(No Model.) 4 Sheets—Sheet 1.

D. CARLAW.

PRINTING MACHINE.

No. 385,592. Patented July 3, 1888.

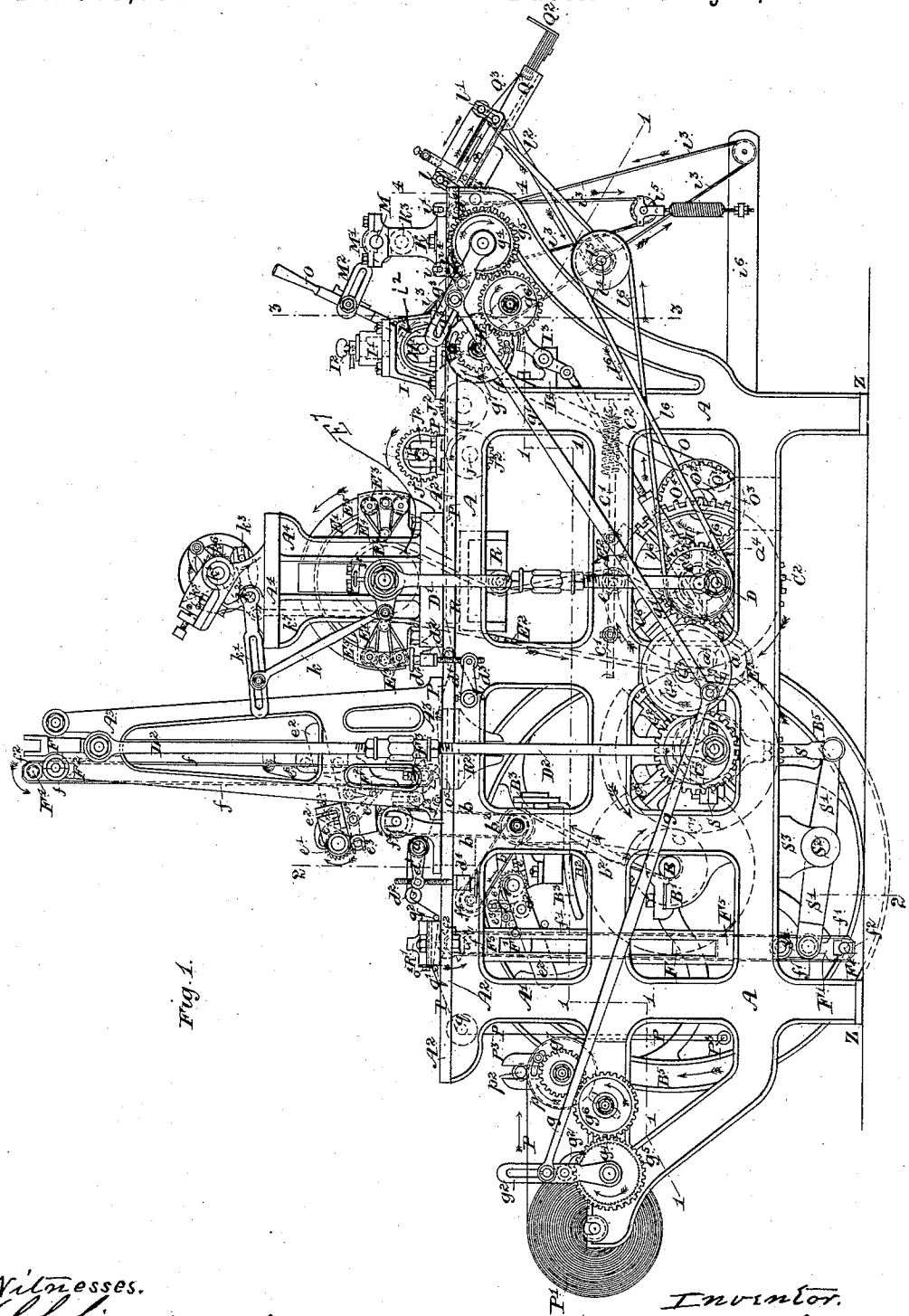

Fig. 1.

Witnesses.
S. S. Sinsabaugh.
W. E. Stearns.

Inventor.
David Carlaw.
By
S. M. Sinsabaugh.
Atty.

(No Model.) 4 Sheets—Sheet 2.

D. CARLAW.

PRINTING MACHINE.

No. 385,592. Patented July 3, 1888.

Fig. 9.

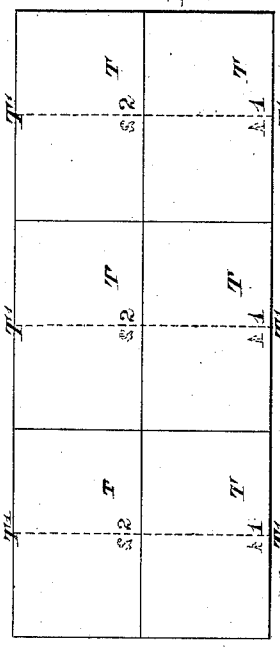

Fig. 2.

Witnesses—
S. S. Simmabaugh.
W. E. Stearns.

Inventor.
David Carlaw.
By
S. M. Simmabaugh.
Atty.

(No Model.) 4 Sheets—Sheet 3.

D. CARLAW.

PRINTING MACHINE.

No. 385,592. Patented July 3, 1888.

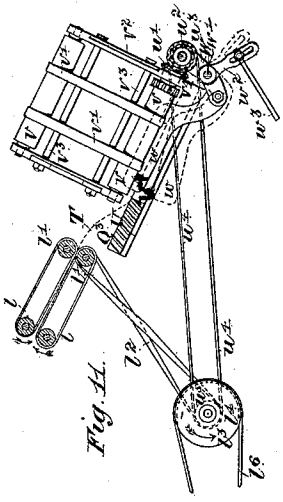

Fig. 11.

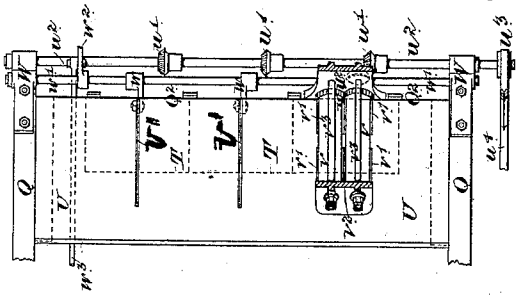

Fig. 12.

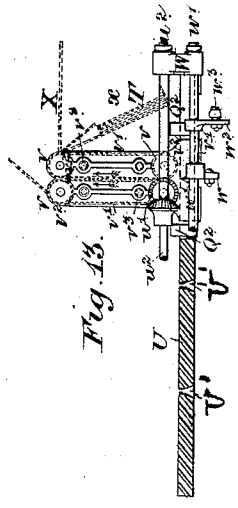

Fig. 13.

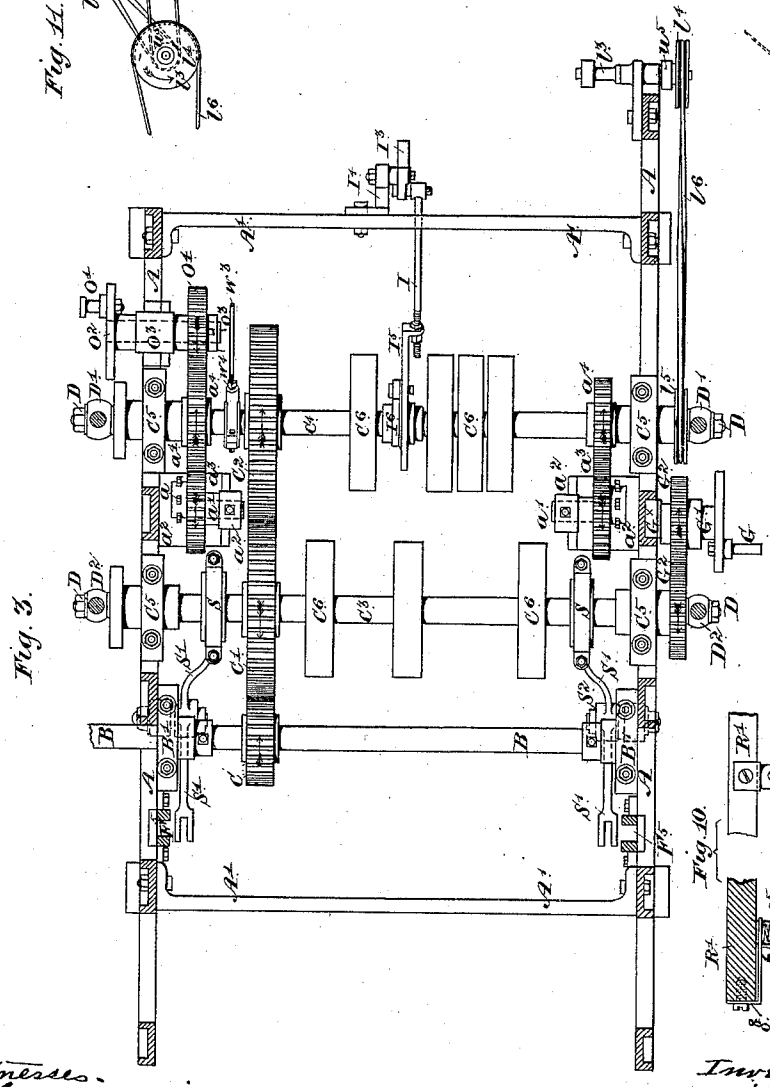

Fig. 3.

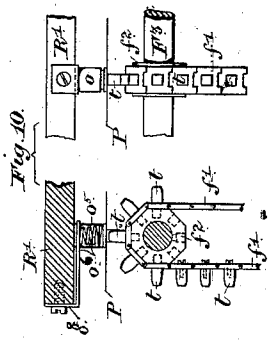

Fig. 10.

Witnesses.
S. S. Sinsabaugh.
W. E. Stedman.

Inventor.
David Carlaw.
By
S. S. Sinsabaugh.
Atty.

(No Model.) 4 Sheets—Sheet 4.

D. CARLAW.

PRINTING MACHINE.

No. 385,592. Patented July 3, 1888.

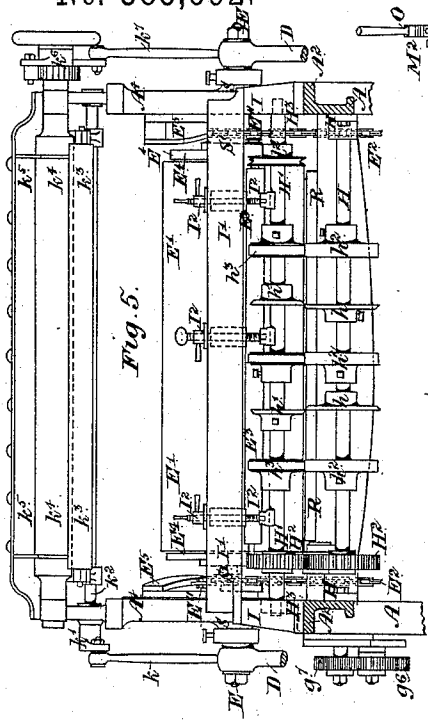

Fig. 5.

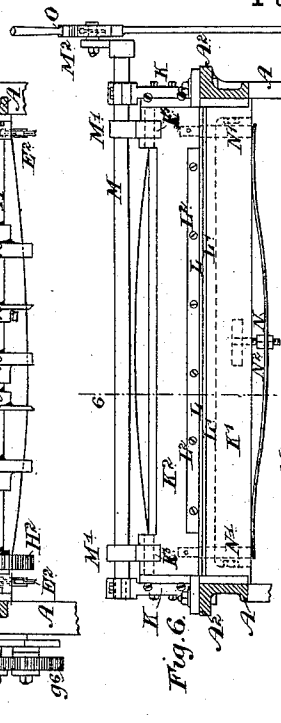

Fig. 6.

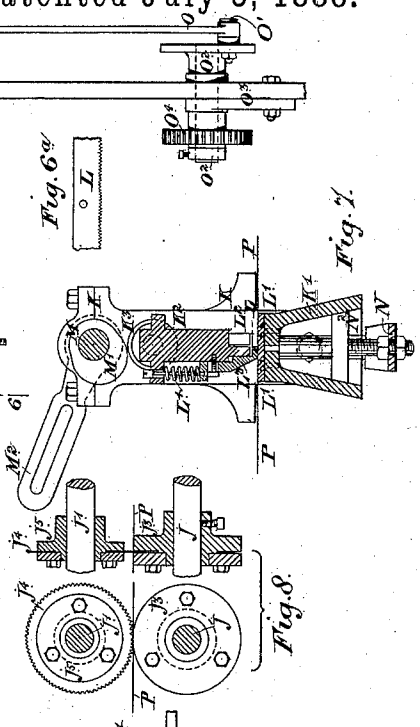

Fig. 6a.

Fig. 7.

Fig. 8.

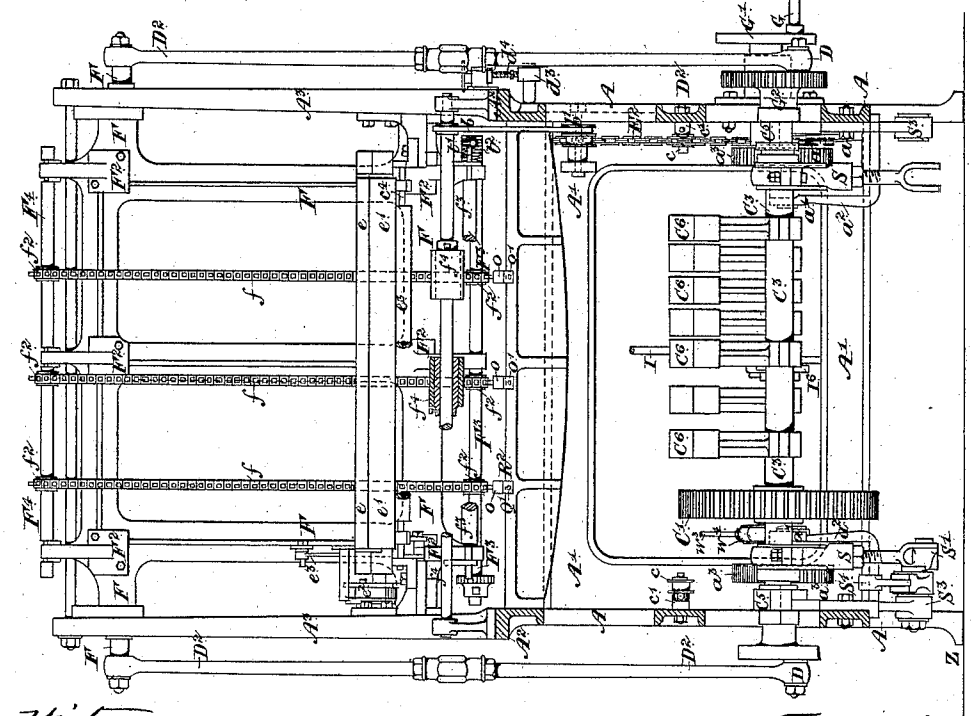

Fig. 4.

Witnesses,
C. S. Sinsabaugh.
W. C. Stearns.

Inventor,
David Carlaw.
By
S. W. Sinsabaugh.
Atty.

UNITED STATES PATENT OFFICE.

DAVID CARLAW, OF GLASGOW, COUNTY OF LANARK, SCOTLAND.

PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 385,592, dated July 3, 1888.

Application filed March 23, 1887. Serial No. 232,175. (No model.) Patented in England February 19, 1886, No. 2,438.

To all whom it may concern:

Be it known that I, DAVID CARLAW, a subject of the Queen of England, residing at Glasgow, county of Lanark, North Britain, engineer and machine-maker, have invented certain new and useful Improvements in Letter-Press Printing-Machines, also applicable for numbering and perforating tickets, checks, and the like, (for which I have received a patent in Great Britain, No. 2,438, dated February 19, 1886,) of which the following is a specification.

My said invention has reference to a special construction of printing-machine and to certain combinations of its parts for printing the paper (or thin mill-board) in or from the roll or web while passing through the machine intermittently into short bills or circulars or into small sheets for being made up into drapers' or similar counterfoil check-books, or into books or sets of pawn-tickets, or railway, steamboat, tramway, or other tickets, either printed on one or both sides, and to numbering these sheets or tickets in one or more parts with the same corresponding numbers, (for making up the book or sets of sheets,) as from 1 to 100 or 1 to 1,000, and then perforating them longitudinally in the proper parts, (for tearing them apart from each other and making them up into their separate sets,) and then finally cutting them off transversely into their separate sheets and deliver, and it might be fold, them all in their numerical order and place them over each other all before leaving the machine, so that they can be carried away in sets by hand to be stitched up into books or sets ready for use. My improved machine will save much time and labor in the production of this class of work as compared with the present modes and means of doing so in separate machines, while several of the improvements or combinations of the mechanism of this improved machine for the separate operations are applicable to other printing-machines; and in order that the nature and novelty of my said invention and the manner of performing or carrying the same into effect or practice may be properly understood, I have hereunto appended four sheets of explanatory drawings, in which the same reference letters and numerals are used to indicate corresponding parts in all the figures where shown.

Figure 1 is a complete side elevation, the feeding mechanism and gearing being indicated by letters *g g'*, &c., of a letter-press printing-machine constructed all in accordance with one modification or arrangement of my improvements. Fig. 2 is a plan of the same machine corresponding to Fig. 1; and Fig. 3 is a sectional plan or horizontal view taken near the line 1 1 in Fig. 1, corresponding to Figs. 1 and 2, showing the main lower and first motion-transmitting shafts, B C^3 C^1, and gearing C C' C^2 of the machine, from which all the other motions of the machine are taken sequentially, as will hereinafter be described. Fig. 4 is a complete transverse vertical section of the machine as taken on the line 2 2 on Fig. 1, looking from the back or feeding-in end, P', of the machine, and showing the arrangement of numbering chain and frame F *f* and the inking mechanism f^3 f^4 *c c' c*^{3}, which print the sequential numbers on the upper side of the tickets or sheets in the web of paper, P, passing under them. Fig. 5 is a transverse vertical section, as taken on line 3 3 on Fig. 1, of the upper part of the machine, looking from the front delivery end, Q^3, showing the arrangement of the under and upper feeding transverse spindles, H H', with their feeding-rollers h^2 h^3 and longitudinal cutting-disks *h h'* in front; and Fig. 6 is also a front section taken on line 4 4 on Fig. 1, showing the transverse cutting-knives L L' and actuating mechanism therefor K^2 M N. Fig. 6^a shows a side view of a portion of knife L. Fig. 7 shows a transverse section of the same as taken on line 6 6 in Fig. 6. Figs. 8, 9, 10, 11, 12, and 13 are detail views of the different parts.

Referring to the drawings, my invention and its improvements are as follows: As applied to a machine for performing the said class of work in sequential operations and in which the printing is done principally on the upper side of the web of paper, P, (indicated in dotted lines in Figs. 1 and 2,) the side frame of the machine consists of two main side frames, A, well bound together by transverse frames and stays A', secured to any suitable foundation at Z, below, and at A^2, where the paper, P, passes through it, so that the attendant could see that the several operations are being performed properly, but having special parts of these

frames A, or additional standards or frames, A^3 A^4, secured on the top of the frames A and carried higher up to support the numbering and printing mechanism, as will hereinafter be described. The first motion driving-shaft, B, is preferably mounted transversely in plumber-blocks B′ in or secured to the lower part of the side frames, A, toward or nearest the end of the machine where the paper, P, is fed in, and is driven by a belt passing over fast and loose pulleys B^2 on its one end, (shifted on these by the belt fork and handle B^3,) and carried in a special bearing-block, B^4, outside the framing for that purpose, and also fitted with a fly-wheel, B^5. This first motion-shaft, B, gives motion through a train of spur-wheels, C C′ C^2, to the other shafts, C^3 C^4, (and counter or supplementary shafts,) all mainly carried in bearing-blocks C^5 in the lower part of the frame. These shafts B and C^3 C^4 give and transmit all the necessary intermittent rotative or reciprocating motions to the several spindles above, all in times to suit their different operations during the intervals of the motion of the paper, P, forward and during its stoppages. Crank or eccentric-disk pins D are fitted on the opposite ends of the shaft C^4, and vertical connecting-rods D′ are fitted on each side of and connected above to the spindle E of the raising and lowering printing cylinder or bowl E′ and its pitch-chains E^2 and wheels E″ for actuating the inking-rollers E^3 and their rotating frame all over the fixed platen R. These two shafts C^3 C^4 have segmental weights C^6 mounted on them on the opposite sides to the crank-pins D to balance the weight of the bowl E′ and its inking mechanism, as also the weight of the frame F and its chain numbering and printing mechanism *f*. Eccentric-pins D and vertical connecting-rods D^2 are also arranged on the shaft C^3 on opposite sides of the machine for raising and lowering the frame F, carrying the upper sequential-numbering printing-chains, *f*, and mechanism, while longitudinal angular connecting-rods *g g′* from one common eccentric or disk crank-pin, G, on a lower short spindle-axis, G′, carried in a bracket, G″, at the lower part of the front side frame, A, in Fig. 1, and actuated by spur-wheels G^2 G^2 from the second motion-shaft, C^3, would give the forward-feeding motion through ratchet-levers g^2, pawls g^3, and ratchet-wheel g^4, and transmitting-gearing g^5 g^6, and change-gearing g^7 to the entering and delivery rollers *p* p^2 and h^2 h^3 of the paper, P, at the entering and delivering end of the machine, respectively.

The different lengths of paper, P, required to be fed forward according to the size of the sheets or tickets being printed are regulated by shifting the throw of the crank-pin G and the pins in the slotted ratchet-levers g^2, all carried on suitable fixed and shifting stud-centers on the frame A, as seen in Figs. 1 and 2, and by changing the sizes of the intermediate change spur-wheels, g^7.

Corresponding change-wheels, g^6 and g^7, are used to give motion to the shafts H H′ through their connecting-wheels H^2, which, by the transmitting-wheels J′ J^2, also give motion to the spindles *j j′* of the longitudinal perforating lower and upper disks, j^3 j^4 j^5, as also the feeding rollers h^2 h^3, mounted on the spindles H H′, which are carried in brackets H^3 near the upper delivery end of the frames A, with standards I and cross-rail I′ above, having set-screws I^2 in it for regulating the pressure on the rollers h^2 h^3 and the paper, P, passing between them, as shown in Figs. 2 and 5. The spindle P^2 of the roll of paper, P′, is placed in bearing-brackets at the back end of the side frames, A, and the end of paper P led forward over the ratchet-controlled feed-roller *p*, preferably having bands of india-rubber on it at *p′* (see Fig. 2) and fitted with a small loose metal roller, p^2, resting on it in open bearing-brackets p^3. To guide the paper, P, forward evenly into the machine from the roll P′ an arrangement of shifting-lever *o* is fitted and carried in a bracket, *o′*, at one side of the frame A close to the spindle P^2, so that one end of the lever *o* is carried in a bracket, *o′*, and works between two collars, o^2, on the spindle, while its other end is actuated by the hand screw and wheel o^3, passed through a swiveling nut in a bracket, o^4, secured to the side of the frame A, so that by turning the hand screw-wheel o^3, the spindle P^2 and its roll of paper, P′, can be set and adjusted to pass evenly through the machine and through the adjustable guide-collars *q′* on the first guide spindle or bar, *q*. From these feed-rollers *p* p^2 the paper, P, is led over a spindle, *q*, at the upper back end of the frames A A^2, to be drawn forward at this horizontal height the proper distance required at each time by the ratchet-gear and rollers h^2 h^3 and disks j^3 j^4 j^5 in front, as will hereinafter be described. To prevent undue strain on the paper, P, between the front rollers, h^2 h^3, and the rear ones, *p* p^2, a deep hanging loop of the paper, P, is left in front of the latter with a light round metal rod lying in it at P^3, which gives proper tension to the paper passing through the machine and gives it off or takes it up more or less, according to any little difference in the feed.

At the feeding or rear end of the machine room is left for fitting a first printing-bowl, E′, with its flat type-recess on top and rotating inking-rollers and driving-shaft below the latter and platen R′ above it. When the paper has to be printed or numbered on the under as well as on the top side, the number-printing mechanism and chains F′ *f′* are arranged and actuated in a reverse manner under the paper to that shown over the paper as actuated by the connecting-rods D^2 from the crank-pins D on the ends of the shaft C^3. This shaft C^3 also actuates this under numbering printing mechanism, F′ *f″*, by two eccentrics and eccentric-rods, S, and beam-levers S′, fulcrumed on studs S^2, carried by brackets S^3 on the lower part of the side frames, A, the rear ends of the levers S′

being connected by links at S^4 to the frame F' to reciprocate it in reverse manner to the frame F and print the numbers upward while the latter is printing them downward on the under and upper surfaces of the paper, respectively, and while the paper is stationary, this frame F' working in slotted guide-frames F^5, secured on the inside of the side frames, A. This under numbering chain printing mechanism is completely counterbalanced by the upper chain printing mechanism, and is actuated in an equivalent but inverted manner to that of the upper chain printing mechanism on its platen R', as indicated in Fig. 10, and its inking-serving mechanism. The paper is drawn forward by the rollers h^2 h^3 from the said top guide-spindle, Q, under the first stationary platen, R', over and under guide-spindles q'' q^2, to have the numbers here printed on its under, side and then over the stationary platen R^2 of the number-printing chain mechanism *f* and its reciprocating frame F' above, and then over the platen R of the letter-press printing-bowl E' and its inking-rollers E^3, which are both carried and reciprocated over the paper, P, and actuated by the side rods, D^2 and D', and transverse shafts C^3 C^4, respectively. The paper, P, is thence drawn forward in sequence through between the disks j^3 j^4, which, though they divide the printed sheets transversely, traverse the paper, P, longitudinally in front of the bowl-printing mechanism E' and some distance behind the rollers h^2 h^3. The spindles *j j'* of the disks j^3 j^4 are actuated by the train of wheels J^2 from the wheel H^2 of the lower cutter-spindle, H, in the same direction and at the same speed. From the drawing-rollers h^2 h^3 the paper, P, is passed on through a pair of small service-rollers, *i i'*, on each side of and close to the vertically-reciprocating transverse paper-cutting knife L K^2 and its gripping-bar L^3, carried in the standards K over and across the paper, P, at the front delivery end of the machine, from the front rollers, *i'*, of which the sheets while being cut are received and held and then delivered individually and successively as cut by the two sets of delivery rollers and bands *l l'* in front of the cutter onto the delivery platform and stops Q^2 in front at Q^3, where they are delivered in sequence over each other as numbered ready for being removed and bound or folded, as will hereinafter be described.

My improvements as applied to this printing-machine for printing the numbers sequentially and automatically, as stated—say on three different divisions of the sheet, for counterfoil check-books having three complete sheets printed in the width, as shown in Fig. 9—consist in erecting some distance behind the letter-press printing mechanism an open rectangular vertical frame, F, right across the machine, to be reciprocated some inches up and down in slotted guides above and below in the standard-frames A^3, erected over the top flange, A^2, of the frames A by connecting-rods D^2. This frame F is adjustable in height and has mounted on it in adjustable bearing-brackets F^2 two horizontal spindles, F^3 F^4—one, F^3, below, and the latter, F^4, above; but there might be any number of these spindles, if desired. The spindles F^3 F^4 have as many polygonal pitch-chain pulleys f^2 and pitch-chains *f* mounted on these as is required for numbering the sets of sheets or tickets T in the width of the paper, P, which are three, as shown in Fig. 9, and the pulleys f^2 are properly adjusted and secured on the spindles F^3 F^4 by set-screws or other equivalent in position across to print the numbers on the paper to suit that of the three divisions on the three sheets to be printed in the width at each movement. Each pitch-chain *f*, which is mounted on its corresponding lower and upper pulleys f^2 and shafts F^3 F^4, has as many links as it is desired to have sets of sheets to be numbered to make up each book (as, say, one hundred,) and the light shafts F^4 above would be geared together by and adjusted to suit the lengths of the chains *f* up or down from the lower spindles, F^3, on the same frame, F. Each chain *f* would have the numbering-type *t*, 1 to 100, formed or secured in succession on its hundred links, and the frame F, with these spindles F^3 F^4 and chains *f*, would be reciprocated up and down by the connecting-rods D^2 at each side of the machine, worked by eccentric-pins D from disks or cranks or other equivalent on the transverse shaft C^3, rotated in bearings C^5 in the lower part of the side frames, A, by the spur-wheels C C', regulated at the proper time to print the numbers in succession each time the frame F, with printing-chains *f*, descended, while the paper, P, and its drawing-rollers *p* p^2 and h^2 h^3 were standing still and the type-printing bowl mechanism E' was also printing another set of sheets previously numbered, and in front of those being numbered, as stated, on the top side. The first down motion of the frame of numbering-chains *f* would print across the machine a row of figures, 1, the second a row of figures, 2, and so on up to 100, when a new set would begin again and go on automatically, as illustrated in Fig. 9, showing a cross-row of numbers 1 and 2 as printed and cut off. Each time the frame F of numbering-chains *f* rises after printing, the whole set of chains is turned by a ratchet-wheel, f^2, on their lower spindle, F^3, (shown in Fig. 10,) and a pawl or lever mechanism at O^5 O^6, fixed on the inside of the stationary frame A^3, to the extent of a single tooth and type-link, *t*, to print the numbers in succession, as stated, and at each turn fresh ink would be served by automatically-acting inking-rollers f^3, mounted on frame F or entering side of the chains *f* onto the printing-surface of the chain of figures or numbers, and as the frame F rose the inking-rollers f^3 would come against a set of stationary revolving ink-serving rollers, f^4, above and receive fresh ink. This ink-serving roller f^4 is actuated by a band, *b*, from a pulley, *b'*, actuated by a cross-belt, b^2, from the first motion-

shaft, B, as shown in dotted lines in Fig. 1. This serving-roller f^4 receives its ink from a serving ink-box, *e*, through the delivery-roller *e'*, actuated by a ratchet-pawl and lever, e^2, each time the frame F is reciprocated. From the roller *e'* a certain quantity of ink would be served by a small roller, e^3, carried on a bell-crank lever, e^5, on a spindle, e^4, to the service-rollers f^4. This spindle and bell-crank lever is actuated by a connecting-rod, e^6, attached to the frame F, at each reciprocation. When the sections of tickets T to be printed in the width of the paper, P, are short and too numerous to allow of the figures being printed from one transverse row of figure-printing chains, *f*, mounted on one set of shafts, F^3 F^4, the two or more sets of upper and lower shafts, F^3 F^4, with the chain-wheels f^2 and their numbering-chains *f*, mounted on these, may be used as described and ranged behind at a regulated distance to print and number the second or alternate tickets T on the back rows, while the chains *f* on the spindles F^3 F^4 would print and number the first and every alternate ticket in its row. When the shafts F^3 F^4 and chains *f* are used, each set will print every third ticket T in their respective rows, so that the whole of the tickets in every row would be correspondingly numbered when the last set of chains *f* had printed their numbers.

When it is found difficult to make the pitch-chains *f* with sufficient links for the numbers required in a set to take in the requisite series of figures, then each chain *f* might be made shorter with a lower series of figures on it, as, say, each set rising by fifty, the first chain *f* printing its set of tickets T from 1 up to 50, inclusive, the second from 51 to 100, and the third from 101 to 150, and so on to as high a series of numbers as may be desired.

The roller f^3, for inking the numbering-type on the face of the numbering-chains *f f'*, is shifted to and fro on end by a small spanner, *t'*, secured on one end of the spindle of the roller f^3, fitted with a swiveling segment which takes into the thread of a short right and left handed cross cut screw-barrel, t^2, secured on the end of the spindle F^3 of the printing chain rollers F *f*, so as to cause the inking-roller f^3 to traverse to and fro and serve the ink from a different part of the roller f^3 onto the type *t*, as seen in Figs. 2 and 4.

The chains *f* might have their figure-printing type *t* cut on them or secured on them, as shown in Fig. 10, to print and read longitudinally or transversely on the paper, P, or ticket T, in the manner described, and when required they could have index letters or numerals made to print along with the successive numbers. The chains *f*, with their printing-letters, would print down on the top of the paper, preferably each over a small spring printing-bolster, *o*, mounted on shifting brackets O^8 on the top of the platen R^2 or on the under side of the platen R', so as to be shifted on their spindles F^3 F^4 to any position the chains were shifted laterally across the machine and web of paper, as also the service inking-rollers f^4 on their spindles, all as particularly shown on Fig. 4, and so as to print the corresponding numbers on the under side of the paper on the duplicate sheets to be folded, as shown in dotted lines, Fig. 9. A small enlarged detailed side and edge view of the chain *f* and its spring-bolster *o* is shown inverted in Fig. 10 for printing on the under side of the paper, P.

From the number-printing mechanism the paper, P, with all the sheets numbered in succession, passes on to the letter-press printing mechanism over a strong transverse platen, R, secured in the top of the side frames, A, below it and under the vertically-reciprocated printing cylinder or bowl E', mounted on sliding bushes *s* in the slotted standards A^4, erected over the upper flange, A^3, of the side frames, A, and actuated by adjusting vertical connecting-rods D', attached at their upper ends to the opposite ends of the axle E of the printing-bowl E', projecting through their bushes. To adjust the length of the paper, P, between the upper and under number and letter-press printing mechanism to suit the size of sheets and position of the numbers and letter-press on the paper, a spindle, *d*, is mounted in bearings across the upper sides of the framing above or below the paper, with two end levers, *d'*, inside, but beyond the edges of the web of paper, with a spindle, d^2, on the extreme end of these levers *d'*. This spindle d^2 is brought up under the paper or down over the top of the paper, so as to bend it down into a loop, and so take up any desired exact length of paper to adjust it to suit where the letter-press is required to be printed, and this action of raising and lowering the spindle d^2 is effected by a lever, d^3, on the end of each spindle *d*, outside the frame, actuated by small screw-spindles and hand-wheels d^4, which turn the spindle *d* as required. Small shifting-rings of india-rubber are mounted on the spindle d^2, set to roll on the paper between the newly-printed numbers, so as not to smear either the paper or the rollers.

The improvements connected with the inking mechanism of the type-printing cylinder or bowl E', which does not revolve, consist in rotating the frame E^4 on a hollow spindle, *s'*, carrying the inking-rollers E^3 round the spindle E of the bowl E' by two vertically-actuated pitch-chains, E^2, passed over a chain-wheel, E^7, on the driving-spindle *s'* of the opposite end disks of this frame E^4, mounted on the opposite ends of the spindle E of the bowl E', above and over an eccentric chain wheel, *a*, below, carried on a short spindle, *a'*, of a spur-wheel, a^3, carried in brackets a^2 inside the lower part of the frames A, the wheels a^3 being actuated by corresponding spur-wheels, a^4, on the shaft C^4 at the lower part of the frames. Each pitch-chain E^2 thus rises and falls vertically with the printing-bowl E' and its inking-rollers E^3, which it drives round the bowl while the latter is in its raised position to ink the type under it on its lower face over the platen R. To compensate for the slacking of

the chains E^2 at the different positions of their eccentric action, a loose horizontally-acting anti-friction pulley, c, fixed on a reciprocating rod, c', on the inside of each frame A, with helical or other spring c^2 attached to it, is mounted within the loop of the chains E^2 near the center, which always takes up the slack of its chain, thus keeping it always tight for the proper driving of the inking-rollers E^3 on both sides, so that if one chain E^2 was to give way in the working no smash of the printing mechanism could happen by the inking-roller E^3 or its rotating frame E^4 stopping under the type while the printing action was taking place.

A stationary segmental cam, E^5, is secured on the sliding bushes of the spindle E at each end of the machine to shift the inking-rollers E^3 transversely while revolving, so that they may ink the type each time. The ink is served onto the rollers E^3 at each rising action of the bowl by the connecting-rod k actuating the slotted lever k' on the end of the spindle k^2, carrying a service pilot inking-roller, k^3, by two levers, and which obtains ink from the upper feed-roller, k^4, of the feed inking-vessel k^5, fitted on top of the standards A^4 over the bowl, the feed-roller k^4 being turned by a ratchet-wheel and pawl, k^6, and connecting-rod k^7, connected to the spinde E of the bowl E' on the opposite side to the connecting-rod k. When transverse rows of perforations are required across or partially across the paper or individual sheets or tickets or these have to be cut, this is done after they have been numbered and printed with the letter-press by erecting between the printing-bowl E' and rollers h^2 h^3 two transverse spindles, j j', in bearing-brackets j^2, attached to the side frames, A, the one below and the other above the paper, P, the lower one with a roller preferably made of double disks j^3, with a very narrow annular sharp groove between them on the periphery fixed on their shafts under the paper, P, exactly where this has to be perforated or partially cut longitudinally, (or across the numbered and printed sheets T, Fig. 9,) and by fitting thin steel disks j^4 in corresponding disks, j^5, on the spindle j', with fine sharp-edged teeth round their periphery set to enter and revolve a short distance into the space between the disks j^3 below, so as to perforate or partially separate the paper, P, according to the depth to which the perforating-cutters j^3 j^4 j^5 are set to work into each other, while it is tangentially carried forward to the cutting-edges of these disks by the rollers h^2 h^3, as seen in the details in Fig. 8. These revolving perforating-cutters j^3 j^4 thus partially cross-cut the numbered and printed sheets T to the desired length, only perforating them across at the parts T', where they have to be kept attached for easy separation afterward, or where they have to be folded into check-books or for other purposes, as shown in detail in Fig. 9.

The spindles H H' of the rollers h^2 h^3 are mounted very similarly to those of the cutting perforating-disks j^3 j^5, some little distance in front of these in bearing-brackets H^3, secured to the frames A and driven at the same speed by the same train of spur-wheels, g^5, g^6, g^7, and H^2, on their shafts H and H', as seen in Fig. 5. The rollers h^2 h^3 are similarly mounted to shift on the spindles H H', and are made narrow and fitted to grip the clean parts of the paper, P, and sheets T between the fresh printed parts, so as not to smear these or the surface of the drawing-rollers h^2 h^3, especially the upper ones. Either the upper or the under rollers, h^2 h^3, may be fitted with an india-rubber or other equivalent gripping-covering.

To instantly stop the rollers h^2 h^3, and their gearing and prevent undue dragging on the paper, P, (when the other parts of the machine are being stopped and give exact measurement and delivery to the sheets T to be cut by the cross-cutters L and gripping-bar L',) a brake-lever, I^3, is mounted on a bracket, I^4, secured to the front cross-frame, A', of the machine to act on the periphery of one of the drawing-rollers, h^2, this lever being actuated by a connecting-rod and anti-friction roller on it at I^5, guided by its lower forked end on the shaft C^4 and reciprocated by a cam, I^6, on this shaft, acting on the anti-friction roller at I^5 all at the proper moment to stop the momentum of the drawing-rollers, as seen particularly in Figs. 1, 2, and 3 of the accompanying drawings. The actual cutters for cutting the paper, P, longitudinally into the proper lengths or widths for the sheets T are preferably made in the form of sharp-edge disks h h', mounted on the shafts H H', so as to be set to any desired position to work with their sharp edges close up to each other and cut the paper, P, into sheets of the required length or width, as shown in Figs. 2 and 3. Pressure is given on "upper" shaft by a small bush on the point of each screw-spindle I^2, held by a hand screw-nut above in the slotted stay I', secured on the brackets I to the arrangement of mechanism for cross-cutting the paper, P, and sheets T, separating these individually as finished, assisted by the set of feeding-rollers i i' immediately behind and in front of the cross-cutting knives L and gripping and cutting bars L', carried in the bearing-brackets K, and fixed transverse beam K', secured to the delivery end of the side frames, A, of the machine.

The improved construction and arrangement of the knife L and bars L' consists in fitting near the front delivery end of the machine between the main frames A close under the paper, P, on the beam K' a strong cross-gripping and cutting bar, L', formed of a fine sharp double-edged tempered-steel plate, or separate plates may be secured on or in the upper face of the cross-beam K', having a very narrow slit between their sharp edges for the same purpose. Over this cutting-bar L' in the brackets K, secured on the ends of the side frames, A, is mounted in suitable slide-guides in these brackets K a slightly reciprocating or rising and lowering cross-bar, K^2, having fitted and secured on its front lower

vertical surface a knife, L, which is preferably provided with small sharp serrated or angled lance or shark needle like cutting-teeth, which in coming down enters the narrow-sharp edged slit in the bar L′ and gently cuts the paper, P, right across the whole set of tickets (previously cut longitudinally by the cutters *h h′*) in a loose single thickness very smoothly without in the least drawing, tearing, or creasing the paper more effectively than a sharp guillotine-knife, although this might be used, when desired, for strong and heavy paper or tickets. On the back face of the block or bar K^2, carrying this bar L, a narrow slightly rising and falling spring-bar, L^3, is mounted, which by the pressure of the spiral springs L^4, mounted over it, is always pressed down, so that when the bar K^2 is brought down by a cam or other action this spring-bar L^3 first comes down and grips the paper, P, or sheets T across the whole width before the knife L comes down to cut the paper, the spring gripping-bar L^3 holding the paper the whole time by the elastic action of the springs during the cutting action. This downward motion of the bar K^2 is effected by a cross-spindle, M, mounted in the brackets K above, with eccentric or cams M′ carried on it at each end, which, on the spindle M being oscillated by a lever, M^2, at one end, come down on anti-friction rollers K^3, mounted in the upper ends of the bar K^2, so as to depress it, and thus cut off each transverse row of sheets T fed forward under this cutting mechanism and knife L. The bar K^2 is depressed against the power of a flat spring, N, which raises it by vertical pressers N′ to its normal highest position clear of the paper when relieved from the pressure of the cams M′ and allows the fresh sheets T of paper, P, to pass between the cutting-knives L and bar L′. The spring N is secured and set to the desired pressure at the center by the screw-stud N^2 to the under side of the cross-beam K′, as seen in detail in Figs. 6, 6^a, and 7. The cam-spindle M is actuated by a connecting-rod, O, attached to its actuating slotted end lever, M^2, above and at its lower end to a crank-pin, O′, on a supplementary spindle, O^2, carried on the bracket O^3, secured to the front lower end of one of the side frames, A, and actuated by a spur-wheel, O^4, from a wheel, a^4, on the front main transverse shaft, C^1. The proper distance for cutting the sheets T of the paper, P, in front of the revolving cutters *h h′* by the knife L and bar L′ is effected by making the whole frame and brackets K K′, carrying the cutters L L′, to shift and be secured on the top A^2 of the delivery end of the side frames, A, to suit the different sizes of sheets T fed forward to be cut off and delivered. The feeding-forward and delivery rollers *i i′*, close behind and in front of the knife L and bar L′, described, are actuated from a double grooved pulley, i^2, on the spindle H′ of the upper rollers, h^2 h^3, or by the spindle H of the lower rollers by light crossed cords or bands i^3, carried forward from these grooves and passed over small grooved rollers i^4, Fig. 2, on the spindles of the said under feeding and delivery rollers *i i′*, and over a grooved pulley attached to a movable helical or india-rubber spring, i^5, and other guide pulleys secured to the bracket i^6, projecting from the lower part of the frame A of the machine and capable of regulation, all arranged in such a manner as to feed the paper, P, forward steadily with the slightest degree of tension to keep it tight, but so that when the tension is exceeded, the bands slip on their grooved pulleys i^2 i^4 and prevent undue tension on the paper. The front set of delivery rollers, *i′*, deliver the cut sheets into the receiving-rollers *l* of the delivery-rollers *l′ l′* and bands or tapes over these. The under roller of the front delivery-rolls, *l′*, is driven by a cross-band l^2 from a small pulley, l^3, carried on a short spindle and bracket, l^4, from the front of the frame A. This small pulley l^3 is driven by a large pulley on the same center by a cross-band, l^6, from a pulley, l^5, on the front main driving-shaft, C^1, all so as to deliver the cut sheets T sequentially over each other as numbered, printed, and cut off onto the platform at Q′, with knee-stops Q^2 for receiving them and keeping them all in line ready for being lifted away in sets of one hundred, or so for being stitched and bound up, as shown particularly in Figs. 1 and 2. When the sheets T, as for long or duplicate sheet check-books, have to be folded, the separate cut-off sheets would be delivered onto a special table different from that shown at Q′ Q^2 in Figs. 1 and 2, and when there were, say, three sheets cut in the width of the paper, as shown in Fig. 9, each would be automatically laid or delivered with the perforated part T′ in the sheets T where it had to be folded over or under a V-shaped groove or slot, U′, in a table, U, of the folding mechanism. Above or below this groove or slot U′ and the paper, P, placed over it a pair of drawing-in rollers, *v*, would be mounted, which rollers would grip and completely fold each sheet as it was creased and fed into them. One modification of this folding arrangement of mechanism is illustrated detached in sectional side view, plan, and end view in Figs. 11, 12, and 13, showing one double pair of the folding and delivery rollers *v* and their bands *v′*, of which there would be a set erected vertically over each folding V-shaped groove or slot U′ in the angled table U. This table U would be secured to the arms Q, (carrying the delivery-platform Q′ and stops Q^2 in the machine shown in Figs. 1 and 2, and in place of this platform Q′ when the sheets T are to be folded as delivered,) and would have the sheets T delivered onto it with the perforated parts over the V-shaped grooves or slots in the table U to be folded, as hereinafter described. Two sets of the delivery-rollers *v* would be erected over each other with their vertical bands *v′* passing over them a little wider below than above, right over and in line with each V-shaped groove or slot in the table U. The spindles of these rollers *v* are carried

in end frames, v^2, bolted together by stays v^3 and by strong flanges v^4 under the platform U at the end of the V-shaped grooves or slots U′. The two lower rollers v of each set have small spur-pinions u on them gearing into each other, and the lower rollers drive the upper rollers by the bands or tapes v', and the spindle of one of the lower rollers v of each set is continued beyond the front frame, v^5, and its securing-flanges v^6, and is geared by a pair of bevel-wheels, u', to a transverse spindle, u^2, which drives the whole three sets of folding and delivery rollers. One set only, however, of these rollers v is shown on the platform U in the plan view, Fig. 12. This transverse shaft u^2 is driven by a pulley, u^3, at its one end through a band, u^4, from a pulley, u^5, on the spindle of the pulleys l^3 at l^4, which drives the delivery rollers and bands $l\,l'$ to deliver the sheets T onto the platform U under the lower rollers v and their bands v' to be folded up by thin knife-blades w, mounted on a second transverse oscillating spindle, w', as a rocking lever-frame, with the knife-blades w each projecting out under the folding grooves or slots U′ in the platform U and adapted to pass through the same. The revolving spindle u^2 and oscillating spindle w' are both carried in journal-bearing brackets W, bolted to the arms Q, carrying the delivery-platform U, and a little in front of this, and the spindle w' is actuated by the oscillating lever-arm w^2 through a connecting-rod, w^3, from an eccentric, w^4, on the front lower main revolving shaft, C^4. Thus the feeding-rollers v and their bands v' are continually revolving, and the eccentric w^4 and oscillating lever w^2 are so set on their shafts that the knives w come up through their grooves or slots U′ in the platform U and fold the sheets T over these at the perforated divisions T′ just after the set of sheets T are delivered onto the platform U, the perforated divisions T′ assisting the sheets to take the crease and fold on the knives w and be caught between the rollers v and bands v' as the knives w rise. The eccentric w^4 and lever w^2 would take the knives w down out of their grooves or slots U in time before another set of cut sheets T were fed forward from the delivery-rollers l' on the platform U. The rollers v and their bands v' then deliver the sheets T up over the top rollers v to one side or the other onto a light platform, as shown in dotted lines at X, or down over and into an angled chute or other convenient receptacle, (as indicated at x on one side of the three sets of folding and delivery rollers, and bands v, indicated in Fig. 13,) all regularly over each other in sequence as numbered, perforated, cut off, folded, and thus delivered ready for being taken away by hand to be bound without requiring any collating or arranging.

By a further improvement, which it is not necessary to illustrate, this doubling and feeding in of the sheets T at the weak perforated parts T′ into the creasing and folding rollers v may be wholly done or assisted by a slight blast of air from the tube of a small bellows or blower for the purpose fitted below the V knife-groove and lower folding-rollers v.

When it is desired to have letter-press printing done on the under side of the tickets T, instead of printing numbers only with a duplicate set of the numbering chain mechanism, it is done by mounting in the space where the under chain mechanism, F′ f', has been shown an inverted arrangement of the reciprocating printing-bowl E′ in vertical slotted guides on the side frames, with its flat type-face and printing-surface of the type on top, in this case reciprocated up toward the paper, P, and platen R′, which in this case may be mounted in swiveling bearings in the side frames close over the paper for printing. The bowl E′ would then be brought sufficiently down below the paper to allow the inking-frame E^4 of the rollers E^3 to clear it and ink the type on its upper flat surface actuated by the improved arrangement of the pitch-chains E^2 and their eccentric driving and spring compensating pitch-chain pulleys a and c, rod c', and helical spring c^2, all from an extra transverse shaft below and at the back of the first motion-shaft, B, to which it would be geared, and actuated as in the arrangement hereinbefore described for doing the letter-press printing on the top surface of the paper and sheets after the numbers have been printed thereon by the special arrangement of chain numbering mechanism F f therefor.

In some cases, instead of printing the numbers by endless chains f, as before described, narrow-faced divided and figured disks may be used to so print the numbers on the sheets or tickets by mounting these disks on oscillating cross-spindles F^3 and having pinching-screws in their eyes for setting and fixing them on their spindles in proper position, as and instead of the numbering chain wheels f^2. These numbering disk-wheels would be turned by a ratchet-wheel on their spindle one tooth at a time by a pawl-lever arrangement to bring each number in line to print on the paper below, and the figure for the time-printing might do so through a recess in a thin guard on the lower side of the disk over the paper, by a narrow cross-padded bar platen, o, below the paper, which would insure the proper printing of the number brought into position without the adjacent figures on the disk touching the paper. Small numbering-wheels of this character may be mounted on transverse spindles analogous to those F^3 and close to these for printing an index number or letter in addition to the regular sequential page-number and set and fixed by pinching-screws on their spindles in any desired position over spring-bolsters o of their own.

Having now particularly described the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In an intermittent web-printing machine for printing sheets or tickets in sequence, the printing-bowl E′, for printing letter-press, the

shaft C^4, and side rod, D, for raising and lowering the same, the frame E^4, carrying the inking-rollers, the driving-chain E^2, compensating motive eccentric, and spring take-up fitting, all substantially as and for the purpose set forth.

2. In a web-printing machine, the combination of two reciprocating frames, each carrying a series of numeral-printing chains and arranged one above and one below the web, with the reciprocating letter-press printing mechanism and the intermediate adjustable spindles registering the several impressions, substantially as described.

3. In a web-printing machine, the frames F, carrying numeral-printing chains and arranged one above and one below the web, and the letter-press printing mechanism, substantially as described, combined with the crank-shafts C^3 C^4, geared together, the pitmen D' D^2 S, and the lever S', substantially as described.

4. In a web-printing machine, the numeral-printing frames arranged above and below the web, and the letter-press printing mechanism, as described, reciprocated by crank-shafts, pitmen, and levers, as set forth, in combination with the intermittingly-rotated cutting-disks and perforating-wheels, and the cutting-knife, the crank-disk G, the pawl-and-ratchet feed geared to said disks and wheels, and the brake securing positive stop to the feed.

5. In a web-printing machine, the numeral-printing frames, the letter-press printing-mechanism, as described, the cutting-disks, perforating-wheels, and transverse cutting-knife, all intermittingly operated, as set forth, in combination with the series of folding-frames mounted over the slotted table receiving the sheets, and the folding-blades working through the table.

6. In an intermittent web-printing machine for printing and cutting sheets or tickets, the endless driving-cord i^3, its grooved driving and guide pulley i^2 i^4, for actuating the feed-delivery rollers i i', the cross-cutting knife mechanism, and the compensating and tension-regulating spring mechanism i^5 i^6, substantially as and for the purpose set forth.

In testimony whereof I have hereto set my hand in the presence of two subscribing witnesses.

DAVID CARLAW.

Witnesses:
A. PHILLIPS JOSH,
JOHN WATSON,
Both of 183 *St. Vincent Street, Glasgow, Clerks at Law.*