No. 618,252. Patented Jan. 24, 1899.

J. MEYRUEIS.

MACHINE FOR PRINTING IN COLORS.

(Application filed Dec. 7, 1898.)

(No Model.) 7 Sheets—Sheet 1.

Fig. 1.

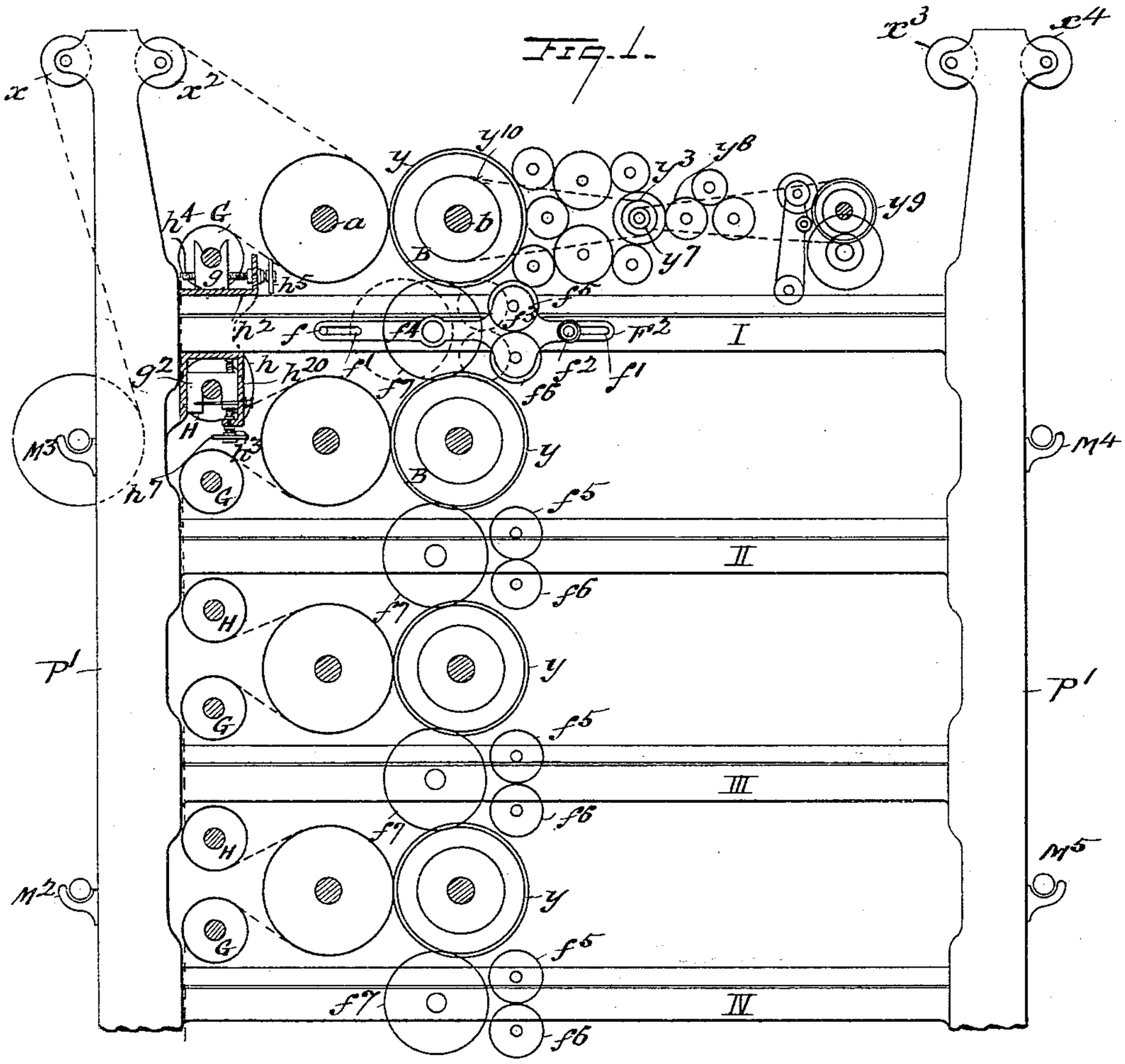


Fig. 10.

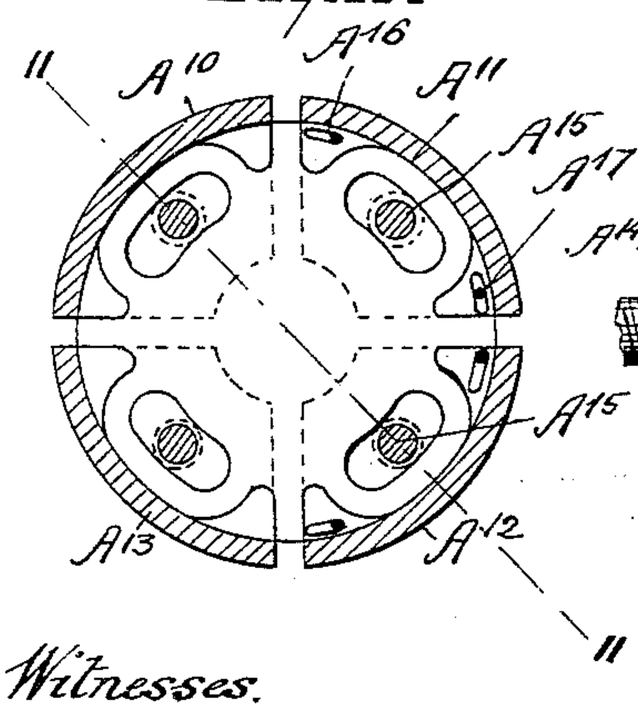
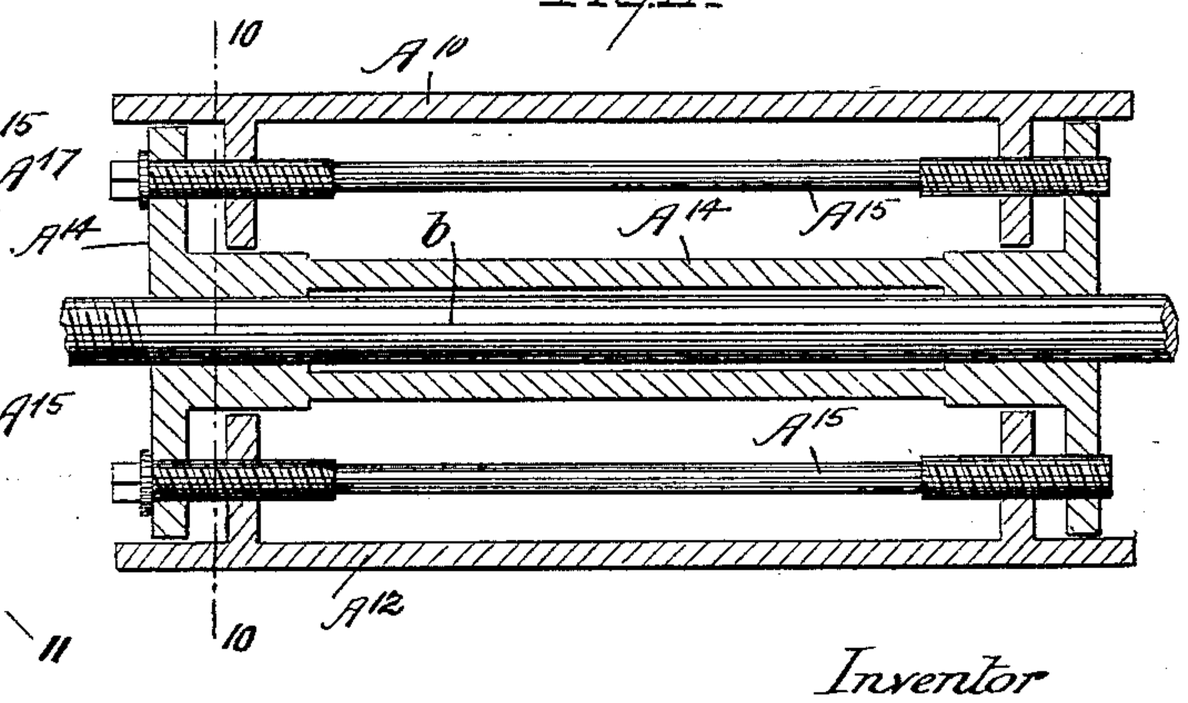


Fig. 11.



Witnesses.
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No. 618,252. Patented Jan. 24, 1899.

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MACHINE FOR PRINTING IN COLORS.

(Application filed Dec. 7, 1896.)

(No Model.) 7 Sheets—Sheet 2.

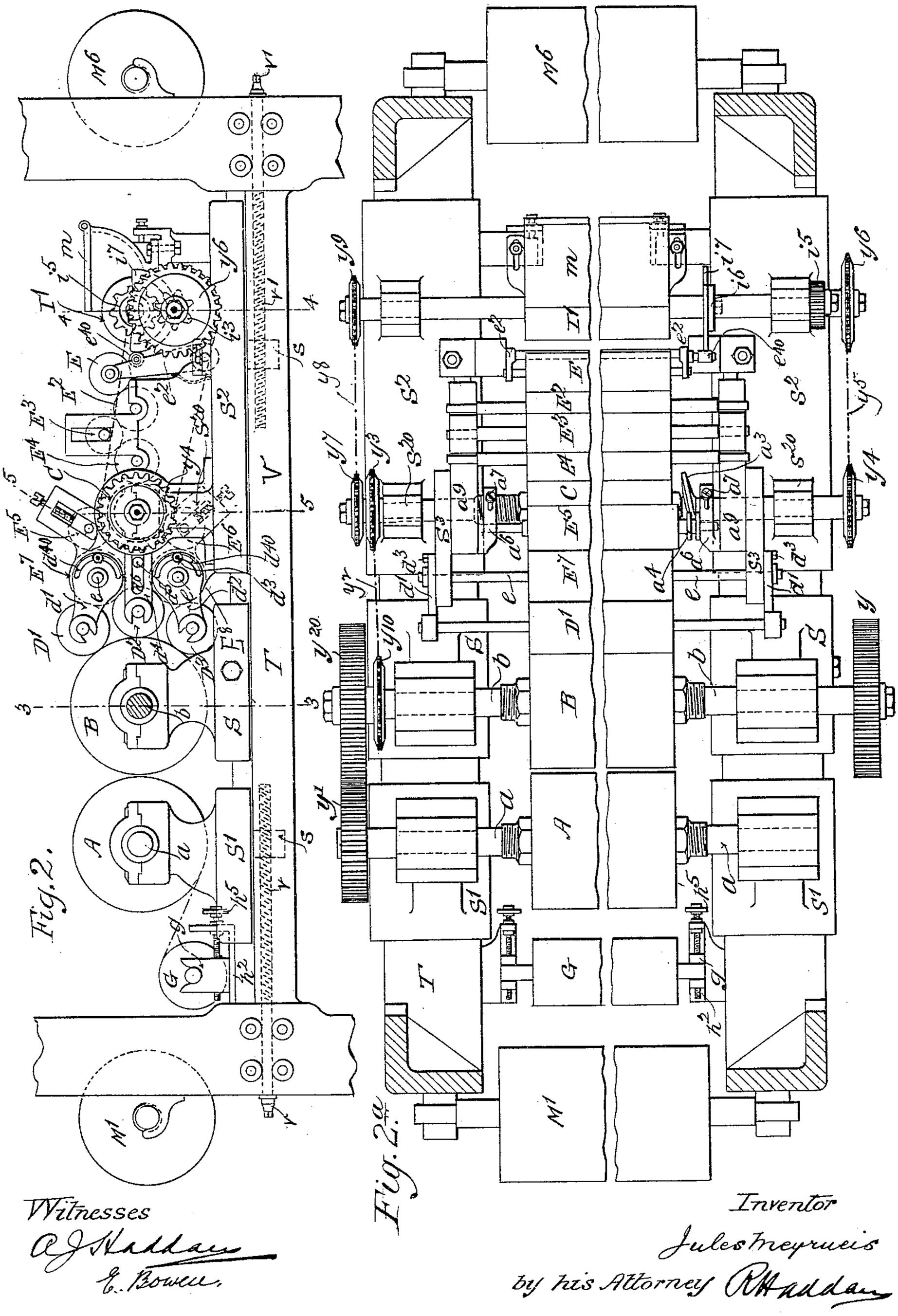

Fig. 2.

Fig. 2a.

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No. 618,252. Patented Jan. 24, 1899.

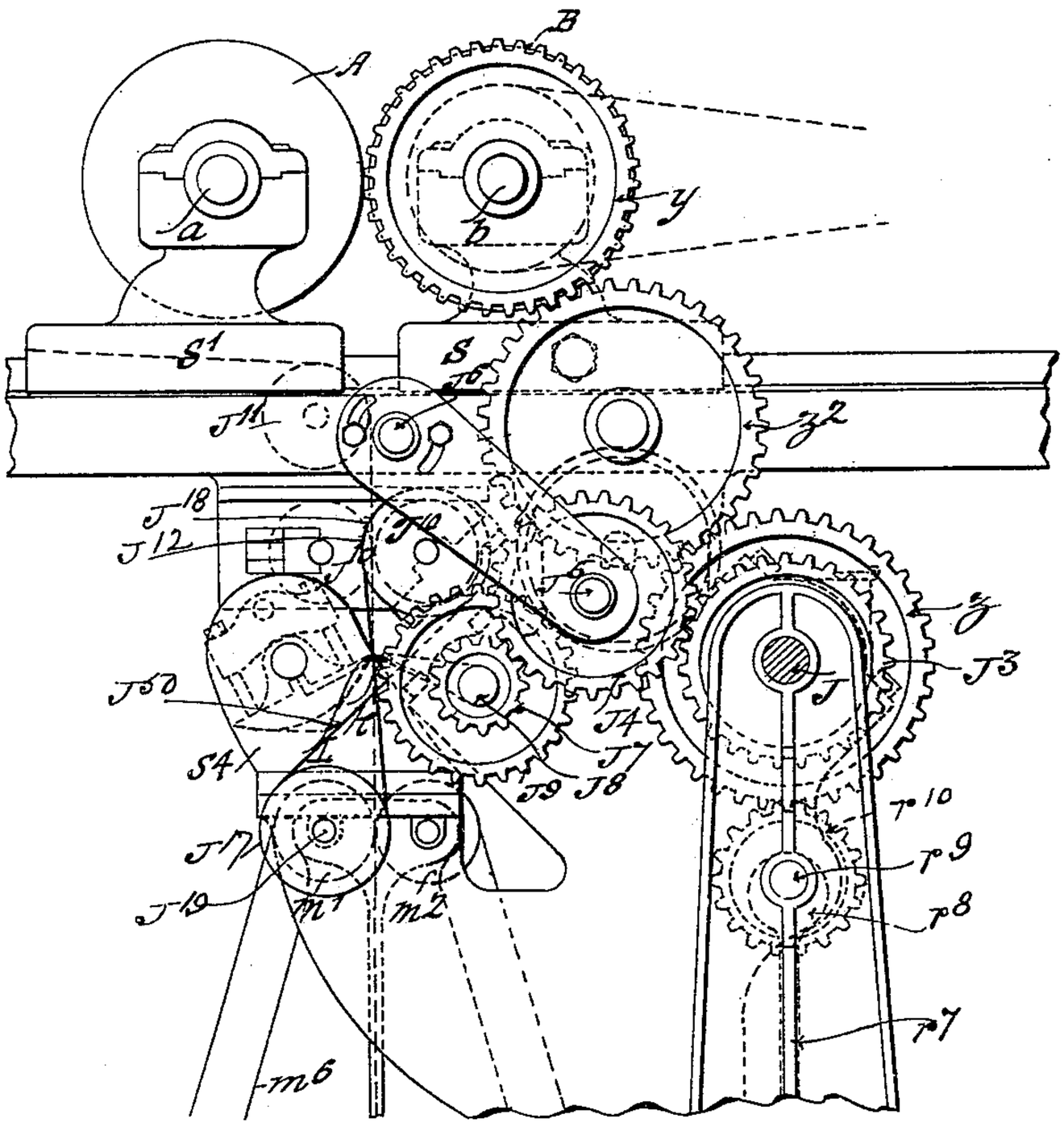
J. MEYRUEIS.

MACHINE FOR PRINTING IN COLORS.

(Application filed Dec. 7, 1896.)

(No Model.) 7 Sheets—Sheet 3.

Fig. 2b



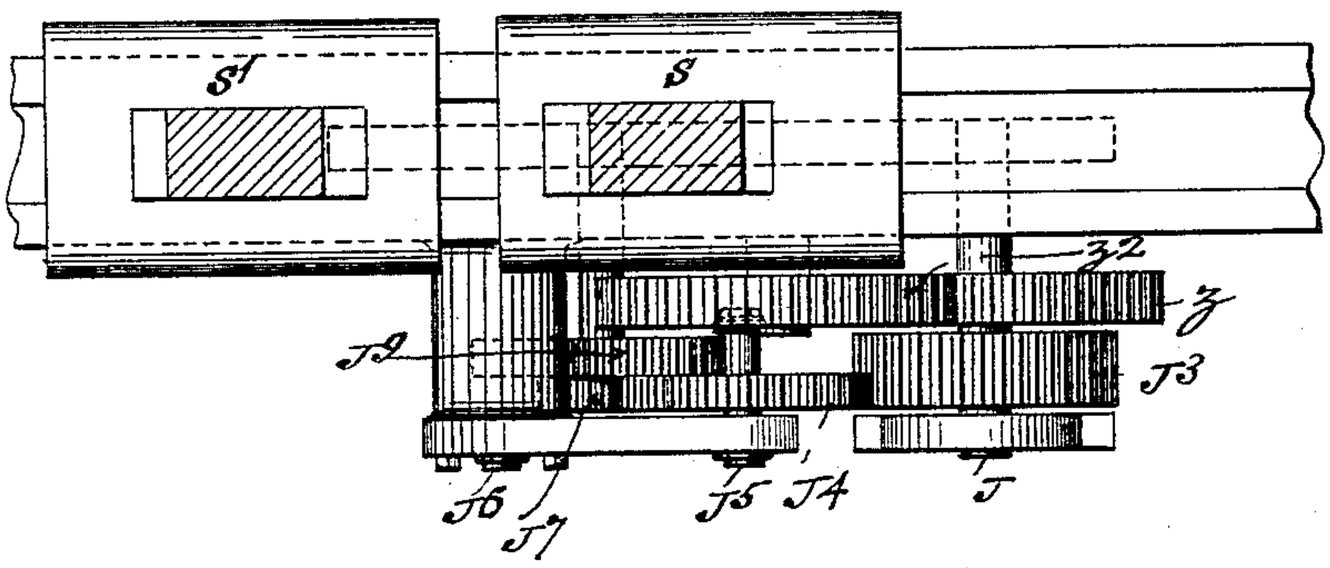


Fig. 2c.

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No. 618,252. Patented Jan. 24, 1899.

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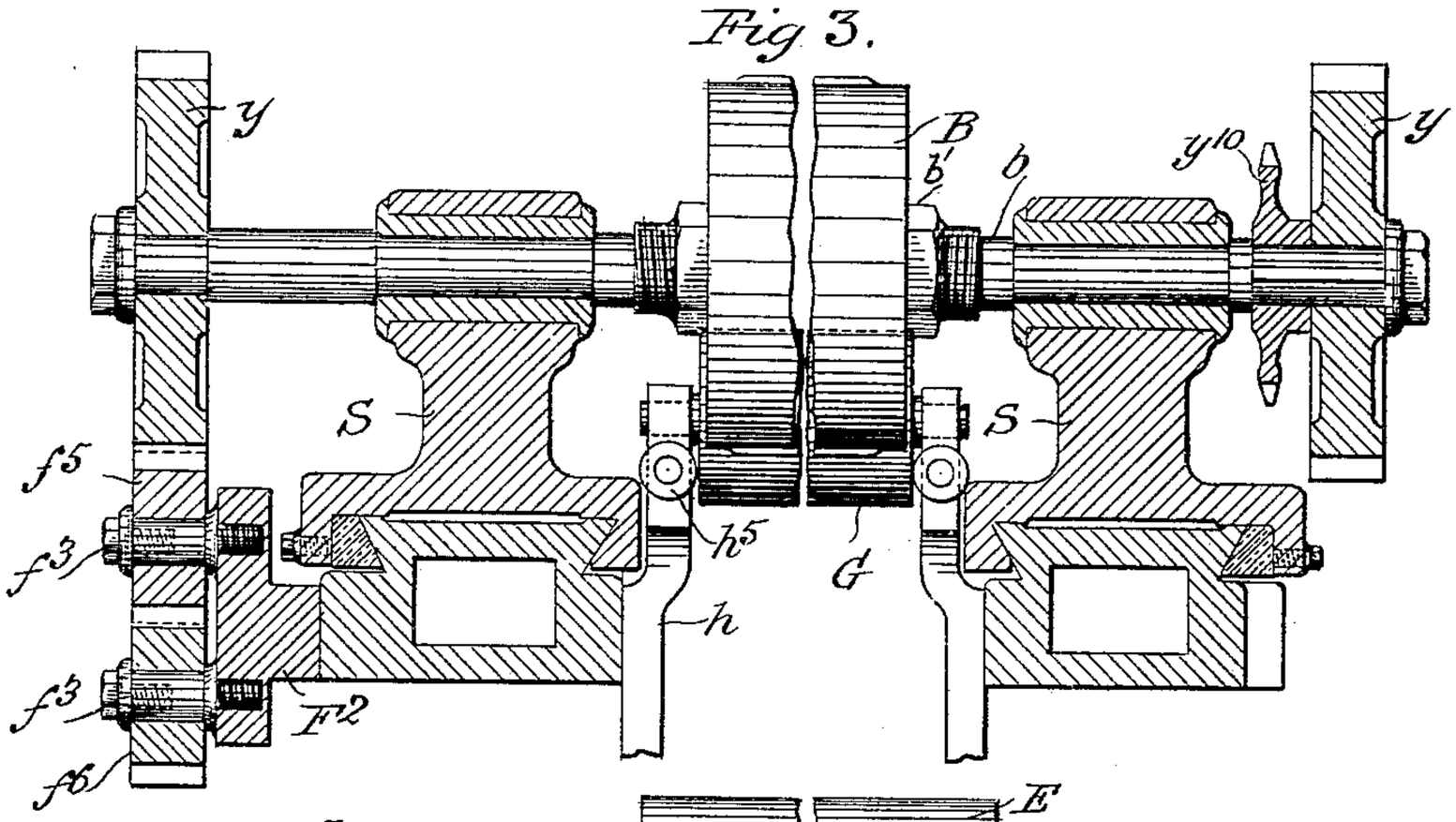
MACHINE FOR PRINTING IN COLORS.

(Application filed Dec. 7, 1896.)

(No Model.) 7 Sheets—Sheet 4.

Fig 3.



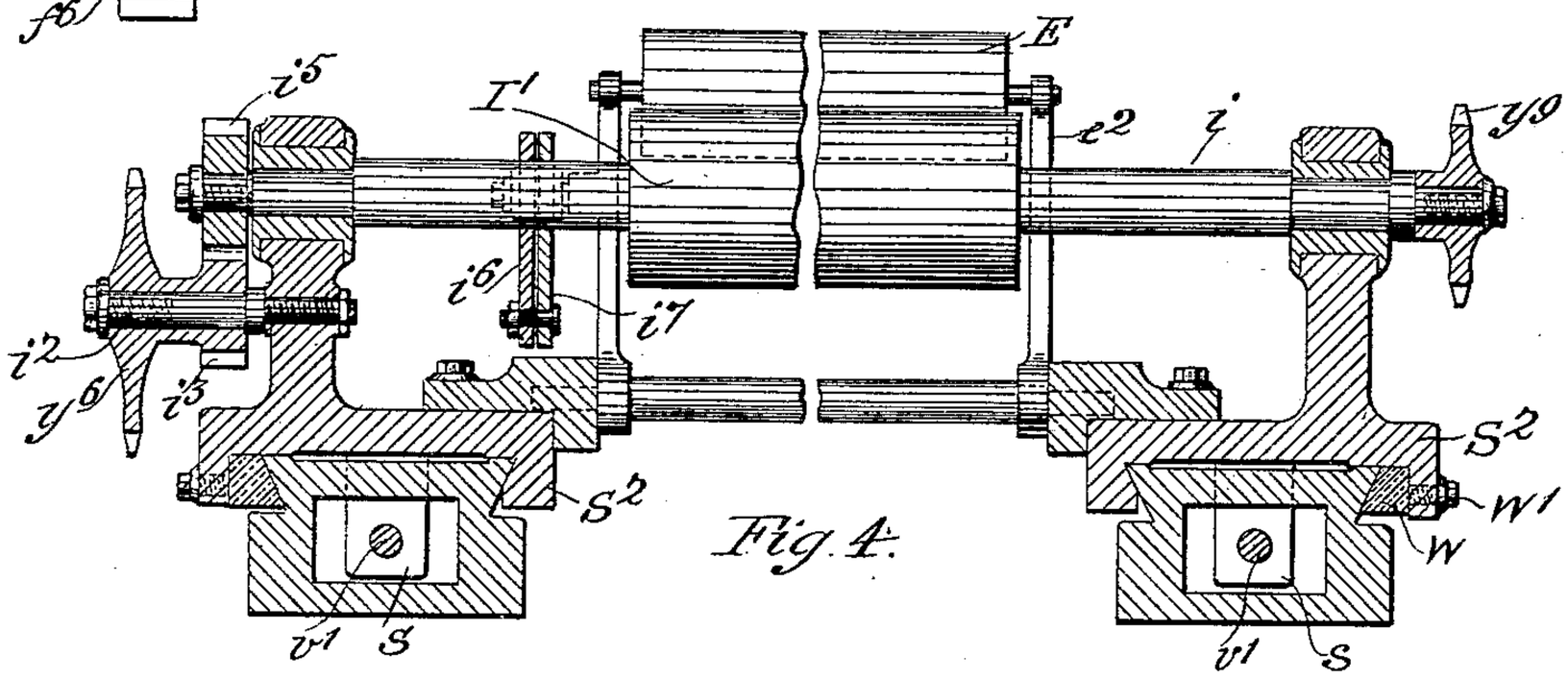


Fig. 4.

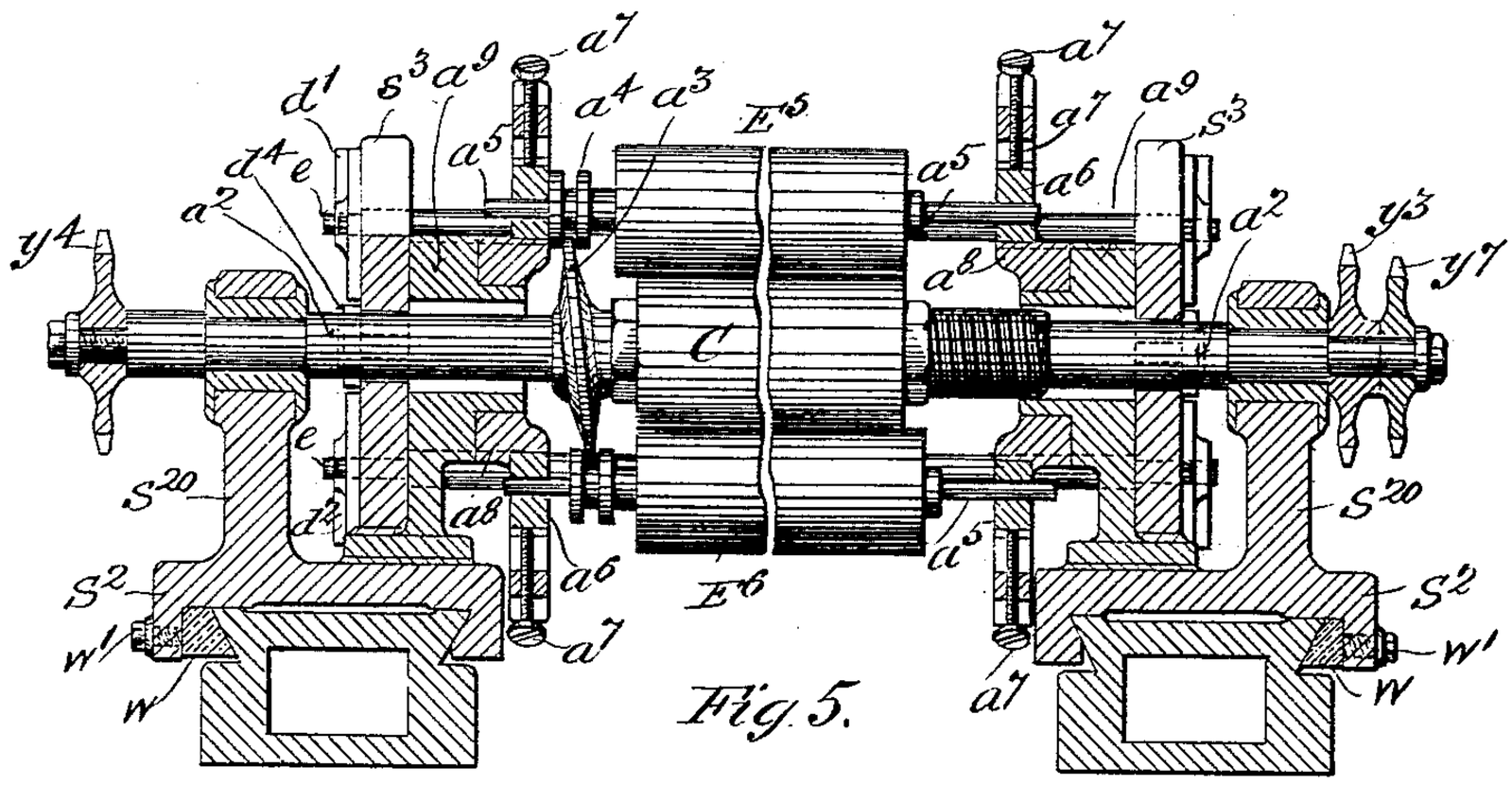


Fig. 5.

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No. 618,252. Patented Jan. 24, 1899.

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MACHINE FOR PRINTING IN COLORS.

(Application filed Dec. 7, 1896.)

(No Model.) 7 Sheets—Sheet 5.

Fig. 6.

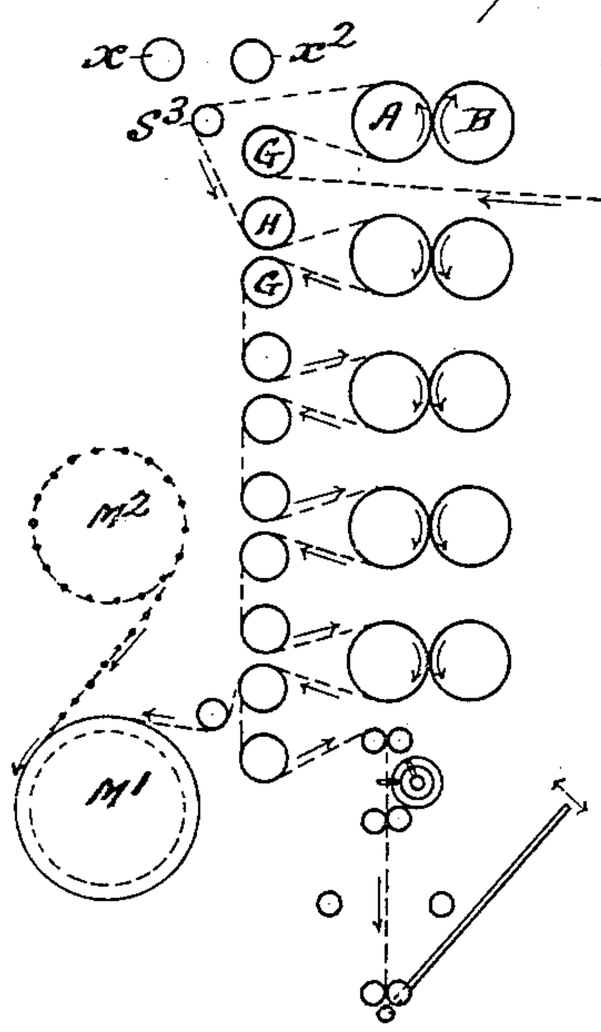


Fig. 7.

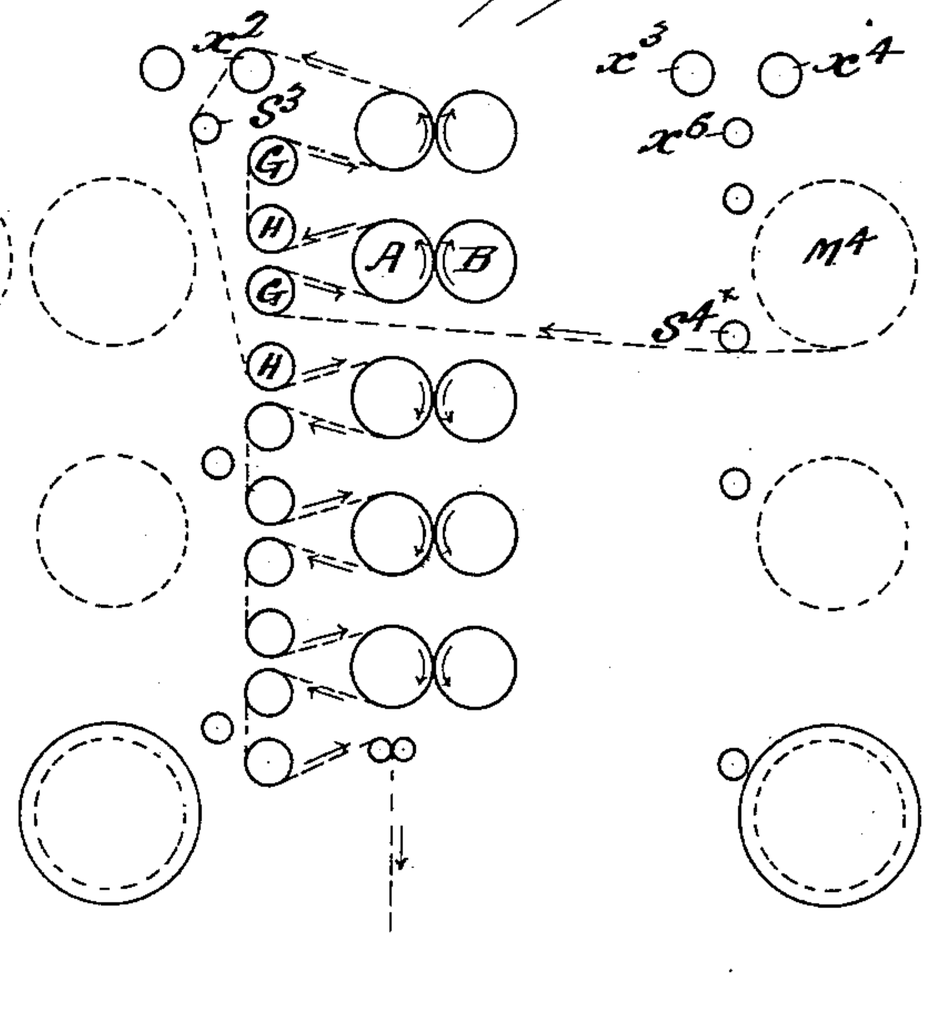


Fig. 8.

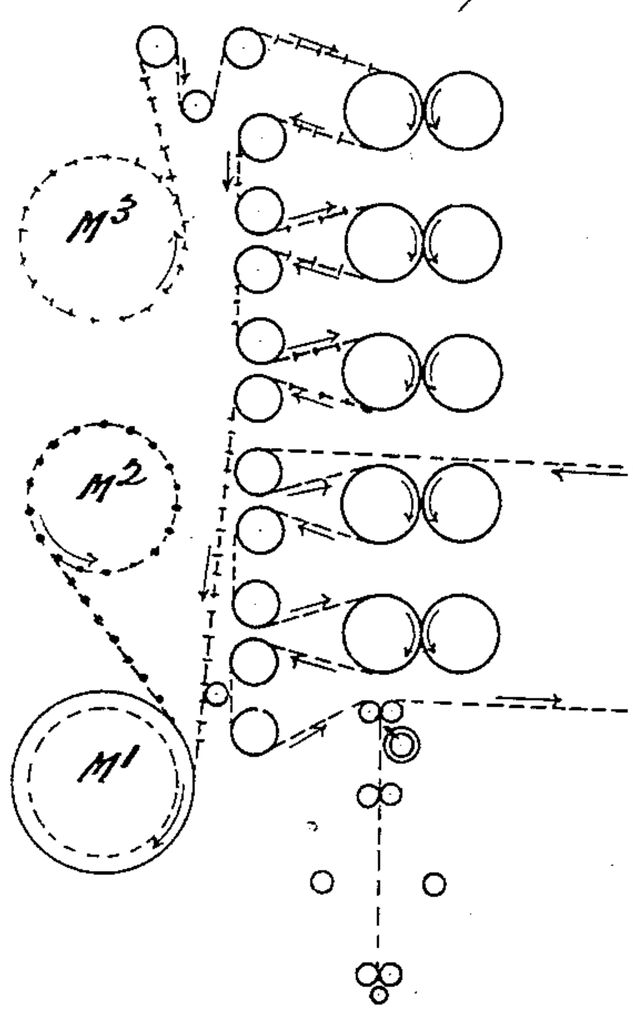
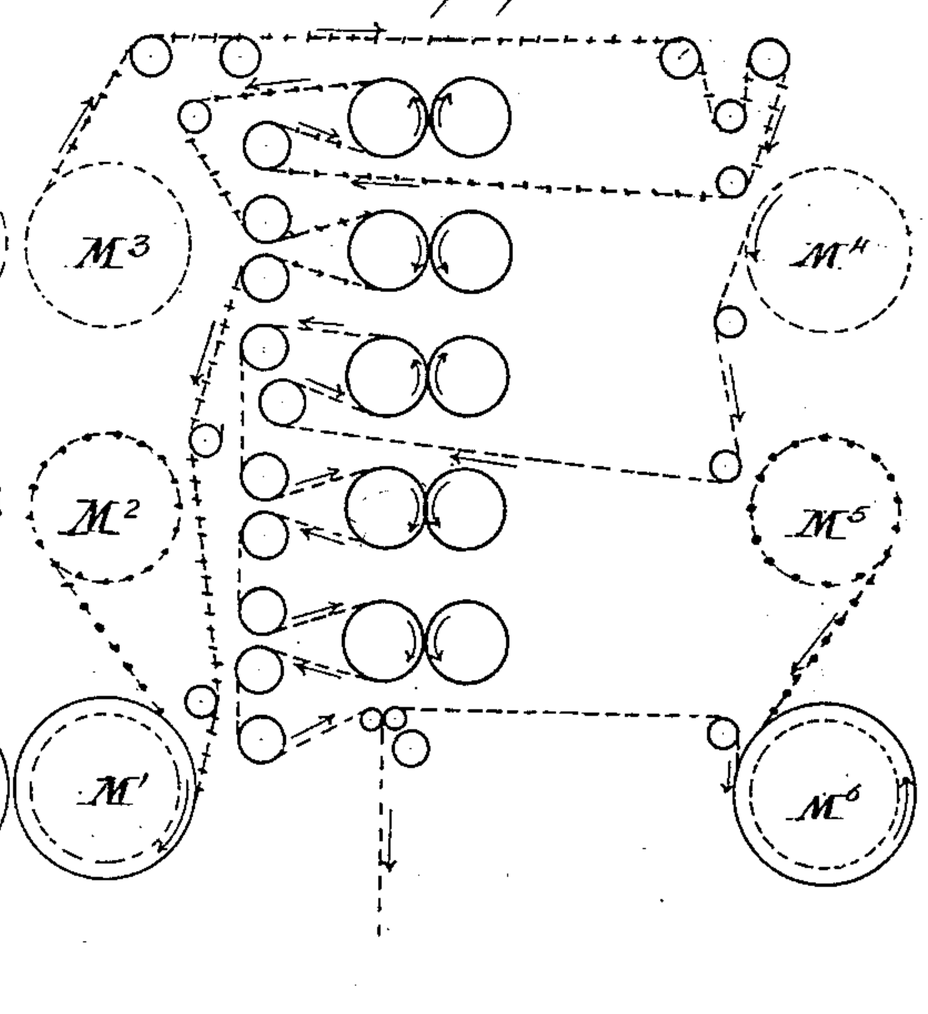


Fig. 9.



Witnesses
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No. 618,252. Patented Jan. 24, 1899.

J. MEYRUEIS.

MACHINE FOR PRINTING IN COLORS.

(Application filed Dec. 7, 1896.)

(No Model.) 7 Sheets—Sheet 6.

Fig. 12.

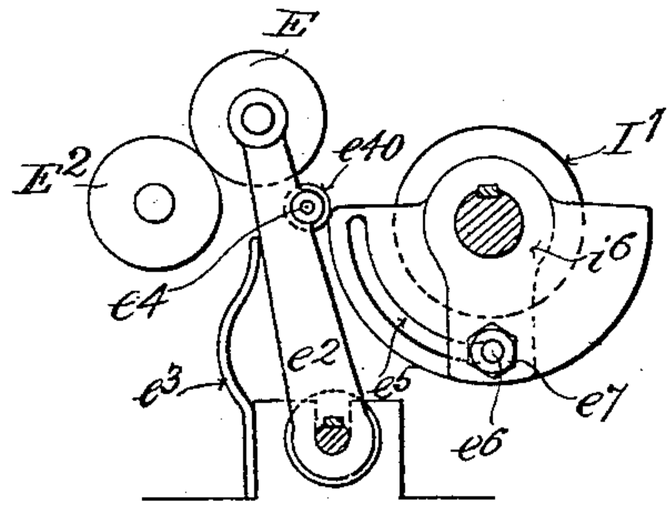


Fig. 13.

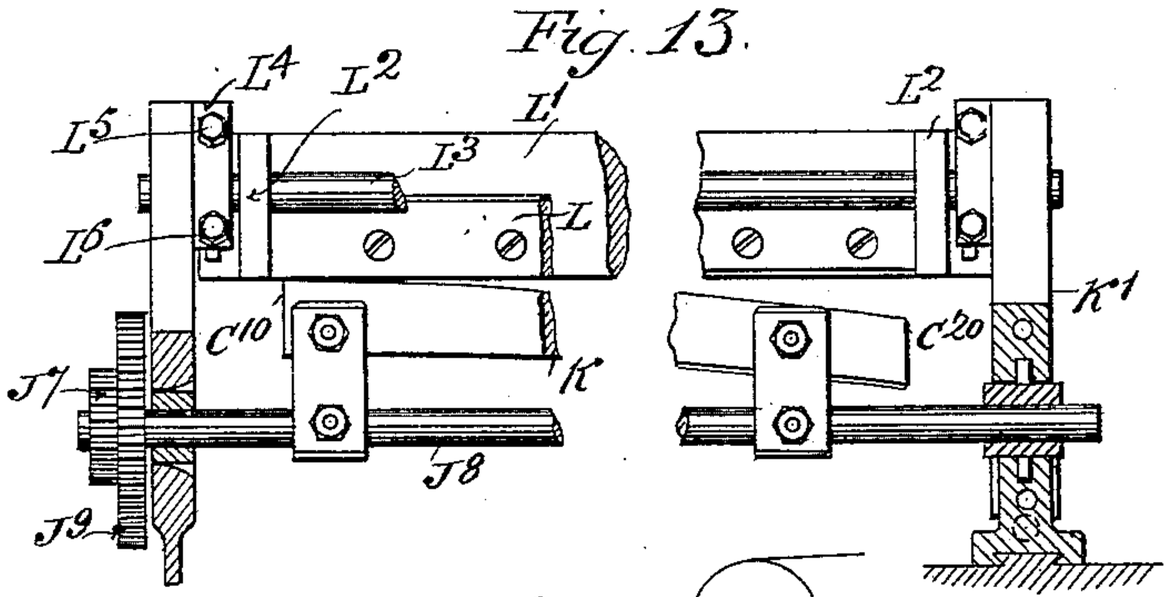
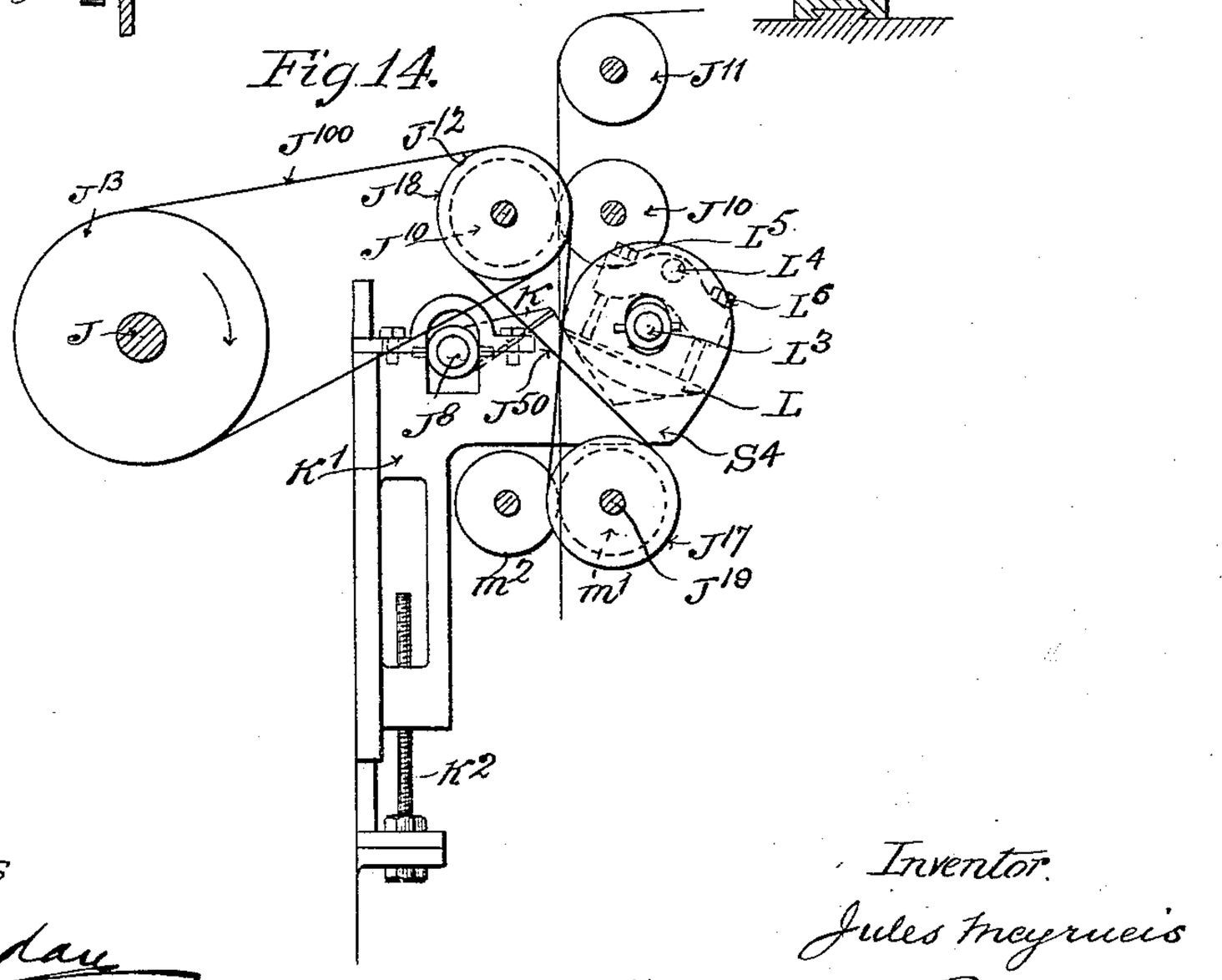


Fig. 14.



Witnesses
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E. Bowen.

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Jules Meyrueis
by his Attorney R. Haddaway

No. 618,252. Patented Jan. 24, 1899.

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MACHINE FOR PRINTING IN COLORS.

(Application filed Dec. 7, 1896.)

(No Model.) 7 Sheets—Sheet 7.

Fig. 15.

Fig. 16.

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UNITED STATES PATENT OFFICE.

JULES MEYRUEIS, OF PARIS, FRANCE.

MACHINE FOR PRINTING IN COLORS.

SPECIFICATION forming part of Letters Patent No. 618,252, dated January 24, 1899.

Application filed December 7, 1896. Serial No. 614,825. (No model.)

To all whom it may concern:

Be it known that I, JULES MEYRUEIS, a citizen of the French Republic, and a resident of Paris, France, have invented certain new and useful Improvements in Color-Printing Machines, (for which I have obtained a patent in Great Britain, No. 23,322, dated December 5, 1895,) of which the following is a specification.

This invention relates to machinery for printing, which may be used for printing in one or different colors on one or both sides of the paper when a continuous roll of paper is used for the paper-feed and for cutting off or severing the printed sheets and stacking the said sheets.

The general object of this invention is to provide a machine in which a variety of printing may be effected and in which when printing in colors is to be performed a true register of the different colors may be produced without delay or difficulty and correctly retained throughout the process of printing. In order to obtain this result, the invention comprises means whereby all parts of the continuous roll of paper, which I hereinafter term the "web," remain constantly subject, so far as possible, to uniform conditions of strain, tension, pressure, and resistance. This cannot be the case where the lengths, directions, and modes of pressure upon the paper vary substantially in the course of travel of the web from one printing-cylinder to another; and the essential principle of this machine consists in the obviation of the difficulties arising from unequal and varying resistances and pressures by means of the similarity in the distances and relative positions of the similar parts of the machine which arises from the nature of this construction, as hereinafter more particularly described. As a consequence of the similar disposition of the parts of the machine the web of the paper also in its course of travel remains subject to constantly similar conditions both as regards the various lengths of unsupported travel and as regards the degrees of strain and pressure incident to the direction or manner in which the continuous web approaches or recedes from each separate printing-cylinder until the printing on one side is completed, after which the web is again subject to similar and equal tension during the printing on the other side. A difficulty in continuing to retain a correct register arises from the cumulative effect of irregularities in working when the machine contains a diversity or a complication of mechanical parts. By my present invention I have also reduced the number, the complication, and the diversity of the mechanical parts to a minimum, and I have thus, in addition to attaining the principal object of a correct register, succeeded in devising a machine which can be constructed with great precision at a comparatively small cost and which for the same reason can be worked at much greater speed and with much less expense in labor and material than is usual.

Partly in consequence of the similar disposition invented I am able to arrange the cylinders, the stretching-rollers, and other principal adjustable parts of the machine in such a manner that they are readily accessible and each of them easily adjusted even while the machine is in actual operation.

The accompanying drawings illustrate so far as will be necessary for those having a knowledge of the art a machine constructed according to this invention and having a capacity of five colors.

Figure 1 is a side elevation of the upper part of the whole machine. Fig. 2 is a similar elevation, on a larger scale, of one of the stories of the machine. Fig. 2^a is a plan view thereof on the same scale as Fig. 2. Fig. 2^b is a side elevation, also on a larger scale, of the driving-gear at and below the lowest story of the machine. Fig. 2^c is a plan view of this gear. Fig. 3 is a cross-section on line 3 3, Fig. 2. Fig. 4 is a cross-sectional view on line 4 4, Fig. 2. Fig. 5 is a cross-sectional view on line 5 5, Fig. 2, Figs. 3 to 5 being on a larger scale. Figs. 6, 7, 8, and 9 illustrate diagrammatically arrangements for varying the travel of the web, hereinafter referred to. Fig. 10 is a cross-section on line 10 10 of Fig. 11; and Fig. 11 is a longitudinal section on line 11 11 of Fig. 10, showing the construction of the printing-cylinder. Fig. 12 is a side elevation of the ductor-roller and adjacent parts. Fig. 13 is a plan of the cutting-knives. Fig. 14 is an end elevation on the side of the machine opposite to that shown in Fig. 1.

Fig. 15 shows the fly-operating mechanism in side elevation. Fig. 16 shows part of the fly and adjacent parts in front elevation.

The machine shown in the drawings comprises a base-plate continued upward on each side in the form of columns P′, which carry the cross-frames of the stories, (marked I II III IV V.) Each frame essentially comprises two rabbeted beams T, on which slide the supports S S′ S^2 of the printing-cylinders B, of the impression-cylinders A, and of the inking-train, respectively. Each of these superposed frames, with the gear upon it, furnishes the impression of one color, the number of superposed frames being equal to that of the colors to be printed.

Between the stories are guides carrying the stretching-rollers, of which there are usually two for each story—namely, G and H. Each story is similar to the next, and consequently all the printing-cylinders are in one plane, all the impression-cylinders in another plane, and the corresponding stretching-rollers are in another plane or planes—that is to say, approximately in such planes allowing for adjustment—the planes being parallel to one another and vertical in the machine illustrated.

As an example showing the comparatively small size of the machine it will be seen that in a machine having printing-cylinders of two feet in circumference capable of being replaced by cylinders with a circumference of three feet the dimensions of the printing-machine (excluding the cutter and fly) would scarcely exceed six feet in height by five feet in width, with a depth of about three feet. The greatest stretch of unsupported web in its travel from one cylinder to another while being printed on one side scarcely amounts to half a foot, and the approach of the web to the impression-cylinder and its recession therefrom are in such a direction that the impression-cylinder exerts a speed-regulating pressure upon it over two-thirds or thereabout of its circumference. Each printing-cylinder B is secured on its axle *b* by means of screw-nuts *b′*, engaging screw-threads on the axle *b*, to permit of displacement of the cylinder along its axle, as shown more particularly in Fig. 3.

For the printing of several colors each by a different story of the machine the lateral register is regulated by displacing the printing-cylinder B longitudinally upon its axle; but if upon this cylinder there are several different stereotypes each requiring for its adjustment an amount of longitudinal displacement different from the other formerly one had to remove and refix each stereotype separately in order to give a true register to each of them, which is a delicate operation and requires time. I remedy this inconvenience by composing my printing-cylinder of four sectors A^{10} A^{11} A^{12} A^{13}, movable on a core A^{14}, through which passes the driving-axle *b*. These sectors are each adjustable parallel to the axle by means of the regulating-screws A^{15}, which allow of changing the position of any of the sectors without touching the others. These sectors are also adjustably secured, so that they may be displaced in direction of the circumference. This is permitted without hindrance from the screws A^{15}, since the latter pass through elongated slots in the end flanges of the core A^{14} and so are enabled to move circumferentially. Screws A^{16} A^{17}, passing through slots in the said flanges and engaging with the sectors A^{10} A^{11} A^{12} A^{13}, respectively, also participate in the circumferential movement and after adjustment of the sectors are screwed tight to hold the sectors in the position previously given to them. One can thus regulate any of the stereotypes in the two directions without losing time and without touching anything else in the machine.

The impression-cylinder A, which carries the paper and brings it in contact with the printing-cylinder B, is also mounted on a screw-threaded axle *a* and secured by means of screw-nuts in order that it may also be adjusted in like manner to the printing-cylinder B, so that the contact of the same points of the circumference of cylinders A and B may be assured.

The base of each support S overlaps the edge of the beam T, being inclined inward thereunder on one side to engage under the dovetailed top of the beam and spaced at the other side to receive between it and the side of the beam a key W. A similar construction provides for the guiding of the supports S′ and S^2 on the beam, and set-screws W′ are provided, the ends of which bear against the side faces of these keys W for holding the supports securely and firmly when they have been adjusted to the positions desired. The supports S′ and S^2 are adjusted by means of screws *v v′*, by means of which they may be respectively caused to approach or recede from the supports S, so as to cause the requisite pressure between the impression-cylinder and the printing-cylinder, on the one hand, and between the inking-train and the printing-cylinder on the other hand. These screws *v v′*, respectively, are journaled in opposite ends of the beams T, which are hollow and have at suitable places slots cut in their upper faces through which project lugs *s* on the under sides of the supports S′ S^2, having screw-threaded holes for passage and engagement of the screws *v v′*. The exterior ends of the screws *v v′* have square heads, on which cranks or hand-wheels may be fitted.

It will be seen that in the case of a slight defect occurring in the registering of any cylinder a correction may immediately be made without stopping the machine by the adjustment either of the impression-cylinder or of one or both of the stretching-rollers.

The course of travel of the web is also capable of modification by the omission of the use of the lower set of stretching-rollers

in cases when owing to the fineness of the paper it may be desirable to reduce its manipulations to a minimum.

I may use any convenient inking-train. That illustrated in the drawings comprises an ink-trough m, feeding, by means of the roller I′, the ductor-roller E, which transfers the ink to the roller E^2, whence it passes consecutively to E^3 to E^4 and to the cylindrical table C. The shaft a^2 of the table C, which is journaled in the pillow-bearings S^{20}, Fig. 5, on the support S^2, carries a drunken disk a^3, which engages with the flanged sleeves a^4 a^4 on the shafts a^5 a^5, respectively, of the ink-spreading rollers E^5 E^6. The shafts a^5 a^5 have rotary bearing and also endwise movement in blocks a^6 a^6, adjustable by screws a^7 in guides in the plate a^8, carried by the standard a^9 on the support S^2. The ink is transferred from the table C to rollers E^5 E^6, rollers E^7 E^8, and from there to the rollers D′ D^2 D^3, which have contact with the cylinder B.

The following is the gear by which the printing-cylinders and adjacent parts are connected. The axle b of the cylinder B carries gear-wheels y^{20} y, of which wheel y^{20} meshes with a gear-wheel y' on the shaft of cylinder A. This pair of gear-wheels is replacable by a pair of wheels of other size corresponding to the cylinders when the latter are changed. The gear-wheel y is driven by power, as hereinafter described. On shaft b is also a wheel y^{10}, geared by chain y^2 with a wheel y^3 on the axle a^2 of the table C, and on the said axle is also a wheel y, geared by chain y^5 to wheel y^6 on the stub-shaft i^2, the wheel y^6 carrying also a spur-wheel i^3, gearing with a spur-wheel i^5 on the shaft of roller I′. When the printing-cylinder B is driven in the reverse direction for the purpose hereinafter described, it is necessary that the roller I′ should not be reversed. On the shaft a^2 of the table C is placed another wheel y^7, which may be geared by chain y^8 direct to another wheel y^9 on the shaft i of roller I′, this chain being brought into operation while the chain y^5 is taken off or put out of operation in order that means may be afforded for revolving the roller I′ in the same direction, whichever be the direction of rotation of the cylinder B. The bearings or trunnions of rollers D′ D^3 are mounted in arms d' d^2, pivoted at e to the frame S^3, and having curved slots d^{40}, through which pass screw-bolts d^3, on which nuts may be screwed. The trunnions of roller D^2 are mounted in sliding bars d^4, having each a slot d^6, traversed by a screw-bolt d^5. By this construction the rollers D′ D^2 D^3 may be adapted to cylinders B of different diameters. The ductor-roller E is carried by arms e^2, against which press springs e^3, tending to press the roller E against the roller I′. On the shaft of the roller I′ is a cam formed of two leaves i^6 i^7 of similar radius and adapted to be adjusted to more or less cover one another, so as to form, in effect, a single cam adjustable in the length of the arc of its greatest radius. e^5 is a slot in leaf i^7, and e^6 is a bolt traversing said slot and passing through a hole in leaf i^6. e^7 is a nut for tightening the bolt e^6, and thus securing the two leaves of the cam against relative movement. (See Fig. 14.) The cam meets roller e^{40} on the stud e^4 on the arm e^2 and presses the roller E into contact with the roller E^2 for a period corresponding to the length of the aforesaid arc. Such are the details as applicable to the inking mechanism shown in the drawings; but if other inking mechanism is used the gear will be correspondingly altered.

To gear each tier with that above, so that the direction of movement may be similar or reversed, there is provided on the side of the beam T a bar F^2, adapted to slide with the axis of its length midway between the axes of the cylinders B B of the two tiers and be secured by set screws or bolts f f^2 in slots f'. This sliding bar F^2 carries gudgeons f^3 f^3 f^4, on which revolve wheels f^5 f^6 f^7, the wheels f^5 and f^6 meshing with each other. The wheel f^7 and the pair of wheels f^5 f^6 are so proportioned to the space between wheels y y of two adjacent stories and they are so spaced from each other and arranged to the one and other side, respectively, of the plane containing the axes of wheels y y that by a movement of the bar F^2 in the one or other direction the wheel f^7 engages with the two wheels y y, or the wheels f^6 f^5 engage, respectively, with the two wheels y y. In the former case the wheels y y will rotate in similar direction. In the latter case they will rotate in contrary directions, the surface velocity being equal so long as wheels y y are equal and wheel f^5 equal to wheel f^6. To provide for accurate adjustment of this gearing when the wheel axes b b are not in the same vertical plane, the set-bolts f f^2 may pass also through vertical slots in the beams T or in adjuncts thereof, which, in addition to the horizontal slots f' in the bar F^2, will provide for limited adjustment horizontally and vertically in the vertical plane of the bar F^2.

The lowermost printing-cylinder B is driven from the main shaft J through spur-wheels y z^2 and spur-wheel z on the shaft J. The shaft J also carries a spur-wheel J^3, gearing with the wheel J^4, journaled in a movable arm J^5, pivoted at J^6 to the beam T and adapted to be fixed in either of two positions, in each of which it engages with the spur-wheel J^3, but in one of which the wheel J^4 engages with a smaller spur-wheel J^7 on the shaft J^8 and in the other position the wheel J^4 engages with wheel J^9 of twice the diameter of wheel J^7. To enable this to be done, the width of wheel J^3 is equal to the combined widths of wheels J^7 J^9, and the wheel J^4 may be moved longitudinally on its shaft to engage either wheel J^7 or J^9 while still remaining in gear with wheel J^3. The shaft J^8 carries a helical knife K, and the proportion of the above-mentioned gearing is such that when the wheels J^4 and J^9 are in engagement the

knife-shaft J^8 makes one revolution for each revolution of the printing-cylinders; but when the wheels J^4 J^7 are in engagement the knife-shaft J^8 makes two revolutions for each revolution of the printing-cylinder. On the support S^4 is mounted an adjustable stationary knife L, forming, with the knife K, shears by which the printed paper passing between the knives will be cut into separate sheets.

To permit of the adjustment of the knife L, it is fastened upon a carrying-plate L′, the ends of which are provided with lugs L^2, through which the shaft L^3 passes, mounted in the framework. In the block L^4 above the shaft L^3, which block is part of or fixed on the framework, are screw-threaded holes for two set-screws L^5 L^6, the ends of which bear on the plate L′, the one near the cutting edge of the knife L, the other near the rear edge of the plate. By adjustment of these set-screws the plate L′ may be rocked upon the shaft L^3, and the edge of knife L may thus be brought nearer to or farther from the axis of the rotary knife K.

In order to cut the paper without stopping it during the time of cutting and in order to obtain a good square cut, it is indispensable that the line of contact of the two cutting-blades be inclined with regard to the paper sheet and that this inclination be proportional, first, to the linear velocity of the paper in the machine, and, second, to the linear velocity of the movable knife in the circumference which it describes. In this machine shown, the movable knife K being fixed in helical line upon its axle J^8, each of its points comes successively in contact with the fixed blade L. If c^{10} c^{20} represent the two extreme points of the helical knife K, the plane containing the axis of shaft J^8 and the point c^{10} will bear a certain angular relation to the plane containing the axis of said shaft J^8 and the point c^{20}—that is to say, the point c^{20} is displaced behind the point c^{10} by a circumferential distance the magnitude of which may be expressed as a ratio to the whole circumference and may be conveniently referred to as a "circumferential displacement" of this magnitude. This circumferential displacement must be compensated for by an equivalent inclination of the axis of the rotary knife and with it the axis of the fixed knife, and this inclination must vary, first, with the linear velocity of the paper, which velocity depends on the circumference of the printing-cylinders, and, second, with the velocity of the knife, which may be geared to revolve once or twice for each revolution of the printing-cylinders and so cut once or twice for each revolution of the said cylinders. If the circumferential velocity of the knife equals the linear velocity of the paper, the elevation of one end of the knife above the other end equals the circumferential displacement between its two ends. Therefore if for cutting twice for each revolution of the printing-cylinder the velocity of the knife is doubled, the velocity of the paper remaining the same, the elevation of one end above the other is half of that required for one cut only. It is in effect only necessary to lift or lower one end of each knife, preferably that end remote from the gearing which drives the knife-shaft J^8. The slight movement of the gear-wheels J^7 J^9 due to the tilting of the shaft J^8 is of no consequence. The support K′, Figs. 13 and 14, at that side of the machine remote from the gear-wheels J^7 J^9 is adapted to slide vertically and is provided with a screw-threaded rod K^2, allowing of raising or lowering it at pleasure for regulating the inclination. The form of these supports can vary; but what is important is the variation of the cutting-line, as hereinbefore described, for rotary printing-machines and allowing a free cut without indents and of square form obtained upon the printing-machine without stopping the paper during the cutting, which simplifies the organs necessary for the cutting.

In the vertical plane above the shearing-line meet two feed-rollers J^{10} J^{10}, between which the paper passes, and above one of these rollers is a third roller J^{11}, around which the web passes from beneath the stretching-roller G. The feed-rollers J^{10} J^{10} are driven one by means of a pulley J^{12} and a belt J^{100} from a pulley J^{13} on the main shaft J, the other by friction from the former. In the vertical plane close under the shearing-line meet the narrow rollers m' m^2, and below, near the shaft of the fly, meet two other rollers m' m^2. The rollers m' of those two pairs of rollers m' m^2 which are at the upper ends of the frames m^6 are separately driven as follows: The shafts J^{19} J^{19} of these rollers m' m', passing through the frames m^6 m^6, are prolonged also to pass through and project beyond the fixed side frames of the printing-machine. On the parts of the shafts J^{19} J^{19} thus projecting outwardly beyond the side frames are pulleys J^{17} J^{17}, respectively, (see Figs. 2^b, 15, and 16,) driven by crossed belts J^{50} J^{50} from pulleys J^{18} J^{18}, respectively, on the shaft of one of the rollers J^{10}. The pulleys J^{17} are keyed on the shafts J^{19}, so as to be capable of sliding endwise thereon, or, more strictly speaking, of remaining stationary, while the shafts J^{19} are slid endwise when the frames m^6 are moved to or from one another to accommodate different widths of paper. Around these rollers m' m' passes an endless ribbon m^3, and a similar ribbon m^4 passes around the rollers m^2 m^2. These two endless ribbons are stretched by rollers m^5 m^5. A similar set of rollers is arranged on each side of the machine, each set being carried by a plate m^6, mounted in a sliding bar or bars m^7 to permit of adjusting the two sets of rollers nearer to or farther from each other, according to the width of the paper, the edges of which are held and drawn downward between said ribbons.

In the frame of the machine is the shaft r of the fly R. This shaft is screw-threaded, and on it are run the nuts r^2, which hold

pressed between them the bosses r^3 of the bars r^4. These bars extend radially from the shaft r, and to the latter is given a rocking movement through one hundred and eighty degrees, or thereabout, by which the bars r^4 are caused to take the sheets of paper cut off by the knives alternately from the one side and the other and deposit them alternately to the right and left. By thus placing the fly immediately below the knives the paper passes directly to the fly and no intervening carrying mechanism is required, thus reducing expense. By depositing the sheets in two heaps the fly has ample time to return from its lower position on either side while the next following sheet is descending, so that rapid and jerky movement of this part of the mechanism is avoided, enabling the machine to be run at a quicker rate and with greater steadiness than would be the case if the fly-arms had to make a quick return movement to pass to the farther side of the next sheet of paper before it descends. An adjustable ledge l^5 permits of the fly receiving sheets shorter than its full length.

On the end of the shaft r is a gear-wheel or sector R^6, with which meshes a larger wheel or sector R^3, having on it an eccentrically-placed wrist-pin r^6, embraced by the end of the connecting-rod r^7, by which oscillating movement is given to the sector R^3. The rod r^7 is driven by an eccentric r^8 on the shaft r^9. The shaft r^9 is driven from the main shaft J by gear-wheels $x^\times$.

The position of the bearings of the register-rollers is adjustable in such a manner that the distance traversed by the web in passing about any one of them may be lengthened or shortened. This may be done in various ways; but it is preferable that similar means should be used for adjusting all the rollers D and similar means also used for adjusting all the rollers H, although the one means may be different from the other. Thus the bearing g of the roller G may be adjustable horizontally in the plate h^2 of bracket h by means of screw h^4 and hand-wheel h^5. The bearing g^2 of roller H may be adjusted vertically in the guide h^{20} by means of the screw h^3 and hand-wheel h^7. At suitable places on the framework are bearings for the trunnions of the paper-roll or of the set-off roll or rolls. These bearings are indicated by M' M^2 M^3 M^4 M^5 M^6. At the upper ends of the columns P' and P' are rollers x x^2 x^3 x^4. At each end of each story are also bearings (not shown) for the reception of the trunnions of rollers hereinafter referred to, such as S^3 $S^{4\times}$, which may be shifted to different stories of the machine, as required.

I will now describe, with the assistance of Fig. 1 and of the diagrammatic views shown in Figs. 6 to 9, how the web may be printed on one or both sides. As an example, a five-colored machine is shown, and Fig. 1 illustrates the method of printing all five colors on one and the same side of the web. Fig. 6 shows the method of printing four colors on the one side and one on the other. Fig. 7 shows the arrangement for three colors on the one side and two on the other. Fig. 8 shows a method of printing and rewinding two separate webs, one in three colors and the other in two colors, wherein set-off rolls are used. Fig. 9 shows the perfecting of one web and the printing of another web in one color on one side and in two colors on the other side, set-off rolls being also used.

In the first example, Fig. 1, the roll is at M^3 and the web passes over rollers x x^2 and thence downward between the printing and impression rollers and around the register-rollers, commencing with the uppermost tier, as shown in dotted line in Fig. 1.

In the second example, Fig. 6, the web-roll is placed at M^4, and the web after passing the rollers x^4 x^6 x^3 s^5 and the register-roller G passes upward between the cylinders A B of the uppermost tier, thence over a roller at s^3, back under the roller H, over the impression-cylinder of the second tier, thence over roller G of that tier, and so forth downward to be cut off or to be rolled up at M', together with a set-off web from a roll at M^2. The rotation of the cylinders A B of the upper tier is reversed.

In the third example the web-roll is placed at M^4 and the web passes around rollers s^4 G, upward between the cylinders A B, and around the register-rollers of the two upper tiers, thence over rollers x^2 s^3, and back under the roller H, over the impression-cylinder of the third tier, thence around the register-rollers and impression-rollers downward.

Where it is desirable to prevent soiling the impression-cylinders by the contact with them of a web already printed on that side, a roll of guard-paper called a "set-off" web is placed in the appropriate bearing and is led over the pressure-cylinder, being either again wound or cut off with the web.

In the fourth example (shown in Fig. 8) the upper three stories are used to print in three colors on one web drawn from roll at M^3 and rewound at M', while the other two stories are used for printing in two colors on another web drawn from roll at M^4 and rewound at M^5. At M^2 and M^5 are rolls of "set-off" paper, which are wound up with the printed web at M' and M^6, respectively.

In the fifth example (shown in Fig. 9) the upper two stories are used to print on both sides of the web drawn from M^3 and rewound at M', together with the set-off web from M^2, while the three lower stories are used to print once on one side of another web and twice on the other side, this web coming from a roll at M^4 and either cut off or rewound at M^6, together with a set-off web from M^5.

The course of the web in these examples will be obvious from the drawings.

In all the above, given as examples only, it will be noticed that so long as successive printings are being performed on one side of

the web the angles or curves through which the web is turned and the distances from one to another of the rollers carrying it are the same between the different stories and that when the other side is to receive successive printings the said angles, curves, and distances are again the same. It will further be noticed that by the use of the register-rollers G H for each story, placed in a plane parallel to but spaced laterally from the plane of the axes of the impression-cylinders, the web when in contact with the impression-cylinder has contact therewith for about two-thirds of its circumference and that even when one register-roller only is used the lateral displacement thereof from the plane between one printing-couple and the next is such that the web has contact with the impression-cylinder over nearly half the circumference of the latter. By this means the slipping of the web on the impression-cylinders is avoided, and since the strains on the paper are the same between each printing and the next on the same face of the web the tendency to slip is also avoided, while the register-rollers are located in a most favorable position for adjustment to secure accurate register of impressions and can be so adjusted while the machine is running. The movability of each bearing S S′ S^2 along its supporting-frame not only admits of relative adjustment of the bearings to one another, but enables the whole set to be moved toward the one or other end of the frame, as may be required to give the maximum or minimum stretch of web between each impression.

Having now described this invention, I claim in machinery for printing by successive impressions in one or more colors on one or both sides of a continuous web—

1. The combination of a series of printing-cylinders having their axes equally spaced from one another in one plane, a series of impression-rollers having their axes equally spaced from one another in a parallel plane, the surfaces of contact between said printing and impression rollers being equidistant from one another and in a plane tangent to the series of printing-rollers, a series of register-rollers having their axes in a plane parallel to the aforesaid planes and similarly placed with regard to the axes of the respective impression-rollers and at such distance therefrom on the side remote from the printing-cylinders that the web passing alternately around the impression-rollers and the register-rollers has prolonged contact with the former, bearings for said printing, impression, and register rollers respectively and a series of juxtaposed parallel detachable frames such as I, II, III, IV, V carrying respectively the bearings for each set of printing impression and register rollers.

2. The combination of a series of juxtaposed parallel and equidistant frames each constituting a slide-bed, a series of printing-cylinders, bearings therefor adjustable longitudinally on said slide-beds, a series of impression-cylinders, bearings therefor adjustable longitudinally in said slide-beds, to or from said printing-cylinders on one side thereof, a series of inking-trains adjustable longitudinally on said slide-beds to or from said printing-cylinders on the other side thereof, a series of register-rollers G H and bearings therefor, the axes of the printing-cylinders of the impression-cylinders and of the register-rollers being respectively in three parallel planes, and the axes of the printing-cylinder, impression-cylinder and register-rollers of each single set having relative positions similar to those of each other set for the purpose set forth.

3. The combination with a base, a fly and cutter mechanism, of pillars upon said base, and a plurality of horizontal superposed frames carried by said pillars, printing-cylinders B bearings S therefor adjustable along said frames, impression-cylinders A, bearings S′ therefor adapted to slide on said frames, inking-trains and bearings S^2 therefor adapted to slide on said frames, screws v v' for adjustment of bearings S′ and S^2 respectively, register-rollers G H, means for guiding a continuous web to the uppermost frame, and means for guiding the same from the lowermost frame to the cutter mechanism and fly, the said parts being so placed that lengths of web between each printing-couple are equal and deflected symmetrically through equal angles and so that the web has contact with each impression-cylinder over a distance greater than half the circumference of the latter.

In witness whereof I have signed this specification in presence of two witnesses.

JULES MEYRUEIS.

Witnesses:
A. J. HADDAN,
CHAS. ROCHE.