These cylinders are of one-half the size of the cylinder 30, and being driven turn for turn therewith by means of a toothed wheel, 64, on one of the shafts, which gears, through an intermediate, 63, with the wheel 62 on the shaft of cylinder 30, they are caused to move at one-half its surface-speed.

The sheets are directed from the folding-rollers 55 56 and 51 52 to the cylinders 40 50 by means of interposed conducting-channels. One of these channels is formed by sets of tapes 27, that run from the folding-roller 56 to a roller, 72, set near the cylinder 40, and overlying rods 29, that reach from the folding-roller 55 over said cylinder, the space between the roller 72 and the cylinder 40 being spanned by guards 74 entering grooves in said roller 72. The other channel is formed by sets of tapes 28, that run from the folding-roller 52 to a roller, 73, set near the cylinder 50, and overlying rods 39, that reach from the folding-roller 51 over said cylinder, the space between

the roller 73 and the cylinder 50 being spanned by guards 75, entering grooves in the roller 73.

The cylinders 40 50 are each provided with a folding mechanism of like construction. That connected with the cylinder 40 will therefore be described, it being understood that corresponding parts in each marked with like reference-characters have same construction and mode of operation. Said folding mechanisms consist of a rotating folding-blade, 2, projecting from a shaft, 8, that is journaled in the heads of the cylinder, one end of said shaft being extended beyond the cylinder, and provided with a driving-pinion, 37. This pinion engages with an annular wheel, 38, that is fixed to the side frame so as to stand concentric with the cylinder. As the cylinder revolves, the pinion 37, remaining in gear with the annular wheel 38, is caused to continuously rotate, so that while turning many times at each revolution of the cylinder, according to the proportion of the gearing, will during one of its rotations be protruded between and withdrawn from the stationary folding-rollers 53 54. A set of grippers, 86, for controlling the sheet, are provided, and operated to seize and release the sheets at the proper times by means of a rock-arm, 85, and stationary cam 84, fixed to the side frame. These cylinders 40 50 and the folding mechanisms they carry are then so operated and timed as to capacitate them to manipulate the product delivered to them from the cylinder 30, which, being once folded, and thereby reduced to one-half its former size, is suited in dimensions to those of the cylinder 40 or 50. Such a folding mechanism is shown and fully described in the Patent No. 171,196, December 14, 1875.

The apparatus may be modified, as is shown in Figs. 9 to 15, by providing its cylinder 30 at each end with a stationary oblong annular wheel, fixed to the frame, so that the eccentric portion of one, as 32, shall project toward the folding-rollers 51 52, and that of the other, as 45, shall project toward the folding-rollers 55 56.

The cylinder 30 is slotted at opposite points, and there provided with bearings for two rotating folding-blades, as 1 7, and their appurtenances, and at right angles thereto in like manner arranged to receive two sets of removable grippers, as 14 15, and their appurtenances. The folding-blade 7 is removable, and a set of grippers, 16, are constructed so as to be adjusted in its bearings. The auxiliary gripper-cam 24 is arranged to be removable from the cam 33 of the annular wheel 32, and a main gripper-cam, 46, is fixed to the inner face of the cam 33 of the annular wheel 45.

The structure and mode of operation of the rotating folding-blades and their actuating mechanism are the same as has been hereinbefore described with respect to the folding-blade 1, when its annular wheel 32 stands in the same position relative to the folding-rollers 51 52 as here represented.

The apparatus thus modified may be arranged to fold large sheets through the rollers 51 52 as follows: The cylinder, with its folding-blade 1 in place, is further supplied with the grippers 16. These grippers are placed in the bearings opposite to those supporting the rock-shaft 5 of the folding-blade 1, and operate with respect to said blade as to the grippers 19, hereinbefore described; but as bearings sometimes supporting the rock-shaft of the folding-blade 7 and their position for that purpose is one which will not accommodate the hangings of the grippers 19, the said grippers 16 have their rock-shaft 3 fixedly sustained by arms 47 48, that are supported by a shaft, 49, that enters the said bearings, and set-screws connecting them with the cylinder-heads. The shaft 3 is thus held in a position to insure a proper operation of the grippers by the contact of its rock-arm 17 with the main griper-cam 46.

Each sheet received from the tapes 34 35 will be seized by the grippers 16 and carried by the cylinder 30 and folded into the rollers 51 52 by the rotary folding-blade 1, in precisely the same manner as has been described with respect to the said mechanism when operating as in Fig. 4.

When it is desired to fold half-sheets, the grippers 16 and their hangings are removed and the folding-blade 7 adjusted in their place, as in Figs. 13 and 14. This folding-blade has the same construction as the folding-blade 1, and is in like manner adjusted and operated, except that its driving-pinion 76 and rock-arm 77 extend into engagement with the annular wheel 45 and its cam 33. The grippers 14 and 15—each set and the mountings being alike, except that the set 14, illustrated in Fig. 16, has rock-arms 78 79 projecting from opposite ends of the cylinder, while the set 15 has but one such arm, as 79—are now adjusted in place, as in Figs. 13 to 15. The auxiliary griper-cam 24 is also fixed to the cam 33 of the annular wheel 32. (See Figs. 13 and 14.)

The first half-sheet received from the tapes 34 35 will be seized by the grippers 14, which are opened and closed for that purpose by the contact of their rock-arm 79 with the main griper-cam 46, and carried around upon the cylinder 30 until the middle of the sheet has reached a position to be acted upon by the folding-blade 1, when the grippers 14 will be opened to release it by the contact of their rock-arm 78 with the auxiliary griper-cam 24. This sheet will thereupon be doubled into the nip of the rollers 51 52 by the folding-blade 1, which, controlled by the cam 33 and the annular wheel 32, will be projected into said rollers. The second sheet received will be seized by the grippers 15, which are opened and closed for that purpose by contact of their rock-arm 79 with the cam 46, and this sheet will be carried around with the cylinder until its middle portion has reached the folding-rollers 55 56, whereupon the grippers 15 will be opened by their rock-arm 79 again coming into contact with the cam 46, and the folding-blade 7,

which is controlled by the cam 33 and annular wheel 45, will be projected and fold the sheets into the said rollers 55 56.

In this modification the proportion of the teeth of the driving-pinions of the folding-blade are to those of the annular wheels as 1 is to 3, so that one of said blades shall not, in making one of its inoperative turns, be projected beyond the periphery of the cylinder and strike the sheet it will fold at its next turn, as would be the case if that proportion were less, as 1 to 5.

The modification Figs. 17 and 18 shows the arrangement of the parts when the apparatus is designed to operate upon full-sized sheets, and to fold them at one pair of stationary rollers, 51 52. Their structure and operation do not differ from those already described, as shown in Fig. 4, (as the characters of reference indicate,) except that the foci of the oblong annular wheel 32 are in a plane supposed to be parallel with that of the bed-plate of the machine, and the cam 33, single pair of folding-rollers used, and the griper-cam 23 are correspondingly placed.

The modifications illustrated in Sheet 7 show the stationary wheel 32 to be a true annular, which, being greater in diameter than the cylinder 30, and set eccentrically with respect thereto, provides what has been called the eccentric portion of the annular wheel that is protruded beyond the cylinder toward the folding-rollers.

As shown in Figs. 19, 20, and 21, two eccentrically-grooved fixed cams, 33, for projecting and withdrawing the folding-blade shaft to and from the center of the cylinder, are provided. One of these cams 33 is attached to the annular wheel 32, and the other fixed to the framework at the opposite end of the cylinder, and both cams are set so that their grooves stand in the same eccentric relation to the cylinder 30 as that given to the annular wheel 32.

The folding-blade 1 has its shaft 4, carrying the driving-pinion 13, set in boxes 80, that slide in radial grooves 82 in the heads of the cylinder 30. These boxes have a pin or arm, 83, projecting from them into the cam-groove 33, so that while the cylinder 30 revolves, the folding-blade 1, the teeth of whose driving-pinion 13 are to those of the annular wheel 32 as 1 is to 3, will be forced to remain in gear with the said annular wheel and make but three rotations while the cylinder revolves once, two of which rotations are inside the periphery of the said cylinder, and during the other rotation of which the blade is projected from and withdrawn toward the center of the cylinder, and is thus while rotating caused to enter and withdraw from the folding-rollers and perform the folding operation.

In the modification Figs. 22 and 23, the structure of the parts differs from that just described in the substitution for the cam 33 of stationary eccentrics 81, to the straps 84 of which the sliding boxes 80, carrying the folding-blade shaft, are fixed. In these modifica-

tions, Sheet 6, the grippers 19 are opened by a cam, 23, projecting from one of the fixed cams 33 or eccentrics 81, as will be readily understood.

What is claimed is—

1. The combination, with a revolving carrier, supporting a rotating folding-blade, its shaft, and driving-pinion, of a cam for protruding the blade-shaft and driving-pinion to and from the center of the carrier, and an annular wheel shaped and related to said carrier substantially as described, so that that portion of it in which the driving-pinion runs while the blade approaches, enters, and recedes from the folding-rollers is protruded toward said rollers or stands in an eccentric relation to the periphery of said carrier.

2. The combination, with a revolving carrier, a rotating folding-blade, its shaft and driving-pinion carried thereby, and two independent sets of folding-rollers, of mechanisms for constantly rotating the folding-blade and projecting it into co-operative relation with said folding-rollers, and means for changing the position of said blade rotating and projecting mechanisms, so that the folding-blade shall operate alternately at the two sets of folding-rollers, all substantially as described.

3. The combination, with a revolving carrier, a rotating folding-blade, its shaft and driving-pinion, and two independent sets of folding-rollers, of an oblong annular wheel and a correspondingly-shaped cam, whereby

said folding-blade is constantly rotated and intermittently projected, so as to enter and be withdrawn from the folding-rollers, and mechanism for oscillating said annular wheel and cam, so that the folding-blade shall co-operate alternately with the two sets of folding-rollers, all substantially as described.

4. The combination of revolving carrier 30, rollers 51 52 and 55 56, folding-blade 1, shaft 4, driving-pinion 13, shaft 5, arms 11 12, rock-arm 6, annular wheel 32, cam 33, crank-rod 41, and crank-disk 42, substantially as described.

5. The combination of revolving carrier 30, rollers, as 51 52, folding-blade 1, shaft 4, driving-pinion 13, shaft 5, arms 11 12, rock-arm 6, annular wheel 32, and cam 33, substantially as described.

6. The combination, with the carrier 30 and its single folding mechanism, operated so that successive sheets are alternately folded through the two independent sets of folding-rollers 51 52 and 55 56, of the two carriers 40 50, which are provided with folding mechanisms, and the sheet-conducting channels interposed between the said folding-rollers and carriers 40 50, 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,
M. B. PHILIPP.