4 Sheets--Sheet 1.

JOHN C. MACDONALD & J. CALVERLY.

Improvement in Printing-Presses.

No. 114,020. Patented April 25, 1871.

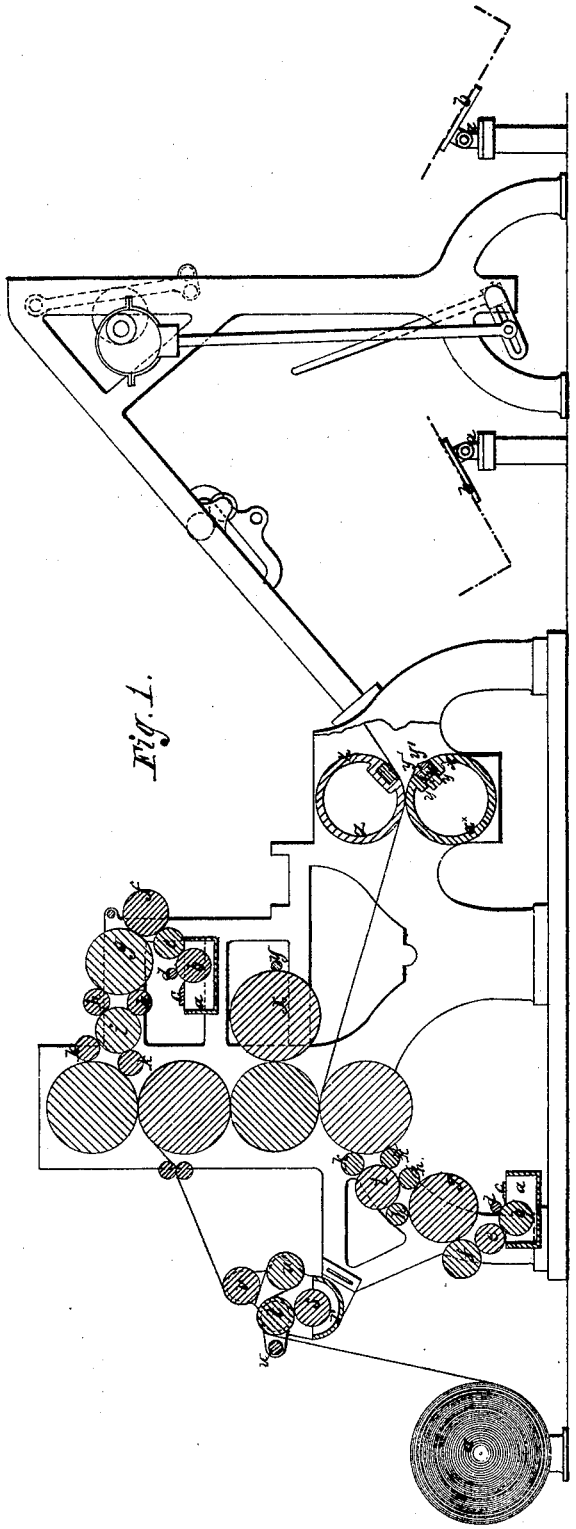

Fig. 1.

Witnesses.
S. Wheeler
L. Gandebilde

Inventors.
John C. Macdonald
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4 Sheets--Sheet 2.

JOHN C. MACDONALD & J. CALVERLY.

Improvement in Printing-Presses.

No. 114,020. Patented April 25, 1871.

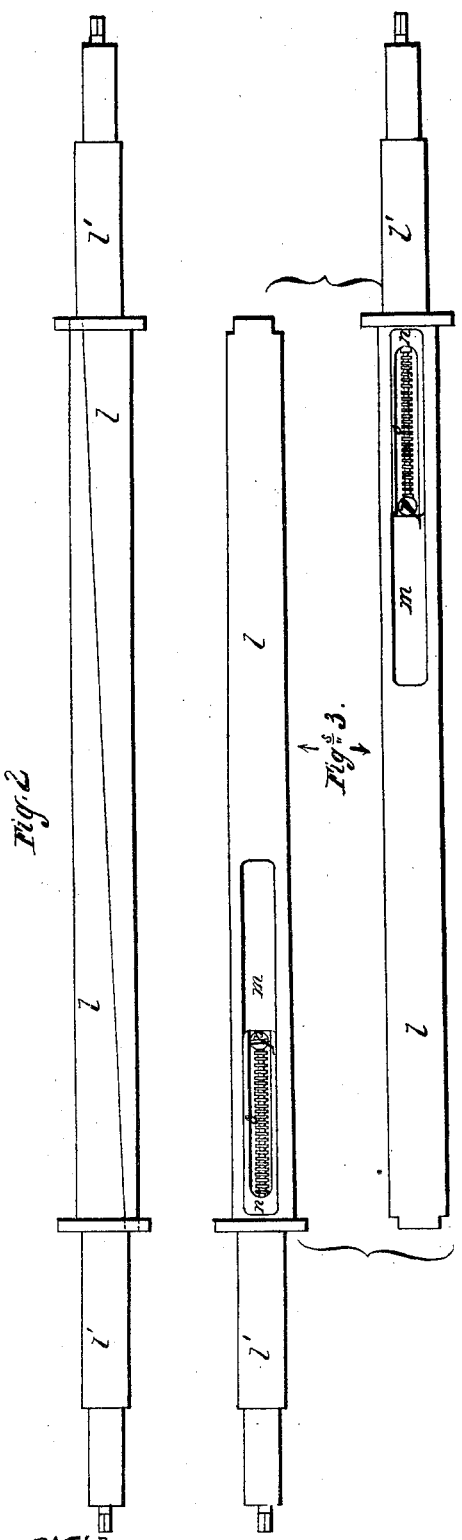

Fig. 2

Fig. 3.

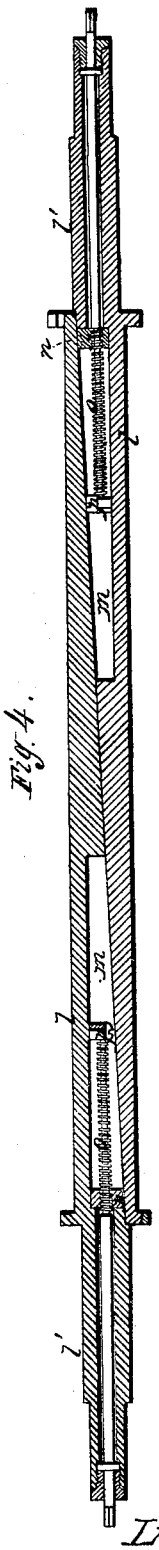

Fig. 4.

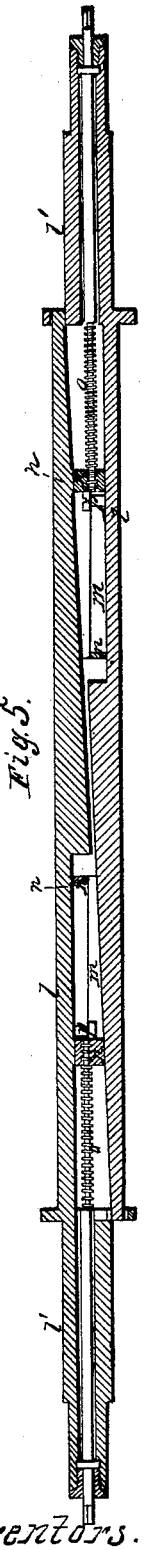

Fig. 5.

Witnesses.
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Inventors.
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4 Sheets--Sheet 3.

J. C. MACDONALD & J. CALVERLY.

Improvement in Printing-Presses.

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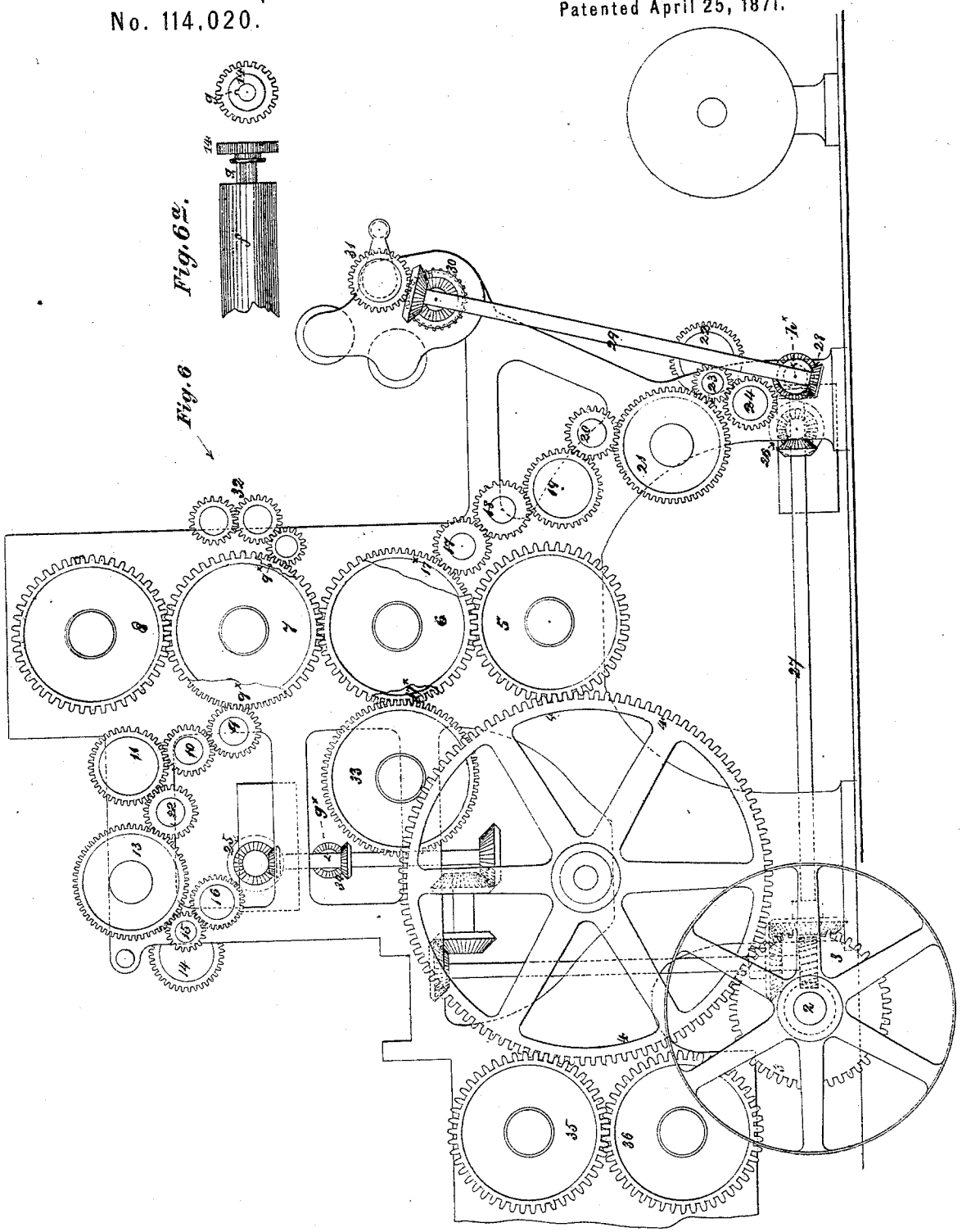
Fig. 6a.

Fig. 6



Witnesses { Henry Knight, Geo. F. Haselden

John Macdonald, Joseph Calverly

4 Sheets--Sheet 4.

J. C. MACDONALD & J. CALVERLY.

Improvement in Printing-Presses.

No. 114,020. Patented April 25, 1871.

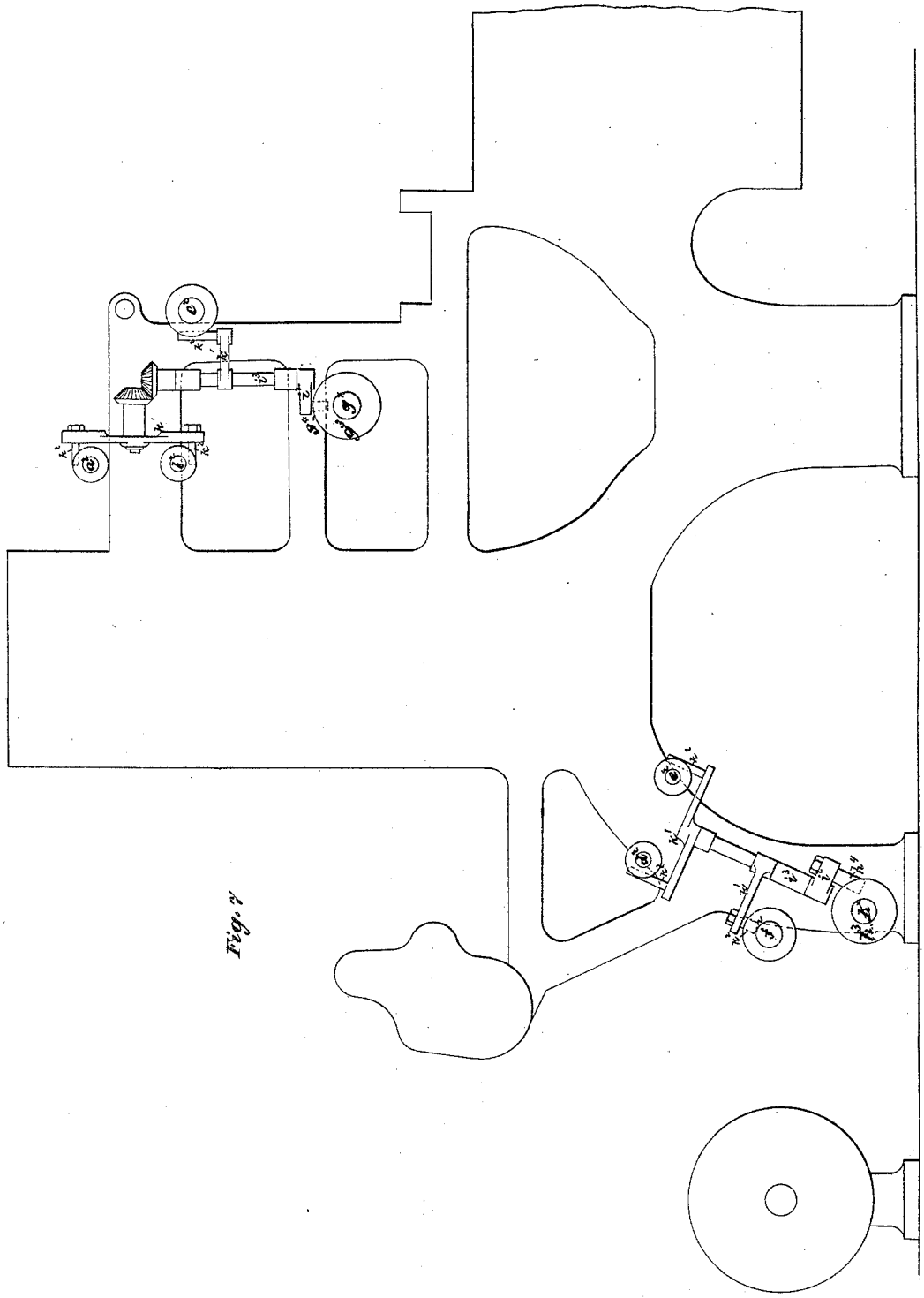


Fig. 2

Witnesses- W. Knight, Geo. F. Haselden

John C. Macdonald, Joseph Calverley

UNITED STATES PATENT OFFICE.

JOHN C. MAC DONALD, OF WADDON, AND J. CALVERLY, OF CAMBERWELL, ENGLAND.

IMPROVEMENT IN PRINTING-PRESSES.

Specification forming part of Letters Patent No. **114,020**, dated April 25, 1871.

To all whom it may concern:

Be it known that we, JOHN CAMERON MAC DONALD, of Waddon, in the county of Surrey, and JOSEPH CALVERLY, of Camberwell, in the same county, England, subjects of the Queen of Great Britain, have invented or discovered new and useful Improvements in Printing-Presses; and we, the said JOHN CAMERON MAC DONALD and JOSEPH CALVERLY, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof—that is to say:

In order to hold the roll of paper in that class of printing machines in which the paper is drawn continuously through the machine from a roll, we employ a spindle which passes through the roll, and which is so formed that it may then be expanded and caused to fit tightly in the hole through the roll of paper. For this purpose the portion of the spindle which is to enter the hole in the roll of paper is divided longitudinally into two wedge-formed pieces, each of which wedge-formed pieces carries, at its end, one of the axes upon which the spindle and roll are to rotate. When the two halves of the spindle have been introduced into the roll of paper, they are caused to separate one from the other by smaller wedges, which are embedded in recesses in the inclined faces of the two halves of the spindle, being moved endwise by screws, and so caused to stand up above the faces in which they are previously embedded.

For damping the paper, we supply to the surface of the paper, as it passes into the machine, a thin film of water. For this purpose we employ a roller running slowly in a trough of water, and from the surface of this roller we take a thin film of water by another roller, which is placed so as almost to be in contact with it. This second roller is caused to revolve approximately at the same surface-speed as that at which the paper is traveling; or it might be at a considerably less speed, and the paper being led over a portion of its circumference, the film of water upon it is brought into close contact with the paper. The amount of water taken up by the paper can, to some extent, be regulated either by the difference in speed of this roller or by the extent to which the paper is lapped over it. Afterward the paper is led under and over two or more rollers, and the water is thereby thoroughly pressed into the paper as the paper bears against the surface of the rollers. The tension on the paper requisite to prevent creasing is also thus materially promoted.

A thin film of water may, if desired, be similarly supplied to both sides of the paper, or to one side only.

To give a continuous and even supply of ink to the inking-roller, in place of transferring the supply of ink from the feeding-roller, which revolves slowly in a trough containing the supply of ink, to the first of the distributing-rollers, which travel at the same surface-speed as the type-surface, by means of a roller vibrating to and fro, so as alternately to come in contact with the two rollers, as heretofore, we dispense with this vibrating roller, and place the roller which is to take the ink from the supply-roller so nearly in contact with it that although the metal surfaces of the roller are not absolutely in contact with one another, yet they are so close that the thin film of ink in the first slowly-revolving supply-roller is taken off from it by the other rapidly-revolving roller, both the rollers being of metal. The thickness of the film of ink which the revolving feeding-roller presents to the second roller we regulate by a strong straight-edge or knife, made perfectly true, and set so as to be almost in contact with the feeding-roller, the circumference of which is also made truly cylindrical. The knife scrapes off from the surface of the roller all excess of ink taken up by it from the supply-trough, and a thin and even film of ink is thus left on the surface of the feeding-roller.

The series or train of distribu**ing** rollers, which are employed to equalize the film of ink taken from the feeding-roller, we also form of metal, in place of forming them with a soft elastic surface, as heretofore, as we find that not only will such metal distributing-rollers last longer than the composition-rollers heretofore employed, but that the spreading of the ink is effected far more perfectly by them,

and when once they are adjusted they require no alteration, and, in addition, they help to grind the ink fine.

We have also found it of great advantage that those distributing-rollers which, in addition to revolving, have an endwise motion imparted to them, should be caused to revolve by gearing at a surface-speed equal to the surface-speed of the rollers with which they are in contact, in place of being driven, as heretofore, only by being in surface-contact with such rollers.

This arrangement for giving a continuous and even supply of ink to the inking-rollers is applicable to other classes of printing-machines.

When the roll of paper is to be printed in succession on its two opposite sides, there is a difficulty in getting rid of the set-off from the last impression-cylinder, which, as it presses upon the side of the paper which has immediately before been printed on, takes some of the ink from the printed paper.

According to our invention, we remove the set-off from the last impression-cylinder by means of a metal cylinder revolving in contact with it. This metal cylinder takes up all the ink from the blanket of the impression-cylinder, and the ink may be removed from the metal cylinder either at intervals or continuously.

In order to cut up the roll of paper into sheets, after it has been printed upon both sides, we employ, as described in the specification of a former patent granted to us on the 1st June, 1869, No. 90,858, a pair of rollers, one of which carries a knife, and in the other is a slot for the knife to enter. The paper also, at the time of cutting, was held by spring-plates on each side of the knife. We now form the acting surface of these spring-plates of a curve to correspond with the curve of the roller against which they are pressed at the moment when the cutting-action is taking place. By this we are enabled to gripe the paper close up to where the cutting takes place, and we also obtain a broad holding-surface for laying hold of the paper at the time of cutting.

In the specification of the before-mentioned patent was also described an apparatus by which the paper, after it has been printed and cut into sheets, was delivered into bundles on boards or tables. We now support the boards or tables which receive the sheets of paper from the delivery apparatus of printing-machines upon the plungers of hydraulic cylinders, so that the tables can be brought to any elevation desired by allowing water to enter or escape from the hydraulic cylinders. The tables or boards rest upon a plate at the top of the plunger, and the plate is connected to the plunger by a joint, so that the plate and table can be set at any angle desired.

In Figure 1 of the drawings hereunto annexed, is shown a longitudinal vertical section of a printing-press, with the various improvements above described applied to it. In this figure the mandrel for holding the roll of paper to be printed and cut up into sheets is marked *a*. Detailed views of this mandrel are shown in Sheet 2 of the drawings annexed.

Fig. 2 shows a side view of the mandrel unexpanded. Figs. 3 show separately the wedge-formed pieces *l l*, into which the spindle of the mandrel is divided. Fig. 4 shows a longitudinal section of the mandrel unexpanded; and Fig. 5 shows a longitudinal section of the mandrel expanded.

At the base of each of the wedge-formed pieces *l* is one of the spindles, *l'*, upon which the mandrel is to revolve when in the printing-machine. *m m* are recesses in the inclined faces of the pieces *l*, in which are received the small wedges *n n*, through which work the screws *o o*. These screws are prevented from moving endwise by a collar near their outer ends, as shown at Figs. 4 and 5, so that, when they are turned by a key applied to their ends, the small wedge *n* can be moved along the recess *m*, and so caused to force the two pieces *l l* away from one another. *p p* are stops for preventing the wedges *n* passing off the ends of the screws *o*.

As the paper is drawn off the roll water is supplied to one of its surfaces from the trough *r*, containing water. *s* is a brass roller, revolving in the trough at a comparatively slow surface-speed. *t* is a roller, by preference of brass, also in close proximity to the roller *s*, and is, by preference, caused to revolve at a speed less than the surface-speed of the paper. The paper, as is shown, is led from the roll over the top of this roller, and is thus supplied with water; or, if it be desired to apply less water to the paper, the paper might first be led over the roller *u*. After the paper has passed over the top of the roller *t* it is led under and over the brass rollers *v w*, which are allowed to revolve freely.

We will now describe the manner in which ink is supplied to each of the two type-cylinders employed for printing the continuous sheet of paper on its two opposite sides.

a is the ink-supply trough; *b*, metal roller, revolving slowly therein, as usual; *c*, a strong knife, made with a perfectly true surface, which is set up into close proximity with the circumference of the roller *b*, to scrape off the excess of ink taken up by it. *d* is an equalizing-roller, which is free to revolve, and has, also, a to-and-fro endwise motion imparted to it to equalize the film of ink on the roller *b*. *e* is a metal roller set in close proximity to the roller *b*, and caused to revolve at the same surface-speed as the type-cylinders. *f*, *g*, *h h*, and *i* are distributing-rollers, of metal, and *k k* are the inking-rollers, which are covered with a soft elastic composition, as is usual. The rollers *h h* and *f* have an endwise motion given to them, and, in addition, we transmit to them,

by gearing applied to one of their ends, a positive revolving motion in place of allowing them to derive their revolving motion from being in contact with the other rollers next to them. To thus give a revolving motion to these rollers, we form the rollers with a projecting spindle capable of sliding freely endwise through the center of the toothed wheel, which is to give the revolving motion to the roller; but the wheel is prevented from revolving around the spindle of the roller by a key received into a keeping, g, in the spindle, as shown in detail, Fig. 6^a of the drawings. By thus giving a positive revolving motion to the equalizing-rollers a more even supply of ink is delivered to the inking-rollers than if they were allowed to run free. These distributing-rollers are employed as above described, as we are enabled to employ equalizing-rollers of larger diameter than could otherwise be employed, and thus these rollers can be brought more accurately to a true cylindrical form than if rollers of smaller diameter were employed.

To remove the set-off from the last impression-cylinder, a metal roller, x, (by preference a cast-iron roller,) is set to revolve in contact with it. From this metal roller the ink is removed at intervals by wiping with a rag moistened, if desired, with oil or spirit. y is a roller covered with blanket, or a like soft material. This roller is held in contact with the metal roller x, and prevents too great an accumulation of ink taking place on its surface.

To cut the continuous length of paper into sheets after it has been printed on both sides, it is passed between the rollers $x^\times$ and z, the lower one, $x^\times$, carrying the knife and the nipping-plates $y\ y$, which are on either side of it, and which are pressed outward by springs. The acting-surface y of these plates may be made to a curve corresponding to the curve of the upper roller z. The outer angles of these plates may be rounded off, as we prefer they should be.

As the paper is cut up into sheets, it is, by a delivery apparatus, such as described in the specification of the before-mentioned patent, delivered onto two tables or boards, each supported on the top of the plunger a of a hydraulic press, this plunger having hinged to its upper end the plate b, upon which the wooden table or board which is to have the sheets of paper piled upon it rests.

At the back of the wooden board or table strips of wood are fixed to come against the sides and end of the plate b, so that the table or board may rest securely on it.

Sheets 3 and 4 of the drawings hereunto annexed show two opposite side views of the machine. On that marked Fig. 6 is shown all the driving-gear, and on Fig. 7 is shown the means of giving an endwise movement to some of the distributing-rollers.

The machine is driven by a belt passing round the pulley 1, on the axis 2 of which a toothed wheel, 3, gives motion to the cogged wheel 4, which drives the toothed wheel 5 on the axis of the lower printing-cylinder. This wheel drives the wheel 6 in the axis of the lower impression-cylinder. The wheel 6 drives wheel 7 on the axis of the upper impression-cylinder; wheel 7 drives wheel 8 on the axis of the upper printing-cylinder.

The inking and distributing rollers are driven by the trains of wheels 9 to 16 and 17 to 24 respectively. The wheel 9 is driven by the wheel $9^\times$ on the axis of the upper impression-cylinder. The wheel 17 is driven by the wheel $17^\times$ on the axis of the lower impression-cylinder. The "licking up" rollers 25 and 26 are driven from the axis 2 by the wheels and shafting, as shown.

On the axis 27, which drives, by bevel-gear, the lower licking-up roller 26, is another bevel-wheel, (shown by dotted lines,) which gears with a bevel-wheel (also shown by dotted lines) on a transverse axis, $h^\times$. On one end of this shaft is the bevel-gearing for giving motion to the damping apparatus, and on the other is the cam h^3, for giving an endwise motion to some of the distributing-rollers. (See Fig. 7.) The damping apparatus is driven from the transverse shaft $h^\times$ by means of the bevel-gearing 28 and inclined shaft 29, from which motion is given to the two toothed wheels 30 and 31, on the axis of the two first rollers of the damping apparatus. The two guide-rollers are driven from the wheel $9^\times$ by the toothed wheel 32. The cylinder for preventing the set-off is driven from wheel $17^\times$ by the toothed wheel 33. The apparatus for cutting the paper into sheets is driven from the cog-wheel 4 by the wheels 35 and 36, as shown. The axes of the rollers which receive an endwise motion are marked $a^2\ b^2\ c^2\ d^2\ e^2\ f^2$ in Fig. 7. To impart this endwise motion an inclined cam-groove is used, into which a stud, $g^4\ h^4$, carried by an arm, i^2, projects. This arm is carried by a rocking-shaft, i^3, which carries other arms k^1, and studs k^2, which studs are received in grooved disks on the ends of the axes $a^2\ b^2\ c^2\ d^2\ e^2\ f^2$. As the cams g^3 and h^3 revolve they impart a to-and-fro motion to the rocking-shaft i^3, which transmits the required endwise motion to the axes of the distributing-rollers. The axis $g^\times$, on which the cam g^3 is fixed, is driven by the bevel-gearing 34, as shown in Fig. 6.

We claim as our invention—

1. The expansible mandrel, constructed, as set forth, of two longitudinal wedge-formed sections, each carrying a journal to support the mandrel.

2. The combination of the longitudinal wedge-formed sections of the mandrel, the wedges working in recesses therein, and the forcing-screws passing through the journals of the mandrel, all these parts being constructed to operate in combination, substantially as hereinbefore set forth.

3. The combination of the mandrel and its

supports for the paper-roll, the printing-cylinder, the dampening-rolls, and the water-trough for supplying water for dampening, substantially as before set forth, so that the paper is dampened by the application of water between the paper-roll and the printing-cylinder.

4. The combination of the ink-fount, the series of metal ink-feeding rolls, the gearing which causes these rollers to revolve positively, the endwise-moving metal ink-distributing rollers, the composition inking-rollers, and the type-cylinder, all constructed and operating as set forth.

5. The combination of the gear-wheels, revolving in a fixed position, the endwise-moving ink-distributing rollers, and their shifting-gear; all these parts being constructed to operate in combination, as set forth.

6. The combination of the two type-cylinders for printing both sides of the sheet of paper, the two impression-cylinders for presenting the opposite sides of the paper in succession, to the type-cylinders, and the metal roller for removing the set-off received upon the second impression-cylinder from the side of the paper first printed, these members being constructed to operate in combination, as set forth.

7. The combination of the delivering apparatus for the sheets, and the table which receives the printed sheets, with a hydraulic ram to vary the elevation of the table, these parts being constructed to operate in combination, substantially as hereinbefore set forth.

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Witnesses:
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J. GOODCHILD.

2