O. E. BRAITMAYER.

PAPER TESTING MACHINE.

APPLICATION FILED OCT. 12, 1917.

1,277,039.

Patented Aug. 27, 1918.

5 SHEETS—SHEET 1.

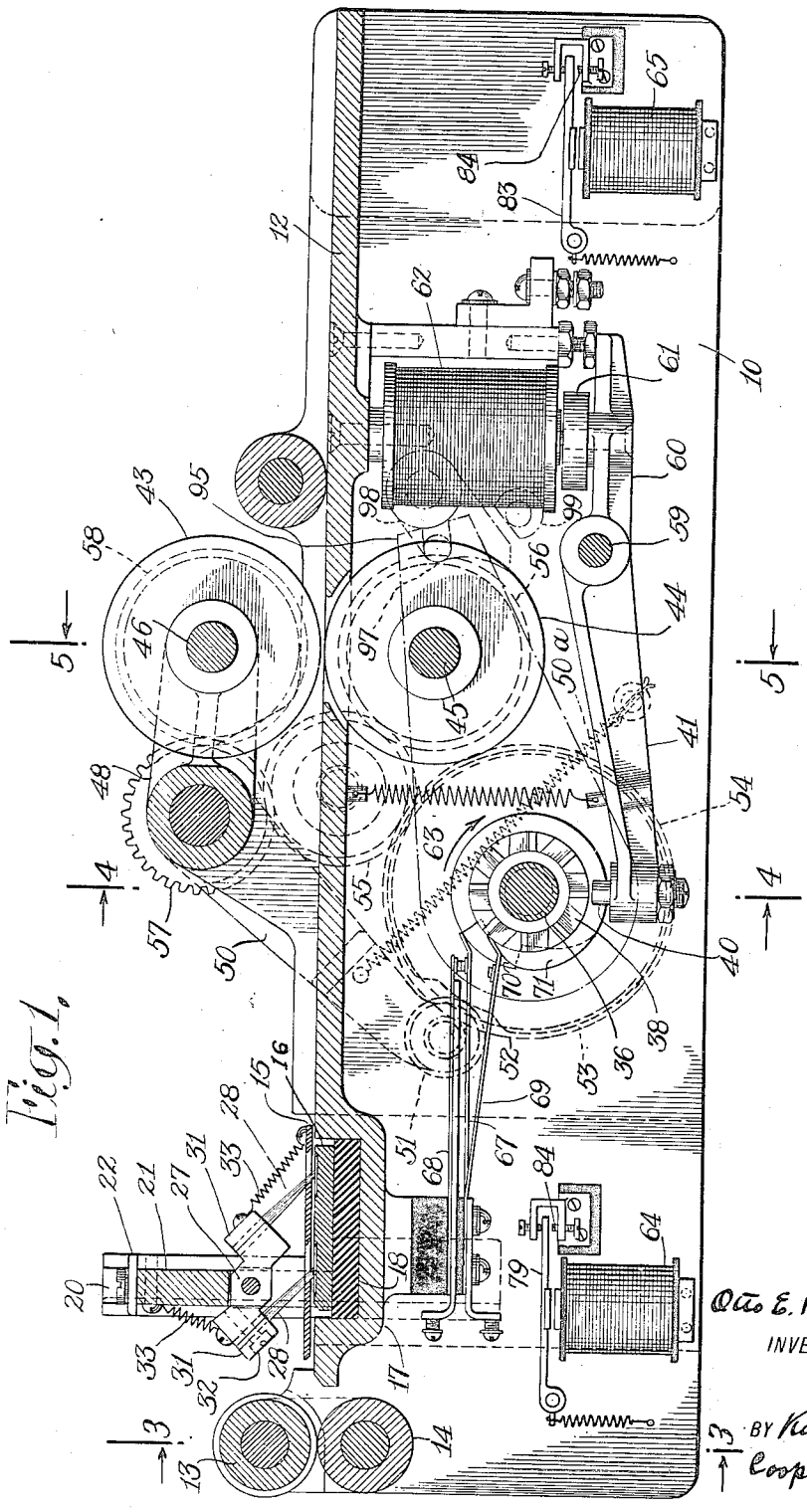


Fig. 1.

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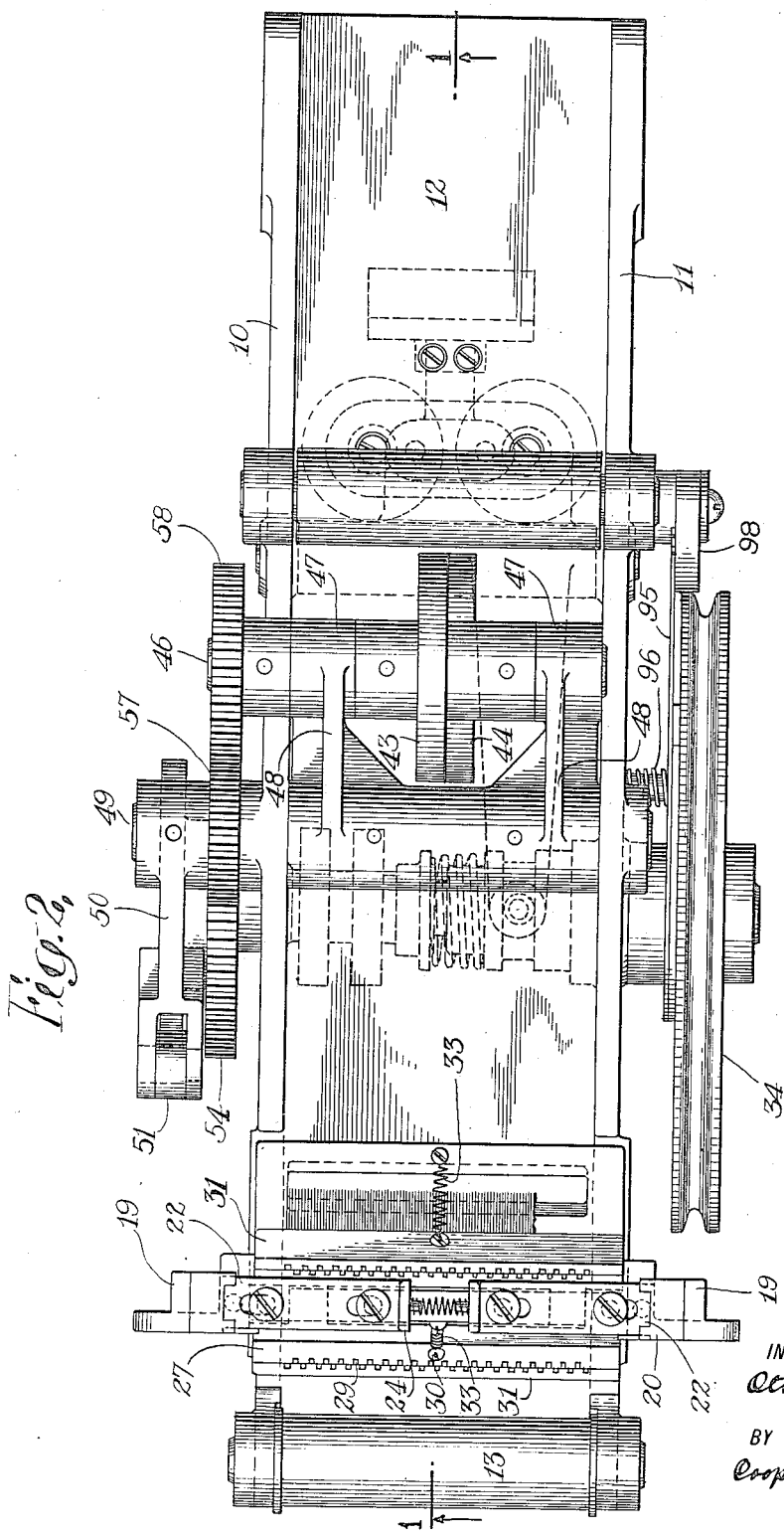


Fig. 2.

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Fig. 4.

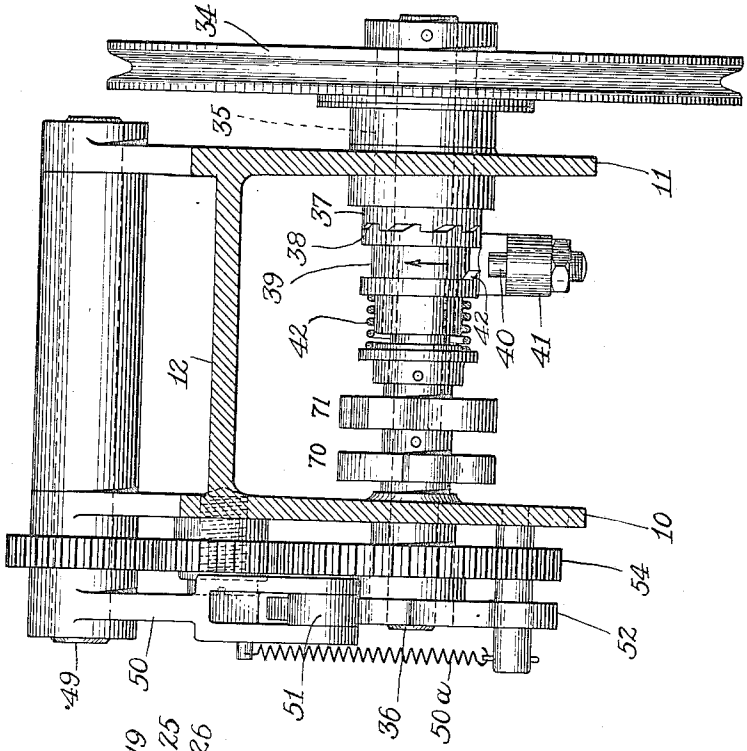
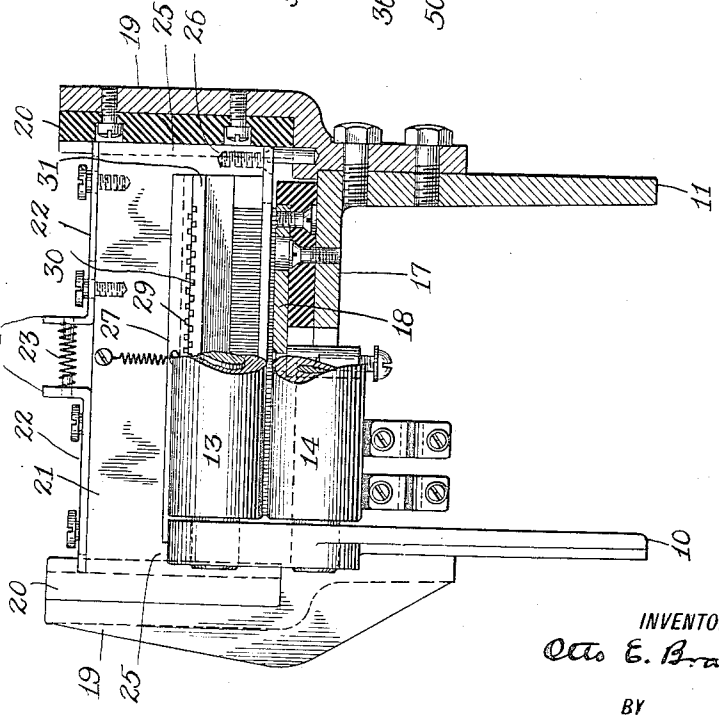


Fig. 3.



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5 SHEETS—SHEET 4.

Fig. 7.

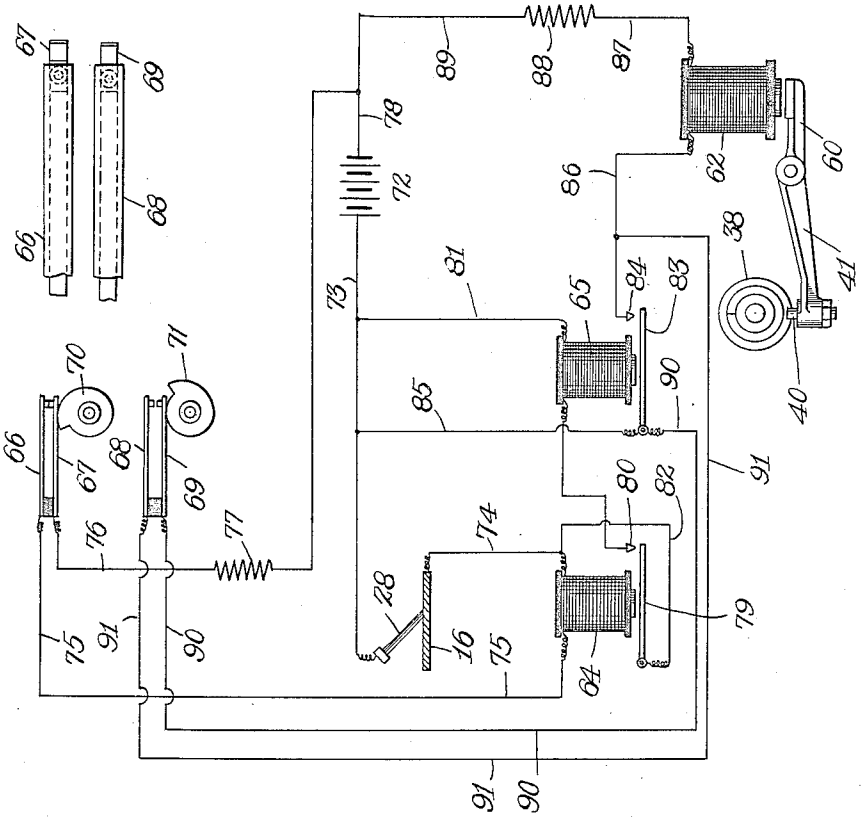
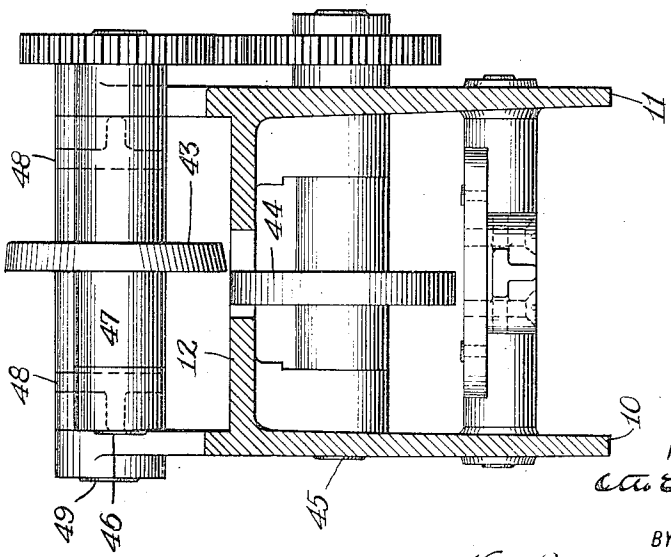


Fig. 6.

Fig. 5.



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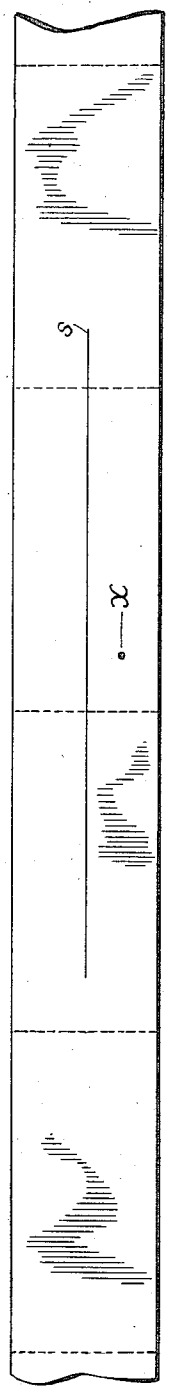


Fig. 8.

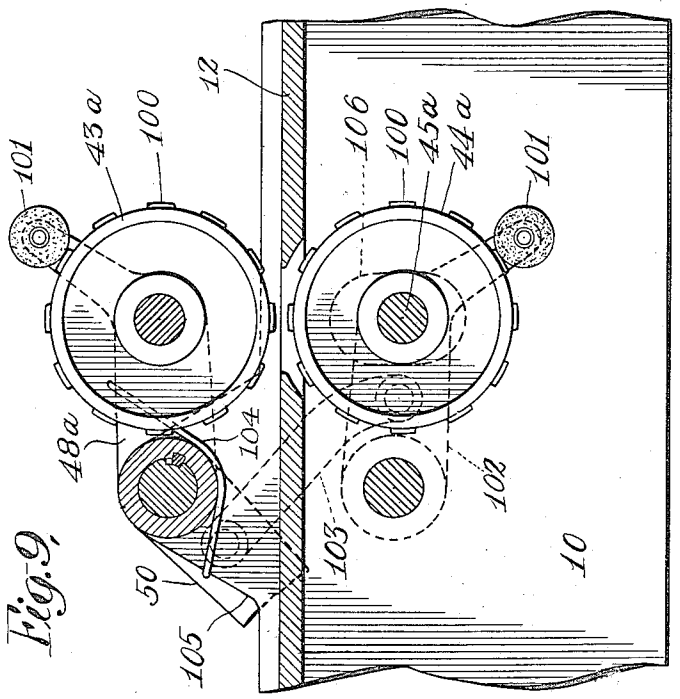


Fig. 9.

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UNITED STATES PATENT OFFICE.

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PAPER-TESTING MACHINE.

1,277,039. Specification of Letters Patent. Patented Aug. 27, 1918.

Application filed October 12, 1917. Serial No. 196,210.

To all whom it may concern:

Be it known that I, OTTO E. BRAITMAYER, a citizen of the United States, residing at Washington, District of Columbia, have invented certain new and useful Improvements in Paper-Testing Machines, of which the following is a full, clear, and exact description.

In the Hollerith tabulating system the data to be tabulated are recorded on cards by punching holes therein, after which the punched cards are run through a tabulating machine. In the latter a bank or box of movable contact points or pins are presented to the card. Wherever a contact point finds a hole in the card the point or pin passes through the hole and by engagement with an insulated contact, on which the card rests, closes a circuit, which in turn causes operation of the appropriate register. Where a pin finds no hole it is maintained out of contact with the plate and the corresponding circuit is not closed. The card thus serves as an insulator, and should permit electrical connection to be made only through holes that have been punched for the purpose. Obviously, apertures otherwise occurring in the card, for example imperfections in the stock, may be in such position as to allow a connection to be made elsewhere than through a punched hole. Or there may be embedded in the card a bit of conducting material, usually carbon, which will permit the same result if touched by one of the pins. In either case one or more of the registering mechanisms are actuated unintentionally, thereby rendering the tabulation incorrect.

In Hollerith's prior Patent No. 1,132,345, issued March 16, 1915, he has described and claimed broadly an apparatus for detecting such imperfections as will permit closing of a circuit through the unpunched card. In the specific apparatus described in the patent the cards themselves, of course before they are punched, are passed over the surface of a metal contact plate, above which is a brush extending across the path of the cards and composed of closely set pieces of spring wire with their free ends bearing upon the cards as the latter pass. If any wire comes into electrical connection with the underlying contact-plate by reason of a hole in the card or because of an embedded particle of carbon or metal a circuit is established which stops the card-advancing devices and so permits the defective or imperfect card to be removed.

The present invention is designed for the same general purpose, that is, to detect imperfections in the cards, but it operates preferably on the paper stock before the same is cut up into cards, and mutilates the portion in which an imperfection is found or stamps on the strip in the neighborhood of the imperfection a warning such as the word "Defective," or "Imperfect," or a legend such as "Do not use this card." In the preferred embodiment the paper stock is fed to the machine in the form of a strip of the width of a single card, from which cards of the proper size can be cut by severing the strip transversely. When the brush or brushes strike an imperfection permitting electrical connection with the underlying contact-plate the circuit thus established brings into operation a slitting mechanism which cuts in the strip a longitudinal slit of such length that when the strip is subsequently cut transversely to form the cards the one containing the imperfection will fall into two parts both of which are too small for their intended use. This makes it certain that each full size card cut from the strip contains no imperfection of the kind indicated.

The embodiment thus briefly outlined is illustrated in the accompanying drawings, in which—

Figure 1 shows the machine in vertical longitudinal section, about on line 1—1 of Fig. 2.

Fig. 2 is a plan view of the machine.

Fig. 3 is an end view, partly in cross section about on the line 3—3 of Fig. 1.

Figs. 4 and 5 are cross sections on lines 4—4 and 5—5, respectively, of Fig. 1.

Fig. 6 is a diagram illustrating the wiring, or electrical connections, of the machine.

Fig. 7 is a detail plan view of the start and stop contacts.

Fig. 8 is a plan view of a portion of the card-strip, showing a hole or other imper-

fection and the longitudinal slit cut by the machine.

Fig. 9 is a fragmentary section, on a plane indicated by the line 1—1, Fig. 2, illustrating an embodiment in which the paper-strip, instead of being slit, is stamped with words or characters indicating that the cards bearing the same are unfit for use.

The operative parts of the machine are mounted in or upon a frame comprising two side plates 10, 11, and an elongated bed 12 supported by and between them, the side plates extending a trifle above the bed to form lateral guide-flanges for the paper strip, which, it will be understood, travels lengthwise on the bed between the said flanges. The paper strip, not shown, is received between two horizontal rollers 13, 14, at the rear end of the bed, the roller 13 having guide-flanges at its ends. From the rollers the strip passes forwardly, under a guide-plate 15 and over and upon a universal contact plate 16 sunk in a recess 17 formed in the bed 12, the plate 16 being mounted on a slab or support 18 of insulating material. At the other or forward end of the bed, means (not shown) may be provided, such as friction feed rollers, to draw the paper strip along the bed, but in practice I prefer to use the machine in conjunction with a reeling or winding apparatus, in which case the strip issuing from the bed is seized by the feed mechanism of the reeling apparatus and is drawn over the bed thereby.

At the sides of the path of the strip at the point where the latter passes over the contact 18 are two standards 19, fixed to the side plates 10, 11, and carrying on their inner faces above the bed 12 two vertically slotted members 20 of insulating material, to receive a transverse block 21, which can be removed by sliding it vertically out of the slots. On top of the block are two sliding bolts 22 urged outwardly by a spring 23 into appropriate recesses in the members 20 to hold the block in place. Finger pieces 24 are provided for retracting the bolts to permit removal of the block. The bolts also serve to support the block at the proper height above the bed 12.

The block 21 is provided at its sides with depending arms 25, to the bottoms of which the guide plate 15 is fastened by means of screws 26. Between the arms is a pivoted brush-holder 27, of metal, extending across the plate 15. The brushes are composed of flexible spring wires 28, the alternate wires being mounted in recesses 29, Fig. 3, in the edges of the body of the brush-holder, and the intermediate wires in recesses 30 in the metal strips 31, Fig. 1, which are bound snugly upon the edges of said body by means of screws, as 32, thereby holding the wires tightly in their sockets. Light coil springs 33 are provided to urge the brush-holder in the clockwise direction, causing the brushes, extending through transverse openings in the guide-plate 15, to bear lightly on the paper strip passing beneath.

The machine is driven by a pulley 34, Fig. 4, fixed on the outer end of a sleeve 35 rotatable freely on the transverse shaft 36, which is mounted at its other end in the side plate 10. Fixed on the inner end of the sleeve is a clutch disk 37. The other clutch disk, 38, is feathered on the shaft 36 and has a cam groove 39 coöperating with an actuating pin 40 on the arm 41. The parts being in the positions shown in Fig. 4, and the shaft (and clutch) rotating in the direction of the arrow, it will be evident that if the pin 40 is raised into the groove the incline 42, engaging the pin, will cam the clutch-disk 38 leftwardly out of engagement with the disk 37, thereby disconnecting the shaft 36 from the constantly rotating driving pulley 34. Contrariwise, if the pin is then withdrawn from the groove the spring 42 will shift the disk 38 rightwardly into engagement with disk 37 and the shaft 36 will again be rotated.

The slitting disks 43, 44, Fig. 1, working through an opening in the bed 12, are in shearing engagement with each other, as shown in Fig. 5. Disk 44 is fixed on a transverse shaft 45 journaled in the side plates 10, 11, below the bed, while disk 43 is fixed on a transverse shaft 46, mounted in bearings 47 carried by arms 48 fixed to and extending forwardly from a rockshaft 49. The latter carries an arm 50 having an anti-friction roller 51 bearing on a cam 52, Figs. 1 and 4, rigidly mounted on and therefore rotated by the shaft 36. Hence it will be seen that as the cam rotates, the arm 50 will be rocked, thereby rocking the arms 48 and raising and lowering the cutting disk 43 out of and into engagement with disk 44. Inasmuch as the drop 53 in the cam 52 is of limited extent it will be clear that the disk 43 is held in engagement with the other during the greater part of the revolution of the cam. A spring 50^a urges the arm 50 in the counterclockwise direction and holds the roller 51 in contact with the cam 52.

The slitting disks 43, 44 are rotated from a gear 54 fixed on the shaft 36 alongside of the cam 52. This gear meshes with the gear 55,—which in turn drives gear 56, fixed on shaft 45, and gear 57, which drives gear 58. The latter is fixed on shaft 46. Thus both slitting disks are positively driven from shaft 36.

The arm 41, which, it will be remembered, carries the clutch-actuating pin 40, is fixed on a transverse rock-shaft 59, on which is rigidly mounted an arm 60 carrying the armature 61 of an electromagnet 62. When the magnet is energized the arms 61—41 are rocked counterclockwise, against the

tension of spring 63, thereby carrying the pin 40 out of the cam groove 39 in clutch member 38, and when the magnet is de-energized the spring rocks the arms in the opposite direction, carrying the pin into the groove.

The electrical circuits are controlled by two relays, 64, 65, and two pairs of spring contacts, 66—67 and 68—69. The latter are carried below the recess 17 in the bed 12, and are controlled by two cams 70, 71, rigidly mounted on the shaft 36.

The machine operates as follows: Circuit *a*, which will be traced hereinafter, contains the brushes 28 and universal contact-plate 16, and also contains the contacts 66—67. Normally these contacts are held closed by cam 70, as shown in Fig. 1. The clutch magnet 62 is deënergized and hence shaft 36 and cams 70, 71 are not rotating. Assume now that one or the other of the detector brushes makes contact with plate 18, by reason of a defect in the paper strip passing under the brushes, for example a speck of carbon shown somewhat exaggerated in size at *x*, Fig. 8. Current now flows through circuit *a*, Fig. 6, as follows: battery 72, wire 73, brush 28, universal plate 16, wire 74, relay 64, wire 75, contacts 66—67, wire 76, resistance 77, and wire 78 back to the battery, the resistance being provided to diminish arcing at the brush when the circuit is closed. Relay 64 is thus energized, bringing its armature 79 against contact 80, thereby closing circuit *b*,—from battery 72, wire 73, wire 81, relay 65, contact 80, armature 79, wire 82, relay 64, wire 75, contacts 66—67, wire 76, resistance 77, and wire 78 back to the battery. Thus a shunt is laid across the brushes 28, so that relay 64 will remain energized after the defect or imperfection in the paper has passed the brushes. Relay 65 being energized by the making of circuit *b*, its armature 83 is brought into engagement with contact 84, establishing circuit *c*, as follows: battery 72, wires 73 and 85, armature 83, contact 84, wire 86, clutch magnet 62, wire 87, resistance 88, and wires 89 and 78 to battery 72. This energizes magnet 62, rocks lever 60—41, and withdraws the pin 40 from clutch disk 38, thereby permitting the spring 42 to shift the disk into engagement with clutch disk 37. Shaft 36 now begins to rotate, and with it the slitter-actuating cam 52 and the contact cams 70, 71. Contact cam 70 (rotating in the direction of the arrow, Fig. 1) acts first, breaking circuit *a* at contacts 66—67, though this circuit may have already been broken by movement of the paper strip carrying out from under the brushes the imperfection which permitted one or the other of the brushes to come into electrical connection with the plate 16. But the opening of circuit *a* at contacts 66—67, also opens circuit *b*, thereby deënergizing relay 65,—without, however, deënergizing the clutch magnet, for the reason that in the meantime contact cam 71 has raised contact 69 into engagement with contact 68, so that circuit *d* is established as follows: battery 72, wires 73, 85 and 90, contacts 69—68, wires 91, 86, clutch magnet 62, wire 87, resistance 88, wires 89 and 78, to battery 72; thus maintaining the clutch magnet energized and the clutch 37—38 in operation. Circuit *d* may therefore be conveniently termed the "maintaining circuit." Shaft 36 therefore continues to rotate, carrying the drop in cam 52 beyond the end of arm 50 and thereby swinging cutter disk 43 down into coöperation with disk 44. The disks named now begin to cut a slit *s*, Fig. 8, in the advancing paper-strip. Also, contact cam 70 re-closes contacts 66—67, without, however, reëstablishing circuit *a* since the latter has been opened at brush 28, and without reëstablishing circuit *b* since the reëstablishment of that circuit requires closing at brush 28 as well as at contacts 66—67. Eventually the continued rotation of shaft 36 brings the drop in cam 52 back under the arm 50, thus raising the upper disk 43 and hence stopping the mutilation of the paper-strip; and, also, the drop in contact cam 71 comes under contact 69, thereby breaking circuit *d*. This deënergizes clutch-magnet 62, whereupon arm 41 carries the pin 40 up into the cam groove 39 as the rise therein approaches, and shortly afterward the clutch opens. Shaft 36 now ceases to rotate, leaving the parts in the positions shown in Fig. 1, namely, with the drop 53 in cam 52 under the end of arm 50, the drop in contact cam 70 a short distance from the contact 67, and the drop in contact cam 71 under contact 69. The paper-mutilating cycle is thus completed.

If before the completion of the above-described cycle the brushes should find another imperfection in the paper-strip the circuits *a* and *b* will be reëstablished as already described, thereby causing another slitting operation to be performed immediately upon the conclusion of the one then in progress.

In the specific embodiment described, the linear length of the slit cut in the paper-strip depends, in general, upon the speed of the strip and the angular speed of the cam shaft 36. Thus if the rate of travel of the strip be increased the paper will move farther, and hence have a longer slit cut in it, before the clutch magnet is deënergized and the cutting disks are separated; and vice versa. Also, if the angular speed of the cams be increased the cutting disks will be separated earlier, and the slit will therefore be shorter. But it is best not to advance the strip faster than the cutting disks can shear it, inasmuch as attempting to pull

the strip faster through the disks is apt to result in tearing the strip. Attempting to push the paper through faster than the disks can shear it will simply buckle the paper up in front of the disks.

Two brushes are used to insure complete covering of the strip, so that if the first brush (the leftward brush in Fig. 1) misses an imperfection the second will find it. In many, probably in most, cases both brushes "find" the same imperfection. This will lengthen the normal cycle from one revolution of the cam shaft to two revolutions, unless, in general, the timing of the electrical functions of the machine be such that the clutch is not engaged (and the cycle therefore not begun) until the imperfection has passed the second brush.

The cam shaft should rotate only in the direction of the arrow (Fig. 1) since reverse rotation might damage one or both of the contacts 67, 69. To prevent such reverse rotation I provide a friction plate 95, (shown in broken lines in Fig. 1) loose on the hub of the pulley 34, Figs. 2 and 4, but held in frictional contact with the side of the hub by a spring 96. At its free end the plate is recessed to receive the stud 97 on the side of a pawl 98 the point of which is adapted to engage serrations on the inner edge of the pulley. When the pulley is rotating in the direction of the arrow, Fig. 1, the friction plate 95 is urged in the same direction thereby holding the pawl down upon the stop 99. The pawl then offers no interference with the free rotation of the pulley; but if the pulley starts in the opposite direction the friction plate instantly swings the pawl up into engagement with the serrated edge and prevents further movement.

As previously indicated, it is within the spirit of my invention to mark the strip in a distinguishing manner so as to warn the subsequent user of the cards which are cut from the strip. For this purpose the machine may be exactly like the one already described, except that one or both of the cutting disks are changed to printing disks, for example as in Fig. 9. In this figure the disks 43^a, 44^a, are arranged in the same vertical plane and are provided with type 100 on their peripheries, inked by porous rollers 101 charged with ink. The lower disk is mounted on a swinging arm 102 connected by a link 103 to the arm 50 so that as the latter is rocked by the cam 52 the disks will be swung into and out of contact with the opposite sides of the paper-strip. The arm 48^a, which carries the upper disk may have spring connection 104 with the standard 105 so that it will yield upwardly as the disks bear upon the paper and press upon the latter with sufficient force to produce clean, strong imprints. The shaft 45^a, on which the lower disk is mounted, rises and falls in a slot 106 in the side frame 10. The gearing for driving the disks is not shown in Fig. 10. In fact the gearing is preferably omitted and the disks rotated by frictional engagement with the advancing paper-strip.

It is to be understood that the invention is not limited to the specific construction herein described but can be embodied in other forms without departure from its spirit. In the appended claims I use the expression "damaging the strip", or the like, as a generic term to mean any effect upon the paper which will render it unfit for cutting into cards or will indicate that particular cards cut from it are unfit for use.

I claim:

1. In a machine for testing a paper-strip moving therethrough, the combination with mechanism for damaging the strip, of means for controlling the same, including a normally open controlling circuit having devices acting automatically to close the circuit through an imperfection in the strip.

2. In a machine for testing a paper-strip moving therethrough, the combination with mechanism for damaging the strip longitudinally, of means for causing the said mechanism to damage the paper-strip from a point in front of to a point behind an imperfection in the strip, said means including a controlling circuit having relatively movable contacts normally separated by the paper-strip.

3. In a machine for testing a paper-strip moving therethrough, the combination of a contact on one side of the path of the paper-strip, a brush on the other side of said path and normally insulated from the contact by the paper-strip but adapted to make electrical connection with the contact through an imperfection in the paper, a normally open circuit controlled by the brush and contact, and mechanism controlled by the circuit to damage the paper-strip when the circuit is closed.

4. In a machine for testing a paper-strip moving therethrough, the combination with normally separated slitting disks on opposite sides of the path of the paper-strip, of means for shifting at least one of the disks into coöperation with the other to slit the strip, and a controlling circuit for said means, having contacts on opposite sides of the path of the paper strip and normally separated by the latter but adapted to close the circuit through an imperfection in the paper.

5. In a machine for testing a paper-strip passing therethrough, the combination with normally separated and normally non-rotating slitting disks on opposite sides of the path of the paper-strip, of means for

rotating the disks, means for shifting at least one disk into coöperation with the other to slit the paper-strip, and a normally open controlling circuit for both said means, having devices operating automatically to close the circuit through an imperfection in the paper-strip.

6. In a machine for testing a paper-strip moving therethrough, the combination with normally separated slitting disks on opposite sides of the path of the strip, of a normally inactive cam for shifting at least one of the disks into engagement with the other to slit the strip, means for actuating the cam; and electromagnetic mechanism for controlling said means, including a normally open controlling circuit provided with devices normally separated by the paper-strip and acting automatically to close the circuit through an imperfection in the paper.

7. In a machine for testing a paper-strip moving therethrough, the combination with normally inactive mechanism for mutilating the paper-strip; of driving means for said mechanism; means for setting the driving means in operation, including a normally open circuit having devices acting automatically to close the circuit through an imperfection in the paper-strip; and means for disabling the driving means, including a maintaining circuit having means actuated by the driving means to open the maintaining circuit.

In testimony whereof I hereunto affix my signature.

OTTO E. BRAITMAYER.