J. S. BANCROFT & M. C. INDAHL.

STRIP PERFORATOR.

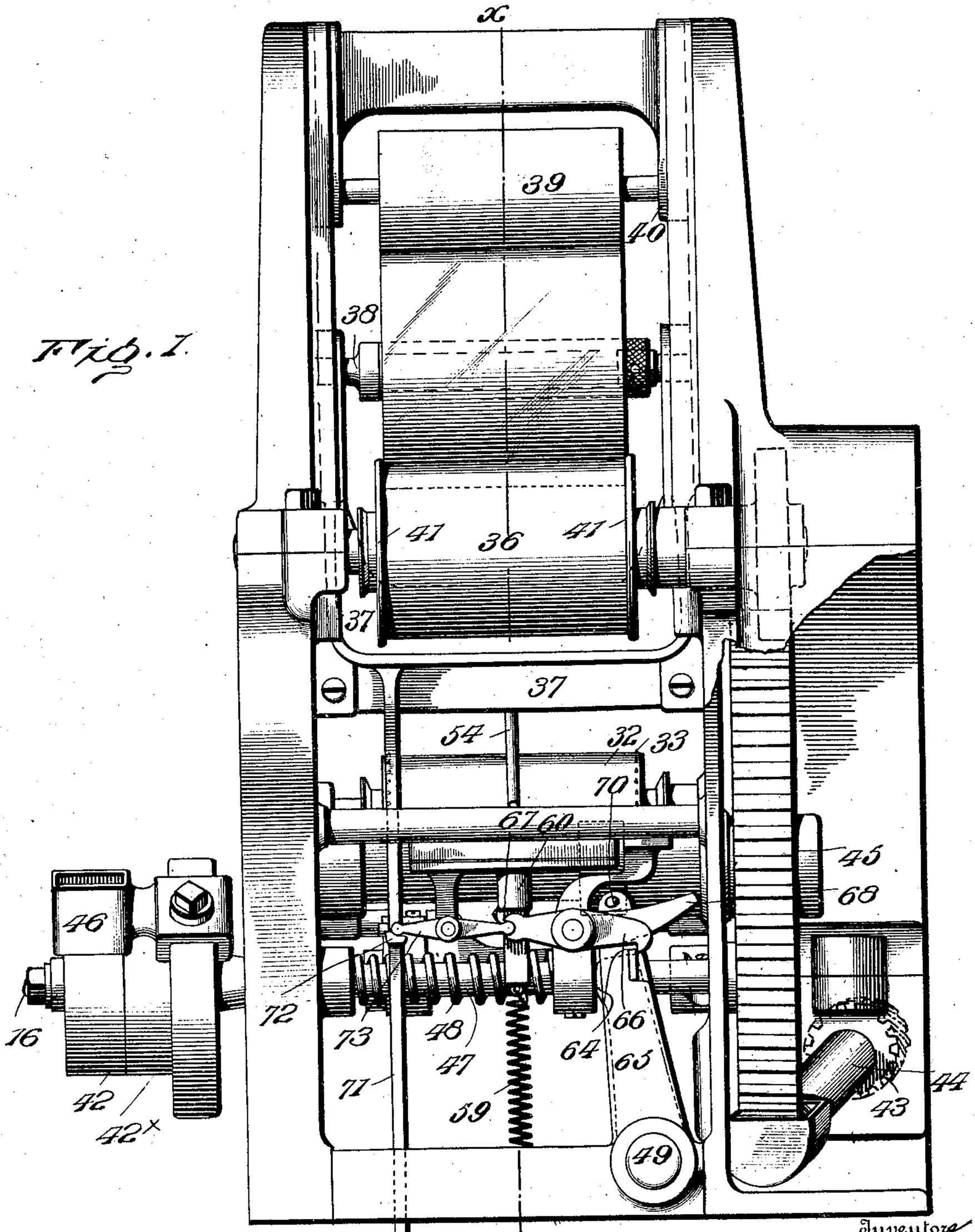
APPLICATION FILED JAN. 10, 1905.

915,537.

Patented Mar. 16, 1909.

4 SHEETS—SHEET 1.

FIG. 1.




Witnesses

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4 SHEETS—SHEET 2.

Fig. 3.

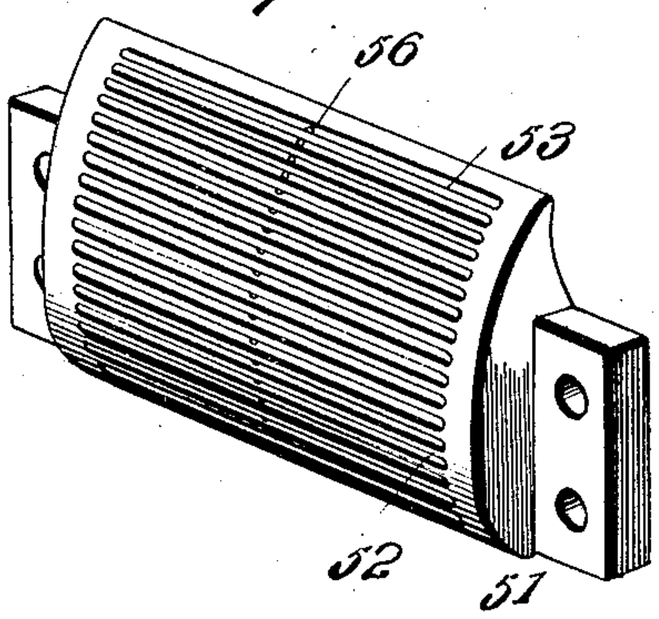


Fig. 2.




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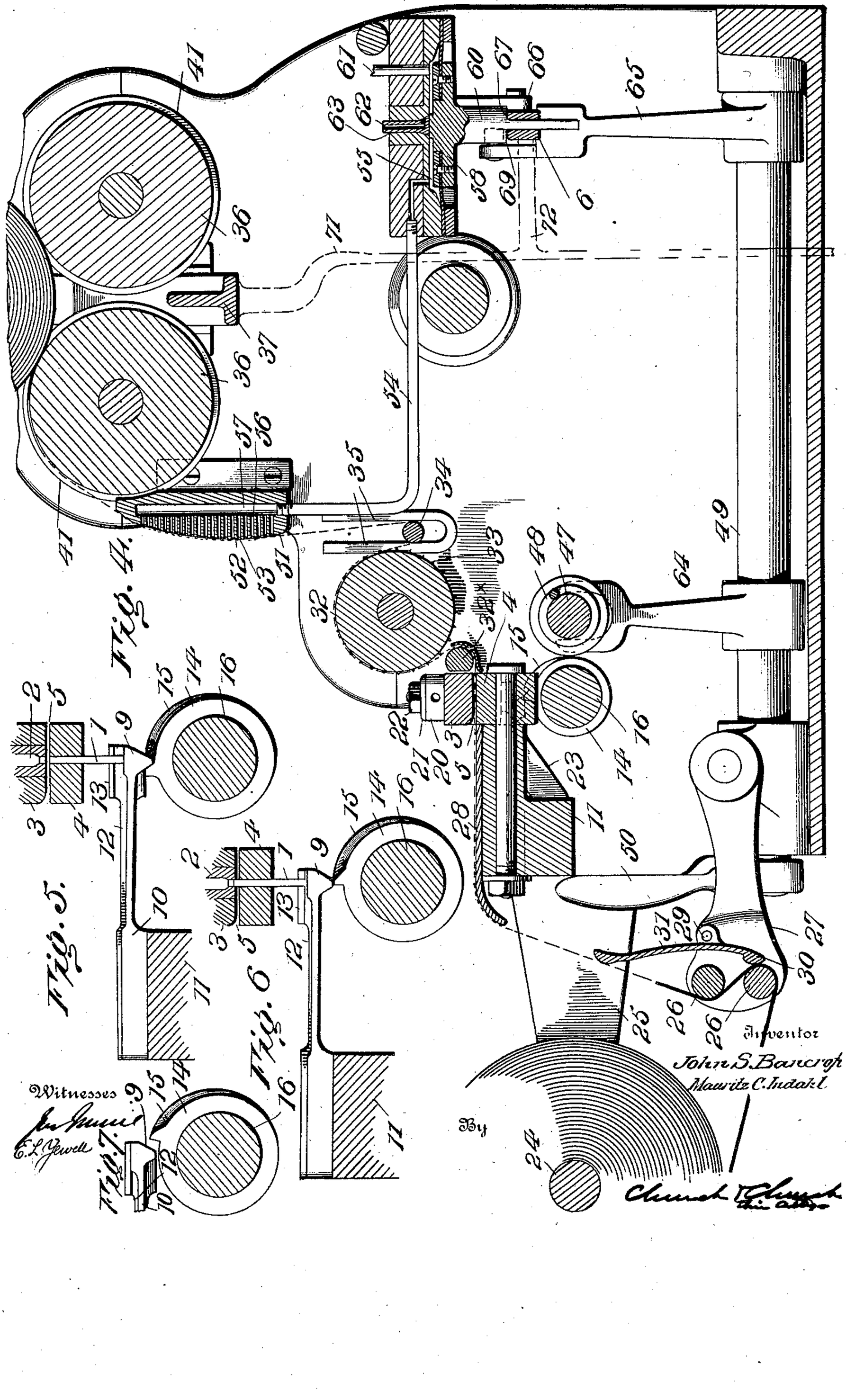

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4 SHEETS—SHEET 4.

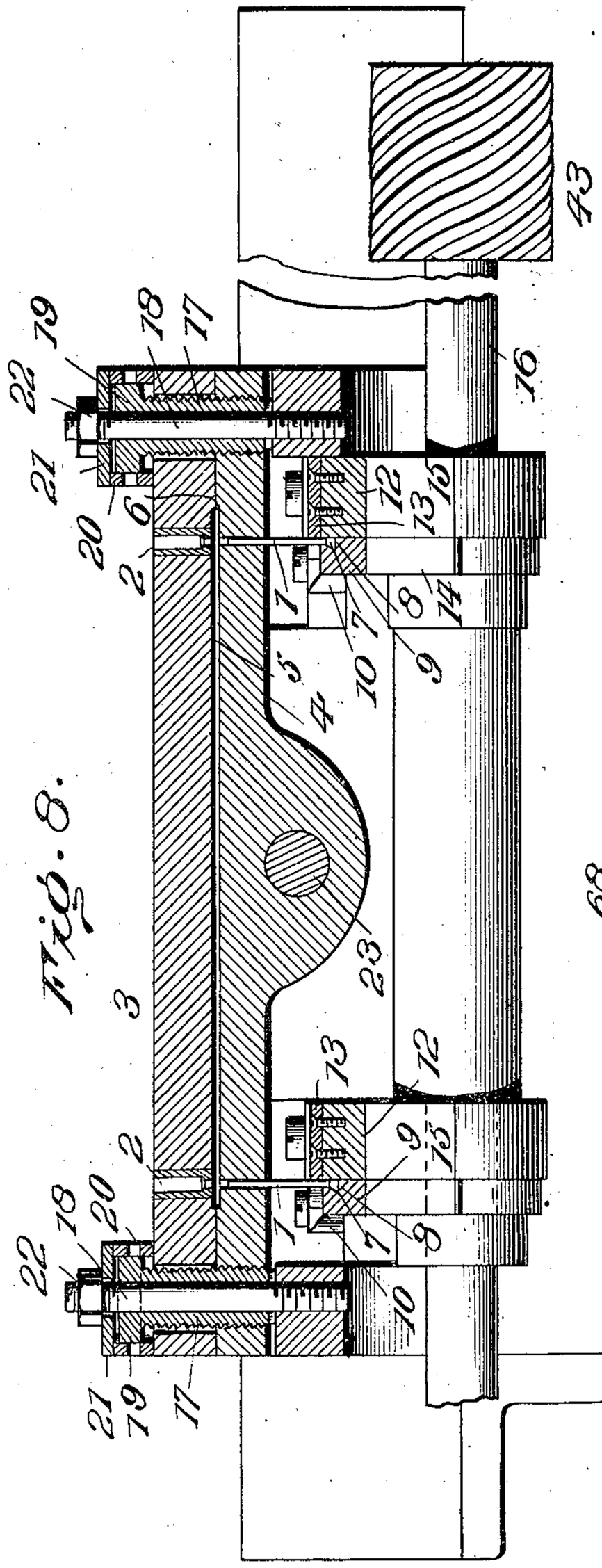


Fig. 8.

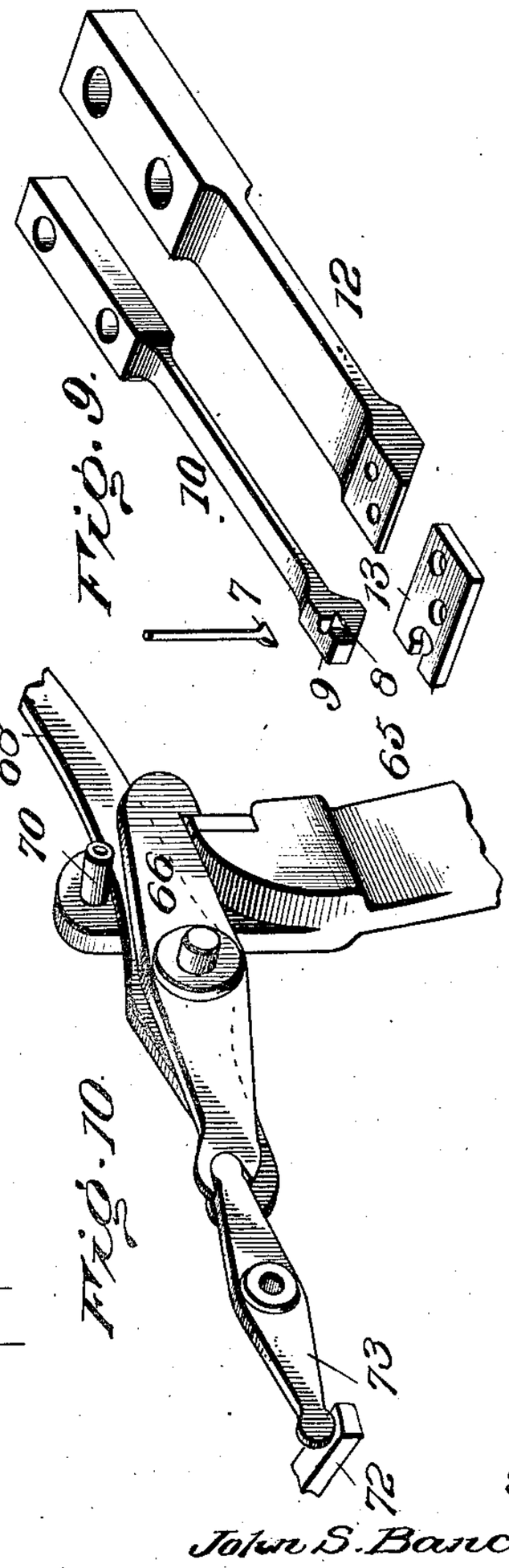


Fig. 9.

Fig. 10.

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# UNITED STATES PATENT OFFICE.

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## STRIP-PERFORATOR.

No. 915,537. Specification of Letters Patent. Patented March 16, 1909.

Application filed January 10, 1905. Serial No. 240,493.

*To all whom it may concern:*

Be it known that we, JOHN SELLERS BANCROFT and MAURITZ C. INDAHL, both citizens of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Strip-Perforators; and we do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures of reference marked thereon.

This invention relates to machines for producing one or more longitudinal series of equally spaced perforations in a strip or band of flexible material, such as paper, to serve as a register and feeding means for record-strips or controllers in their passage through composing and type casting machines of the monotype system, as exhibited, for example, in Patents 628,620; 654,115, 625,998 and 633,088, but is applicable to other uses, and it has for its principal objects to provide a high speed punching mechanism competent to produce said serial perforations with great accuracy and equipped with means for automatically detecting and locating imperfections in the material such as would interfere with its normal functions as a controller. These record strips or controllers consist of continuous strips or bands of paper, usually wound in cylindrical or spool form, and provided with two sets of perforations disposed longitudinally thereof, one of said sets serving for feeding and registering purposes, and the other for controlling the action of the type casting or other machine. The feeding set comprises two parallel continuous series of equally spaced perforations extending along opposite margins of the strip, while the control perforations occupy the space between said feeding perforations and are located at different positions transversely of the strip and at regular intervals in its length.

It is of the utmost importance that the two series of feeding perforations should be truly formed on parallel lines and equally spaced throughout each series in order to preserve registry with the feeding devices, and the correct presentation of the control perforations to the control mechanism of the casting or other machine. These marginal feeding perforations are usually formed in the strips before they are supplied to the composing machine, and during this preliminary operation the strips are inspected for imperfections in the material, such as would interfere with the control signals, thereby avoiding a separate or additional rewinding for this purpose. Visual inspection for perforations and weak spots is the method commonly employed, and this is rendered possible by the relatively slow action of the punching mechanism, with its intermittent feeding mechanism, so that in the interval between successive feed movements the operator can view the strip as it is rewound.

The advantages derived from the intermitting feed in the way of inspection are more than offset by the reduction in speed incident thereto, and numerous attempts have been made to increase the speed of production even at the expense of an additional rewinding for inspection. Among others rotary punching machines have been proposed as possessing the quality of continuous feeding motion, hence speed, but this, it has been found, is more than off-set by the defects incident to the system, *i. e.*, rapid deterioration of the punches and dies due to the angular motion of one upon the other, and the consequent irregularity and inaccuracy in the perforations and the delays and expense of repair.

All these difficulties are overcome by this invention which consists, broadly, first in the employment of a reciprocating punching mechanism in connection with a continuous, as distinguished from an intermittent, feeding mechanism so as to render available the inherent advantages of said types of mechanism in the way of accuracy, endurance and speed; second, in providing an automatic inspector adapted to detect and locate defects in the material while the latter is in motion; and third, in minor features of construction, combination and arrangement, all as hereinafter fully described.

In the accompanying drawings illustrating a preferred form of embodiment—Figure 1 is a rear elevation of the machine. Fig. 2 is an end view. Fig. 3 is a perspective view of the breast or vacuum chamber forming part of the detector. Fig. 4 a vertical section on the line *x*—*x* Fig. 1. Figs. 5 and 6 and 7 are detail views illustrating the punch carrier, its retainer and retractor, and the actu-

ating devices therefor in different positions assumed when in action. Fig. 8 is a longitudinal section through the punch bar and punch carrying and actuating devices, the cams and their shafts being in elevation. Fig. 9 is a detail of the punch, its carrier and retractor, said parts being shown separated and in perspective. Fig. 10 is a detail view of a portion of the trip for the driving mechanism.

Like numerals designate corresponding parts in the several figures.

The punching mechanism illustrated is of the reciprocating as distinguished from the rotary type, that is its relatively movable coöperating elements, represented by the punch 1 and die 2, reciprocate in a plane transverse to the direction in which the material is introduced or fed between them. Heretofore this type of punching mechanism has been successfully employed only in connection with intermitting feeding devices it being regarded as essential that all motion of the material in a direction transverse to the line of reciprocation of the punch should be suspended while the latter is traversing the material in order to prevent tearing or mutilation due to the drag against the side of the punch. It has been demonstrated, however, that it is not only possible, but entirely practical in the case of thin material such as paper to so proportion the movements of the punch and paper that the perforations can accurately be produced while the paper is in motion without danger or liability of tearing or mutilation from this cause. To accomplish this it is necessary that the speed of the punch while in engagement with the paper should greatly exceed the feeding movement of the latter, and that the duration of such contact should be reduced to the minimum or just sufficient to effect a clean cut, and the mechanism illustrated is of such character.

The die 2, preferably detachably secured to its supporting bar 3, is held in fixed relation to a stripper bar 4, the latter perforated to form a guide for the punch 1, said bars 3 and 4 being grooved or spaced to form a passage 5 and edge guides 6, for the paper, as by recessing the proximate faces of the bars after the manner shown in Fig. 8.

Two punches and complementary dies are shown, one near each end of passage 5, but as they are duplicates, a description of one punching mechanism will serve for both. The punch 1, consists of a short section of wire provided at one end with a head 7 adapted to enter and be retained in an open socket or bearing 8 formed in the head 9 of a carrier in the form of an elastic bar 10, whose opposite end is firmly attached to a cross bar 11 or other portion of the frame. The bar 10 is preferably reduced in section intermediate head 9 and the point of attachment to the frame, to increase its flexibility and reduce inertia. Attached at one end to the frame and extending alongside bar 10 is a second and somewhat heavier or stronger spring bar 12, provided with an offset or shoulder 13 above and in position to engage head 9 and serving as a retractor therefor. As thus arranged bar 12 closes the side of open bearing 8 and serves as a keeper for the punch.

Beneath the heads or free ends of bars 10 and 12 and in position to engage the latter are two cams 14, 15, carried by a shaft 16 rotating in bearings in the frame. These cams are of relatively different pitch but of substantially the same projection and termination, the shorter and steeper cam 14 engaging the punch carrier 10 and the longer and smaller angle cam 15 engaging lever 12. The purpose of this arrangement is two fold, first, to effect a short quick reciprocation of the punch by successive applications of drivers operating in opposition, and, second, to overcome inertia and diminish resistance. As shaft 16 revolves cam 15 acts first upon bar 12, to gradually deflect the latter, thereby placing it under tension and at the same time withdrawing shoulder 13 from head 9. When the bar 12 is at or near the extreme end of its motion, cam 14 engages head 9, to quickly advance the punch and drive it through the paper, whereupon both cams pass off their respective bars, releasing the latter and permitting their return to position. The sudden release of the heavier and stronger spring 12 constituting the driver causes its shoulder 13 to immediately impinge upon punch bar 10 thereby instantly reversing the motion of the punch and effecting its instantaneous withdrawal from the paper. If the punch carrying spring bar was made sufficiently heavy to obtain the quick return desired it would not only greatly increase the resistance incident to the sharp angle of its driving cam, but the inertia, due to increased weight, would tend to delay the quick return desired. As it is, the bar 10 is made light, its principal function being to preserve contact with the cam, and the inertia of the heavier bar 12 is materially reduced by the slower rate of motion derived from the longer cam, so that it is practically at rest and under maximum tension at the instant bar 10 leaves its cam, while arm 13 serves as a stop to limit the motion of the punch and prevent overthrowing.

To facilitate the proper adjustment and location of the two punches the following arrangement has been devised.—Through each end of bar 4 is threaded a tubular screw 17, the latter surrounding a stud or bolt 18 and engaging a bearing on the frame. Each screw 17 passes upward through a socket in the bar 3 and is provided with a head 19 fitted to a collar 20 in a manner to permit inde-

pendent longitudinal movement and compel simultaneous rotary movement. Collar 20 is longer than the head of screw 17, in the direction of its traverse, and it occupies a position intermediate bar 3 and a washer 21, the latter surmounted by a nut 22 on bolt 18. To adjust the dies in proper relation to the punches, nuts 22 are loosened, and by the application of a spanner or its equivalent to collars 20, screws 17 may be turned to shift bar 4, and when the desired position of adjustment has thus been obtained bar 3 is clamped firmly in place and screws 17 held against accidental displacement by setting nuts 22 down upon washers 21, the latter acting through the collars 20 to clamp bar 3 upon bar 4, and at the same time to clamp the screws 17 upon their bearings. A brace rod 23 connects the bar 4 with the frame in a plane transverse to the bolts 18, to assist the latter in maintaining the punching mechanism rigidly in position.

The feeding mechanism employed for advancing the strip continuously is coupled with the driving device for the punches in order to synchronize their action and produce the perforations at regular predetermined intervals. The spool 24 from which the supply of paper is withdrawn is supported upon brackets 25 secured to the front of the frame. In rear of and slightly below the axis on which the spool is supported is arranged a tension and take up device in the form of two parallel rods 26 carried in the outer ends of links 27, the latter pivotally supported upon the frame to swing, by gravity, away from the spool. The paper strip is conducted beneath the lower rod 26 (see Fig. 4) which it partly encircles, being passed forward between the two rods and thence upward to the platform or plate 28 in front of the bars 3 and 4 of the punching mechanism. Pivoted to arms or links 27 is a lever or apron 29 one arm whereof carries a bar 30 parallel with and in proximity to lower rod 26, while the other arm 31 is in the path of and borne upon by the paper strip intermediate the upper rod 26 and front edge of plate 28, the arrangement being such that under normal conditions the links 27 and their connections will be supported by the friction of the paper in its passage between bars 26, thereby establishing a uniform degree of tension upon the strip; but should the frictional resistance be materially diminished, as by the overrunning of the supply spool, the descent of the links and rods incident thereto would correspondingly advance the power end of lever 29 and cause its weight end or bar 30 to press the strip against the surface of the lower bar 26. As the strip leaves the punching mechanism it is conducted around a bar $32^{\times}$ onto the feeding roll 32 whose pins 33 are spaced to correspond with the marginal perforations formed in the strip by the punches. The roll 32 controls the rate of feed, and in order to insure proper engagement the strip is held to more than half the circumference of the roll by a rod or roller 34 held to position by end guides 35 on the frame and resting in a fold of the strip, said bar also serving as a variable tension and take up for the rewinding mechanism, the latter comprising two rolls 36 mounted in the frame in parallel relation, and a frame 37 movable in guides in a direction substantially perpendicular to a plane passing through the axes of rolls 36. The spool upon which the paper is wound is supported upon a pin 38 carried by frame 37, the roll being held in frictional contact with the peripheries of the winding rolls 36 by a third roll 39 whose support 40 is guided to move radially of the axis of the spool. Rolls 36 are each provided with heads or flanges 41 to serve as guides in directing the strip. The punching, feeding and winding mechanisms are geared together as follows:—The driving pulley 42 is fast on shaft 16 and the latter is coupled through spiral gears 43 with a worm shaft 44, the latter engaging a worm wheel 45 whose teeth mesh with pinions on rolls 32 and 36, thereby insuring correlative motion of the punching and feeding devices.

The driving shaft 16 is provided with a suitable, controllable driving mechanism by which it can be coupled and uncoupled with its motor represented, in this instance, by fast and loose pulleys 42, $42^{\times}$, and a belt shifter 46, the latter carried by a bar 47 acted upon by a spring 48, to hold the shifter in position with the belt on the fast pulley, and provided with a rock shaft 49 and handle 50 whereby the belt shifter can be moved against the tension of its spring to transfer the belt from the fast to the loose pulley. Equivalent forms of driving mechanism provided with means for coupling and uncoupling the prime mover may be employed in lieu of that shown.

The automatic inspector is located in position to engage the strip in its passage from the supply to the rewinding spool and in the present instance it is located intermediate the front roller 36 and the tensioning rod 34.

To the frame is secured a breast 51 provided with flat margins 52 over which the paper is tightly drawn by the winding devices, the central section being cut away, more or less, to form a vacuum box or chamber 53, communicating through a pipe 54, with the interior of a chamber 55. In the form illustrated, the face of the breast is grooved to present a series of channels extending transversely of the strip, said channels communicating through ports 56 with a chamber 57 within the breast to which the pipe 54 is con-

nected. The object is to provide a vacuum box or chamber of which the paper strip, as it passes through the machine, serves as a closure for preventing the ingress of air, the transverse ribs between the channels merely serving as intermediate supports, to prevent the buckling of the strip and the breaking of the vacuum incident thereto. Chamber 55 is provided with a piston 58, preferably of the diaphragm form, to which is coupled a retracting means, such as spring 59, connected to piston stem or rod 60, and said chamber is in open communication with suitable exhausting means as through a pipe 61.

The degree of attenuation normally maintained within chamber 53 when closed by the strip is such that the preponderating atmospheric pressure equals or exceeds the operating pressure of the control means coöperating with individual elements of the control signals or perforations and is sufficient to overcome the retracting devices coupled with piston 58, consequently, so long as the paper strip covering the vacuum chamber is of a quality and texture to prevent the entrance of sufficient air to materially diminish the pressure, hence is adapted for use as a controller, the piston will be held to position in chamber 55; but when a perforated or weak section of the paper is brought over the vacuum chamber, air is admitted in sufficient volume to partially or wholly destroy the vacuum in chamber 55 and the piston is at once retracted. Such would be the action if the perforation was large or the machine was run slowly, but at the high rate of speed for which this machine is specially designed the smaller perforations would pass the inspector so rapidly that the piston could not be fully retracted before the vacuum was reëstablished. To prevent this and insure not only a prompt but complete movement of the piston whenever a defective section of the paper is reached, chamber 55 is provided with a quick action valve 62 responsive to a slight variation in pressure and operating to quickly admit air and thus completely break the vacuum in said chamber so that the piston is free to respond to its retracting spring.

In the preferred form illustrated the quick-action valve 62 is located in a duct in the head of chamber 55 opposite piston 58, said valve seating outward and being engaged by the piston, to close the inlet passage, when the piston is at the inner end of its stroke under the influence of atmospheric pressure. The inlet passage 63 is in this instance located within the stem of valve 62, its lower end terminating at or above the seat for said valve. So long as the normal vacuum is maintained in chamber 55 piston 58 holds valve 62 to its seat and prevents the admission of air through passage 63, but the moment the vacuum is broken at chamber 53 and piston 58 begins to withdraw valve 62 will immediately unseat and admit air through inlet passage 63. By the movement of piston 58 as thus obtained is the presence of a defect in the strip indicated, and it remains to be seen how the position of the defect is located so that it may, if desired, be cured, as by pasting a strip over it, or the strip be rejected as unsuited for the purpose desired. This is accomplished through the stopping mechanism, to which end rock shaft 49 whose arm 64 engages the belt shifter bar 47 is provided with an arm 65 in position to be engaged by a latch 66, the latter pivotally supported upon a bracket attached to the frame and having its opposite end beneath a shoulder 67 on piston rod 60, the arrangement being such that when the belt shifter 46 is opposite fast pulley 42 with spring 48 under compression, latch 66 will engage arm 65, to hold the belt-shifter in position. This is the condition when starting after the paper strip has been threaded up to close the chamber 53, the atmospheric pressure on piston 58 serving to hold the latter up in position against the quick action valve. When the vacuum is broken, in the manner explained, and piston 58 is retracted by its spring, shoulder 67 will engage latch 66, to release arm 65, thus permitting spring 48 to move the belt shifter and the belt from the fast to the loose pulley, thereby bringing the machine to rest with the section of the strip containing the perforation or weak spot opposite breast 51.

In order that the ingress of air through the quick action valve may be automatically interrupted immediately the driving mechanism has been disconnected, a lever 68 is arranged with one arm beneath a shoulder 69 on piston rod 60 and the other arm in position to be engaged by a pin or shoulder 70 on arm 65, so that when the latter is unlatched and thrown back it will ride against lever 68 and elevate piston 58 to close the valve 62, holding the latter in position until the machine is again started up by reëngaging arm 65 and latch.

To limit the size of the spool and prevent overwinding the frame 37 carrying the spool and which is elevated as the paper is wound upon the latter, is provided with a rod or extension 71 having an arm 72 in position to engage one arm of a lever 73, the opposite arm whereof is coupled with latch 66. As frame 37 rises this arm 72 engages lever 73 to raise latch 66 and thus stop the machine. A treadle or other convenient means can be connected with this rod 71, to serve as a convenient means for disconnecting the driving mechanism.

Having thus described our invention what we claim as new and desire to secure by Letters Patent, is:—

1. A perforating machine provided with punching and feeding mechanisms and an

automatic inspector for the material operated upon said inspector being adapted to detect perforations and operating in a field distinct from that acted upon by the punching devices.

2. A perforating machine provided with punching and feeding mechanisms and automatic means for indicating the presence of perforations or weak spots in the material operated upon.

3. The combination with a perforating machine of means for automatically indicating and locating perforations in the material operated upon at points beyond the field of the perforating devices.

4. The combination with a reciprocating punching mechanism such as described, of means for continuously feeding the material between the punch and die, and means for indicating the presence of defects in the material as it passes through the machine.

5. As a means for actuating the movable member of a punching mechanism the combination of a carrier, a cam acting through said carrier to advance the latter, a retracting member, and means independent of the cam and carrier for actuating said retracting member, to engage the carrier and return it immediately it is released by the cam.

6. In a perforating machine such as described, the combination with the punch, its carrier and driving cam, the latter provided with an abrupt releasing shoulder, of a yielding retractor adapted to engage the punch carrier in a direction opposed to the cam action, and a second cam of less angularity than the first and operating upon the retractor to advance it beyond the point to which the punch carrier is advanced while in contact with its cam, the terminal shoulder of said second cam registering with that of the first cam.

7. In a perforating machine such as described, the combination with the punch and its spring bar carrier, a spring bar retractor provided with a shoulder overlapping the punch carrier, a driving shaft, and two cams differing in length, the longer cam engaging the retractor, to move its shoulder away from the punch carrier, and the shorter cam engaging the punch carrier, to quickly advance the latter and complete its stroke preliminary to the release of the retractor.

8. In a perforating machine such as described, the combination of the following elements, to wit; a spring bar fixed at one end and carrying a punch at its opposite or free end; a second spring bar provided with an arm or shoulder overlapping the free end of the first bar; and a driving shaft provided with two cams of different lengths or angles with their terminals in register, the shorter cam contacting with the free end of the first or punch carrier bar and the longer cam with the free end of the second or retractor bar.

9. In a perforating machine such as described, the combination with the punch carrier bar provided with an open sided socket for the reception of a headed punch, of a retractor bar closing the open side of the socket and provided with an engaging shoulder overlapping said punch bar.

10. In a perforating machine such as described, the combination with the stationary die and reciprocating punch, of the elastic punch carrying bar fixed at one end and provided with means for attaching the punch to its free end; an elastic retractor bar extending in parallel relation with the punch bar with one end fixed and the other or free end provided with an engaging arm overlapping the free end of the punch bar; and a driving shaft extending transversely of the two bars and provided with two cam surfaces of different lengths but corresponding projection their terminating shoulders being in register, the shorter cam operating upon the punch bar and the longer cam upon the retractor.

11. In a perforating machine such as described, as a means for adjusting the punching mechanism in position, the combination with the separable bars carrying the die and the guide for its punch, of the tubular screw guided in the upper and threaded through the lower bar, said screw surrounding a stud and engaging a bearing on the frame; a collar movable longitudinally of the screw and engaging the head thereof said collar contacting with the upper bar; a washer engaging said collar; and a nut on the stud engaging said washer and operating to clamp the two bars together and the screw upon its bearing.

12. In a perforating machine such as described the combination with the supply spool and strip feeding devices, of a strip tension device comprising a plurality of parallel bars for engaging a bight of the strip supported to swing freely in a path intersecting the strip and away from the supply spool.

13. In a perforating machine such as described, a tension device for the strip as delivered from the supply spool to the punching devices, the same comprising in combination a laterally movable bar adapted to be supported by friction in a fold or turn of the strip, and a lever movable with said bar and having one member in position to clamp the strip upon the bar and the other member in position to engage the strip at a point beyond said bar as the position of the latter is shifted.

14. In a tension device for a perforating machine such as described, the combination of the following elements, to wit: a plurality of rods in parallel relation about which the strip travels; pivoted links or arms supporting said rods to permit them to swing laterally of the strip; and a friction clamp mounted upon said links and provided with

an actuating member held in such relation to the path traversed by the strip that when said bars are swung laterally beyond a predetermined position the strip will operate said member to apply the clamp.

15. In a perforating machine such as described provided with reciprocating punching mechanism and in combination therewith a continuous feeding mechanism provided with a feed roll in rear of the punching devices and a take-up and tension device engaging the strip in advance of its delivery to said punching devices.

16. In a perforating machine such as described the combination of the following elements, to wit; a punching mechanism provided with a reciprocating member, such as a punch, driven by a continuously revolving shaft; a feeding mechanism provided with a toothed roll engaging the perforations in the strip as the latter is delivered from the punching mechanism; and transmitting devices coupling the punch shaft and feed roll to cause them to rotate in unison as and for the purpose set forth.

17. In a perforating machine such as described the combination of the following elements, to wit; a reciprocating punching mechanism provided with a continuously revolving, driving shaft; a continuously acting feeding mechanism provided with a pin wheel located in rear of the punching devices and engaging the perforations in the strip; transmitting devices connecting said punch shaft and pin wheel, to cause simultaneous rotation thereof, and a tension device engaging the strip in advance of its delivery to the punching devices.

18. In a perforating machine such as described, the combination of the following elements, to wit; a support for the supply spool; a bar or apron over which the strip is conducted in its passage to the punching mechanism; a tension device located intermediate said spool support and bar and engaging the strip; a reciprocating punching mechanism in rear of said bar; a pin roll in rear of the punching devices; a rewinding mechanism engaging the strip in rear of said feed roll; and continuously, as distinguished from intermittingly, operating driving mechanism for said pin roll.

19. In a perforating machine such as described, provided with reciprocating punching mechanism and a continuously acting feeding mechanism, and in combination therewith an automatic inspector coöperating with the strip to indicate the presence of defects, such as perforations, occurring therein.

20. In a perforating machine and in combination with the punching and strip feeding mechanisms thereof, an inspector for the strip engaged by the latter and operated by defects contained therein, to arrest the punching mechanism.

21. In a perforating machine and in combination with the punching and strip feeding mechanisms thereof an inspector engaging the strip and actuated by defects contained therein to arrest the feeding mechanism.

22. In a perforating machine and in combination with its punching and strip feeding mechanisms, an automatic inspector engaged by the strip and actuated by defects contained therein to arrest both the punching and feeding mechanisms.

23. In a perforating machine the combination with the punching and strip feeding mechanisms, of an automatic inspector provided with a vacuum chamber of which the strip constitutes the closing element.

24. The combination with a strip feeding mechanism of an automatic inspector controlled by the strip and operating to indicate the presence of perforations and weak spots occurring therein.

25. The combination with a strip feeding mechanism provided with detachable driving mechanism of an automatic inspector controlled by the strip and operated by defects occurring therein to disconnect said driving mechanism.

26. In a perforating machine and in combination with the punching and strip feeding mechanisms thereof, an inspector, for detecting defects in the strip, provided with an open sided vacuum chamber adapted to be closed by the strip, and a piston whose cylinder or chamber is in open communication with said vacuum chamber and an exhaust, and means for retracting the piston when the vacuum is broken by the presence of a perforation in the section of the strip forming part of said vacuum chamber.

27. In a perforating machine and in combination with the punching and strip feeding mechanisms thereof, an automatic inspector for the strip comprising a vacuum box or chamber open at the side and provided with marginal seating surfaces for the strip; a piston whose chamber or cylinder communicates with said vacuum chamber and air exhaust; and a quick action valve controlling an inlet passage, to expedite the action of the piston.

28. In a perforating machine provided with punching, strip feeding, and driving mechanisms including means for uncoupling or disconnecting the motor, and in combination therewith an automatic inspector for detecting defects in the strip as it is fed through the machine, the same embodying in its construction a piston controlling the uncoupling devices for the motor and a vacuum chamber or box of which the strip forms the cover or closure, said vacuum box or chamber controlling said piston, to disconnect the motor

when the vacuum is broken by a perforation in the strip.

29. A vacuum box or chamber for the automatic strip inspector of a perforating machine provided with a plurality of intercommunicating channels extending transversely of the line of travel of the strips, and a marginal seat for the strip.

30. An automatic strip inspector for perforating machines such as described, provided with a vacuum box or chamber one side whereof is provided with a marginal seat for the strip, the space within said seat being provided with a plurality of channels communicating with a chamber common to all of said channels.

31. In an automatic inspector for perforating machines such as described, the combination with a vacuum box or chamber for the strip to be inspected, and a chamber communicating therewith containing a piston and an exhaust connection, of a quick-action valve movable with the piston to control the admission of air through a supply port.

32. In an automatic strip inspector for perforating machines such as described, the combination with the vacuum box or chamber adapted to receive and be closed by the material to be inspected and a chamber containing a piston and communicating with said vacuum box or chamber and the exhaust apparatus of a quick-action valve opening toward said piston chamber and controlling an inlet passage, said valve being held in closed position against atmospheric pressure by a contact engagement with the piston when and while the latter is maintained in advanced position by the preponderating atmospheric pressure on one side thereof.

33. In an automatic strip inspector for perforating machines such as described the combination with a vacuum box or chamber controlled by the material to be inspected and a piston chamber communicating therewith and with an exhaust apparatus, of a piston working in said chamber and provided with retracting means, and a quick-action valve opening into said piston chamber and controlling an inlet passage, said valve projecting into the path of the piston, to limit the advance of the latter and seat the valve.

34. In a perforating machine such as described, provided with strip feeding and winding mechanisms and in combination therewith an automatic inspector for detecting imperfections in the strip located intermediate the feeding and winding mechanisms in position to engage the strip in its passage from one to the other of said mechanisms.

35. In a perforating machine such as described, the combination of the following elements, to wit; a strip feeding mechanism provided with means for detachably coupling it with a driver or motor; an inspector for detecting defects in the material provided with a vacuum box or chamber controlled by the material to be inspected and a piston working in a chamber communicating with said vacuum chamber and provided with retracting means; and means controlled by said piston and acting upon the driver coupling, to uncouple the driver.

36. In a perforating machine such as described, the combination with the feeding mechanism of an automatic strip inspector acting in a field distinct from the perforating devices provided with a movable member and means controlled by perforations in the strip for shifting said member.

37. In a perforating machine such as described the combination of the following elements, to wit; a feeding mechanism provided with a driver and means for detachably coupling the latter with the feed mechanism; a motor for shifting said coupling devices in a direction to disconnect the driver; means for maintaining said coupling devices in driving relation with the feeding mechanism; and an automatic inspector provided with a movable member and means controlled by defects in the material for shifting said member, the latter in turn controlling said means for maintaining the coupling devices in driving relation, to release the latter and permit the motor to shift the coupling devices and thus disconnect the driver.

38. In a perforating machine such as described, the combination of the following elements, to wit; a strip feeding mechanism provided with a driver detachable coupling means, a motor for shifting said coupling means, to disconnect the driver and a locking device controlling the action of said motor; and an automatic inspector controlled by the strip and provided with a movable member responding to defects in the strip and acting upon said locking device to release the motor, thereby disconnecting the driver from the feeding devices and arresting the strip.

39. In a perforating machine such as described the combination of the following elements, to wit; a strip feeding mechanism provided with a driver; means for uncoupling or disconnecting the feeding devices from the driver including a motor for uncoupling and a detent device for restraining said motor with the driver coupled up with the feeding mechanism; and an automatic inspector provided with a vacuum chamber coöperating with the strip and communicating with a chamber containing a piston, the latter provided with retracting means and coupled with the said detent device in a manner to release the motor when the vacuum is broken by the admission of air through the strip.

40. In a perforating machine such as described provided with a detachable driving connection and means for uncoupling said

connection including a motor and a detent, and in combination therewith, a piston acting upon said detent to release the motor.

41. In a perforating machine such as described, the combination with the motor and detent for the driving connection or coupling of a piston controlling said detent and working in a chamber or cylinder one end whereof communicates with a vacuum chamber and the other with the atmosphere, a motor device for retracting said piston, a quick-action valve opening into said piston chamber and engaged by the piston when in advanced position, to prevent the entrance of air, and means actuated by the motor of the driving connection for shifting the piston, to close the quick-action valve preliminary to the reëngagement of the detent.

42. In a perforating machine such as described provided with means for disconnecting the driving devices including a motor, an arm coupled therewith, and a latch for engaging said arm, to restrain the motor, and in combination therewith, a piston working in a chamber or cylinder communicating with a vacuum chamber, a valve controlling an inlet passage into said chamber and engaged by the piston to close said passage, a retracting spring for said piston, a shoulder on said piston for engaging the latch, and a lever engaged by the arm with which the latch coöperates and acting upon the piston to return the latter and close the valve when the driving devices are disconnected.

43. In a perforating machine such as described the combination with the spring actuated shipper rod, the arm coupled therewith and the latch engaging said arm, of the piston rod engaging said latch, to release the latter, and the lever engaged by the arm and engaging the piston rod to advance the latter.

44. In a perforating mechanism such as described, the combination with the strip feeding and winding mechanisms of an automatic inspector for the strip adapted to be actuated by perforations therein.

45. In a perforating machine such as described the combination with the strip feeding and winding mechanisms, of an automatic inspector adapted to detect perforations and engaging the strip intermediate said mechanisms.

46. In a perforating machine such as described the combination with the strip feeding and winding mechanisms, of an automatic inspector controlling the connection between said mechanisms and the motor therefor.

47. In a perforating machine such as described and in combination with the feeding devices thereof, means controlled by defects in the strip for automatically arresting the feed motion.

48. In a perforating machine such as described and in combination with the feeding and winding devices thereof, means controlled by defects in the strip for arresting the feed and winding motions.

49. In a perforating machine provided with strip winding mechanism and automatic inspecting devices, the combination with the driving mechanism including uncoupling devices, of means controlled by the strip and acting through the inspecting devices upon the uncoupling devices, to disconnect the winding mechanism.

50. In a perforating machine the combination with a strip inspector provided with a vacuum chamber, a piston and cylinder communicating therewith and an inlet, of means controlled by the piston for opening said inlet as the piston is retracted.

51. In a perforating machine provided with a strip inspector including a vacuum chamber, piston and an inlet and in combination therewith means controlled by the piston for alternately closing and opening said inlet.

52. In a perforating machine provided with a strip inspector including a vacuum chamber and piston, and a strip winding mechanism including driving devices and means for uncoupling the motor or driver and in combination therewith means controlled by the spooled or wound strip and acting upon the driving devices of the winding mechanism, to arrest the latter.

53. In a perforating machine the combination of the following elements, to wit; a strip inspector including a vacuum chamber and piston; a strip winding mechanism provided with detachable driving mechanism; and means controlled by the spooled strip and controlling said driving mechanism to arrest the winding mechanism.

54. In a perforating machine the combination of the following elements, to wit; a strip inspector including a vacuum chamber, piston and inlet controlled by the latter; a strip winding mechanism provided with detachable driving devices; and means controlled by the spooled strip for disconnecting said driving devices to arrest the winding mechanism when a spool of predetermined size has been wound.

55. In a perforating machine provided with a strip spooling mechanism and an inspector and in combination therewith a piston controlled by the inspector, a detachable driver for the spooling mechanism, means for holding said driver in operative relation with the spooling mechanism, and means under control of said piston and the spooling devices for disconnecting the driver, to arrest the spooling mechanism.

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Witnesses:
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