United States Patent

[11] 3,547,265

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[54] **SCANNING MECHANISM**
24 Claims, 18 Drawing Figs.

[52] **U.S. Cl.** **209/111.7,** 250/219

[51] **Int. Cl.** **B07c 5/342**

[50] **Field of Search** 209/73, 74, 111.7; 250/211, 212, 219DC, 219DOC, 234, 219; 271/29

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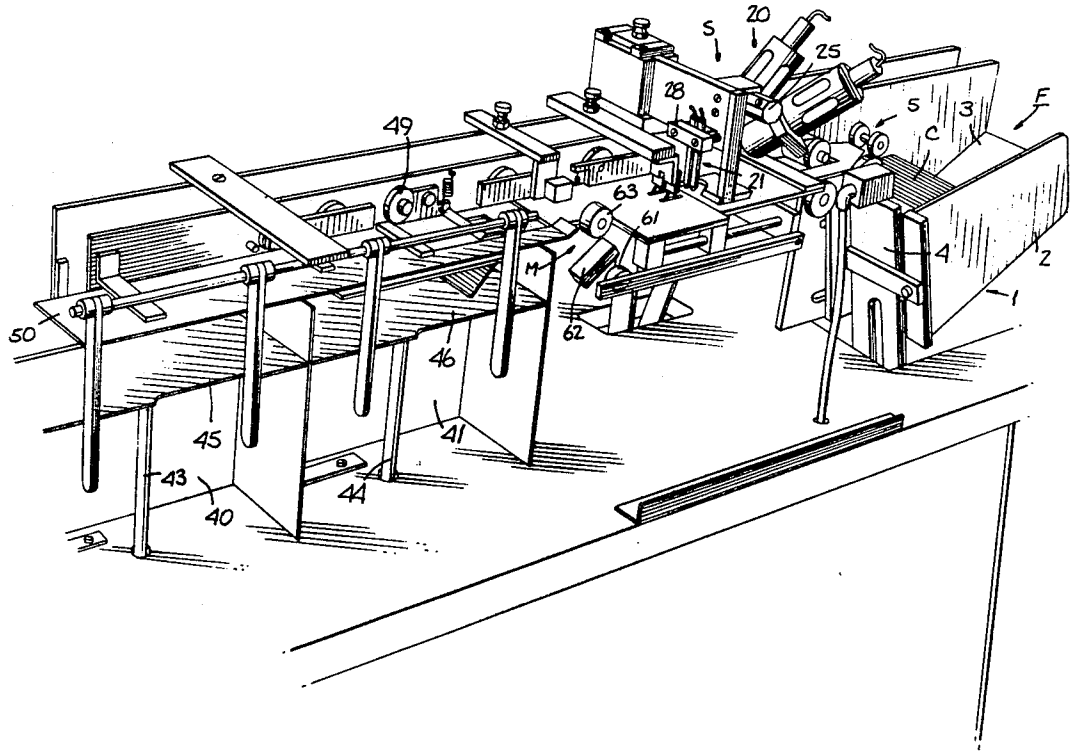
Primary Examiner—Richard A. Schacher
Attorney—Norman N. Holland

ABSTRACT: A scanning mechanism for detecting markings on cards wherein a light source and cooperating photocell are used to detect the markings. Markings on a card causes the photocell to trip a pair of switches thereby conditioning a flip-flop circuit causing it to apply voltage across a gate circuit. A relay is energized and raises a tiltable ramp directing the marked card into a marked card receptacle located below the ramp. An unmarked card will not fire the gate circuit and does not raise the ramp. The unmarked card is fed to an unmarked card receptacle.



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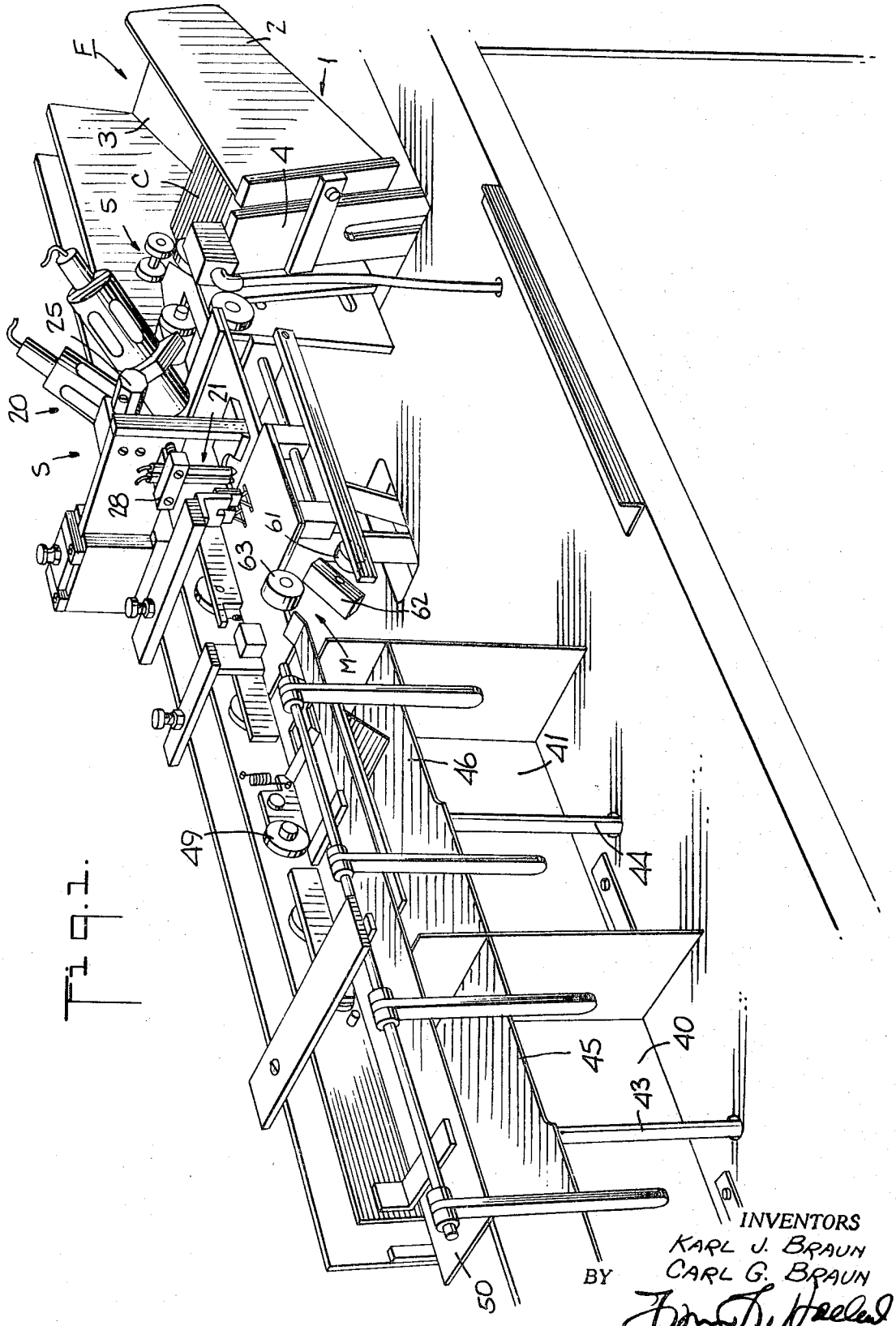

Fig. 1.

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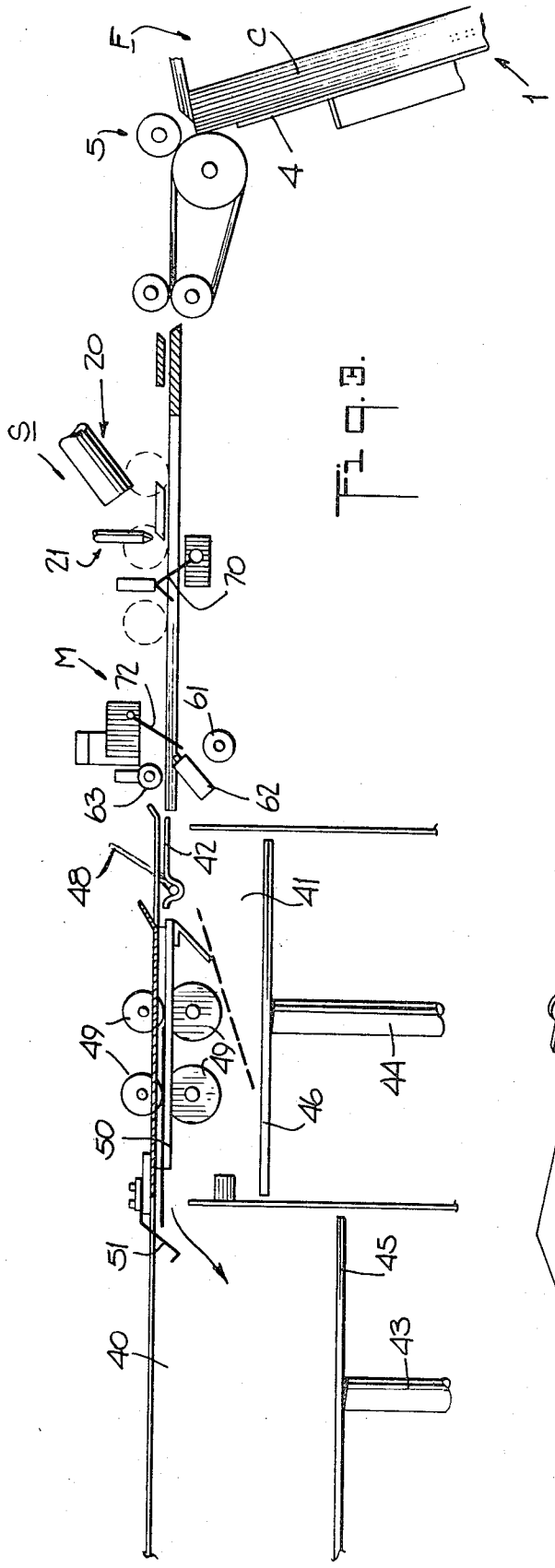

Fig. 1.

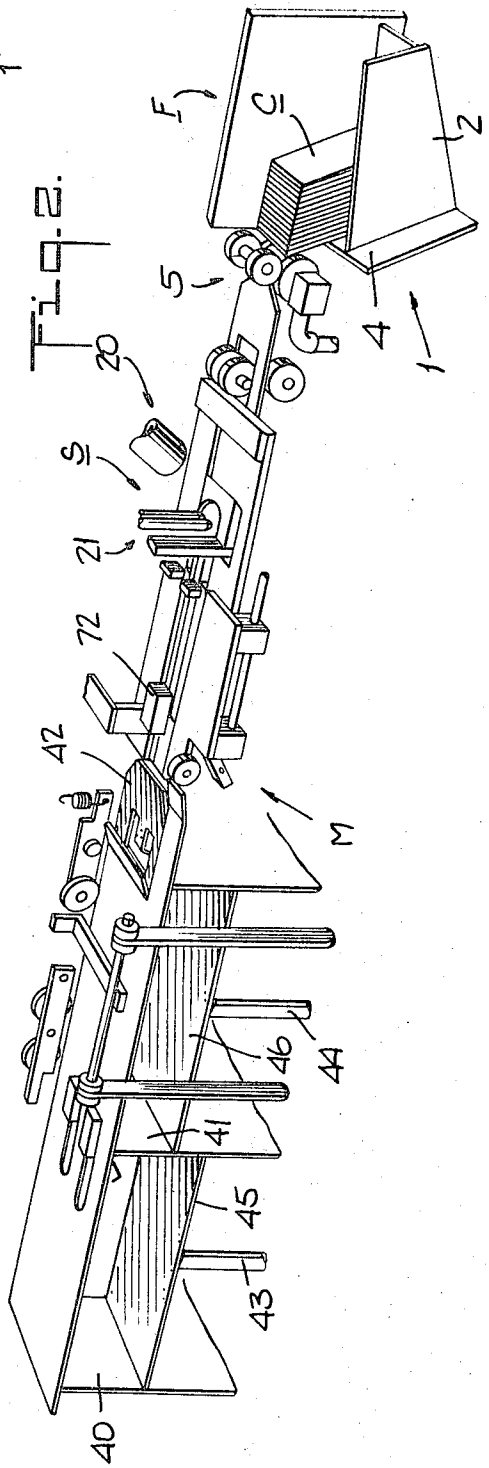

Fig. 2.

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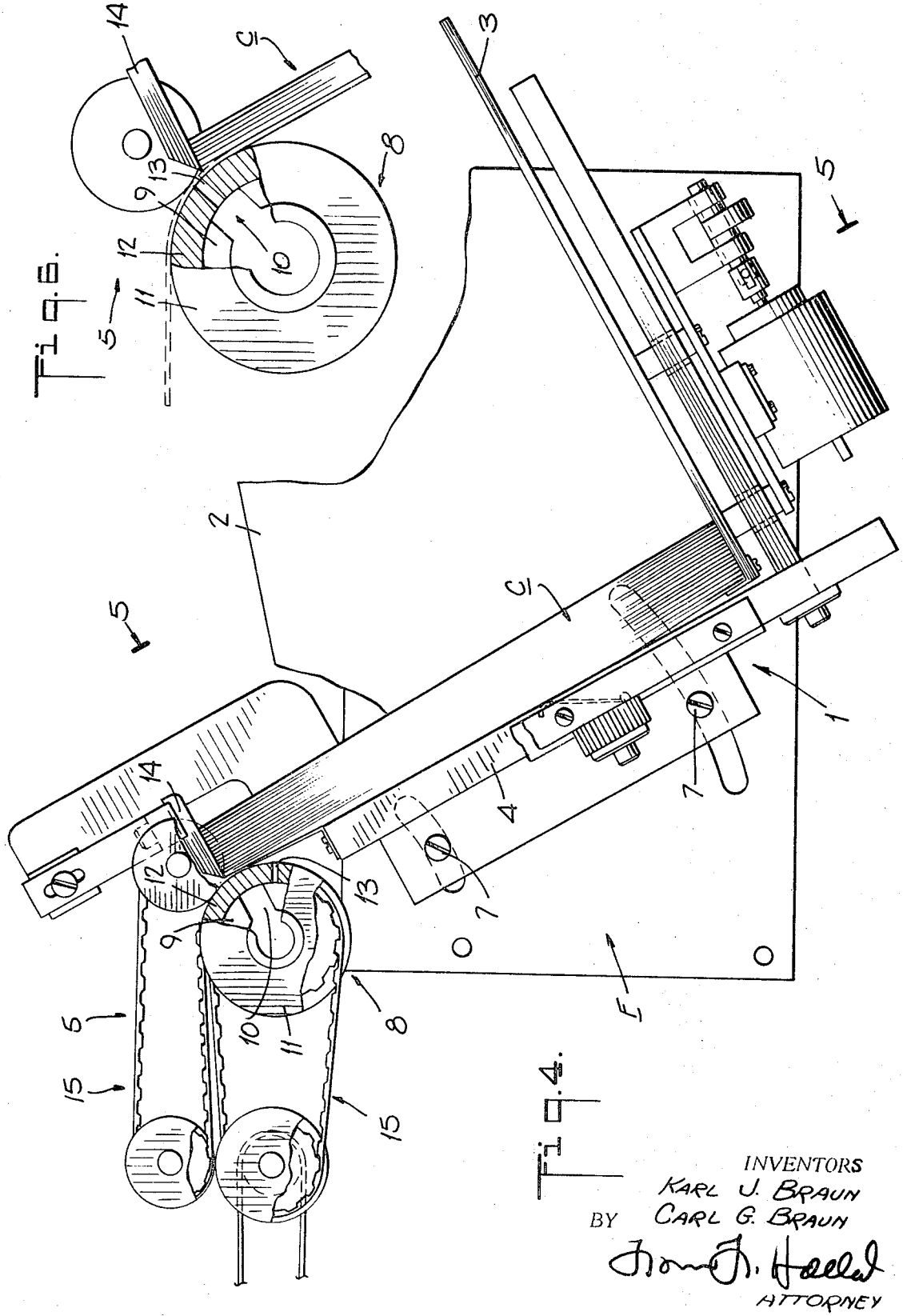

Fig. 6.

Fig. 4.

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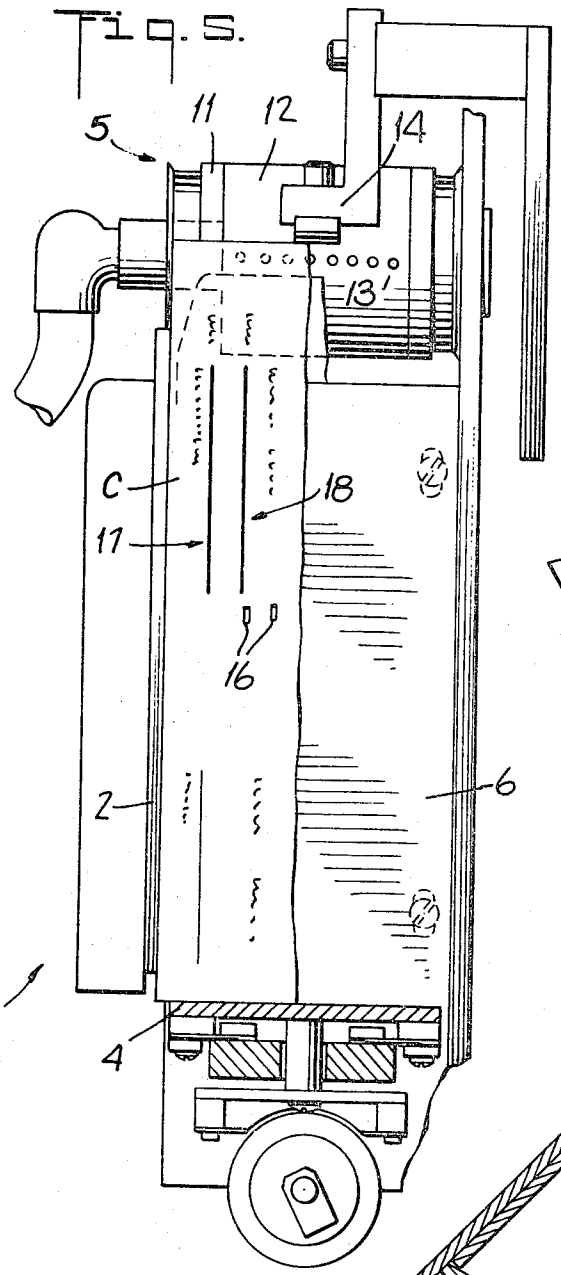
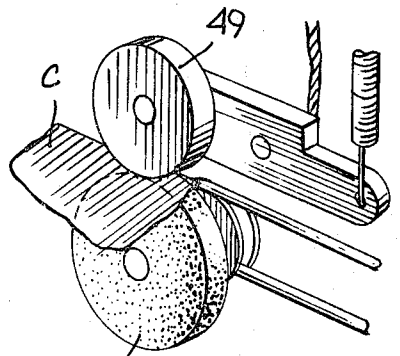
Fig. 5.





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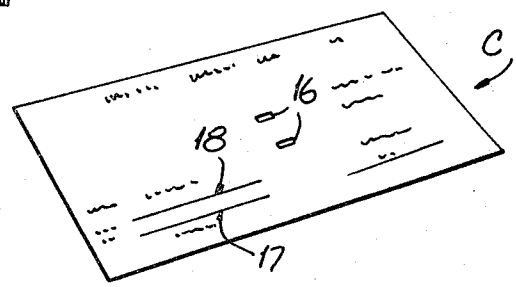
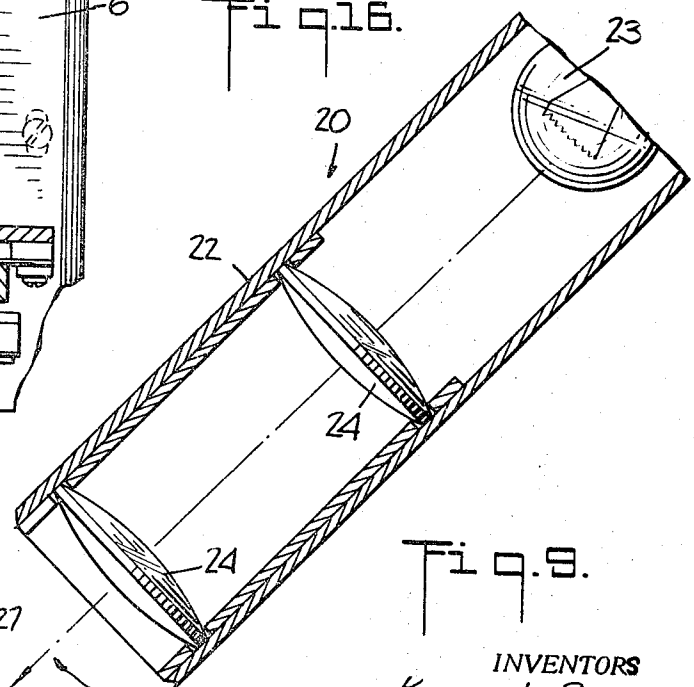


Fig. 16.



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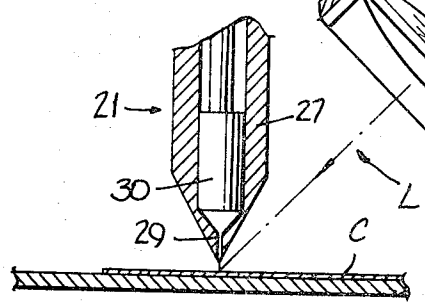

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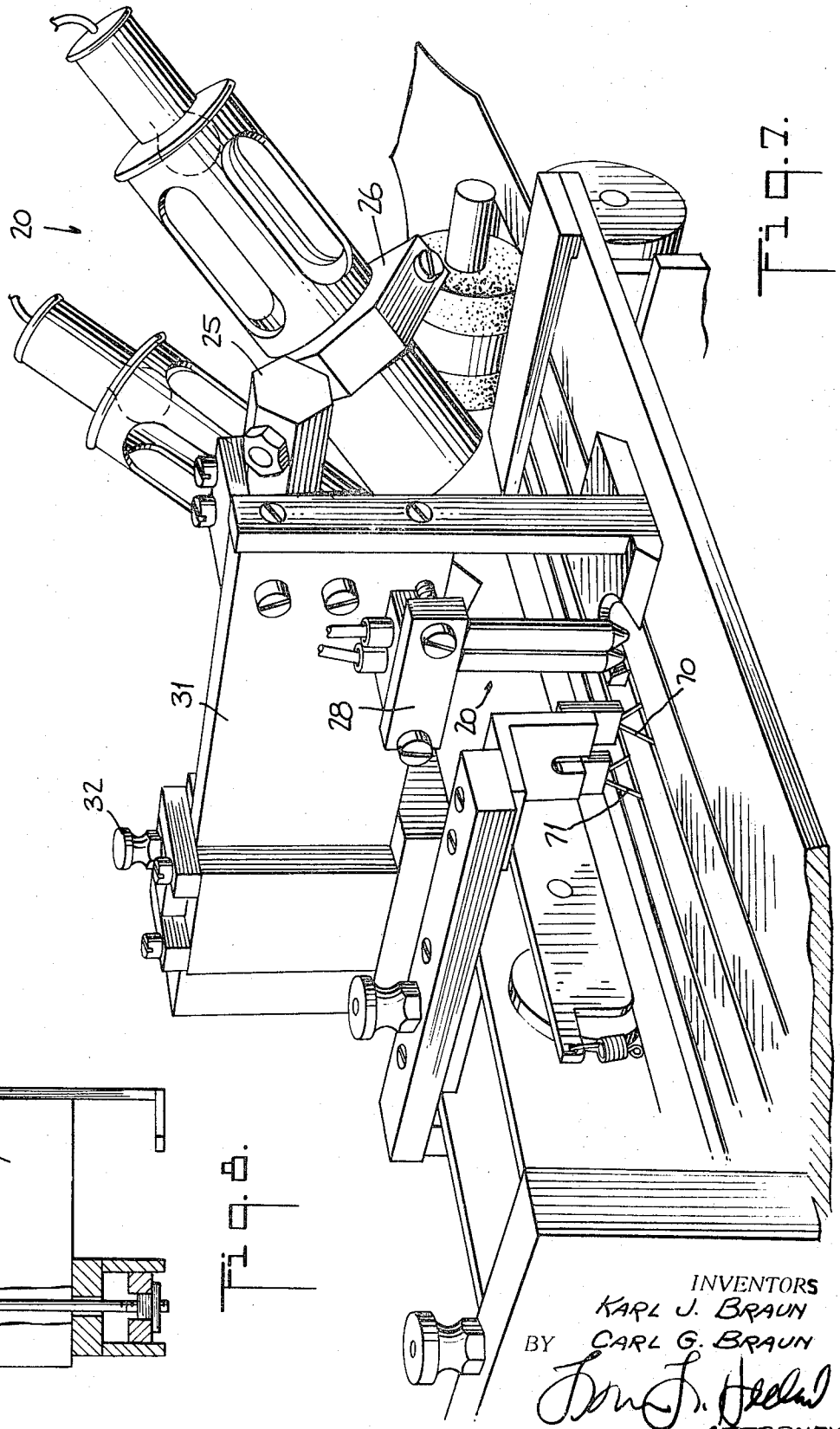

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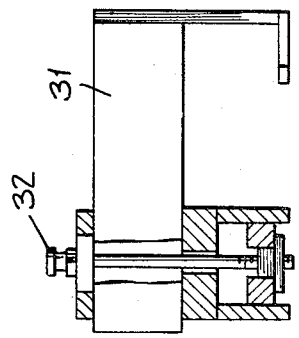

Fig. 8.

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Fig. 10.

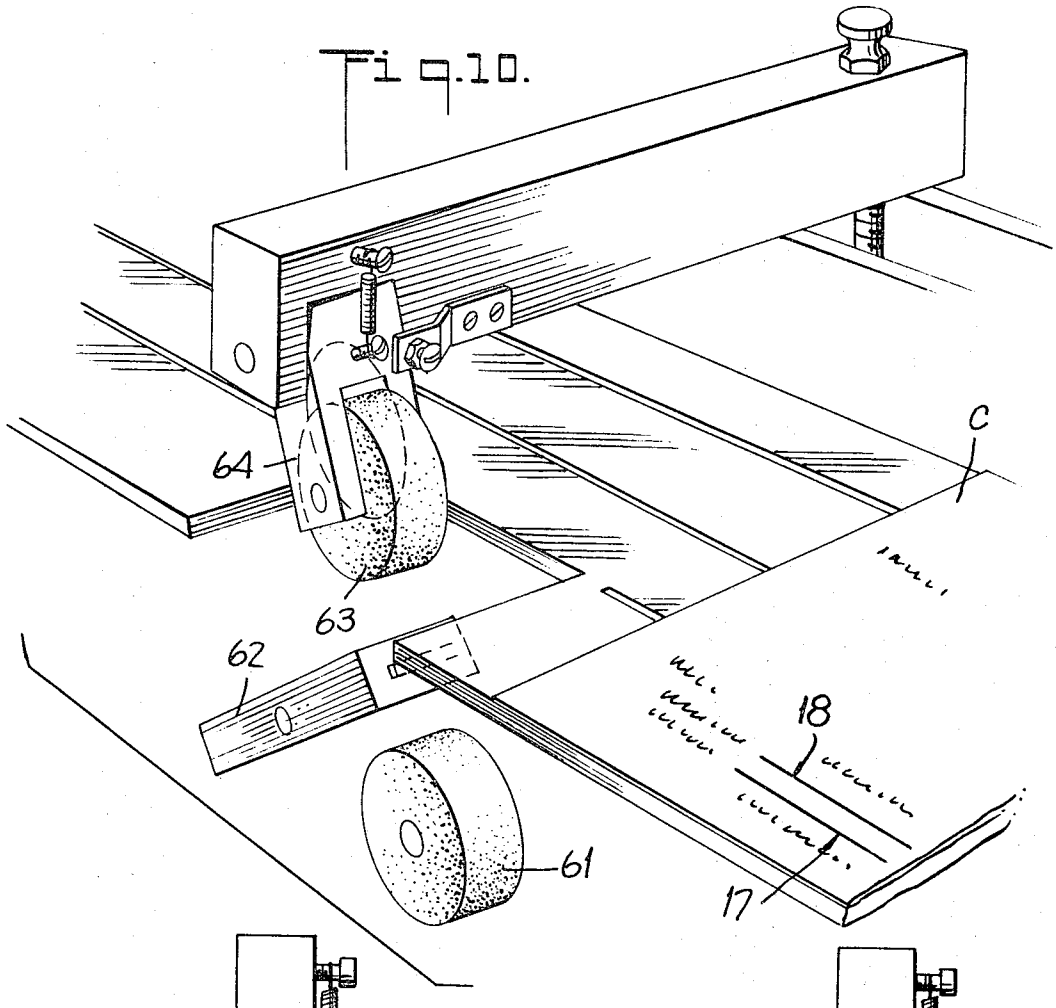

Fig. 11.

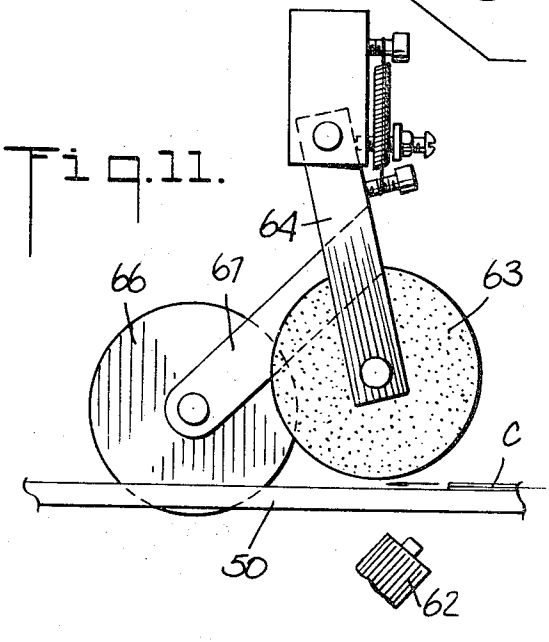

Fig. 12.

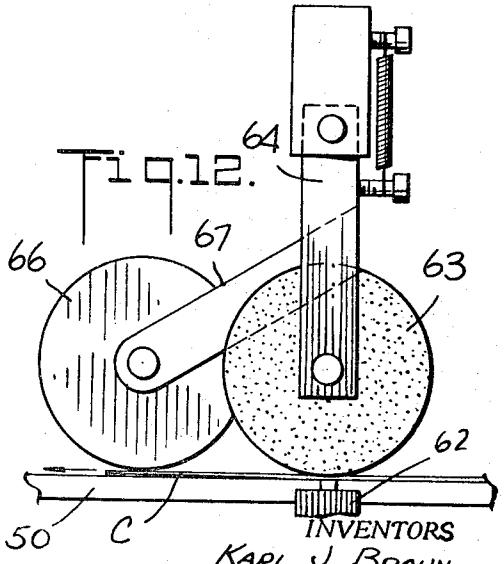

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Fig. 19.

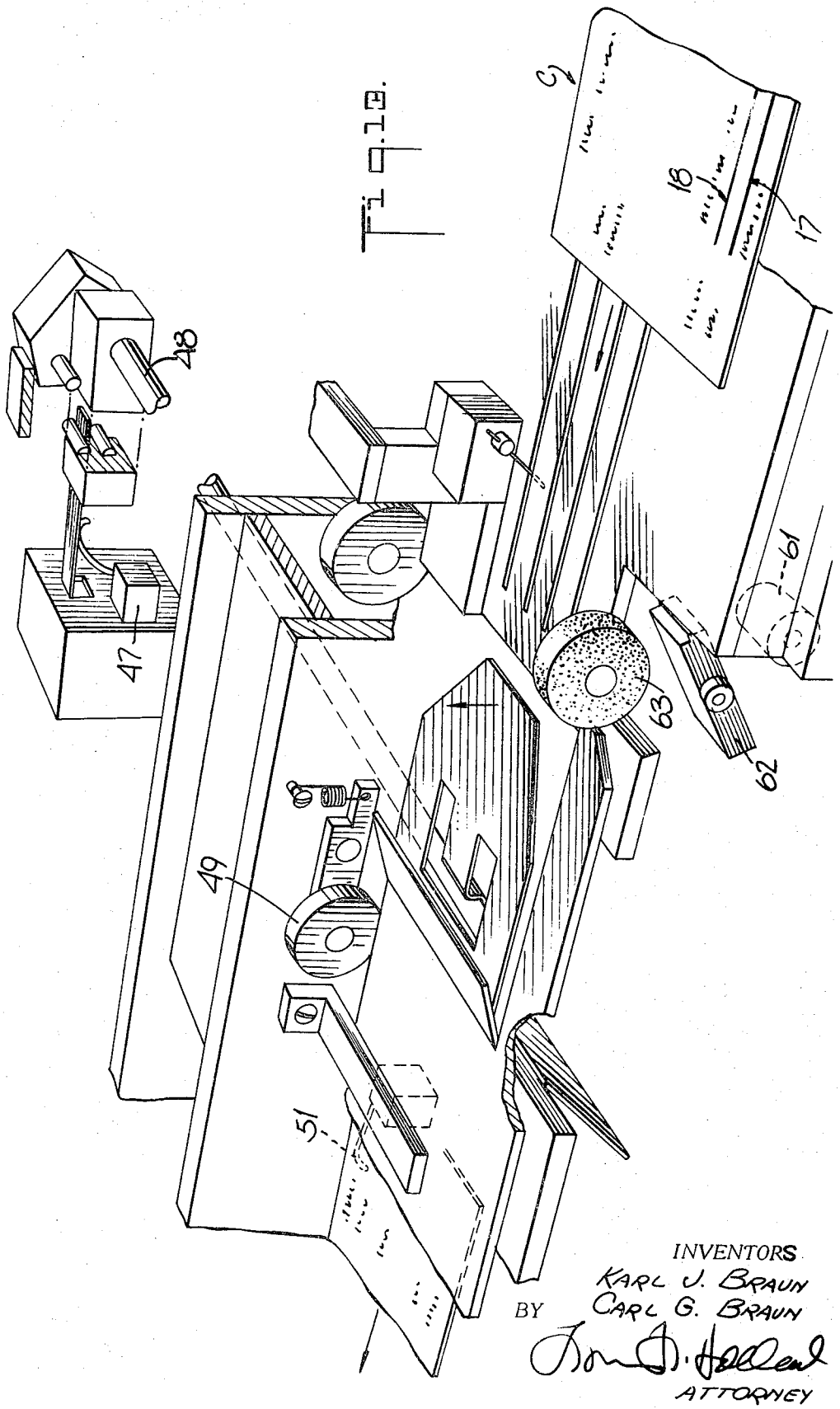

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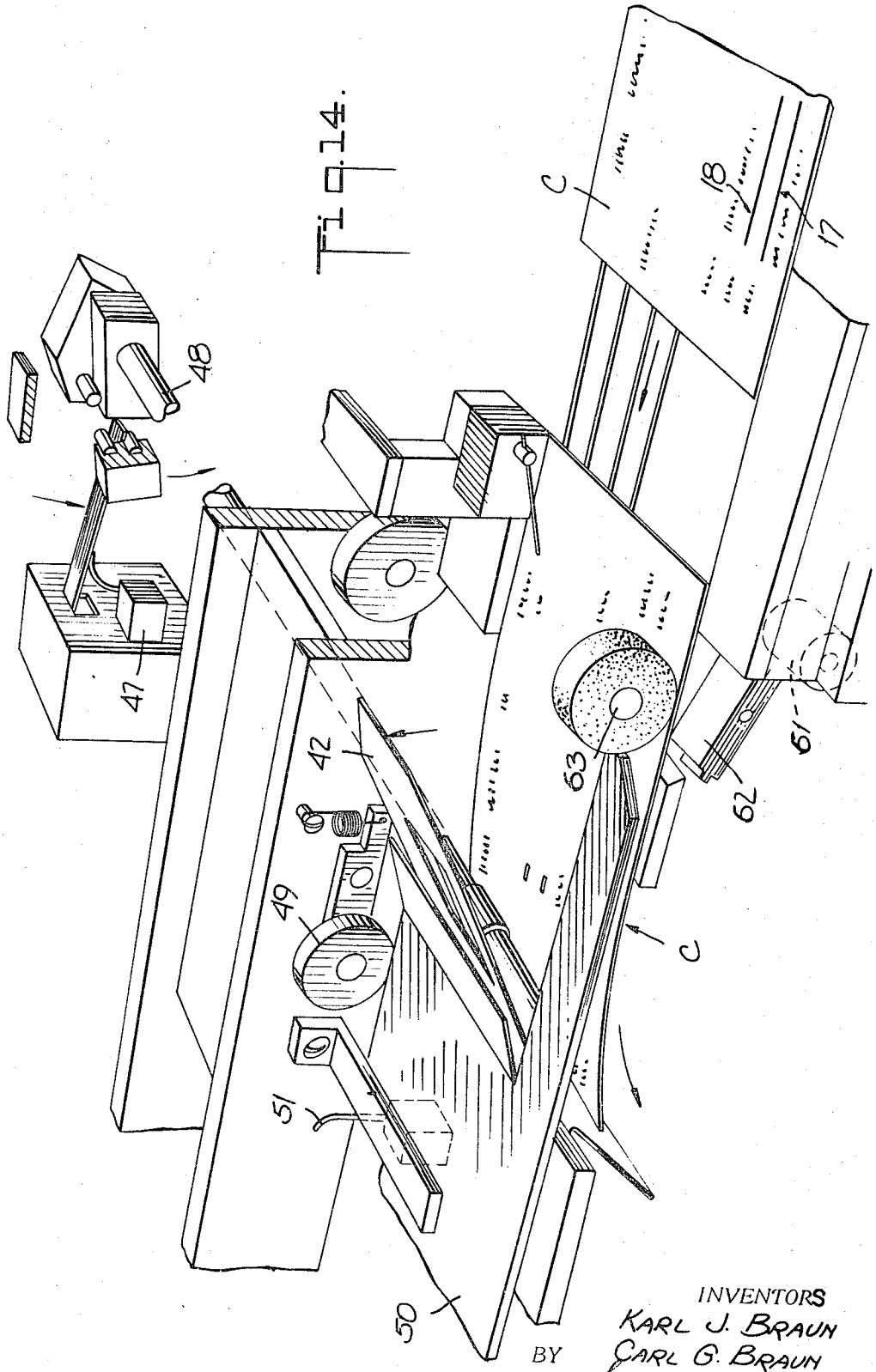
Fig. 14.



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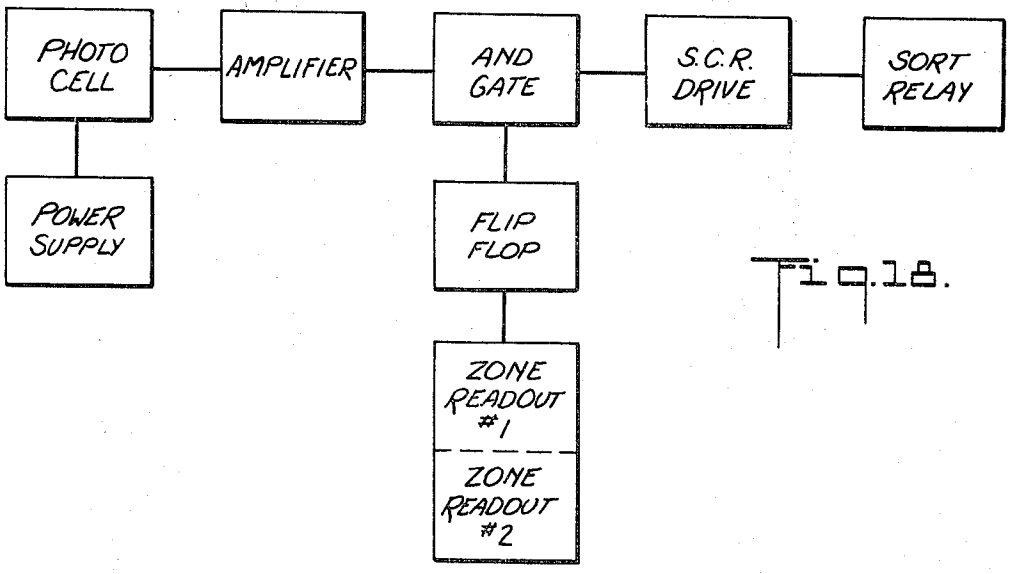

Fig. 18.

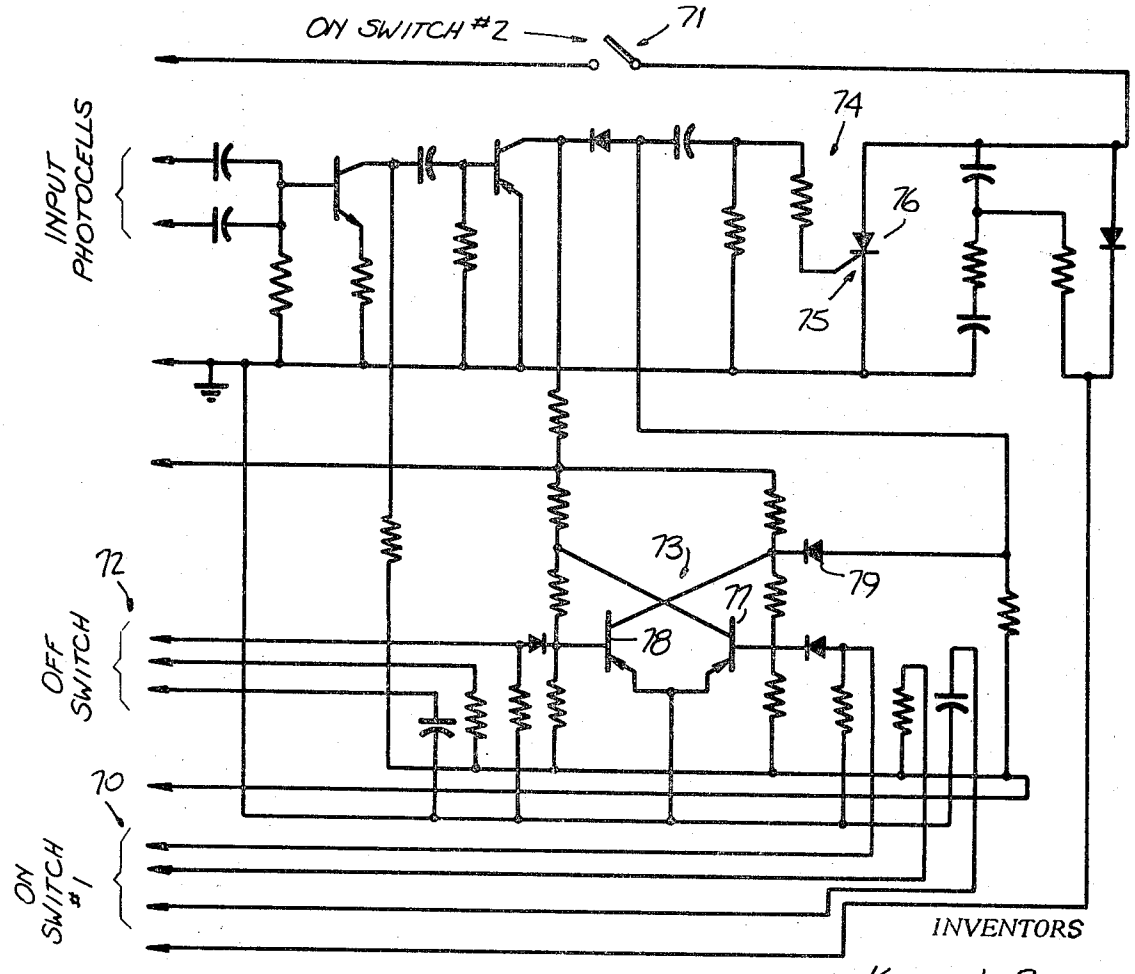

Fig. 17.

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SCANNING MECHANISM

The present invention is directed to an improved scanning mechanism and more particularly to an improved scanning mechanism adapted to scan a document, such as a card or sheet, to determine whether it has been marked in any manner and to separate marked documents from unmarked documents.

Cards or sheets, which may have information codes or other data thereon, such as proxies, checks, etc., are also provided a blank space which is to be marked by the recipient for various purposes, such as change of address, proxy voting, etc.

Heretofore, scanning mechanisms have been designed which are adapted to scan the cards and to indicate which cards have been marked. It has been found, however, that such prior scanning devices do not operate with the speeds necessary for present day requirements and that they involve complicated mechanisms and/or electronic circuitry which makes the cost of such machines prohibitive. It has also been found that present machines are not able to effectively separate both stiff cards and resilient paper sheets.

Furthermore, such machines do not have readily adjustable scanning devices to permit scanning of different parts of the card or sheet. Likewise, such machines do not have means for scanning cards of any length. Moreover, such prior machines require a special sensitive marking device.

Accordingly it is an object of the present invention to provide an improved scanning mechanism which will scan both stiff cards and flexible sheets.

Another object of the present invention is the provision of an improved scanning mechanism which will sense markings even though not marked with a special marking device.

Another object of the present invention is the provision of an improved scanning mechanism which will separate marked cards and sheets from unmarked ones at greater speeds.

Another object of the present invention is the provision of an improved scanning mechanism which is adapted to be used both with flexible paper sheets and with relatively stiff cards.

Another object of the present invention is the provision of an improved scanning mechanism in which the scanning means are easily adjustable to scan different areas thereof.

Another object of the present invention is the provision of an improved scanning mechanism in which a predetermined area only of the card or sheet will be scanned by the scanning means.

Another object of the present invention is the provision of an improved scanning mechanism which will scan cards of varying length.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawings, forming a part of the specification, wherein:

FIG. **1** is a perspective view of a scanning mechanism made in accordance with the present invention;

FIG. **2** is a schematic perspective view of the scanning mechanism;

FIG. **3** is a schematic side view of the scanning mechanism;

FIG. **4** is a detail view of the card feeding station;

FIG. **5** is a sectional view taken along line **5–5** of FIG. **4**;

FIG. **6** is a detail of the vacuum feeding means in the feeding station;

FIG. **7** is a perspective view showing the scanning station of the present invention;

FIG. **8** is a sectional view showing the means for adjusting the scanning means;

FIG. **9** is a diagrammatic sectional view of the scanning means;

FIG. **10** is a perspective view showing the marking station;

FIG. **11** is a detailed side view of the marking station;

FIG. **12** is another detailed side view thereof;

FIG. **13** is a perspective view of the separating station showing the separating ramp in one position;

FIG. **14** is another perspective view of the separating station showing the separating ramp in another position;

FIG. **15** is a detail showing the feeding mechanism in the separating station;

FIG. **16** is a perspective view of a card or sheet adapted to be processed by the present invention;

FIG. **17** is a diagrammatic view of electric circuit of the present invention; and

FIG. **18** is a block diagram thereof.

GENERAL DESCRIPTION

Referring more particularly to the drawings, the present invention is adapted to process cards or sheets C, which are preferably rectangular as shown in FIG. **16**. The card C has areas, represented by the lines **17** and **18**, which are to be marked by the user. Although, for convenience, the sheets and/or cards adapted to be scanned will be referred to as cards, it will be understood that the present invention may also be used to scan materials other than cards or sheets.

As shown in FIGS. **1**, **2** and **3**, the cards C are stacked in a feeding station F which comprises a stacking magazine **1**, having sidewalls **2**, a bottom wall **3** and an inclined front wall **4**. The cards C are stacked on the front wall **4** and are fed one-by-one by a vacuum feed assembly **5** to the scanning station S.

The scanning station S is provided with a light source assembly **20** and a photoelectric cell assembly **21**. The light source assembly **20** emits a beam of light which is directed onto the portion of the card C as the card passes therebeneath. The light is reflected by areas **17** and **18** of the card C upwardly into the photoelectric cell assembly **21**.

If areas **17** and **18** of the card C are not marked, a tiltable ramp **42** is not tilted and remains in a level position and the unmarked card will be deposited in an unmarked card bin **40**. However, if areas **17** and **18** of the card C have been marked, a relay in an electric circuit is energized to tilt the tiltable ramp **42** upwardly so that the marked card falls into a marked card bin **41**.

If desired, a marking station M may be provided to apply a number or other suitable indicia to each card as it passes thereby.

In addition, counting switches may also be provided so that an accurate count of the unmarked and the marked cards may be determined.

THE CARD

The card C which is adapted to be used with the present invention, is the usual rectangular card C shown in FIG. **16**. The card C has marking areas, represented by the lines **17** and **18** which may be marked by the user. The card C may be relatively stiff or flexible and may be provided with spaced information or data holes **16** as is usual with these items. Although, for convenience, the word "card" will be used to describe the card C, it will be understood that it is within the purview of the present invention to scan either stiff cards, flexible sheets or other materials, and that the use of the word "card" is intended to encompass such items.

FEEDING MECHANISM

The feeding mechanism F used with the present invention is shown in FIGS. **4** to **6** and comprises a magazine **1** adapted to receive the cards C. The magazine **1** has sidewalls **2**, a bottom wall **3** and an angled front wall **4**. The cards C are stacked on the font wall **4** of the magazine **1** with their end edges resting on the bottom wall **3**. The angle of the magazine **1** is adjustable by means of a pair of setscrews **7**.

A vacuum feed assembly **5** is provided which comprises a feed roller **8** having a stationary hollow inner core **9** with a conduit **10** communicating with its outer periphery, an end plate **11** and a rotatable outer sleeve **12** having at least one port **13** therein. The upper end of the lowermost card C lies adjacent the sleeve **12** and a stop member **14** retains all the

cards C, except the lowermost few. The conduit **10** faces in the direction of the stacked cards C. Air is withdrawn from hollow core **9** and conduit **10** to create a vacuum. As the sleeve **12** rotates and its port **13** communicates with conduit **10**, the suction is transmitted to the lowermost card through the port **13** so that the port **13** will pick up the lowermost card and move it between feed belts **15**. If the card C has data openings **16** therein, the port **13** is so positioned that it strikes the card C between the data openings **16** so that one card only will be fed.

SCANNING MECHANISM

Feed belts **15** move the card to the scanning station S shown in FIGS. **1**, **7**, **8** and **9**. The scanning station S comprises a light source assembly **20** and a photo cell assembly **21**. The light source assembly **20** comprises a pair of tubes **22** each having a light source **23** therein and lens system **24** to project a beam of light L onto a card C passing therebeneath. The tubes **22** are adjustably mounted in a bracket **25** by means of adjustable sleeves **26**.

The photoelectric cell assembly **21** comprises a pair of sleeves **27** mounted on a bracket **28**. Each sleeve has an opening **29** and a light sensitive photodiode cell **30** therein.

The lens system **24** of the light assembly **20** concentrates the light L on a small area only of the card C, adjacent lines **17** and **18**. The opening **29** of th the photoelectric cell sleeve **27** is very small and elongated so that no stray light strikes the photodiode cell **30**. It is formed in the apex of the tapered nose of sleeve **27**. The apex is positioned so closely adjacent to the card C that a small area only of the card C will be scanned by the photoelectric cell assembly **21**. Furthermore, the elongated opening **29** terminates below the photodiode **30** so even if stray light enters, it will not strike the photodiodes **30**. Thus, only light from the small marking area on the card will strike the photodiodes.

As shown in FIGS. **7** and **8** the brackets **25** and **28** are mounted on an adjustable plate **31** controlled by a bolt **32** so that the light assembly **20** and the photoelectric cell assembly **21** may be adjusted simultaneously transversely across the path of the cards to permit scanning of any portion of the card C.

A pair of light sources and photoelectric cells are shown in the drawings to permit scanning of marking areas adjacent lines **17** and **18** on the card C. It will be understood that, if desired, the number of scanning units used may be changed depending on the number of marking areas to be scanned. It will also be understood that either one of the two photocell assemblies **21** or the light source assembly **20** may be rendered inactive if desired.

CARD BINS

The marked card bin or receptacle **41** and the unmarked card bin or receptacle **40** are adapted to receive marked cards and unmarked cards, respectively. Each bin as seen in FIG. **3** has an elevator **46** and **45**, respectively, which may be spring pressed, and mounted on supports **43** and **44**.

A tiltable ramp **42**, operatively connected to a relay, is provided over the marked card bin **41** and is adapted to either tilt upwardly when a marked card is sensed or remain in its lower position when an unmarked card is sensed. As seen more clearly in FIGS. **13** and **14** the ramp **42** is connected by a rotatable rod **48** which is controlled by the relay. When the relay is energized by a marked card being sensed by the scanning station, it will rotate the rod **48** and tilt the ramp **42** upwardly so that the marked card is deposited in the marked card bin **41** and onto the elevator **46**. When this occurs a switch **47** is actuated which counts each card. The elevator **46** will lower slightly with each marked card that is placed therein.

Unmarked cards will not energize the relay so that the ramp **42** is not raised and unmarked cards are moved by rollers **49** to the end of the platform **50** and deposited in the unmarked card bin **40** and onto elevator **45**, which also lowers slightly. A switch **51** is provided in the path of the unmarked cards so that they may be easily counted.

MARKING STATION

The marking station M is adapted to apply a mark to each card. As shown in FIG. **1** it comprises an inking roller **61** mounted and a rotatable marker **62**. The rotatable marker **62** brushes against the applicator inking roller **61** to receive ink therefrom. Ink may be brushed onto the inking roller **61** or, if desired, an ink reservoir may be utilized.

Referring to FIGS. **10** through **12** an ink pressure roller **63** is mounted on a spring-pressed pivoted lever **64** which is controlled by a guide roller **66** extending from arm **67**. The weight of the guide roller **66** ordinarily moves the pressure roller **63** away from the platform **50**, as shown in FIG. **11**. However, when a card C passes therebeneath, it lifts the guide roller **66** upwardly. This will pull lever **64** downwardly to lower the pressure roller **63** at the same time that the inking bar **62** is beneath the card C (FIG. **12**) so that a mark is impressed on the card C.

ELECTRICAL CIRCUIT

The control circuitry and block diagram of the present invention is shown in FIGS. **17** and **18** and comprises a pair of "on" switches **70** and **71** and an "off" switch **72**. These switches **70**, **71** and **72** are actuated by the cards C passing thereby.

The first "on" switch **70** conditions a flip-flop circuit **73** so that it will be in a position to receive a signal. The second "on" switch **71** is actuated simultaneously with the first "on" switch **70** and applies a voltage across an electric gate circuit **74**. The gate circuit **74** controls a relay (not shown) which in turn rotates the rod **48** which controls the tiltable ramp **42**.

If a marked card passes beneath the scanning station, an indicative signal will be impressed on the gate **75** of the controlled rectifier or SCR **76**. The flip-flop circuit **73** at this time is in the reset position with conduction occurring through the transistor **77**. Substantially simultaneously, the card will pass over the "on" switches **70** and **71**. Switch **71** is closed thereby and impresses an operating voltage across the SCR **76**. Switch **70** is simultaneously closed and will cause the flip-flop circuit **73** to switch to the set position so that the transistor **78** will conduct. This cuts off conduction in the transistor **77** and correspondingly impresses a higher voltage through diode **79** on the SCR gate **75**. This latter voltage, combined with that from the photocell, will trigger the SCR **76** to conduction thereby operating the pivoted cam and diverting the card to the first bin or receptacle. When the card has passed, "on" switch **71** will open causing the SCR **76** to cut off.

If an unmarked card passes beneath the scanning station, the gate circuit **74** does not fire and the tiltable ramp **42** remains level with the platform **50** to direct the card to the unmarked card bin **40**.

The "off" switch **72** is closed by each passing card and will cause the flip-flop circuit **73** to switch to the reset position to await the passage of the next card.

The switches **70**, **71** and **72** are adjustable along the path of the card so that the cycle may be started at any desired point.

OPERATION

Cards C are stacked on a stacking mechanism **1** and each card is removed one-by-one by the vacuum feed assembly **5** which takes the cards and moves them beneath the scanning mechanism. In passing therebeneath light from light source assembly **21** is reflected by the scanned area of the card C upwardly into the photoelectric cell assembly **21**. At the same time, a pair of "on" switches **70** and **71** are tripped by the card C. These switches condition the flip-flop circuit **73** so that it will receive a signal and also apply a voltage across the gate circuit **74**. If a card is not marked, the circuit is not activated so that the relay controlling the ramp **42** is not energized and

the ramp is not raised. The card will move along platform **50** and be deposited in an unmarked card bin **40**. However, if the card is marked, and the mark is sensed by the photoelectric cell assembly **21**, the SCR **76** of the gate circuit fires to energize a relay which rotates rod **48** and raises the ramp **42** so that the card falls into the marked card bin **41**. An "off" switch **72** is tripped by the card as it passes thereby to recondition the circuit so that it can sense and process another card.

It will thus be seen that the present invention provides an improved card scanning mechanism which will scan cards and separate marked from unmarked cards at greater speeds, which is adapted to be used both with resilient and stiff cards, which will scan a small predetermined area regardless of its position on the card, and which will scan cards of varying length.

As various changes may be made in the form, construction and arrangement of the parts herein without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

We claim:

1. A scanning mechanism for scanning cards having a predetermined marking area thereon comprising means for moving a card in a path past a scanning station, means for directing light against the marking area of a card passing thereby, light sensitive means comprising a unit having an outer sleeve and a relatively small elongated opening and a photodiode spaced above said opening, said opening terminating a distance below said diode, said light sensitive means being adapted to receive reflected light from said marking area to detect whether the marking area has been marked, means responsive to said light sensitive means for separating marked cards from unmarked cards, said light sensitive means and said light directing means being simultaneously adjustable in a direction transverse to said path, said light sensitive means comprising a plurality of light sensitive units for simultaneously sensing a plurality of marking areas, marked card receptacle means and unmarked card receptacle means adjacent one another and below the path of travel of said cards, said means responsive to said light sensitive means causing marked cards to be deposited in said marked card receptacle means and causing unmarked cards to be deposited in said unmarked card receptacle, a ramp along the path of travel, said ramp being adapted to be lifted from a position directing unmarked cards into the unmarked card receptacle to a position directing marked cards into the marked card receptacle, said ramp being lifted by means of a relay operated by an electric circuit responsive to said light sensitive means, said circuit being energized to actuate said relay by a marked card, said relay being controlled by said electric circuit having a pair of switches adapted to be simultaneously actuated by a card passing thereby for conditioning said electric circuit to receive a signal.

2. A scanning mechanism as claimed in claim **1** wherein said relay is controlled by an electric circuit having a flip-flop and a gate circuit and means are provided responsive to a card for conditioning said flip-flop to receive a signal and for applying a voltage across said gate circuit.

3. A scanning mechanism as claimed in claim **2** wherein a marked card will cause the light sensitive means to energize the gate circuit to actuate the relay.

4. A scanning mechanism as claimed in claim **3** wherein switch means are provided responsive to cards passing thereby for conditioning said flip-flop and to apply voltage across said gate circuit.

5. A scanning mechanism as claimed in claim **1** wherein said light directing means and said light sensitive means are mounted on a common bracket which is slidably adjustable in a transverse direction in its support.

6. A scanning mechanism for scanning cards having a predetermined marking area thereon comprising means for moving a card in a path past a scanning station, means for directing light against the marking area of a card passing thereby, light sensitive means comprising a unit having an outer sleeve and a relatively small elongated opening and a photodiode spaced above said opening, said opening terminating a distance below said diode, said light sensitive means being adapted to receive reflected light from said marking area to detect whether the marking area has been marked, means responsive to said light sensitive means for separating marked cards from unmarked cards, said light sensitive means and said light directing means being simultaneously adjustable in a direction traverse to said path, said light sensitive means comprising a plurality of light sensitive units for simultaneously sensing a plurality of marking areas, said light directing means and light sensitive means being mounted on a common bracket that is slidably adjustable in a transverse direction in its support, marked card receptacle means and unmarked card receptacle means adjacent one another and below the path of travel of said cards, said means responsive to said light sensitive means causing marked cards to be deposited in said marked card receptacle means and causing unmarked cards to be deposited in said unmarked card receptacle, a ramp along the path of travel, said ramp being adapted to be lifted from a position directing unmarked cards into the unmarked card receptacle to a position directing marked cards into the marked card receptacle, said ramp being lifted by means of a relay operated by an electric circuit responsive to said light sensitive means, said circuit being energized to actuate said relay by a marked card, said relay being controlled by said electric circuit having a flip-flop and a gate circuit, a pair of switches adapted to be simultaneously actuated by a card passing thereby for conditioning said flip-flop to receive a signal and for applying a voltage across said gate circuit.

7. A scanning mechanism as claimed in claim **6** wherein marking means are provided for applying a mark to cards passing thereby.

8. A scanning mechanism as claimed in claim **7** wherein said marking means comprises a rotatable marker adapted to cooperate with a pivoted pressure roller mounted above the path of said cards.

9. A scanning mechanism as claimed in claim **8** wherein said pivoted pressure roller is brought into pressure applying position by actuation of a control roller mounted on said pressure roller.

10. A scanning mechanism as claimed in claim **9** wherein means are provided for counting the number of cards in said unmarked card receptacle and the number of cards in said marked card receptacle.

11. A scanning mechanism as claimed in claim **10** wherein card feeding means are provided, said card feeding means comprising vacuum feed means.

12. A scanning mechanism as claimed in claim **11** wherein said vacuum feed means comprises an outer rotatable sleeve having an opening therein and a stationary hollow inner core adapted to have air evacuated therefrom and having a conduit therein.

13. A scanning mechanism as claimed in claim **12** wherein means are provided for accommodating a stack of cards and positioned adjacent said outer sleeve whereby a coincidence of the conduit in the inner core and the opening in the outer sleeve will remove a card from said stack.

14. A scanning mechanism as claimed in claim **13** wherein said cards have data openings therein and wherein the opening in the outer sleeve is adapted to strike the card in an area spaced from said data openings.

15. A scanning mechanism for scanning cards having a predetermined marking area thereon comprising means for moving a card in a path past a scanning station, means in said scanning station for directing light against the marking area of a card passing thereby, a plurality of light sensitive means mounted closely adjacent a card passing thereby simultaneously sensed so that a plurality of marking areas can be scanned, said light sensitive means comprising a unit having an outer sleeve and a relatively small elongated opening, a

photodiode spaced above said opening, said opening terminating a distance below said photodiode, said light sensitive means adapted to receive reflected light from the marking area of said card to detect whether the marking area has been marked, said light sensitive means and said light directing means being simultaneously adjustable in a direction transverse to said path to permit various areas of a card to be scanned, said light directing and light sensitive means being mounted on a common bracket which is slideably adjustable in a transverse direction in its support, and means responsive to said light sensitive means for separating marked cards from unmarked cards, a marked card receptacle and an unmarked card receptacle is provided adjacent each other below the path of said cards and wherein means are provided responsive to said light sensitive means for causing marked cards to be deposited in said marked card receptacle and for causing unmarked cards to be deposited in said unmarked card receptacle, a ramp provided along said path, said ramp being movable from a position directing unmarked cards into the unmarked card receptacle to a position directing cards into the marked card receptacle, said ramp being adapted to be lifted responsive to light sensitive means, said ramp being controlled by a relay operated by an electric circuit responsive to said light sensitive means, said electric circuit having a flip-flop and a gate circuit, a marked card causing the light sensitive means to energize the gate circuit to actuate the relay, and a pair of switches adapted to be simultaneously actuated by a card passing thereby for conditioning said flip-flop and applying voltage across said gate circuit.

16. A scanning mechanism as claimed in claim **15** wherein marking means are provided for applying a mark to cards passing thereby.

17. A scanning mechanism as claimed in claim **16** wherein said marking means comprises a rotatable marker adapted to cooperate with a pivoted pressure roller mounted above the path of said cards.

18. A scanning mechanism as claimed in claim **17** wherein said pivoted pressure roller is brought into pressure applying position by actuation of a control roller mounted on said pressure roller.

19. A scanning mechanism as claimed in claim **18** wherein means are provided for counting the number of cards in said unmarked card receptacle and the number of cards in said marked card receptacle.

20. A scanning mechanism as claimed in claim **19** wherein card feeding means are provided, said card feeding means comprising vacuum feed means.

21. A scanning mechanism as claimed in claim **20** wherein said vacuum feed means comprises an outer rotatable sleeve having an opening therein and a stationary hollow inner core adapted to have air evacuated therefrom and having a conduit therein.

22. A scanning mechanism as claimed in claim **21** wherein means are provided for accommodating a stack of cards and positioned adjacent said outer sleeve whereby a coincidence of the conduit in the inner core and the opening in the outer sleeve will remove a card from said stack.

23. A scanning mechanism as claimed in claim **22** wherein said cards have data openings therein and wherein the opening in the outer sleeve is adapted to strike the card in an area spaced from said data openings.

24. A scanning mechanism for scanning cards having a predetermined marking area thereon comprising means for moving a card in a path past a scanning station, means for directing light against the marking area of a card passing thereby, light sensitive means adapted to receive reflected light from the marking area of said card to detect whether the marking area has been marked, means responsive to said light sensitive means for separating marked cards from unmarked cards, said separating means comprising a relay controlled by an electric circuit having a flip-flop and a gate circuit and means are provided responsive to a card for conditioning said flip-flop to receive a signal and to apply a voltage across said gate circuit, a marked card causing the light sensitive means to energize the gate circuit to actuate said relay, and a pair of switches responsive to cards passing thereby, said switches being simultaneously actuated by a card for conditioning said flip-flop and applying voltage across said gate circuit.