(No Model.) 2 Sheets—Sheet 1.

D. T. SIMPSON.

WEB PERFECTING CYLINDER PRINTING MACHINE.

No. 345,079. Patented July 6, 1886.

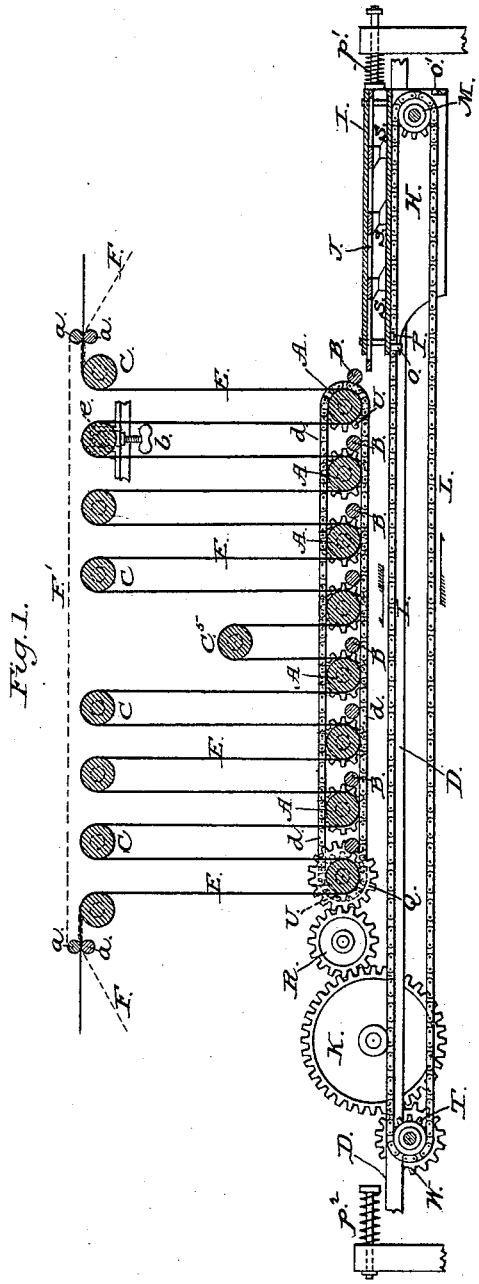

Fig. 1.

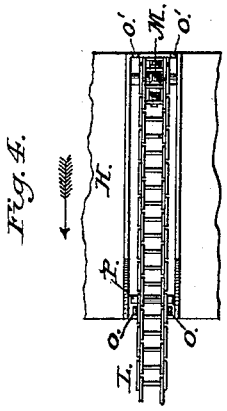

Fig. 4.

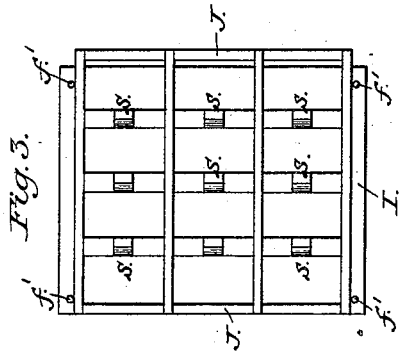

Fig. 3.

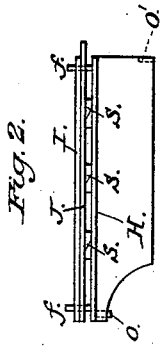

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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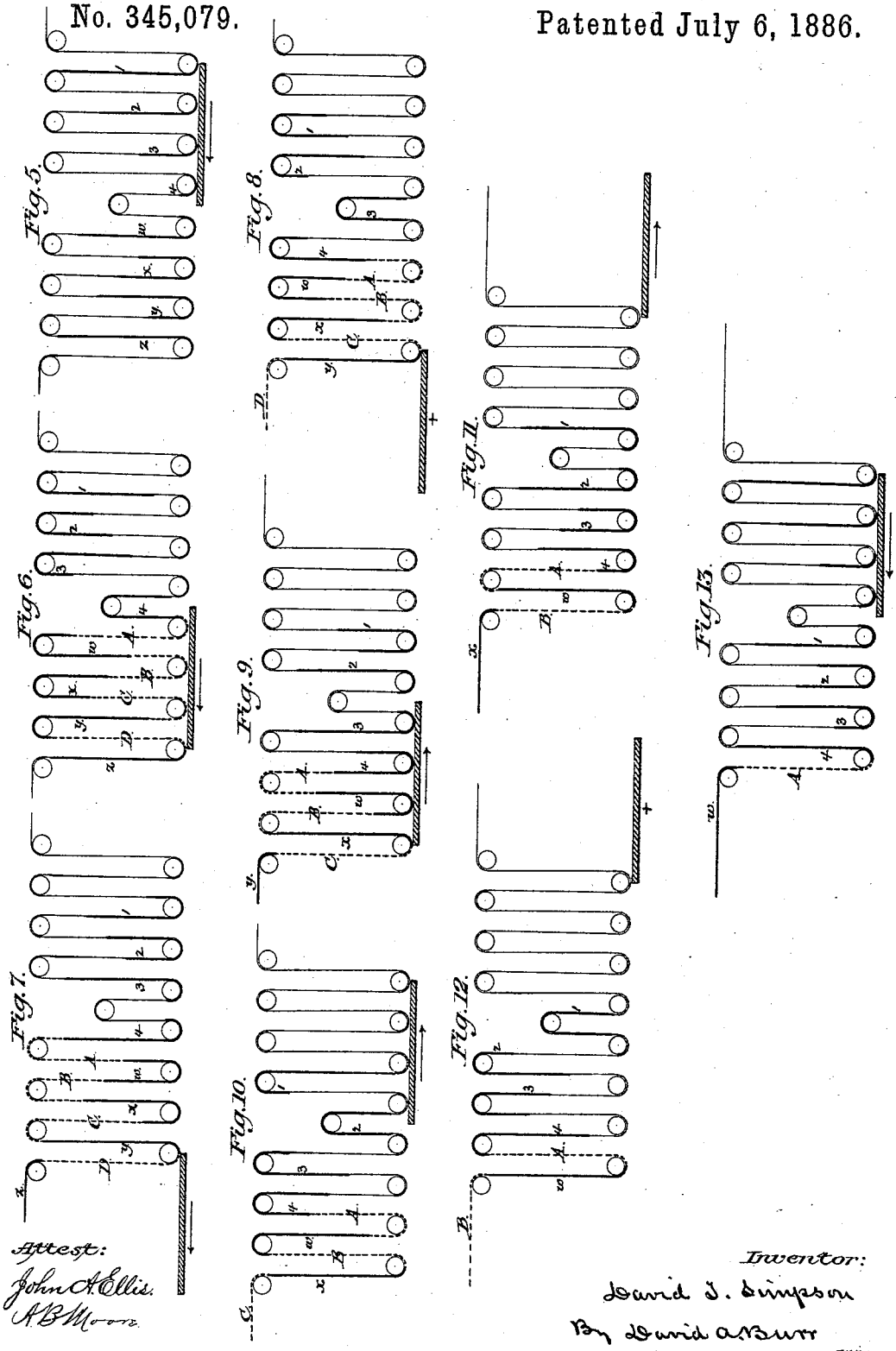

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UNITED STATES PATENT OFFICE.

DAVID TRAQUARE SIMPSON, OF NEW YORK, N. Y.

WEB-PERFECTING CYLINDER PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 345,079, dated July 6, 1886.

Application filed March 28, 1884. Serial No. 125,943. (No model.) Patented in England August 20, 1883, No. 4,020, and in Canada November 7, 1884, No. 20,512.

To all whom it may concern:

Be it known that I, DAVID TRAQUARE SIMPSON, of New York, in the county and State of New York, have invented a new and useful Improvement in Web-Perfecting Cylinder Printing-Machines, (for which Letters Patent were granted to me in England, No. 4,020, bearing date August 20, 1883, and in Canada, No. 20,512, bearing date November 7, 1884;) and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, making a part of this specification.

My invention relates to that class of printing-presses in which repeated impressions are produced from a single form upon a continuous web or sheet of paper, and has for its object to obtain the repeated impressions upon the web from a flat form of type, thereby avoiding the complexity and great cost of cylinder-machines.

In the accompanyings, Figure 1 is a longitudinal vertical section of the machine with the greater part of the frame omitted, illustrating its operation rather than its construction, and showing one only of the movable bearings in which the upper cylinders are all mounted, the frame carrying the form being shown as elevated in readiness to carry the form under the impression-rollers; Fig. 2, a detached side view of the carriage and of the device or frame for elevating and depressing the form on said carriage, the frame being shown as depressed in readiness to pass back freely under the rollers; Fig. 3, a bottom view of said frame or elevating device; Fig. 4, a bottom view, detached, of a portion of the carriage and of the carrying belt or chain under it; Figs. 5 to 13, diagrams illustrating the relative movements of the web of paper and reciprocating form and the manner in which the impressions are repeated upon the paper.

In my invention I carry the continuous sheet or web of paper E to be printed back and forth over a series of cylinders, A A, and intermediate conveying-rollers, C C, all of equal diameter, and which are mounted in two parallel horizontal rows. The axes both of the cylinders and of the rollers are at exactly equal distances apart, the impression-cylinders being placed midway between the conveying-rollers, and, by preference, the intervals between them equal their diameter, so that the peripheries of the cylinders and rollers shall be in the same vertical longitudinal plane. The upper or conveying-rollers, C C, are mounted severally in bearings *e*, which admit of vertical adjustment in the customary manner by means of a set-screw, *b*. (See Fig. 1.) The distance vertically between the axes of the upper conveying-rollers, C C, and of the lower impression-cylinders, A, is made at least equal to the length of the form of type to be printed, with the exception of the middle conveying-roller, C^5, whose axis is mounted at a little more than one-half the distance of the others above the impression-cylinders. This middle roller I designate as a "spacing-roller."

In adjusting the conveying-rollers their distance above the impression-cylinders is determined by the length of paper required to receive an impression from the form. The distance from the center of the semi-circumference of either one of two impression-rollers below its axis, up over the intermediate conveying-roller, and back to a corresponding point on the other impression-roller must be equal to twice said length of paper plus the distance between the two impression-rollers. So also the distance up over the spacing-roller C^5 from the center of the under side of the impression-rollers, on each side of it, must be equal to said length of paper plus the distance between the impression-rollers.

It will be observed that the conveying-rollers are divided into two sets of equal numbers by the intervening middle spacing-roller, C^5. The number of rollers on each side of the central spacing-roller will determine the number of impressions to be made before the intervening blanks are filled up, and may be varied.

Inking-rollers B B are mounted between the impression-cylinders parallel therewith and in position to contact in the usual manner with the form of type.

The conveying-rollers C C and spacing-roll-

er C^5 are geared to the impression-cylinders A A by means of a pair of endless tapes or belts, F F', passing over the rollers and under the cylinders in the entire series and between guide-rollers *a a* at each end of the series, as shown in Fig. 1. These tapes serve likewise to support the web E of paper and aid its progress through the machine.

The impression-cylinders A A, divided into two sets by the spacing-roller C^5, are adapted in the customary manner to operate each in turn to bear the web of paper carried around them from the conveying-rollers upon a form of type made to pass horizontally under them. These impression-cylinders A A are all geared to move in unison by an endless chain, *d*, engaging a sprocket-wheel, U, on the end of each, or by other well-known mechanical devices, and are driven by means of a cog-wheel, Q, on the shaft of the last impression-cylinder in the series, which gears with a main driving-wheel, K, by means of an intermediate pinion, R.

The form of type to be used in the press is secured upon a table or platform, I, supported upon a carriage, H, the table being elevated or depressed upon the carriage by means of an interposed frame, J, resting upon suitable ways on the top of the carriage, which permits a slight longitudinal movement of the frame upon the carriage.

The opposed surfaces or ways upon the under side of the frame and top of the carriage may be fitted with a series of oppositely-inclined or beveled lugs, S S S, (see Figs. 2 and 3,) projecting therefrom to slide one over and upon the other, so that the movement of the frame J in one direction will operate to elevate it from the carriage, (see Fig. 1,) and in the opposite direction will serve to lower it, (see Fig. 2;) but this device for elevating the frame does not constitute a part of my invention. The interposed frame J is made narrower and longer than the table I and top of the carriage H, so as to be confined laterally by means of pins *f f* at each corner of the carriage. These pins are long enough to project up through apertures *f'*, Fig. 3, in the table I, so as to confine it both laterally and longitudinally and yet permit its free vertical play.

The carriage H is mounted to slide freely back and forth upon a horizontal way, D, Fig. 1, secured beneath the impression-cylinders A A, and which extends longitudinally under and beyond the entire series in a plane parallel with the axes of said cylinders, and at such a distance below them as that when the table I of the carriage is elevated the form of type placed thereon shall, as the carriage moves under the cylinders A, come into sufficient contact therewith to produce an impression from the type upon the paper E overlying the cylinder.

The movement of the carriage back and forth over the way D is produced automatically by devices to be hereinafter described, which cause it to engage alternately the upper and the lower length of an endless chain, L, stretched horizontally under the way D, parallel therewith, and which is carried at each end over sprocket-wheels T and M. The length of the chain is so proportioned as that the carriage shall move forward and back in exactly the time required for the paper to pass from the contact or printing point under the first impression-roller of the first set in advance of the spacing-roller to the like point on the first cylinder of the second set, following said spacing-roller, so that so soon as the form has passed from under the first cylinder in the first set and fully completed its imprint on the paper led over said cylinder it will at once begin to print upon the paper over the first cylinder of the second set, so as to cover the space on the paper left between the first and second impressions next before imprinted thereon. (See Figs. 5 and 13.)

The chain L is made to move at the same speed as the cylinders A A and conveying-rollers C C and C^5 by means of a suitable gear-wheel, W, coupling the sprocket-wheel T, which drives the chain L, with the driving-wheel K actuating the impression-cylinders. The movement of the chain *d* and of the paper carried over the impression-cylinders is thus made uniform with that of the chain L, and, consequently, of the carriage H and form.

The engagement of the carriage with the endless chain L is produced in simple manner by means of a bar, P, (see Fig. 4,) secured transversely upon the chain to project laterally therefrom and strike against pins or lugs O O, secured to one end of the carriage in line with the upper length of the chain. When the bar P in the movement of the chain (see arrows in Fig. 1) strikes these lugs O O, it will carry the carriage forward in the same direction until the lugs are carried over the axis of the sprocket-wheel T, when, as the bar is carried down over the periphery of the wheel, it will drop away from the lugs; but as the bar P starts back with the lower length of the chain it strikes against a second set of lugs or pins, O', projecting from the lower portion of the frame of the carriage at its opposite end in line with said lower length of the chain, and thereby operates to carry the carriage back in the direction in which the lower length is moving until said lower lugs, O', pass under the sprocket-wheel M, when the bar P, passing up over its periphery, will become disengaged, and, moving forward, will again engage the first lugs, O, and thereby move the carriage in the opposite direction.

The longitudinal movement of the frame J, by which the table I is elevated or depressed upon the carriage M, is produced automatically by means of springs p' and p^2, fixed at each end of the path in which the carriage reciprocates. When the carriage has been carried forward beyond the impression-cylinders to the required distance, the forward end of the frame J is made to strike against the end of

the spring p^2, and thereby force the frame inward, so as to cause the upper lugs, S, to slide downward over the lower ones and allow the frame J and the superimposed form-table I to drop, and permit the type thereon to pass clear of the impression-cylinders. When the carriage moving back reaches the end of its path, the rear end of the frame J, striking the spring p', forces the frame back and causes the upper lugs to slide up over the lower ones, and thereby force up the frame and table to their highest position to bring the type into contact with the impression-cylinders. When the frame J and table I strike the springs p' p^2, the recoil of the springs serves to quickly reverse the movement of the carriage upon which the frame and table are secured, and to start it back in readiness to be engaged by the bar P on the endless chain L. This will prevent any shock or jar when the bar strikes the lugs O O on the carriage, from the fact that the carriage and its lugs O O will have been thereby brought into movement in the same direction as that of the bar before the bar overtakes it.

In the operation of the machine, constructed substantially as described, a continuous sheet or web of paper, E, drawn from a roll (not represented in the drawings) is carried over the first upper or conveying roller, C, then down under the first impression-cylinder A, then up over the second conveying-roller, and so on, over and under the entire series of rollers and cylinders, as illustrated in Fig. 1 of the drawings. If, now, the machine be put in motion, the form of type on the table I will be carried forward longitudinally under the impression-cylinders A A at the same rate of speed as the web of paper E is moving. As the form passes in succession under each cylinder a full impression of the form will be obtained upon the web of paper. This is illustrated in the diagram, Fig. 5, which represents the form as having passed entirely under the first impression-cylinder, A, after having already passed once forward and back under both sets. The first impression therefrom, numbered 1 and represented by a dark heavy line, is complete, and the movement of the paper is carried up between the first impression-cylinder and the second conveying-roller, while the fourth impression-cylinder has commenced the printing of a fourth impression, which is numbered 4. This fourth impression-cylinder is the last of the first set separated from the second set by the intervening middle spacing-roller, C^5.

The diagram, Fig. 6, represents the form in position with the fourth impression from the first set of cylinders completed, the first impression, A, in the second series already completed, and the fourth or last, D, in said second series about to begin, and illustrates the movement of the paper meanwhile. Fig. 7 represents the fourth impression, D, in the second series completed, the form having passed out beyond the last cylinder. The carriage H is now automatically disengaged, in manner as hereinbefore described, from the upper length of the endless driving-chain and is made to engage the lower length to secure its return movement, and at this point the form is depressed upon the carriage in manner as already described, so that it shall pass clear of the impression-cylinders as it returns under them. During the interval that the carriage remains stationary from the time of its disengagement from the chain until its re-engagement, the web of paper E, whose movement is continuous, has been carried forward a distance equal to the length of the form, and Fig. 8 illustrates the travel of the printed sheet and of the impressions thereon during this interval, the series from the first set of cylinders being indicated by the heavy lines and numbered, and those from the second set by dotted lines and lettered. Fig. 9 represents the position attained by these impressions when the form has traveled its length upon its return movement, Fig. 10 when it has moved twice its length, and Fig. 11 when it has moved three times its length and out beyond the first set of cylinders and has reached its original starting-point. Here it is automatically released from the lower length and attached to the upper length of the driving-chain to be started back under the cylinders, the form being automatically elevated again at this point in manner as described to bring it into line of print; and Fig. 12 illustrates the positions which in the meantime the impressions reach during the continous movement of the web while the carriage is stationary. Fig. 13 represents the form as again under the first set of cylinders, as in Fig. 5, having made a complete impression upon the web of paper in passing under the first cylinder and partial impressions thereon under the remaining three cylinders of the first set. The web of paper in the first diagram, Fig. 5, is represented as having already received an initial set of four impressions from a previous passage under the form, these initial impressions being designated by the letters *w*, *x*, *y*, and *z*, the positions of these several impressions serving to illustrate the distance to which the impressions obtained from the first set of rollers will travel during one complete reciprocating movement of the form forward and back in the press. It will be observed by reference to Fig. 6 that the position attained by these first impressions *w*, *x*, *y*, and *z* when the next set of impressions 1, 2, 3, and 4 (obtained from the first set of cylinders, as shown in Fig. 1) is completed is such as that the blanks left between said first impressions will be in exact register for print when the form passes under the second set of cylinders; hence at the second movement of the form through the press the blanks between these first impressions printed at its preceding movement will all be filled in, as shown at A, *w*, B, *x*, C, *y*, D, and *z* in Figs. 6 to 12, the printing of the intervals between 1, 2, 3, and 4 being illustrated in Fig. 13 as about to take place. This registry with the second set of cylinders

of the blank spaces or intervals between the impressions obtained by means of the first set of cylinders, so that the form in passing under the second set of cylinders shall print and fill in these blank spaces, is due to the arrangement of the central spacing-roller, C^5.

It is evident that the number of impressions to be obtained before the spacing is changed to bring the blank intervals into registry for print may be determined at pleasure by the number of cylinders introduced in the first set in advance of the central spacing-roller, the number to follow being made to correspond; also, that the press may be adjusted to forms of different lengths or the distance between the impressions on the web of paper, if intervals are required between them, may be adjusted by changing the distance between the impression-cylinders and conveying-rollers or the length of their diameters relatively to said distance, and that the mechanical construction of the machine to carry the cylinders and rollers and to produce a reciprocating movement of the flat form of the type under the same may be greatly varied in such different ways as will readily suggest themselves to any skilled mechanic.

I claim as my invention—

1. The combination, in a printing-machine with a series of impression-cylinders rotating at equal speed at equal distances apart in a common plane, of a reciprocating form-carriage traversing their peripheries at a like speed to carry a form of type intermittingly against and over the same, a parallel series of conveying-rollers rotating at the same speed as the impression-cylinders, and a central parallel spacing-roller mounted midway between the impression-cylinders and conveying-rollers, substantially in the manner and for the purpose herein set forth.

2. A printing-machine comprising a series of impression-cylinders rotating in a common plane, a parallel series of conveying-rollers, a central intermediate spacing-roller, an endless tape or belt carried back and forth over the cylinders, the conveying-rollers and the spacing-roller, a reciprocating form-carriage traversing the impression-cylinders in a parallel plane, and mechanism, substantially as described, for producing a reciprocating movement of the carriage back and forth under the impression-cylinders during each movement of the endless tape or belt from a point on the periphery of the impression-cylinder on one side of the spacing-roller to a like point on the periphery of the impression-cylinder next to said spacing-roller on its opposite side, substantially in the manner and for the purpose herein set forth.

3. The combination, with a series of parallel impression-cylinders, A A, rotating in a common plane, and with a carriage, H, mounted to travel back and forth transversely under said cylinders in a parallel plane, of an endless chain carried over sprocket wheels or rollers beyond each end of the series of impression-cylinders to revolve under the same parallel therewith, and a bar, P, projecting from said chain to engage in succession lugs O O′, placed on the under side of the carriage at each end thereof on a different level, and whereby the continued revolution of the chain is made to draw the carriage back and forth under the cylinders, substantially in the manner and for the purpose herein set forth.

4. The combination, with the reciprocating carriage H and its sliding adjusting-frame J, interposed between the top of the carriage and a form-table, I, thereon, of the springs *p p′*, fixed upon standards at each end of the path of movement of the carriage, to strike said frame J, and thereby change its position and arrest the movement of the carriage and produce its recoil, substantially in the manner and for the purpose herein set forth.

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Witnesses:

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