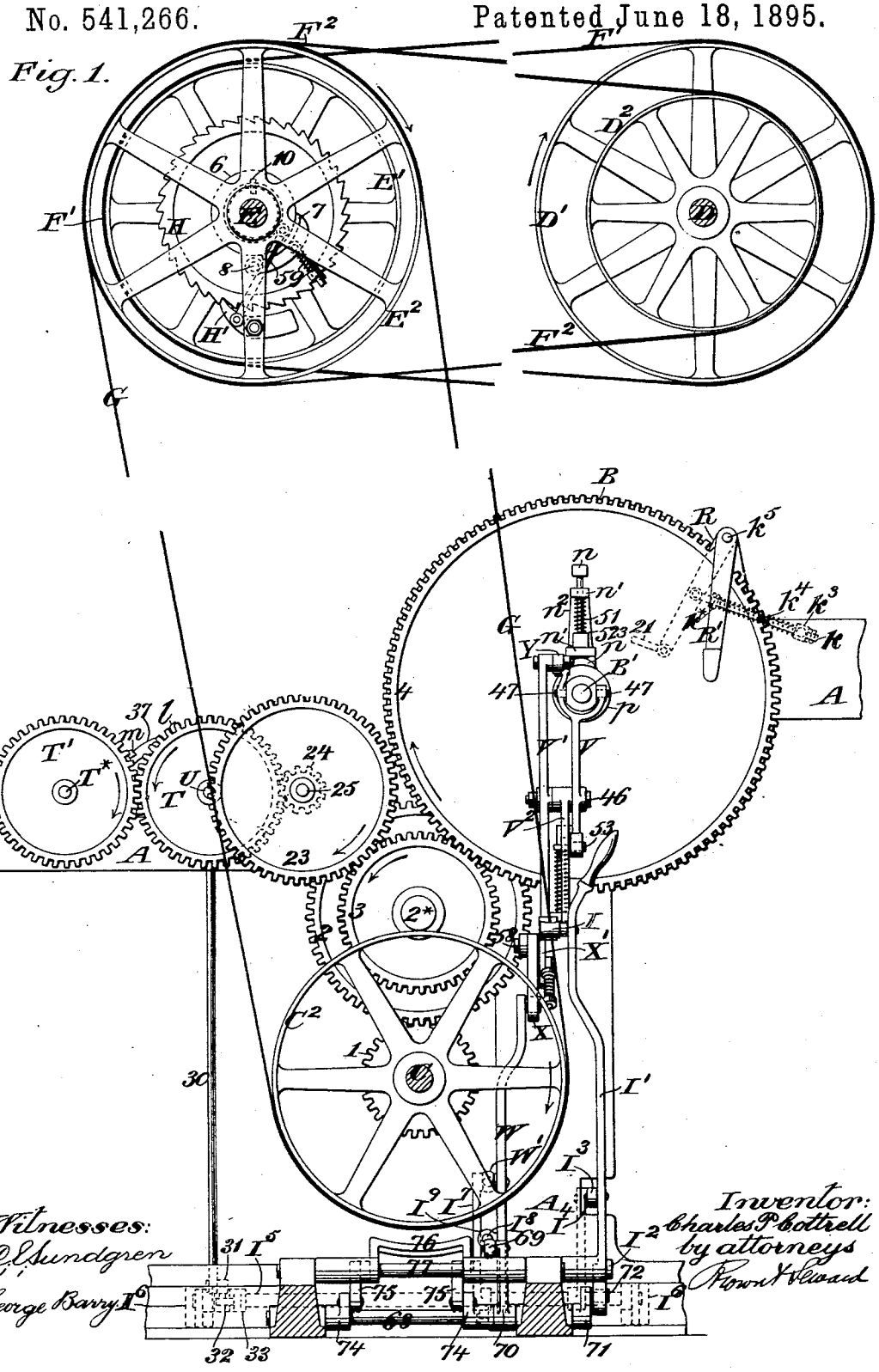
(No Model.) 7 Sheets—Sheet 1.

C. P. COTTRELL.

PRINTING MACHINE.

No. 541,266. Patented June 18, 1895.

Fig. 1.



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(No Model.) 7 Sheets—Sheet 2.

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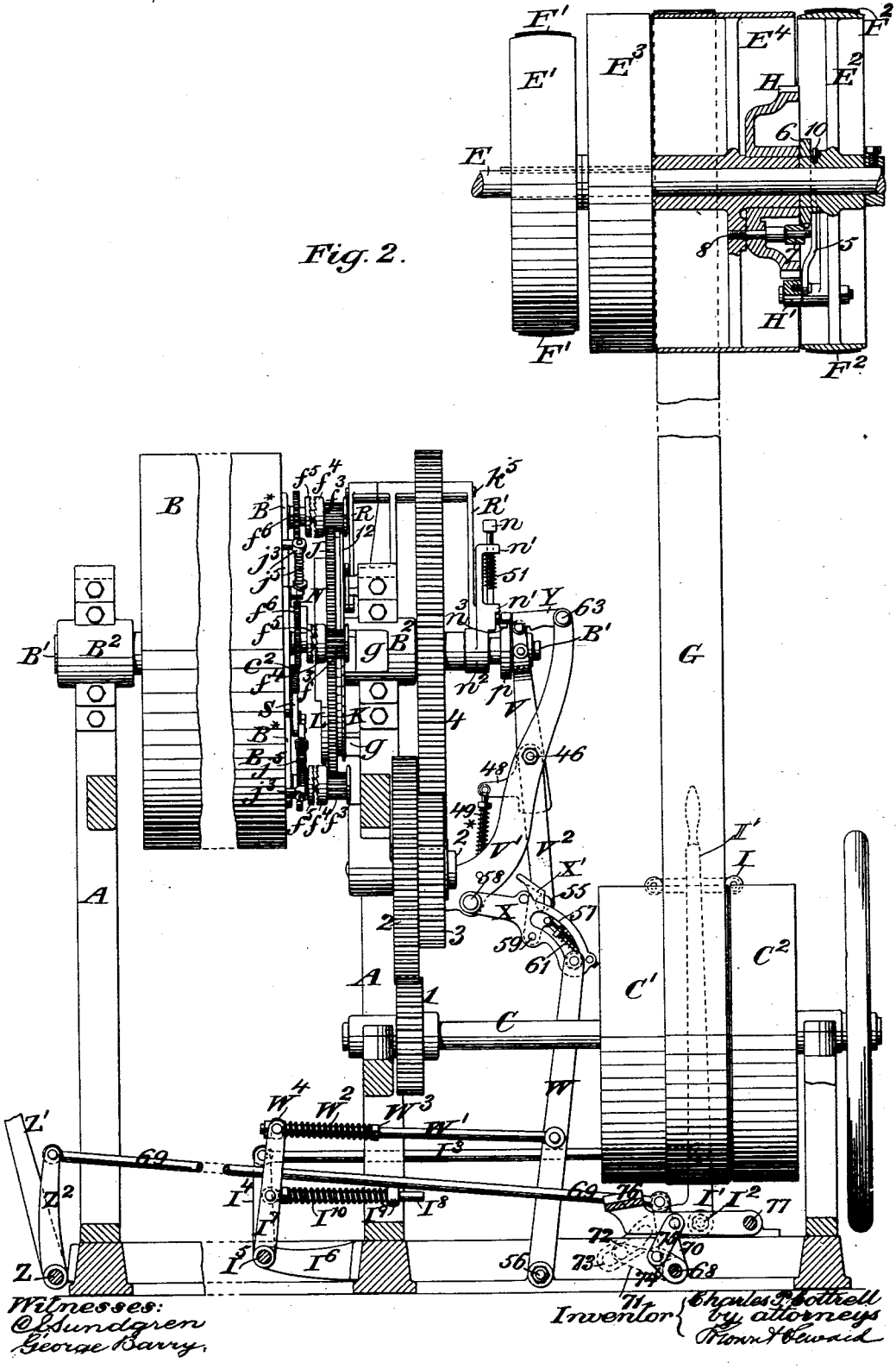
Fig. 2.



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7 Sheets—Sheet 3.

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Fig. 3.

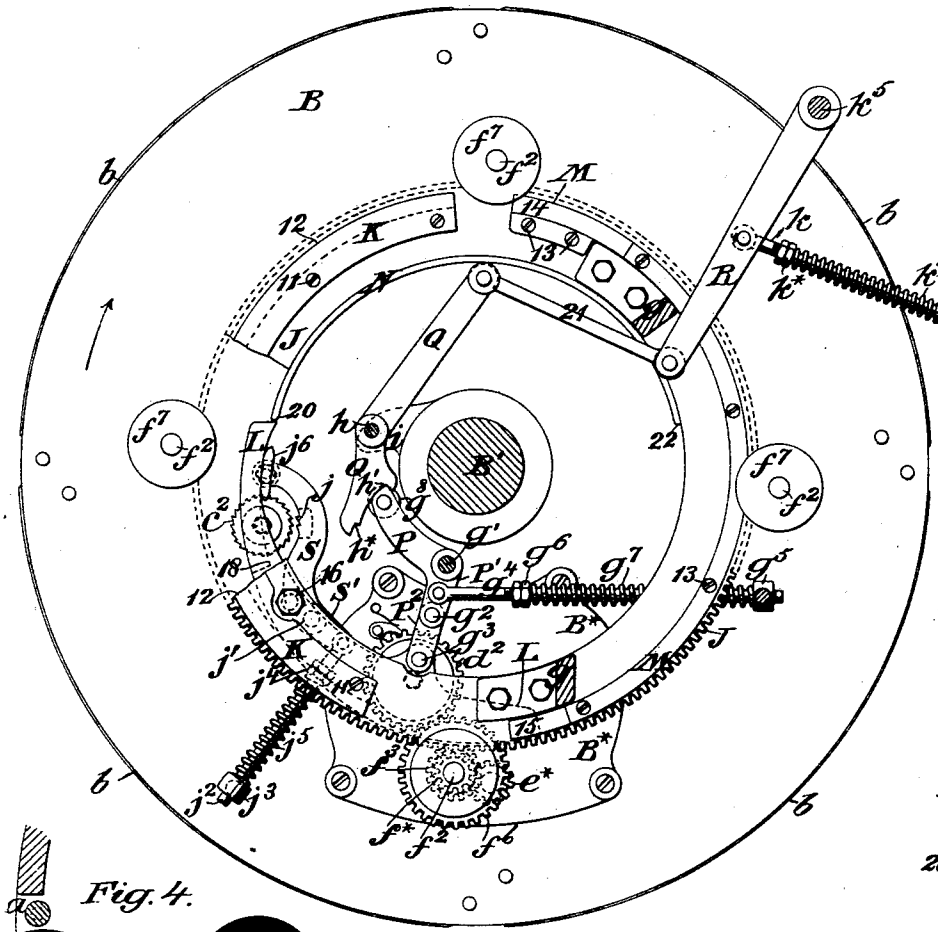

Fig. 4.

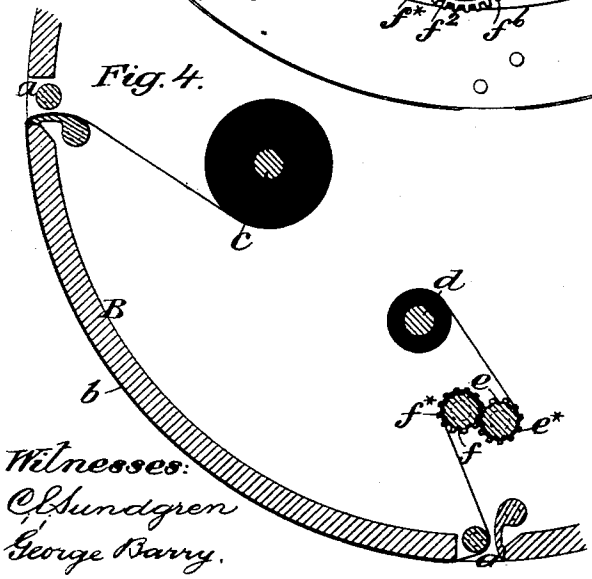

Fig. 5.

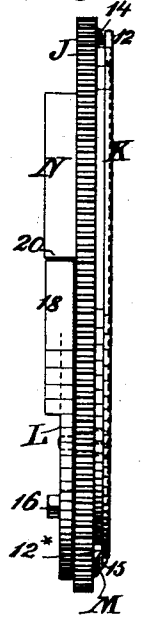

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Fig. 5c.

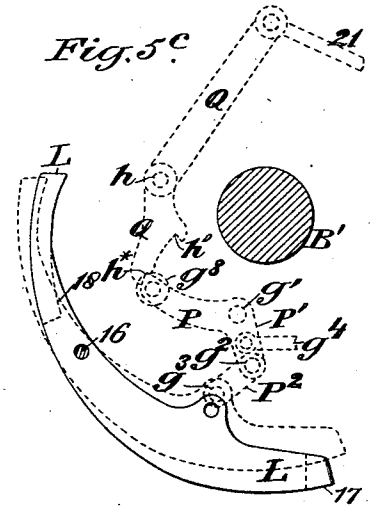

Fig. 5d.

Fig. 5b.

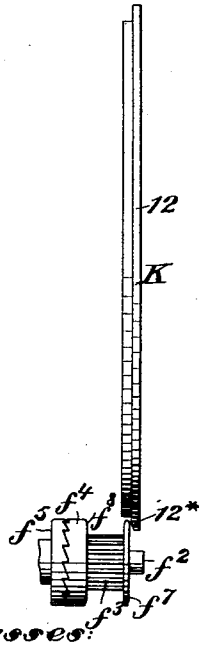

Fig. 5a.

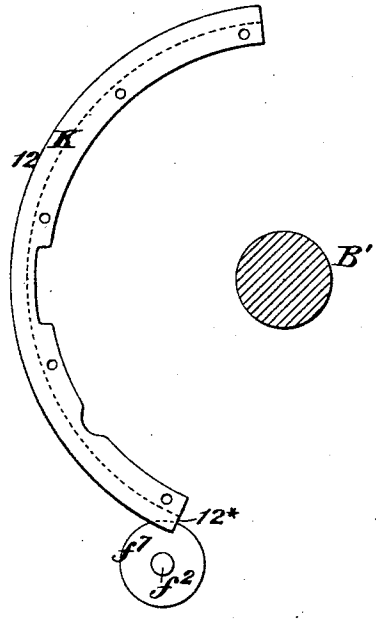

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Fig. 6

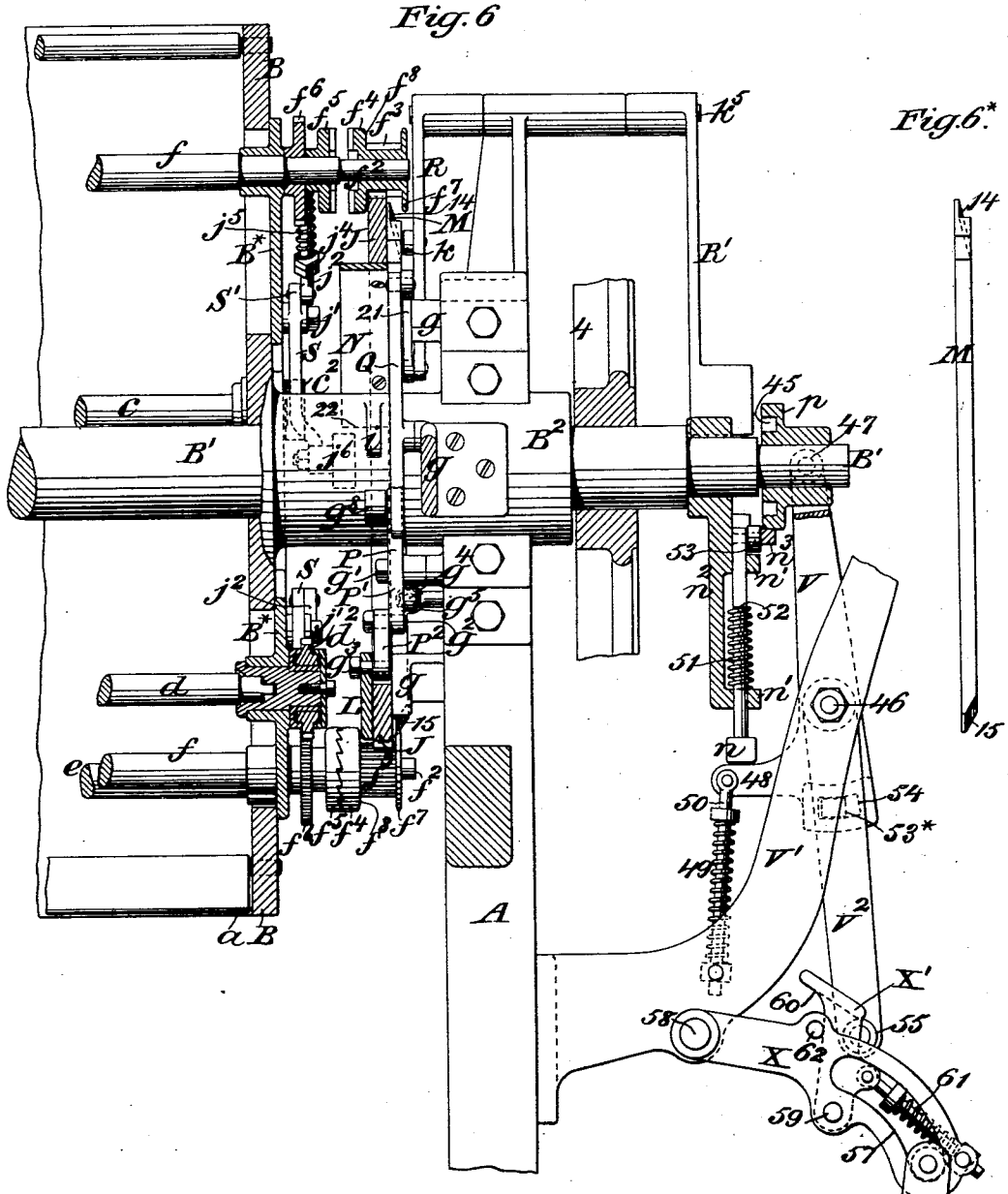

Fig. 6*

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PRINTING MACHINE.

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Fig. 7.

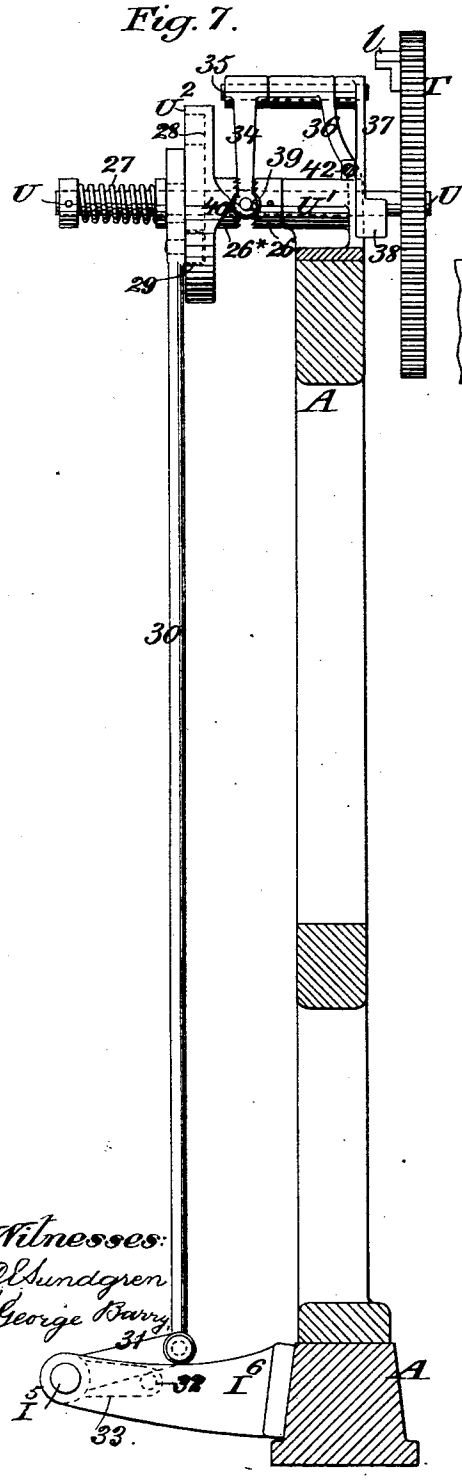
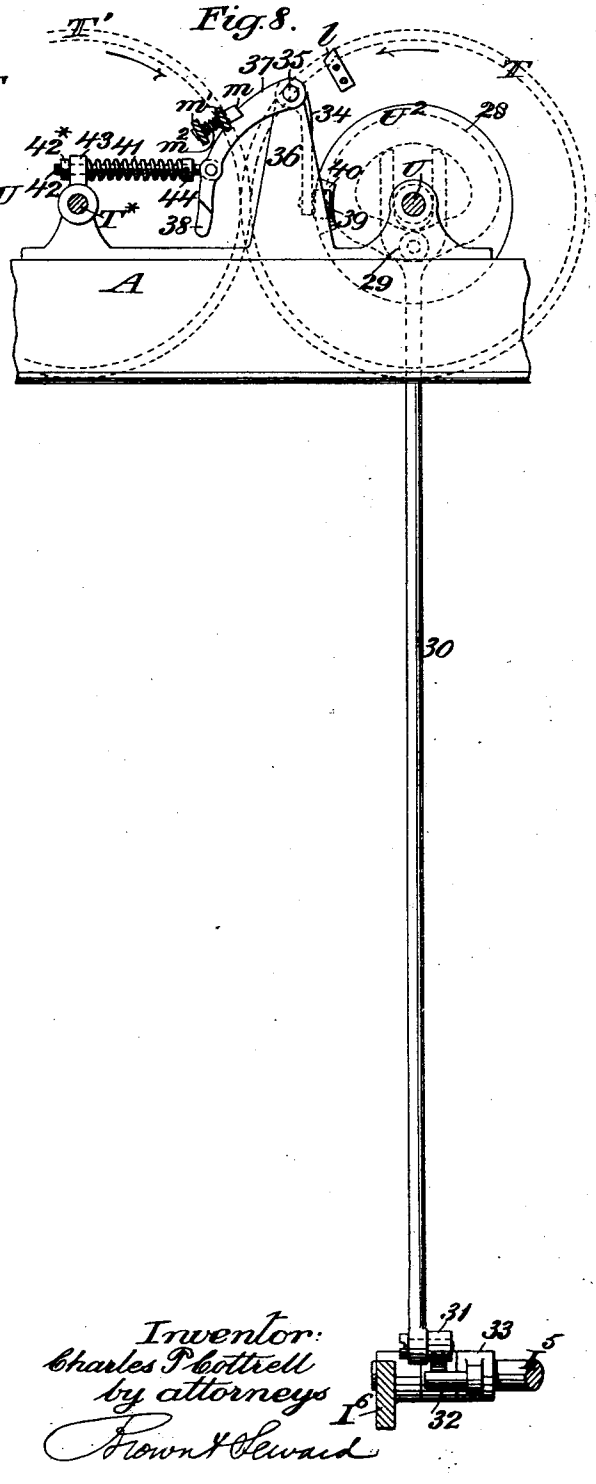


Fig. 8.



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C. P. COTTRELL.

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Fig. 10.

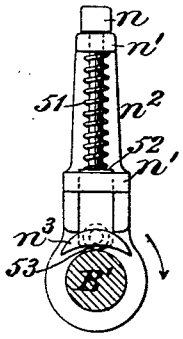


Fig. 9.

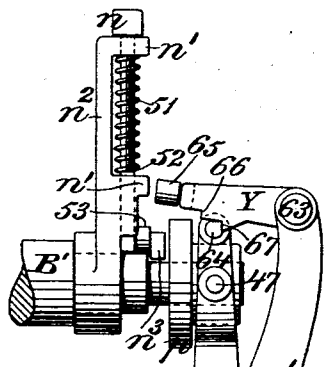


Fig. 11.

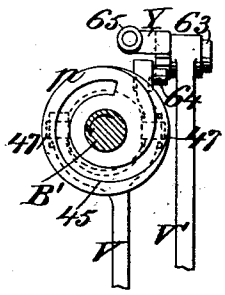
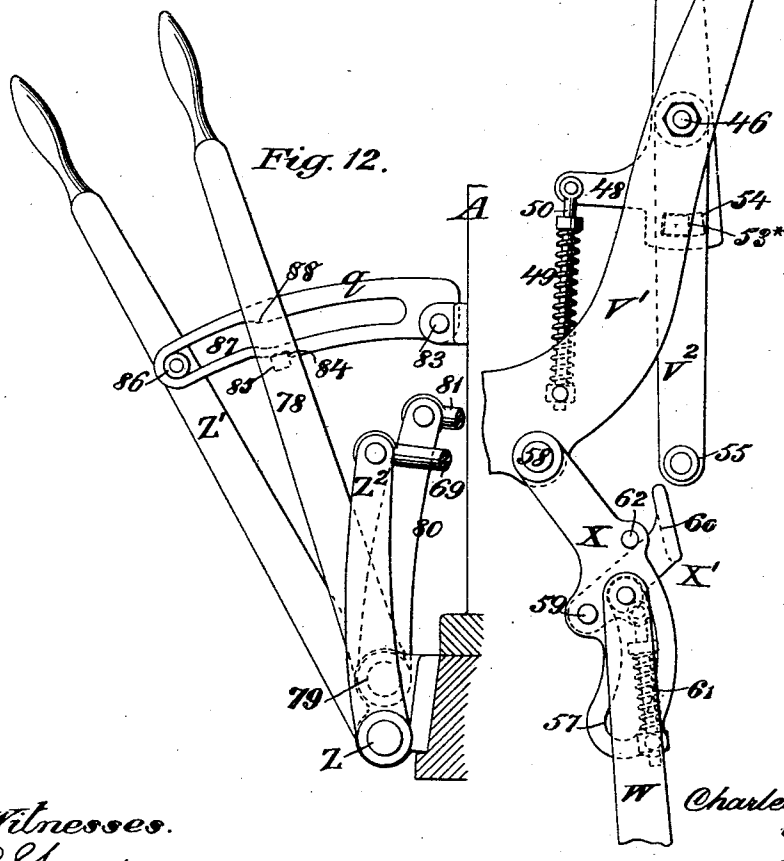


Fig. 12.



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UNITED STATES PATENT OFFICE.

CHARLES P. COTTRELL, OF STONINGTON, CONNECTICUT, ASSIGNOR TO THE C. B. COTTRELL & SONS COMPANY, OF SAME PLACE AND JERSEY CITY, NEW JERSEY.

PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 541,266, dated June 18, 1895.

Application filed February 12, 1895. Serial No. 538,067. (No model.)

To all whom it may concern:

Be it known that I, CHARLES P. COTTRELL, of Stonington, in the county of New London and State of Connecticut, have invented a new and useful Improvement in Printing-Machines, of which the following is a specification.

This invention relates to printing machines in which an impression cylinder is furnished with a movable tympan and means of shifting said tympan while the cylinder continues in motion between two successive printings, and it especially relates to machines in which the tympan is so shifted between two successive printings to the extent or distance necessary to present an entirely fresh clean portion of the tympan outside of the cylinder. Means for so shifting the tympan to that extent or distance have for some time been in successful use on printing machines running at a comparatively high rate of speed; but the object of this invention is to enable such shifting to be successfully performed on machines which run normally at a still higher speed or even at the very highest speed at which printing can be successfully performed. To accomplish this I provide means whereby, either automatically or under the control of an attendant as may be desired, the speed of the machine is temporarily reduced below the normal printing speed before and during the operation of shifting the tympan and the machine is again caused to run at the normal speed after the shifting; and such means constitute the principal features of the improvement which is the subject of this invention.

The invention also includes portions of the speed changing and tympan shifting mechanisms.

To enable others skilled in the art to apply my invention to practice, I will first describe it in detail with reference to the accompanying drawings, and will afterward point out its novelty in the claims.

Figure 1 represents a side elevation of a portion of the framing of a perfecting printing-machine, the second impression-cylinder, the gearing, pulleys, and belting by which said cylinder is driven, and the mechanism for changing the speed of the machine preparatory to and after the shifting of the tympan; Fig. 2, a transverse sectional elevation corresponding with Fig. 1, showing the cylinder, the tympan-shifting mechanism, and the speed-changing mechanism. Fig. 3 is a side view of the impression-cylinder and parts of the tympan-shifting mechanism. Fig. 4 represents a section taken parallel with Fig. 3 of part of the cylinder and one of the tympans and its rollers. Fig. 5 is a view taken at right angles to Fig. 3, showing certain parts of the tympan-shifting mechanism shown in that figure. Figs. 5^a, 5^b, 5^c, and 5^d are detail views showing parts of the tympan-shifting mechanism. Fig. 6 represents a central section of parts of the cylinder and a transverse section of the tympan-shifting mechanism, showing also part of the mechanism for throwing the tympan-shifting mechanism into and out of operation. Fig. 6* is a view corresponding with Fig. 6 of one of the details imperfectly shown in that figure. Figs. 7 and 8 represent elevations at right angles to each other of part of the machine-framing and parts of the automatic trip mechanism for throwing the tympan-shifting mechanism and speed-changing mechanism into and out of operation. Fig. 9 is a view corresponding with Fig. 2, showing certain parts on a larger scale and in a different position. Figs. 10 and 11 represent sections taken at right angles to Fig. 9 of certain details shown in that figure. Fig. 12 represents hand-gear for controlling the tympan-shifting mechanism and speed-changing mechanism. Figs. 3 to 12 are on a scale twice as large as Figs. 1 and 2.

A is the framing of the machine and B the second impression cylinder to which my invention is applied, the shaft B′ of said cylinder being supported in journal boxes B^3 in the framing A.

C is the main driving shaft of the machine, suitably supported in bearings in the framing A and geared with the cylinder B for the purpose of driving the same, by gears 1, 2, 3, 4, the gear 1 being fast on the said shaft C and meshing with and driving the gear 2 which is fitted to turn freely on a fixed stud 2* secured in the framing A, the said gear 2 having firmly secured to it the smaller gear 3 which meshes with and drives the gear 4 which is fast on the cylinder. The shaft C has securely

keyed to it a broad-faced driving pulley C′ and has also fitted to it a loose pulley C^2.

D (Fig. 1) is a line shaft from which is derived the power for driving the machine, the said shaft carrying a larger pulley D′ for driving the machine at the normal speed and a smaller pulley D^2 for driving it at the slow speed for shifting the tympan.

E (Figs. 1 and 2) is a counter-shaft on which is a smaller pulley E′ and a larger pulley E^2, the smaller pulley E′ receiving a belt F′ from the larger pulley D′ on the line shaft for driving the machine at the normal quick speed and the larger pulley E^2 receiving a belt F^2 from the smaller pulley D^2 on the line shaft for driving the machine at the slower speed for shifting the tympan. These pulleys D′ D^2 E′ E^2 may be so proportioned that the belt F^2 will drive the machine at a speed about half that at which it is driven by F′. The counter-shaft E also carries two pulleys E^3 E^4 of equal diameter to receive a belt G running from them to the pulleys C′ C^2 on the driving shaft of the machine. The pulley E^3 which only requires to be wide enough to receive the belt G, is fast upon the shaft E opposite to one portion of the wide pulley C′ on the driving shaft C. The pulley E^4 which is loose upon the shaft E, is wide enough to receive the belt G while the latter is running either upon the fast pulley C′ or the loose pulley C^2 of the driving shaft.

The smaller pulley E′ receiving the quick driving belt F′ is fast upon the counter-shaft E. The larger pulley E^2 receiving the slow driving belt F^2, is loose upon the said shaft E. The said pulley E^2 and the loose pulley E^4 are capable of being engaged together by a ratchet wheel H which is fast on the hub of the pulley E^4 and a pawl H′ which is carried by the pulley E^2. When the belt G runs upon the pulleys E^4 and C′ as illustrated in the drawings, the machine is driven by the slow belt F^2 and pulley E^2, the pawl H′ engaging with the ratchet wheel H and so driving the pulley E^4 which drives the belt G independently of the counter-shaft E which then having no connection with the belt G, is inoperative. When the belt G is on the pulleys E^3 and C′ the machine is driven by the fast belt F′ through pulley E′, shaft E and pulley E^3, and the pulleys E^2 and E^4 still driven by the belt F^2 may both continue running loosely on the shaft E at a speed slower than the said shaft.

In case the friction of the shaft should tend to carry round the pulley E^4 faster than that E^2 which is restrained by the belt F^2, the ratchet wheel H will run away from the pawl H′. This running away of the ratchet wheel from the pawl will also occur while the belt G is being shipped between the pulleys E^3 and E^4 and so prevent the belts F′ F^2 from pulling one against the other at that time. In order to prevent the clicking of the pawl on the ratchet when the pulley E^4 runs ahead of E^2, the pawl is connected by a rod 5 with a ring 6 fitted to the hub of the pulley E^2 and upon this ring there is applied a brake 7 which is pivoted at 8 to the ratchet wheel H and pulley E^4 and to which is applied a coil spring 9 which is also connected with the ratchet wheel H for the purpose of pressing the brake against said ring. The said ring is fitted loosely to the pulley hub but is only permitted to turn a very little way thereon, the turning movement being so restricted by a pin 10 (see Figs. 1 and 2) fast in the hub and entering a notch in the ring that it is only just sufficient to permit the ring by its action through the rod 5 on the pawl, to throw the pawl into and out of engagement with the ratchet wheel. While the pulley E^4 runs no faster than it is driven by the pulley E^2 through the pawl and ratchet wheel, the friction of the brake produced by the spring 9 holds back the ring which then by means of the rod 5 holds the pawl H′ in engagement with the ratchet wheel, but as soon as the pulley E^4 and the ratchet wheel begin to run faster, the friction of the brake pulls forward the ring as far as permitted by the pin 10, and the ring acting through the rod 5, throws the pawl out of engagement from the ratchet wheel.

A belt-shipper I carried by a lever I′, is capable of placing the belt G either in the central position shown in Fig. 2 to run upon the pulleys E^4 C′, or in a position to run on the pulleys E^4 C^2. The lever I′ works on a fixed fulcrum pin I^2 secured in the framing and is connected by a rod I^3 with the arm I^4 of a rock-shaft I^5 which works in bearings in brackets I^6 secured to the framing. The said rock-shaft I^5 carries another arm I^7 to which is connected a rod I^8 working through a guide I^9 on the framing. Between this guide I^9 and a collar on the rod I^8 a spring I^{10} coiled round the rod acts in such manner as to exert a constant tendency to throw and hold the belt G upon the pulley E^3 for driving the machine at the fast or normal speed, until the time arrives for reducing the speed of the machine preparatory to the shifting of the tympan, when the rock-shaft I^5 is so operated by mechanism to be hereinafter described as to overcome the spring I^{10} and give the lever I′ the movement necessary to ship the belt G on the pulley C′ to a position in which it runs on the pulley E^4, the return of the belt to the pulley E^3 being effected at the proper time by the spring I^{10}.

In carrying out my invention the cylinder may have only one tympan or may, as represented, have several tympans or tympan sections *b*, each covering a portion of the cylinder between two openings *a* therein. In the example represented there are four of such sections *b*, which will be hereinafter referred to as "tympans," each consisting of a roll of paper one end of which is fastened to a supply roller *c* and the other end to a take-up roller *d*, the journals of the said rollers having their bearings in plates B* secured to the ends of the cylinder. The tympan runs as

shown in Fig. 4, from the supply roller to the exterior of the cylinder, thence entering the cylinder again and passing around and between feed rollers *e f* to the take-up roller *d*. The feed rollers of each tympan are geared together by gears *e* f** and the feed roller *f* has loosely fitted to one of its journals f^2, a spur gear f^3 which meshes into a spur gear or toothed ring J which is concentric with the cylinder and which will be hereinafter called the "stationary gear." This gear J in the case of a continuous web perfecting press in which there is no lost motion of the cylinder, is supported by brackets *g* secured to the framing A, as represented in Fig. 6; but in the case of a cylinder having a lost motion, the said gear would be, as described in United States Letters Patent of C. B. Cottrell, No. 467,637, carried by brackets secured to one of the cylinder journal-boxes. To the loose spur gear f^3 (see Fig. 6) is secured one member f^4 of a clutch the other member f^5 of which is affixed to the said journal f^2. To the clutch member f^5 there is secured a spur gear f^6 which meshes with a gear d^2 on the take-up roller *d*, and on the outer side of the gear f^3 there is a flange f^7 projecting beyond its teeth. The gear f^3, as it is carried round by the rotation of the cylinder meshing into J, is caused to receive a constant rotary motion upon its own axis; but it is only when the clutch member f^4 attached to it engages with the clutch member f^5 which is fast upon the feed roller journal f^2, that the feeding movement is given to the feed rollers and to the tympan and this engagement does not take place until it is required to shift the tympan. The gearing and clutch above described do not differ essentially from what are shown in the United States Patents of C. B. Cottrell, Nos. 425,123 and 467,637.

The means by which the clutch member f^4 is thrown into and out of engagement with its mate f^5, consists in part of a stationary cam K and a movable switch L somewhat resembling what are described in said Letters Patent No. 467,637 and in part of a second stationary cam M. These are illustrated in Figs. 3, 4, 5, 5^a, 5^b, 5^c, 5^d, 6 and 6*. The movable switch L serves the purpose, by its action against the outer face f^8 of the clutch member f^4, of throwing the clutch member f^4 into engagement with that f^5 and so to couple the gear f^3 with the feed roller *f*. The said switch also serves the purpose of unlocking the supply roller from a pawl lever S S′ by which the said roller is locked except before and during the shifting of the tympan as will be hereinafter described. The stationary cam K serves the purpose, by its action on the outside of the flange f^7 of the gear f^3, of keeping the clutch member f^4 in engagement. The stationary cam M serves by its action on the inside of the flange f^7, to throw the clutch member f^4 out of engagement and uncouple the gear f^3 from the feed roller journal f^2.

The stationary cam K is secured by screws 11 (see Fig. 3) to the outside of the stationary gear J. The said cam is fully shown in Figs. 5^a and 5^b, Fig. 5^a being a side view and Fig. 5^b a back view. It is also shown in Fig. 5 but only portions of it are shown in the side view Fig. 3, the other portions together with a portion of the stationary gear J, being broken away to expose to view a part of the movable switch L which is between the said gear and the cylinder. The said cam consists of a segment of a ring and is concentric with the gear J and the cylinder, extending nearly half way around the said cylinder as shown in Fig. 3, and it has a thin external flange 12 between which and the gear J, there is just room for the flange f^7 of the gear f^3 to run. The flange 12 is beveled on the inner side of its lower end as shown at 12* in Fig. 5^b. The second stationary cam M is also a segment of a ring and is concentric with the cylinder and with the stationary gear J to which it is secured by screws 13 as shown in Fig. 3, and it extends nearly half around the said gear on the opposite side of the center to that on which the cam K is situated. A full view of this cam is given in Fig. 3 and an edge view is also given in Fig. 6* and its ends are also shown in Fig. 6. The outer arc of this cam corresponds with that of the flange 12 of the cam K. The said cam lies flat against the gear J projecting outward therefrom about or nearly flush with the outside of the flange 12 of the cam K, its outer face being straight except that it is beveled at the ends as shown at 14, 15.

The movable switch L consists of a curved bar which is attached to the stationary gear J close against the inner side thereof by a pivot 16. Only portions of this movable switch are shown in Figs. 3 and 6, but it is fully shown in Figs. 5, 5^c and 5^d, Fig. 5 giving a back view, Fig. 5^c a side view and Fig. 5^d a top view. The lower or front end of the said switch, which is opposite the lower end of the cam M, is beveled on its inner side as shown at 17 in Figs. 5^c and 5^d, and its upper end, at and below which there is a projection 18 on its inner side, comes opposite and in close proximity to the end 20 of the stationary guide or track N which is fastened to the stationary gear J and concentric with said gear and with the cylinder. That face of the projection 18 of the switch which is toward the center of the cylinder is curved so as to nearly conform to the inside of the stationary track N. When the switch is in the position shown in Fig. 3 and in full outline in Fig. 5^c, its beveled end 17 is in position to operate as a wedge against the face f^8 of the clutch member f^4 for the purpose of throwing the clutch into engagement for shifting the tympan, and at the same time the inner face of its projection 18 forms a continuation of the inside of the stationary track N, as shown in Fig. 3. The switch is, however, only brought to this position when it is required to throw the clutch into engagement.

It is at all other times in the position shown in dotted outline in Fig. 5ᶜ where it is inoperative.

The movement of the switch L into and out of its operative position is effected through a toggle connection with a lever P P′, termed the "toggle" lever, which works on a fulcrum g' secured in the cylinder journal box B^2. The arm P′ of this lever constitutes one member of a toggle and is connected by a link P^2 which constitutes the other member of the toggle, and pins g^2 g^3 with the movable switch. The toggle arm P′ has connected with it a rod g^4 which runs through a guide g^5 (see Figs. 3 and 6) secured to the framing A. Between said guide g^5 and a nut or collar g^6 on the said rod is a coiled spring g^7 which exerts a tendency to straighten the toggle P′ P^2, as shown in Fig. 3, and bring the movable switch to its operative position when thelever P P′ is free from a locking lever Q, by which said lever P P′ is engaged, as shown in Fig. 5ᶜ, at all times except when the shifting of the tympan is to be produced. The toggle when straight holds the switch in its operative position. The locking lever Q swings upon a pivot h which is secured in the journal box B^2, and its lower arm has in it two notches h' h^* with either of which the upper end of the toggle lever may engage, the said end being pointed to engage in the said notches. The engagement with the upper notch h' locks the switch in its operative position shown in Fig. 3, and in full outline in Fig. 5ᶜ, and the engagement with the lower notch h^* locks it in the inoperative position shown in dotted outline in Fig. 5ᶜ. The upper end of the toggle lever P P′ is furnished with an antifriction roller g^8 to be operated upon by a cam i (Figs. 3 and 6) formed on or fastened to the hub of the cylinder B for the purpose of throwing out the said end from the notch h' and producing the flexure of the toggle P P′ by which the switch is brought to its inoperative position in which it is locked by the engagement of the said end with the notch h^*. The locking lever Q is subject at all times to the pressure of a spring k^4 (see Figs. 1 and 3) which tends to throw it into and hold it in engagement with the toggle lever, the said spring acting against one arm R of a trip lever R R′, the fulcrum of which is a rock-shaft k^5 which works in a bearing in a small stand erected on the framing A. The said arm R is connected by a rod 21 with the upper end of the locking lever. The said spring k^4 is coiled around a rod k which is connected with the trip lever arm R and which slides through a fixed guide k^3 secured to the framing A, the bearings of the spring being between the guide k^3 and a collar k^* on the rod. The trip lever and its connections are substantially counterparts of what are described in United States Patent No. 467,637, but I have found it necessary to thus above describe them to explain the present invention.

It may be understood from the immediately foregoing description that the tympan rollers c d e f, stationary toothed gear or ring J, spur gear f^3, clutch f^4 f^5, stationary cams K, M, movable switch L, toggle levers P P′, and spring g^7, constitute a mechanism for periodically shifting the tympan, and that the locking lever Q, trip lever R R′ and spring k^4 constitute a mechanism for locking said shifting mechanism in an inoperative position between the periods of shifting.

Each supply roller c is furnished outside of the cylinder B, as described in United States Patent No. 467,637, with a ratchet wheel c^2, to be engaged by teeth j j on the arm S of the pawl lever S S′ which is fulcrumed on a stud j' secured in the cylinder head. There is one such pawl lever for each tympan but I have only shown one as that is sufficient to illustrate my invention. The other arm S′ of the pawl lever has connected with it a rod j^2 which passes through a guide j^3 secured in the cylinder head, and between said guide and a nut or collar j^4 on the said rod, there is coiled upon the said rod a spring j^5 which serves to throw the teeth of the said lever into engagement with the ratchet wheel c^2. The arm S of the pawl lever has attached to it a sliding shoe j^6 which conforms to the track N hereinbefore described. The pawl lever is always in engagement with the ratchet wheel to prevent the supply roller from unwinding the tympan except when it is desired to shift the tympan, and when the pawl lever is so engaged, its sliding shoe j^6 may pass outside of the track N; but when the tympan is to be shifted, and the switch L is brought by the toggle lever to the position shown in Fig. 3, the curved projection 18 of the switch comes to such a position that in the revolution of the pawl lever with the cylinder, its shoe j^6 will run against said curved projection 18 and so cause the arm S of the said lever to move inward toward the center of the cylinder far enough to disengage the teeth of said lever from the ratchet wheel c^2. After passing the projection 18, the shoe j^6 will run against the inner face of the stationary track N and the pawl lever will be thereby held disengaged until it passes the end 22 of the said track when it is permitted to be re-engaged by the action of the spring j^5.

I will now describe the mechanism which produces the movement of the belt-shipper lever I′ to ship the belt G from the pulley E^3 to the pulley E^4 for reducing the speed of the cylinder preparatory to the shifting of the tympan and by which in the interval during which the speed is reduced the shifting mechanism is thrown into and out of operation. This mechanism consists in part of two intermeshing tappet gears T T′ which are shown in Fig. 1, and the pitch lines of which are shown in Fig. 8 wherein the tappet mechanism attached to them and the mechanism through which they operate are shown in full outline. One of the said tappet gears and its shaft and attached mechanism are shown

in Fig. 7. The said tappet gears and their tappets are substantially like those shown and described in United States Patent No. 467,637 hereinbefore referred to.

The gear T is driven from the driving shaft C at a speed considerably slower than the cylinder, by gearing which is represented in Fig. 1 as consisting of the gears 2 and 3 hereinbefore described for driving the cylinder and gears 23 and 24 which are fastened together and arranged to turn on a fixed stud 25 secured in the framing A, the said gear 23 deriving motion from the gear 3 and the gear 24 giving motion to the tappet gear T and the latter giving motion to the other tappet gear T′ which will be hereinafter termed the "trip" gear and which has one more tooth than T, the number on T being equal to the number of revolutions which the cylinder B is to make before the slowing of the machine preparatory to the shifting of the tympan. The gear T is affixed to a shaft U which works in a bearing U′ on the framing A, and the trip gear T′ turns freely on a fixed stud T* which is affixed to the framing.

On the gear T is affixed a tappet tooth *l* and on the trip gear T′ a trip tappet *m* which is fitted to slide radially in a guide *m′* on the said gear T′ and to which is applied a spring m^2 which tends to press it outward. The tappet tooth, trip tappet and spring are shown in Fig. 8. The shaft U of the gear T has affixed to it one member 26 of a clutch, the other member 26* of which is affixed to a grooved cam U^2 which is fitted to turn loosely on said shaft and to which a spring 27 coiled upon said shaft is applied in such manner as to tend to push the movable member 26* of the clutch into engagement and couple the cam to the shaft U. The form of the groove 28 in the cam which is the operative part thereof is shown in dotted outline in Fig. 8. This groove receives a roller 29 on the upper part of a yoke rod 30, the lower end of which is connected with an arm 31 which is loose on the rock shaft I^5 and which is situated above a pin 32 which projects laterally from an arm 33 which is affixed to the said rock shaft. When the clutch is brought into engagement the cam, acting through the rod 30, produces a movement of the arm 31 on the rock-shaft I^5 and the said arm 31 in its downward movement strikes the pin 32 of the arm 33 of the rock-shaft I^5 and thereby depresses the said arm 33 so that the rock-shaft through its arm I^4 and the rod I^3 operates the belt shipper lever I′ to throw the belt G on to the pulley E^4 for slowing the machine, but until the slowing of the machine is required to take place, the cam U^2 is kept uncoupled from the shaft by means of a stop which consists of the arm 34 of a small rock-shaft 35 (see Figs. 7 and 8), which is arranged parallel with the shaft U of the gear T in a bearing in a stand 36 erected on the framing and which has secured to it another arm 37 at the end of which is a tappet lug 38. The stop arm 34 is furnished with a roller 39 which is behind the cam U^2 and until the time arrives for coupling the cam with the shaft U to ship the belt for slowing the machine, the cam remains stationary and the said roller 39 is presented opposite to a projection 40 on the back of the cam as shown in Figs. 7 and 8, and holds the members 26, 26* of the clutch disengaged and the cam uncoupled. The rock-shaft 35 is caused to hold the roller in this position by means of a spring 41 and a stop rod 42 (see Fig. 8), the said stop rod being connected with the tappet arm 37 and working through a fixed stop 43 on the framing. The spring 41 which is coiled around the stop rod is compressed between one side of the fixed stop 43 and a collar 44 on said rod and so pushes the stop rod as far as permitted by an adjustable stop 42* provided on the said rod on the other side of the fixed stop 43 which is just far enough to hold the stop 34 with its roller 39 opposite the back of the cam and keep the cam uncoupled.

It will be understood that the time for coupling the cam U^2 to ship the belt is determined by the number of teeth in the trip gear T′, such time arriving at every completion of a number of revolutions of the said gear equal to the number of its own teeth. The tappet tooth *l* on the gear T and the trip tappet *m* then come together in a position in which the trip tappet is just opposite the inclined upper surface of the tappet lug 38, and the tappet tooth *l* then pushes the trip tappet *m* so far inward or toward the center of the trip gear that the continued revolution of the two tappet gears for a short distance with the tappets *l m* in contact brings the inner end of the trip tappet *m* into action on the tappet lug 38 and through it on the rock-shaft 35 and thereby causes the arm 34 to be tripped away from the projection 40 on the cam and to allow the spring 27 to throw the cam U^2 into engagement with its constantly rotating shaft U to operate the belt-shipper. By the time the tappets *l m* have passed each other and the spring 41 is permitted to bring the roller 39 again behind the cam, the projection 40 on the cam will have passed the roller and so the cam is allowed to remain coupled with its shaft U until at the end of one revolution of the gear T, the projection 40 will arrive at the stop roller 39 and so operate as a secondary cam to move the cam U^2 along the shaft and uncouple it from the gear T.

The form of the cam groove 28 is such that it ships the belt G from the pulley E^3 to that E^4 during the first part, say less than one-fourth of its revolution, and keeps it so shipped during little more than half its revolution and then during the remainder of its revolution allows the belt to be returned to the pulley E^3 by the action of the spring I^{10} on the rock-shaft I^5 as hereinbefore described. It will therefore be understood that the shipping of the belt to slow the machine, the retention of the belt so shipped for the time necessary, and the return of the belt for the

resumption of the normal speed of the machine are all performed during one revolution of the trip gear T while the cam U^2 remains engaged with it. The number of revolutions which the cylinder will make, two will be sufficient, while the shipping of the belt back and forth and the slowing of the speed take place, will depend on the gearing by which the relative speeds of the cylinder and the trip gear T are determined. It may be here mentioned that the reason that the yoke rod 30 of the cam U^2 is not directly connected with the rock-shaft I^5 but connected therewith by a loose arm 31 as described, is that the said rock-shaft may, for the purpose of permitting the shipping of the belt G to the loose pulley C^2 to stop the machine, be allowed to move farther than it is required to be moved by the cam U^2 for changing the speed.

In Fig. 2, I have shown a hand gear connected with the belt shipper lever I'. This hand gear consists in part of a rock shaft Z fitted to fixed bearings on the outside of the machine framing and a second rock-shaft 68 fitted to fixed bearings under the driving shaft C. The rock-shaft Z is furnished with a hand-lever Z' and has affixed to it an arm Z^2 which is connected by a rod 69 with an arm 70 affixed to the rock-shaft 68. The rock-shaft 68 has also affixed to it an arm 71 which carries a pin 72 which works in a slot 73 in a downwardly and laterally extended arm of the belt shipper lever I' in such manner that by the movement of the hand-lever Z' in one direction or the other, the belt shipper may be moved in the same direction. This hand-gear may be employed to ship the belt G to and from one and the other of the pulleys E^3 E^4 and to and from one and the other of the pulleys C' C^2. The said rock-shaft 68 is also furnished with arms 74 which are connected by toggle links 75 with a brake 76 which works on a fixed pivot 77 in such manner that when the belt G is on the loose pulley C^2, said brake is applied to the driving pulley C' for the purpose of stopping the machine.

The trip lever R R' (Figs. 1 and 3) hereinbefore mentioned for tripping and setting in operation the tympan shifting mechanism is represented as operated by means of a tappet n (see Figs. 1, 2, 6, 9, and 10) on the cylinder shaft, said tappet being brought to an operative position by mechanism actuated by the same rock-shaft I^5 hereinabove described which operates the belt shipper. The said tappet n is represented as of the form of a headed bolt and capable of sliding in and out toward and from the center of the cylinder shaft in guides n' in an arm n^2 which is firmly secured upon the cylinder shaft B^2. This tappet has at its inner end a curved projection or shoe n^3 to enter a convolute groove 45 in the inner face of a non-rotating cam p which is fitted loosely to the said shaft and capable of sliding lengthwise thereon but is prevented from turning with the said shaft and the cylinder by means of a forked lever V which works on a fixed fulcrum pin 46 in a bracket V' which is affixed to the framing A, the said lever engaging with the said cam by pins 47 and being provided with a projection 48 which is so acted upon by a coil spring 49 and rod 50 applied between the said projection 48 and the bracket V', as to press the cam toward the end of the cylinder shaft and hold it out of engagement with the shoe n^3 of the tappet as shown in Fig. 9. A spring 51 coiled around the tappet between a shoulder 52 thereon and one of the guides n' on the arm n^2, tends to draw the tappet in toward the cylinder shaft as far as permitted by a roller 53 on the inner end of the tappet, the said roller running against the cylinder shaft as shown in Figs. 9 and 10, so long as the lever V holds the cam out of engagement with the tappet shoe. While the tappet is so left under the control of the spring 51, it is not operative on the trip lever R R', but when the lever operates to move the cam along the shaft toward the tappet arm n^2, the cam groove 45 receives the tappet shoe n^3, and the latter being carried round in the cam groove, moves outward from the center of the shaft until it reaches the circular outer periphery of the cam, as shown in Figs. 1, 2 and 6, and projects the tappet outward to a position to strike the arm R' of the trip lever and so trip and start the operation of the tympan shifting mechanism.

A pawl Y pivoted by a pivot 63 to the upper end of the bracket V' serves, by its temporary engagement with a pin 64 on the forked lever V as shown in Fig. 2, to temporarily lock the cam in position to engage the tappet shoe, but the said pawl only remains in engagement until the operation of the tappet on the trip lever, when the shoe, running on the periphery of the cam, strikes a roller 65 on the end of the tappet and lifts the pawl out of engagement with the lever V and allows the latter to be operated by the spring 49 to throw the cam out of engagement from the tappet, leaving the latter free to be brought back to its inoperative position by its spring 51. The pawl y has two notches 66, 67, of which 66 engages with the pin 64 to lock the cam in engagement with the tappet shoe and 67 engages with the said pin 64 as shown in Figs. 9 to limit the outward movement of the cam along the shaft.

I will now describe the connections between the belt shipping rock-shaft I^5 and the cam shifting lever V, all of which are shown in Figs. 1 and 2 and parts of which are shown in Figs. 6 and 9.

On the same fulcrum pin 46 with the lever V, there is a downwardly projected lever V^2 on which there is a lateral projection 53* which so engages with a slot 54 in the lever V that the said lever V^2 will move the said lever V, but with a slight lost motion. On the lower end of the lever V^2 there is an anti-friction roller 55. A lever W working on a fixed fulcrum 56 is connected by a rod W'

with the arm I^7 of the rock-shaft I^5. The said lever W carries at its upper end a roller which works in the curved slot 57 in a link X which is hung on a pivot 58 from the bracket V', and to this link there is pivoted at 59 a latch piece X' the upper end of which is inclined as shown in Figs. 2, 6 and 9, and has a lateral projection 60 indicated by a dotted line in those figures. The said latch piece X' has applied between it and the link X, a spring 61 which presses it toward a stop pin 62 projecting laterally from the said link.

It will be understood by reference to Fig. 9, that when the cam *p* is out of engagement with the tappet *n*, the roller on the upper end of the lever W is at the upper end of the curved slot in the link X, but as the lever W moves in the same direction in which the arm I^7 moves to ship the belt for slowing the machine, the link moves upward on the roller and so brings the outer face of the inclined end of the latch piece into operation on the roller 55, and so causes the lever V^2 to move outward or to the right, and the said lever is thus made to so operate, through its projection 53*, on the lever V as to cause the latter lever to press the cam toward the tappet arm; but when this action begins the tappet shoe may be opposite the blank part of the face of the cam, that is to say, not opposite its groove 45, and the movement of the levers V and V^2 is arrested while the movement of the rock-shaft I^5 and its arms I^4 I^7 is continued and the shipping of the belt goes on. To provide for such arrest of the cam and of the levers V V^2, the connection between the rod W' and the rock-shaft arm I^7 is made by a spring W^2 which is confined between a shoulder W^3 on the said rod and a guide W^4 which is attached to the said arm I^7. Until the tappet shoe arrives opposite the cam groove 45 the movement of the rock-shaft arm I^7 simply compresses the spring W^2, but on this arrival the spring acts upon the rod W' and through it upon the lever arm W which is then free to act through the link X and levers V V^2 as above described to throw the cam into action on the tappet shoe. The above described arrest of the cam and of its connections with the rock-shaft arm I^7 after the rock-shaft and its connections with the belt shipper have been set in operation provides for the shipping of the belt and reduction of speed a little before the tripping of the tympan shifting mechanism. The cam *p* only requires to remain in engagement with the tappet shoe n^3 long enough for the tappet *n* to trip the tympan shifting mechanism of each of the tympans on the cylinder, and it is to provide for disengaging it from the link X as soon as it is unlocked by the lifting of the pawl Y as hereinbefore described that the latch X' is provided on the said link. In the upward movement of the latch with the link, its inclined upper end passes by the roller 55 on the lever and brings the lower inclined edge of the lateral projection 60 above the said roller as shown in Fig. 2, so that the said roller may pass under and by the said projection and permit the spring 49 to produce the movement of the levers V^2 and V for disengaging the cam *p* from the tappet shoe. When the return of the lever W and link X afterward takes place with the return of the belt shipper for resuming the normal speed of the cylinder, the latch is permitted by its spring 61 to swing over the said roller 55 after which the said spring returns it to the position shown in Fig. 9, ready for the next tripping operation. It is to permit this last mentioned operation of the latch that the lost motion is provided between the levers V V^2 by the slot 54 and the projection 53* entering thereinto.

The mechanism for automatically shipping the belt G for the reduction of the speed of the cylinder and that for shifting the tympan, and the operations of the several parts of the said mechanism having now been described, I will describe briefly the operations of the said mechanism in the order in which they occur.

When at the end of the determined number of revolutions of the cylinder B, the tappets *l m* (see Figs. 7 and 8) come together, the first thing which takes place is the throwing out of the roller 39 from behind the cam U^2 which permits the spring 27 to produce the coupling of the cam to the shaft U by means of the clutch 26, 26*. The cam remains thus coupled long enough to produce, by its action through the rod 30 and the rock-shaft I^5 and their connections hereinbefore described, the necessary movement of the belt shipper I to ship the belt G from the pulley E^3 to the pulley E^4, thus reducing the speed of the cylinder, and to retain the belt in that position and keep the speed reduced during only so long a time as may be necessary. The next thing which takes place is the operation through the rod W', lever W, link X and levers V^2 V, the engagement of the cam *p* with the tappet *n* which, by the continued rotation of the cylinder, is caused to strike the arm R' (see Figs. 1, 2 and 6) of the trip lever and so produce through the said lever and its connections hereinbefore described, the disengagement of the locking lever Q from the toggle lever P P', the latter lever up to the present time having been in engagement with the notch *h** of the locking lever and the toggle P' P^2 having been bent as shown in dotted outline in Fig. 5c. The spring g^7 is now permitted to straighten the toggle P' P^2 and so throw the switch L from the inoperative position shown in dotted outline in Fig. 5c, to the operative position shown in full outline in said figure and partly shown in Fig. 5 in which latter position it is at once locked by its point engaging in the notch *h'* of the locking lever Q. The continued rotation of the cylinder then, through the action of the switch L as hereinbefore described, produces the disengagement one after another, of the several pawl levers S S' from the ratchet wheels on

their respective supply rollers and the engagement of the clutch members f^4 with the clutch members f^5 on their respective feed rollers for the shifting of the tympans in regular succession, the re-engagement of the pawl levers with the ratchet wheels on the supply rollers being afterward produced by the springs j^5 and their connections and the throwing of the clutch members f^4 out of engagement with the feed roller being produced by the stationary cam M. The switch L having remained in its operative position only long enough for its operation as above described, the continued rotation of the cylinder brings the cam i into operation on the roller of the locking lever and throws the latter lever into engagement with the notch h^* of the locking lever and so locks the switch in the inoperative position in which it remains until the operation of shifting the tympans has to be again performed. It will be understood that the shifting of all the tympans as above described takes place during a single revolution of the cylinder. It may also be remembered that the tappet n after tripping the tympan shifting mechanism was automatically returned to its inoperative position and left free from the belt shipping mechanism so that after the shifting all that is necessary to cause the machine to resume its normal fast speed is to ship the belt back to the pulley E^3 which is accomplished by the action of the spring I^{10} on the rock-shaft I^5 after the cam U^2 on the trip gear shaft has been disengaged from said shaft by the projection 40 on said cam coming opposite the roller 39.

It will be understood that if it be desired to effect the slowing down of the machine and the shifting of the tympan at any time between the automatic operations which are caused to take place as hereinabove described by the trip gears T T′ and their tappets l m, such slowing down and shifting may be performed under the control of the hand lever Z′. By moving the said lever to ship the belt to the pulley E^4, the rod I^3 connected with the shipper lever I′ is caused to move the rock-shaft I^5, and the latter through the rod W′ is caused to move the lever W and so to throw the automatic tympan shifting tappet n into operation.

It may in some cases be desired for simplifying the machine, to dispense altogether with the trip gears T T′ and all the other automatic mechanism through which they operate on the shipper lever I′, and to provide the machine for shipping the belt only with hand gear substantially such as has just been described, and yet to retain the lever W and its connections such as herein described with the tympan shifting tappet n for automatically shifting the tympan. In such case the hand lever would be operated by an attendant stationed in a convenient position for the purpose who may be warned by a bell operated by the machine every time a certain determined number of revolutions of the cylinder has been completed. In a machine so organized, I have provided, as shown in Fig. 12, a second hand lever 78 arranged near the hand lever Z′, on a rock-shaft 79 which works in fixed bearings and which also carries an arm 80 connected by a rod 81 to the lever W; the said second lever 78 to be operated by the attendant to actuate the latter lever in the same manner in which it has been hereinbefore described as actuated by the rod W′ to throw the tappet n into operation. In order to insure against the possible mistake of throwing the tympan shifting mechanism into operation before shipping the belt, I provide for the lever 78 a lock under the control of the lever Z′. This lock is represented in Fig. 12 as consisting of a slotted link q pivoted at a fixed point 83 to the machine framing and having in its lower edge a notch 84 to engage with an angular projection 85 on the lever. The hand lever Z′ is furnished with a roller or projection 86 which runs in the slot 87 of the link and when the said lever is in its normal position shown in Fig. 12, it holds down the locking link q in engagement with the projection 85 and so keeps the lever 78 locked against any possible movement in a direction to bring the tappet n into operation. The curvature of the slot 87 is such that in the movement of the lever Z′ therein far enough to ship the belt the roller 86 continues to hold down the link and lock the lever 78, but that in a slightly continued further movement, the roller reaching an abrupt bend 88 in the slot lifts the link and disengages the lever 78 and permits the shifting of the tympan. The slot 87 is continued beyond the abrupt bend 88 to such extent and in such form as to permit sufficient further movement of the lever Z′ for the shipping of the belt G to the loose pulley C^2 when necessary.

What I claim as my invention is—

1. The combination with the impression cylinder of a printing machine and a driving shaft therefor, of a tympan on said cylinder and mechanism deriving motion from the cylinder for shifting said tympan periodically, faster and slower driving mechanisms for said cylinder, mechanism deriving motion from the said shaft for engaging said cylinder with either one of said driving mechanisms and disengaging it from the other, the said engaging and disengaging mechanism and the said tympan shifting mechanism being relatively so timed that the engagement of the cylinder with its slower driving mechanism takes place before the commencement of each operation of the tympan shifting mechanism and the re-engagement of the cylinder with its faster driving mechanism takes place after the termination of each operation of the tympan shifting mechanism, substantially as herein set forth.

2. The combination with the impression cylinder of a printing machine, a tympan on said cylinder and mechanism for automatically

shifting said tympan, of faster and slower driving mechanisms for said cylinder, means for engaging said cylinder with either one of said driving mechanisms and disengaging it from the other, and means for setting the automatic tympan shifting mechanism in operation under the control of the said means for engagement and disengagement, substantially as herein set forth.

3. The combination with the impression cylinder of a printing machine, a tympan on said cylinder and mechanism for automatically shifting said tympan, of faster and slower driving mechanisms for said cylinder, means for engaging said cylinder with either of said driving mechanisms and disengaging it from the other, means for holding said tympan shifting mechanism inoperative while the faster driving mechanism is in engagement with the cylinder, means for setting the tympan shifting mechanism in operation, and connections between the means for engaging the cylinder with the driving mechanisms and the means for setting said shifting mechanism in operation whereby the latter means are rendered operative by the act of engaging the cylinder with the slower driving mechanism, substantially as herein set forth.

4. The combination with the impression cylinder of a printing machine, a shifting tympan on said cylinder, faster and slower driving mechanisms for said cylinder, means for engaging the said cylinder with either of said driving mechanisms, mechanism for periodically shifting the tympan, and locking mechanism for locking said shifting mechanism in an inoperative condition between the periods of shifting, of a movable tappet on the shaft of said cylinder, means of holding said tappet in a position in which it is inoperative on the said locking mechanism between the periods of operation of the said shifting mechanism, and mechanism under the control of said means of engagement for projecting said tappet into a position to liberate said locking mechanism and start the operation of said shifting mechanism, substantially as herein set forth.

5. The combination with the impression cylinder of a printing machine, a shifting tympan on said cylinder, mechanism for periodically shifting the tympan, and locking mechanism for locking said shifting mechanism in an inoperative condition between the periods of shifting, of a tappet arm on the shaft of said cylinder, a tappet fitted to said arm to slide to and from said shaft, a spring for drawing said tappet toward the shaft, a cam on said shaft and automatic means of engaging said cam with said tappet to project the latter outward from the shaft to a position for liberating said locking mechanism and starting the operation of said shifting mechanism, substantially as herein set forth.

6. The combination with the impression cylinder of a printing machine, a shifting tympan on said cylinder, mechanism for periodically shifting the tympan, and locking mechanism for locking said shifting mechanism in an inoperative condition between the periods of shifting, of the tappet arm n' with sliding tappet n and spring 51 on the cylinder shaft, for disengaging said locking mechanism and unlocking said shifting mechanism; the sliding non-rotating cam p on said shaft, the lever V for engaging the cam p with the tappet n, and the pawl Y for locking said lever and locking the cam so engaged, said tappet having a projection for operating on said pawl to disengage the said lever and cam from the tappet, all substantially as herein described.

7. The combination with the impression cylinder of a printing machine and a driving shaft therefor, faster and slower moving pulleys, a belt to run on said pulleys for driving said shaft and cylinder at faster and slower speeds, and a belt shipper for shipping said belt from one of said pulleys to the other, of intermeshing trip gears having unequal numbers of teeth and deriving motion from said shaft, a shaft for one of said gears and a cam on the latter shaft for operating the belt shipper, a spring-actuated clutch for engaging said cam with the latter shaft, a stop for holding said cam out of engagement, tappets on said trip gears for tripping said stop and permitting the engagement of the cam, and a secondary cam carried by the first mentioned cam for operating against said stop to disengage the first mentioned cam, substantially as herein set forth.

8. The combination with the belt shipper and the tympan shifting mechanism, of the movable tappet n attached to said shaft for starting said mechanism, the non-rotating cam p movable lengthwise on said shaft for throwing said tappet into operative position, the levers V V^2 for moving said cam, the spring 49 for operating said levers to disengage the cam from the tappet, the lever W connected with the belt shipper and the slotted pivoted link X engaging with the end of said lever W and carrying the spring-actuated latch 60 for operating on said lever V^2, all substantially as and for the purpose herein set forth.

9. The combination with the impression cylinder of a printing machine, a roller in said cylinder for supplying to the exterior thereof clean portions of a tympan, a second roller in said cylinder for drawing the tympan from the first mentioned roller over the cylinder, a ratchet wheel on the first mentioned roller and a pawl for engaging the same, a stationary gear outside of and concentric with the cylinder, a loose gear fitted to said second roller and gearing with said stationary gear, and a clutch for engaging the said loose gear with

said second roller, of a movable switch and two stationary cams outside of the cylinder, one of the said cams serving to hold the clutch disengaged, the said switch serving to produce the disengagement of said pawl and the engagement of the clutch for operating said second roller and the other of said cams serving to retain the clutch so engaged, substantially as herein set forth.

CHAS. P. COTTRELL.

Witnesses:
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