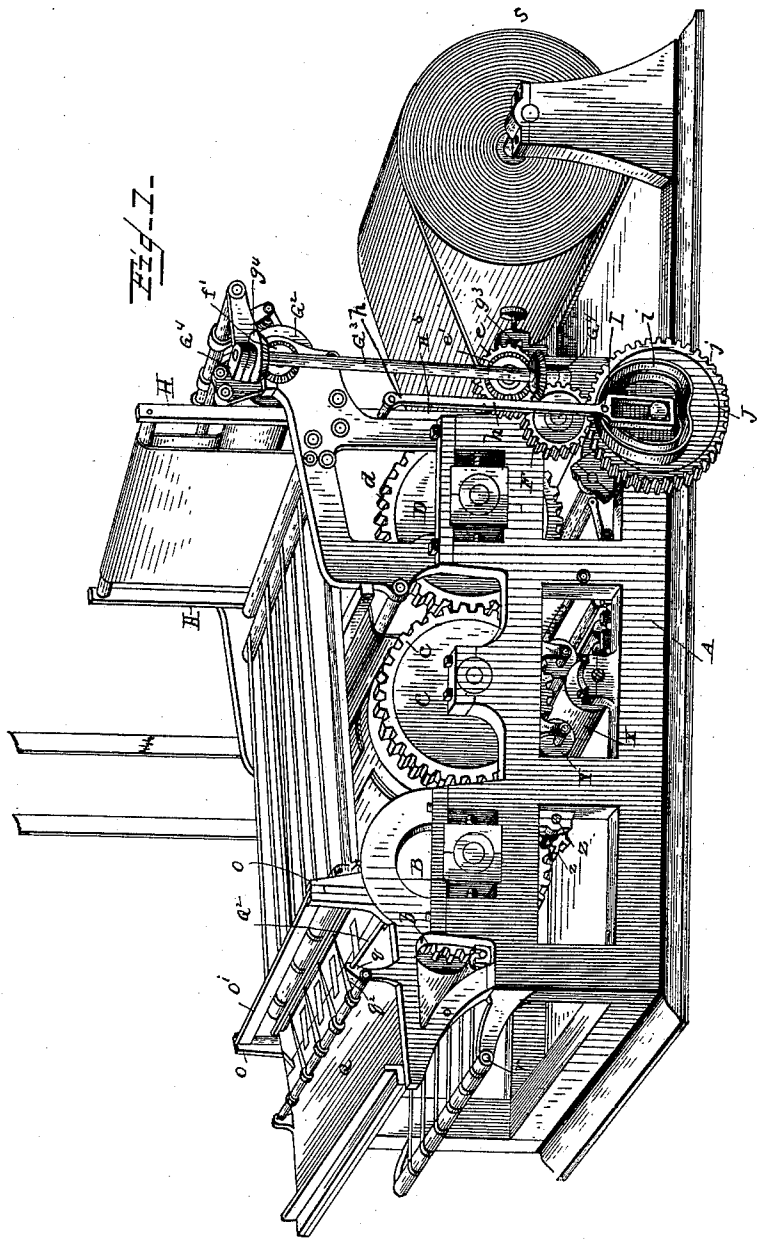
(No Model.)

4 Sheets—Sheet 1.

J. L. COX.

ROTARY PRINTING MACHINE.

No. 392,540. Patented Nov. 6, 1888.



WITNESSES,

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A. E. Towell.

INVENTOR.

Jos. L. Cox,

by T. H. Alexander,

Attorney.

(No Model.)

4 Sheets—Sheet 2.

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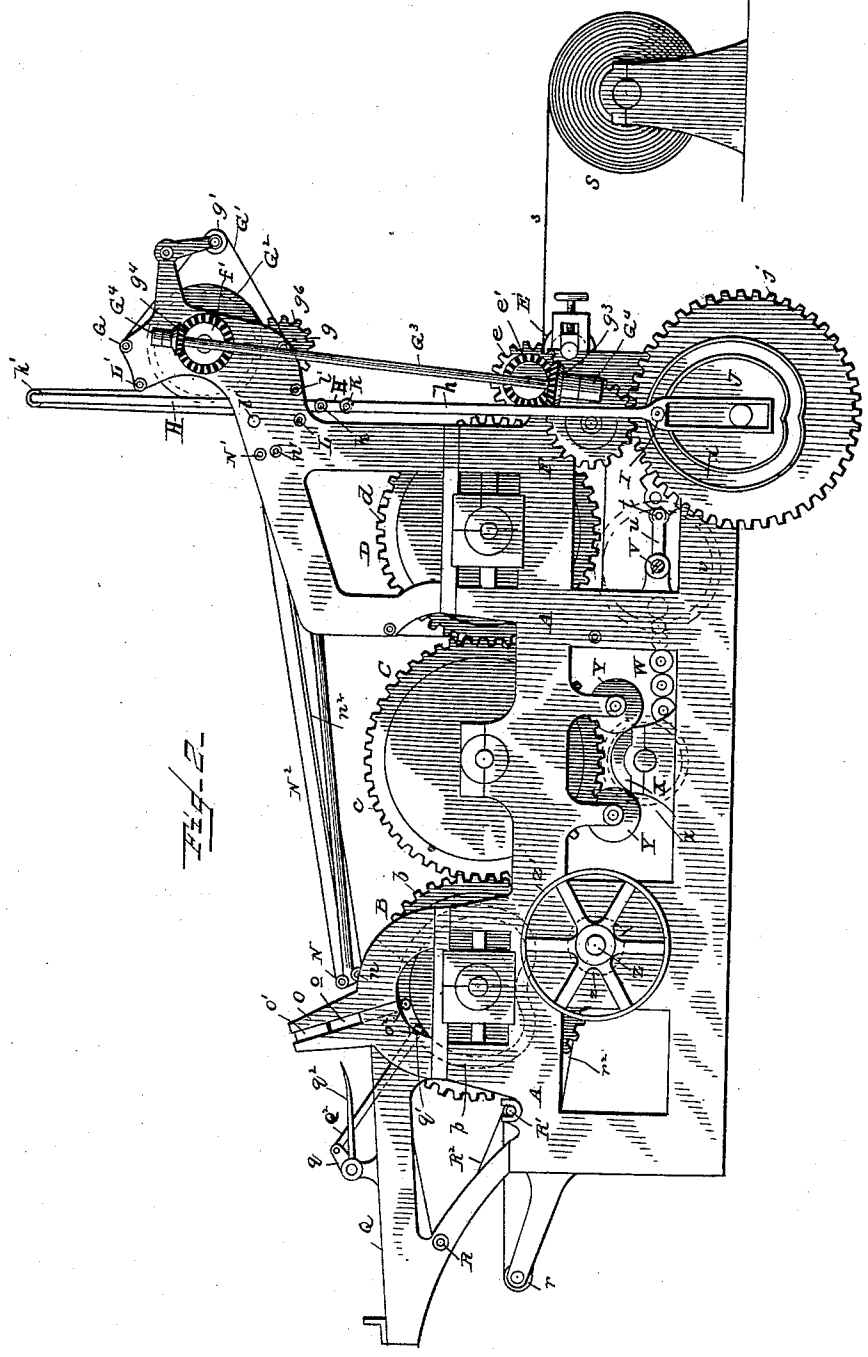

WITNESSES,

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(No Model.) 4 Sheets—Sheet 3.

J. L. COX.

ROTARY PRINTING MACHINE.

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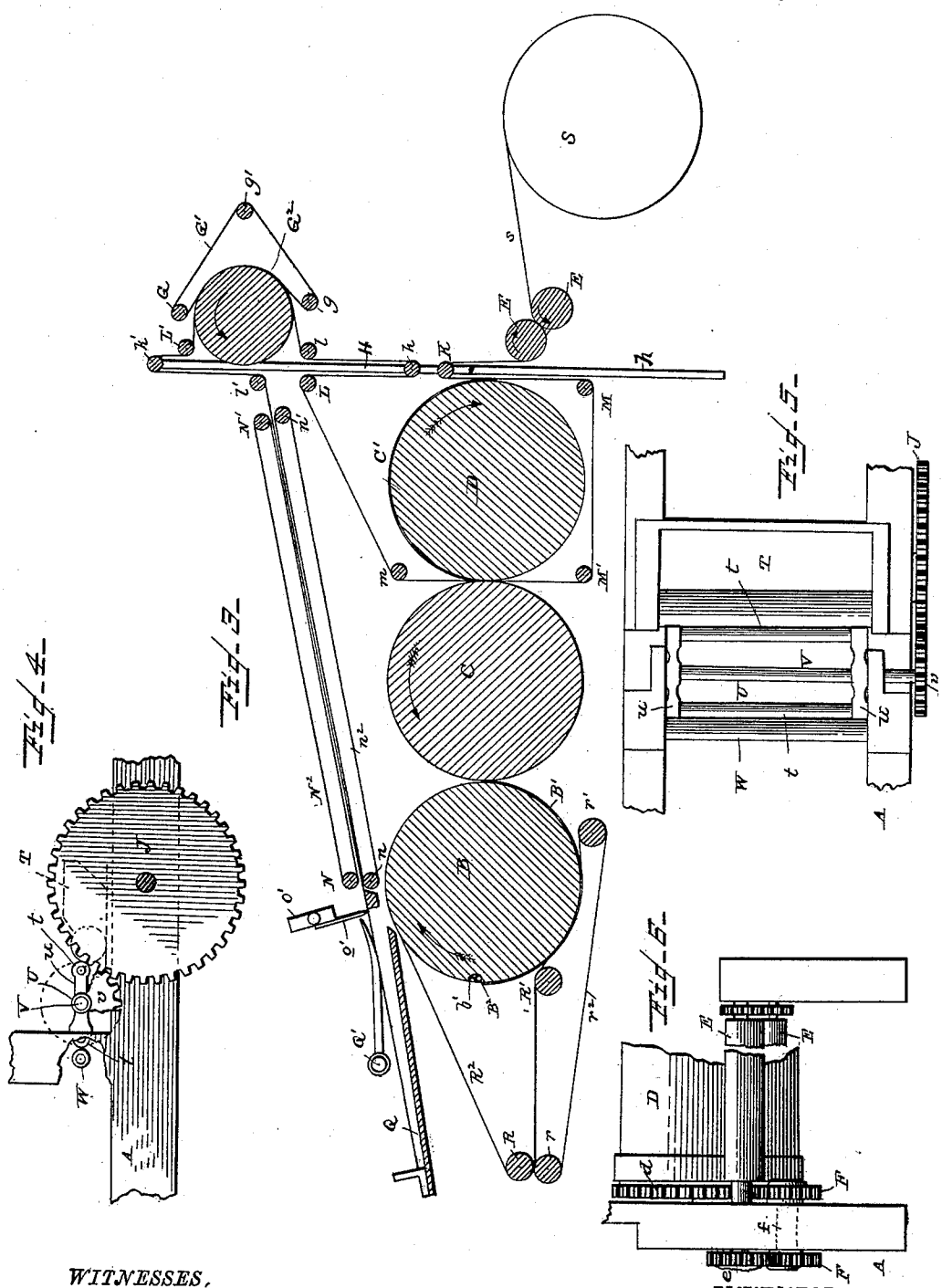

WITNESSES,

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(No Model.)

4 Sheets—Sheet 4.

J. L. COX.

ROTARY PRINTING MACHINE.

No. 392,540. Patented Nov. 6, 1888.

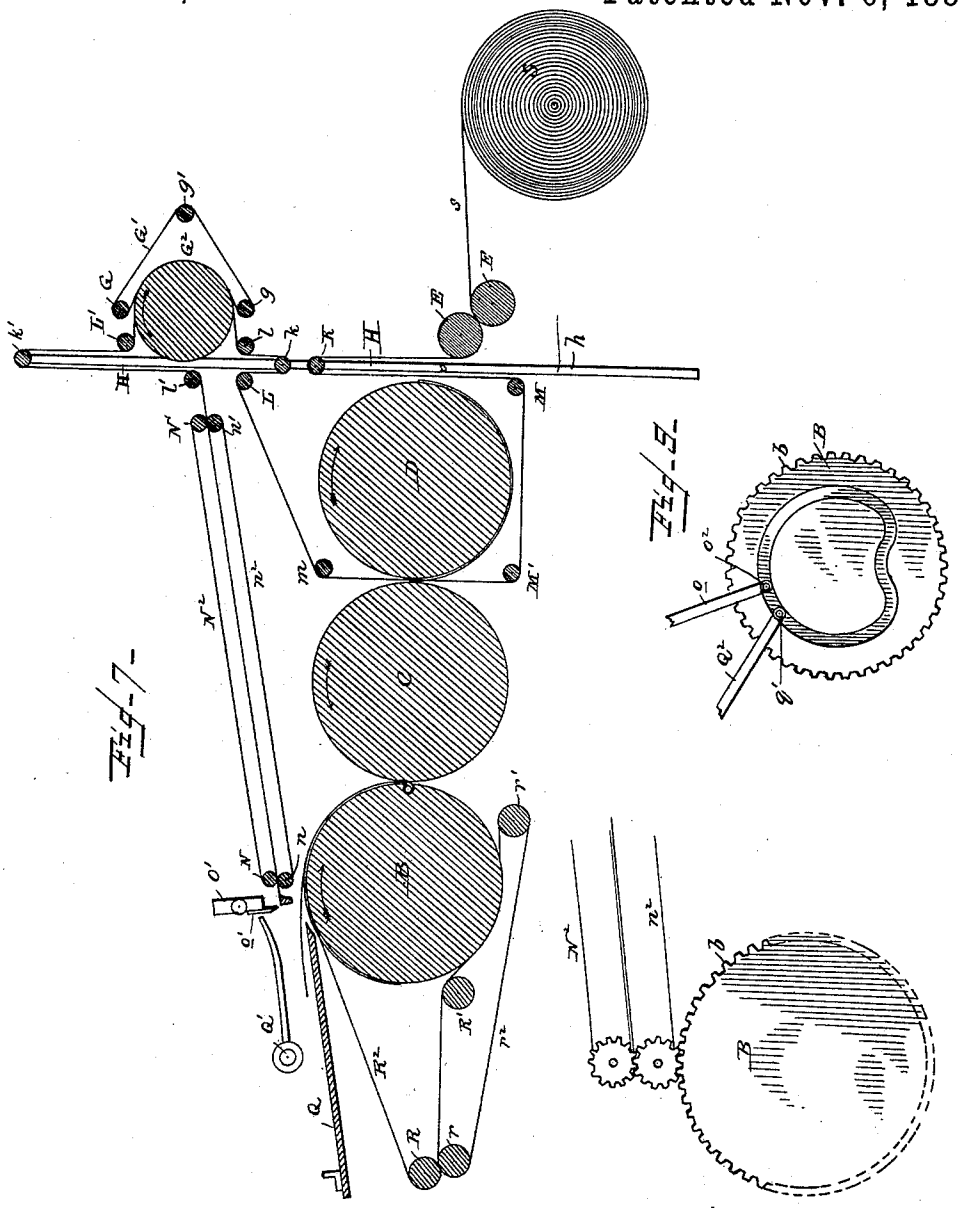

Fig. 1.

Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE.

JOSEPH LEVI COX, OF BATTLE CREEK, MICHIGAN, ASSIGNOR TO THE DUPLEX PRINTING PRESS COMPANY, OF SAME PLACE.

ROTARY PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 392,540, dated November 6, 1888.

Application filed August 10, 1887. Serial No. 246,601. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH LEVI COX, of Battle Creek, in the county of Calhoun and State of Michigan, have invented certain new and useful Improvements in Rotary Printing-Machines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form part of this specification, in which—

Figure 1 represents in perspective view my improved printing-press. Fig. 2 represents a side elevation of the same. Fig. 3 is a sectional view taken vertically and longitudinally through the printing-cylinders and paper-feed devices of the press, showing the position of the parts when paper is being printed between the cylinders C and D. Fig. 4 is a detail view of the inking device. Fig. 5 is a plan view showing the inking-reel. Fig. 6 shows the means for driving the paper-feed rolls from one of the cylinders. Fig. 7 is a view similar to Fig. 3, showing the position of the parts when the impression is being taken upon the severed sheet of paper between the cylinders C and B. Fig. 8 is a detail view showing one manner of driving the tapes N^2 and n^2. Fig. 9 is a detail view showing the cam-grooved wheel on the end of cylinder B for actuating the paper-web sheet-cutting mechanism.

This invention relates to improvements in rotary-cylinder printing-presses of the class known as "perfecting printing-presses," in which the paper or other material being printed is impressed on both sides before leaving the press; and it has for its objects to cheapen and simplify the construction of the press and to perfect its operation; and to these ends the invention consists in the novel construction and arrangement of parts hereinafter described, illustrated in the drawings, and particularly designated in the claims hereto appended.

Referring to the drawings by letter, A designates the main frame of the press, upon which are mounted in suitable bearings the three cylinders B, C, and D, respectively. These cylinders lie transversely of the main frame and are of about equal size and have their axes in the same horizontal plane, so that their peripheries lie close to each other, as shown.

The cylinders B, C, and D are provided at one end with the similar-sized gears *b*, *c*, and *d*, which intermesh, and thereby the rotation of one cylinder will impart a similar amount of movement to the others. The cylinder C is the central one of the three, the cylinder D being on the right and the cylinder B on the left thereof. Consequently when cylinder C is rotated to the left the other cylinder will turn to the right, as indicated by the arrows. To the outside of cylinder D and below its axial plane are situated the feed-rollers E E, the upper one being journaled in rigid bearings on frame A and the lower and outermost one being journaled in adjustable bearings, as shown in Fig. 2, by which the pressure of the rolls E E can be regulated. These rolls are actuated by gearing from the cylinder D, which consists, essentially, of the small gears F F, mounted, respectively, on the inner and outer ends of a short shaft, *f*, Fig. 6, suitably journaled in the main frame between cylinder D and roll E, the inner gear, F, meshing with the gear *d* and the outer gear, F, meshing with a small gear, *e*, on the extended end of the shaft of upper roll, E, as shown. The relative sizes of these gears are such that the peripheral motion of rolls E E for one rotation of cylinder D is only equal to one-half the peripheral motion of said cylinder, for a purpose hereinafter shown.

G^2 designates a delivery-cylinder properly journaled in the sides of the frame A considerably above the rolls E E, and which has its shaft extended outside its bearing at one side and provided with a bevel-gear, *f'*, which meshes with a corresponding gear, g^4, on the upper end of a nearly-vertical shaft, G^3, the lower end of which is provided with a bevel-gear, g^3, which meshes with a bevel-gear, *e'*, on the extended end of upper roll, E. The shaft G^3 is journaled in suitable supports, G^4, at both its upper and lower ends, properly secured to the frame A, as shown. It will thus be ob-

served that motion is imparted to roll G^2 from upper roll, E. The gears are so arranged that the periphery of roll G^2 moves at the same rate of speed as the peripheries of rolls E E and in the same direction as the lowest of said rolls.

G designates a shaft journaled in the main frame of the machine above the journals of roll G^2, and *g* designates a similar shaft situated below the said roll, and *g'* is another similar shaft situated outside of roll G^2 and lying in about the same horizontal plane as the axis of this roll. The shafts *g g'* are suitably journaled in extensions of the main frame, as shown. Around these shafts G *g' g* are passed the continuous tapes G', which as they pass from shaft G to *g* come in contact with the outer periphery of roll G^2, as shown. These shafts and tapes are driven from the shaft *g*, which has a pinion, g^6, on its extended end, which meshes with a pinion on the extended end of the shaft of roll G^2, Fig. 2.

H designates a vertically-reciprocating frame moving in guides formed in the sides of frame A in rear or outside of cylinder D and above the same. This frame H extends some distance above the top of the press, and is reciprocated by means of the pitman-rod *h*, which connects at its upper end to the side of frame H, and has its lower end journaled on or provided with a wrist-pin, I, that plays in a cam-groove, *i*, formed in the face of a disk, J, which is journaled on the main frame vertically below frame H, and is provided on its circumference with gear-teeth *j*, which mesh with the outer gear, F, already described, and receives motion thereby from cylinder D.

K designates a friction roller or shaft journaled in the sides of frame H, and which, when the frame is lowest, stands close to but somewhat above the upper roll, E. *k* designates a similar roller journaled in frame H above roller K, and *k'* designates a third roller journaled in the uppermost end of the frame, and which, when the frame is lowest, will stand above the roll G^2.

L *l* designate two friction-rollers journaled in the main frame on opposite sides of frame H and below the roll G^2, so that they stand above roll *k* at all times. L' designates a similar roller journaled on frame A above roll G^2 and to the inside of shaft G. *l'* designates a similar roller journaled in the main frame to the inside of frame H and below the roll G^2.

M designates a roller journaled in the main frame to the inside of frame H and below the rolls E E. M' designates a like roller journaled in the main frame below the meeting-point of cylinders C D and in a horizontal line with roll M, and *m* designates a similar roller arranged vertically above roll M' and above the cylinders.

The rollers on frame H and the rollers M M' *m* L *l* L' *l'* and roll G^2 form the paper-guides for the first impression, as hereinafter stated.

N designates a tape-shaft journaled in the main frame vertically above cylinder B, and N' designates a similar shaft journaled above cylinder D, near to roller *l'*. N^2 designates the endless tape working on said shafts.

n designates a tape-shaft journaled in the main frame just below shaft N, and *n'* a similar shaft just below shaft N'. n^2 designates the tapes working on said shafts. After passing roller *l'* the paper is caught and carried forward by the tapes N^2 n^2 to the opposite end of the machine. These tapes are driven by means of suitable gearing between the shaft *n* and the gear on cylinder B, as shown in Fig. 8 of the drawings, or from other proper source.

O O are upstanding slotted guide-arms rising from frame A just outside of the rolls N *n*.

O' designates a transverse reciprocating bar moving in guides formed in said slotted arms O O and having secured to its lower edge the cutting-blade *o'*. This bar O' is reciprocated at proper intervals by means of the pitman-rod *o*, which is properly connected to the bar at its upper end and has its lower end journaled to a wrist-pin, o^2, which is engaged in the cam-groove *p* of a gear, *b*, secured on the end of cylinder B, as shown.

Q designates a sheet-receiving table to the outside of bar O', which is adapted to receive the sheets as they are delivered by tapes N^2 n^2 and cut by knife *o'*, as evident.

Q' is a shaft journaled in suitable brackets rising from opposite sides of table Q and having a crank, *q*, at one end connected to a pitman, Q^2, which has its other end engaged by a pin, *q'*, with the cam-groove *p* of gear *b*, so that it transmits oscillating motions to shaft Q' when the disk is rotated.

q^2 designates fingers secured to shaft Q', and which are adapted to be operated by said shaft at the proper time, and after the web has been severed by the knife *o'* force the cut sheet down upon the feed-board or table Q, where the sheet is left in readiness for being removed by grippers on cylinders B, as hereinafter stated.

R designates a tape-shaft journaled in the main frame below table Q, and R' designates a similar shaft journaled close to the cylinder B, near the lower outer portion thereof.

R^2 designates tapes which pass from shaft R up over and partly around cylinder B until they reach shaft R', which they pass over and then back to shaft R. *r* designates a similar shaft journaled just below roll R, and *r'* is a like shaft journaled in the main frame below and to the inner side of the cylinder B. r^2 designates tapes on said shafts, which are adapted, in connection with tapes R^2, to deliver the paper out of the press upon a suitable receiving-board or folding-machine.

The cylinder C is the type-bearing cylinder, and is adapted for receiving the ordinary stereotype-plates or circular "forms" of any description, and these plates are secured to the outer circumference of cylinder C in the ordinary manner, the plates for the opposite side of the paper being secured on said cylin-

der at diametrically-opposite points of its periphery.

The cylinder D has secured to its periphery a blanket or tympan, C′, made up to the same width and length as the plates or circular forms on one-half the peripheral circumference of cylinder C, and this cylinder D is set to mesh with the gear of cylinder C in such position or its blanket is so adjusted as to bring the latter in contact at the proper moment with one-half the forms on cylinder C, with which its blanket corresponds. The cylinder B is also provided with a similar blanket or tympan, B′, in substantially the same manner as described for cylinder D; but its blanket is so arranged as to engage with the remaining half or portion of type-plates on cylinder C. The cylinder B, however, is provided on its periphery with the horizontal shaft B^2, to which are attached gripping-fingers *b′*, and which shaft is arranged and operated in the usual manner, the grippers being so arranged that they will, when the press is in operation, grip the sheets of paper separated from the web, as described, and lay them upon table Q, and carry the same around with the cylinder B and obtain an impression thereon from the half-plates on cylinder C, as is evident.

I will now describe the operation of this part of the press.

S designates the paper-roll supported upon a proper shaft journaled in suitable arms or brackets rising from the main frame in rear of the feed-rollers E E, as shown. The web of paper *s* passes from this roll to the rollers E E, and by them is fed into the press. The paper passes from rolls E E over the traveling roller K, which is reciprocated by the frame H, as described, thence down under the roller M, thence to and under roller M′, thence up between the cylinders C D to the roller *m*, thence over roller L down to and under traveling roller *k*, thence up over stationary roller *l*, partly around roll G^2, where it is kept from bulging or moving backward by the tapes on rollers G *g g′*, under roller L′, over traveling roller *k′*, and down under roller *l′* between the rollers N′ and *n′*, where it is received by tapes N^2 n^2. These tapes feed the yet continuous web of paper down to and under knife *o′*, which at proper intervals, as described, breaks or cuts off a piece or sheet of the desired length that has been spaced off by the roller *k′*, as hereinafter described. This cut sheet is, by means of fingers *q* on shaft Q′, laid upon table Q in position for being gripped by the fingers on cylinder B and carried around thereby. The paper is continuously fed into the press from roll S by the action of the feed-rollers E E, and is then drawn through the press over the various rollers described by the action of roll G^2 and its coacting tapes. While the paper is passing between cylinders C and D it receives an impression on one side from one-half the forms on said cylinder, as previously determined, through the coaction of the blanket on cylinder D, as described. The paper is drawn in by the rolls E E from roll S only one-half as fast as the peripheries of the cylinders move, and the frame H and its rollers are employed to supply the requisite amount of paper to the cylinders C and D when the latter are coacting to produce an impression. At the commencement of the printing between cylinders C and D this frame and its rollers are at their highest position, consequently forming a loop of paper between rolls E E K and the roller M. As soon as the type on cylinder C and blanket on cylinder D begin to register the frame H is set in motion downward, its actuating-cam being properly arranged to effect this movement, and this action is of such extent that, in connection with the half-sufficient supply of paper furnished by rolls E E, it permits the paper to feed between cylinders C and D at the same uniform speed as said cylinders are rotating. The roller *k* keeps the paper correspondingly taut above the cylinders while it is being printed, as said roller has a corresponding degree of similar movement to roller K. During the next half-revolution of the cylinders the loop-system rollers on frame H are elevated by the action of the cam and a loop formed by the roller K in readiness for the next impression from the same forms. During this upward movement of frame H—that is, during the half-rotation of cylinders C and D—no printing is being effected between said cylinders. The loop of paper formed by the roll *k* supplies the roll G^2 with paper at a uniform speed, so that this roll will not tear the web, and its rotation is continuous. While this action is taking place the portion of web between cylinders C and D is at a stand-still. This action of the parts leaves the web of paper always at a uniform tension while passing through this part of the press, and permits the delivery-roll G^2 to be constantly turning out a supply of paper to the roller *k′*, which is in the top of frame H and moves therewith, so that a loop of paper is formed above roll G^2 by roll *k′*, corresponding to the loop formed above rolls E E by roller K. The action of roll G^2, in connection with the descent of roller *k′*, permits sufficient paper to be paid out under the knife *o′*, which during this period is elevated, and as soon as the frame H starts upward its speed is so calculated in regard to the speed of rotation of rolls E E and G^2 as to permit the loops of papers on rollers K and *k′* to be formed, while the paper between the cylinders C D and that under knife *o′* will remain stationary, and during this interval the knife *o′* is actuated as described, severing the sheet of paper from the web, and ascends before the web is again moved forward.

The action of the press, as described, caused the paper to be fed in, printed on one side, and delivered in sheets upon table Q printed side down, as is evident. From board or table Q the sheets of paper are removed at proper time

by means of the grippers on cylinder B, and its blank side is brought in contact with the desired form on cylinder C, said form being the opposite half to that impressed by cylinder D, and an impression is produced thereon by means of the coacting blanket on cylinder B, as is evident. From said cylinder the completed or perfected paper is delivered by the tapes R^2 r^2 to the folding-board as described.

The form on cylinder C that is impressed by the blanket on cylinder B is placed on said cylinder in a reverse position to the form operated upon by cylinder D, thus allowing the heads to be printed to a register on both sides of the sheet. Were the forms not reversed the matter on the inside and outside pages of the paper or book being printed would be upside down with reference to each other.

Any suitable inking device may be employed in connection with said press; but I preferably employ the inking device described and claimed in my application for Letters Patent for improvements in inking devices for printing-presses filed April 13, 1888, Serial No. 270,601, and which is arranged as follows: T designates an ink-fountain of ordinary construction and placed below the cylinder to one side of cylinder C. U designates a reel or feeder, composed of cross-arms *u u*, having journaled in their end small rollers *t t* of printers' composition. This reel is mounted centrally on a longitudinal shaft, V, which is properly journaled in the main frame, and has one end extended outside said frame and provided with a pinion, *v*, which meshes with the teeth of cam J and is rotated thereby. The reel is placed at such a distance from fountain T that when it is rotated, as described, its rollers *t* will be successively brought in contact with the roller in said fountain and then with the series of distributing-rollers W W, journaled in the main frame, as shown, from which the ink is distributed to the inking-cylinder X, which is journaled just below cylinder C, and which in turn furnishes the distributed color to the form-rollers Y Y, which then transmit the color to the revolving forms on cylinder C. These rollers receive their motion from contact with inking-cylinder X, which is driven by means of a gear, *x*, on its shaft, which meshes with the gear on the end of cylinder C. It will be thus seen that I ink both forms from one fountain, the operation of the distributing-rollers being obvious.

It will be observed that when in operation I first carry the web of paper in a continuous sheet through the rollers C and D, where it receives its first impression, and afterward I separate this web into sheets and cause these sheets to be carried, in a reverse direction to the web, through the press between rollers C and B, thereby imprinting its blank face.

The press is preferably driven by means of a driving-shaft, Z, suitably journaled in the main frame and provided with gears *z z*, which mesh with the gears of cylinder B preferably. This shaft Z is driven by means of a pulley, Z', on its extended end and a belt, *z'*, from any proper source of power.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination, with the central type-bearing cylinder having the type-plates arranged at diametrically-opposite points thereon and the opposite impression-cylinders provided with blankets or tympans adapted to register with the opposite set of type-plates, of the paper-feed rolls and looping-frame for supplying the paper for one impression-cylinder and the devices for severing the web and supplying the already-imprinted sheets to the opposite impression-cylinder, all substantially as and for the purpose described.

2. The combination of the central type-bearing cylinder bearing the diametrically-opposite type-forms and the opposite impression-cylinders on each side of and parallel with the type-cylinder, arranged to produce impression from the opposite type-forms thereon, with the paper-feed rolls for supplying a continuous web of paper between one impression-cylinder and the type-cylinder, and the rollers and tapes for delivering the web from said impression-cylinder upon a table at the opposite end of the machine, the knife for severing said web upon the table, and the grippers on the other impression-cylinder for seizing the severed sheets from the table and carrying them around with the cylinder to receive a second impression on their reverse sides, all substantially as and for the purpose described.

3. The combination, in a press, of a type-form-bearing cylinder and an impression-cylinder adapted to produce an impression of one-half the forms of the type-cylinder with the feed-rollers E E and the loop-forming frame H and its rollers and actuating devices, whereby the paper is fed to the cylinders during the time of the impression and allowed to remain at rest when not being imprinted, all constructed and arranged substantially as and for the purpose described.

4. The combination, in a press, of the central type-bearing cylinder, C, having the forms arranged thereon as described, and the outer opposite impression-cylinders, B and D, provided with blankets adapted to register with and produce impressions from the opposite forms on the type-cylinder, with the feed-rolls E E and loop-forming frame H, adapted to supply the paper to cylinders C and D during their printing operation, and the roll G^2, its coacting tapes, and loop-forming roller *k'* in the upper end of frame H, and the delivery-tapes, adapted to supply the paper in proper lengths to a supporting-table, and the devices on cylinder B, adapted to grip the severed sheet of paper and carry it around therewith to cause an impression on its blank side from the opposite set of types to that before imprinted thereon by cylinder D, and the delivery-tapes from cylinder B, all con-

structed and arranged substantially as and for the purpose described.

5. The combination, with the type-bearing cylinder C and impression-cylinders B and D, arranged and operating substantially as described, of the continuous paper-web feed devices for the cylinders C and D, and the looping devices for said web, the devices for delivering the web from said cylinders to the opposite end of the machine, the knife and rock-shaft for severing the web of paper above cylinder B, actuated by a cam-grooved wheel on said cylinder, and the gripping devices for carrying said severed sheets around with the cylinder B, and the delivery-tapes therefor, all substantially as described.

6. The combination, with the type-cylinder C and impression-cylinders B and D, of the paper-feed rolls and loop-frame H, constructed substantially as described, whereby the paper is fed continuously into the press and between cylinders D and C during the printing operation of said cylinders, but is held at rest between said cylinders when they are not printing, but yet revolving, and the rolls and tapes acting with frame H and knife, substantially as described, for taking the web up and over the cylinders and delivering it in proper severed sheets to the cylinder B for impression by the latter over the opposite type-form on cylinder C, all substantially as and for the purpose described.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

JOSEPH LEVI COX.

Witnesses:
GEORGE W. MECHEM,
R. P. YORKSTON.