

March 30, 1948.

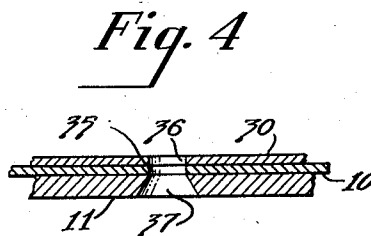
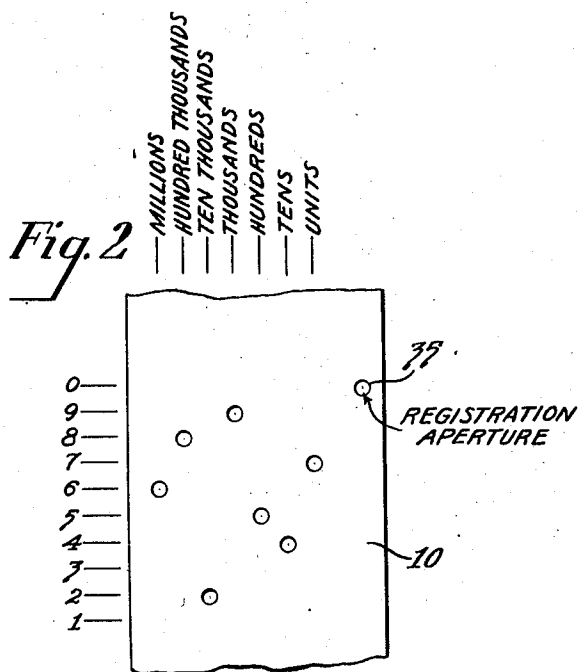
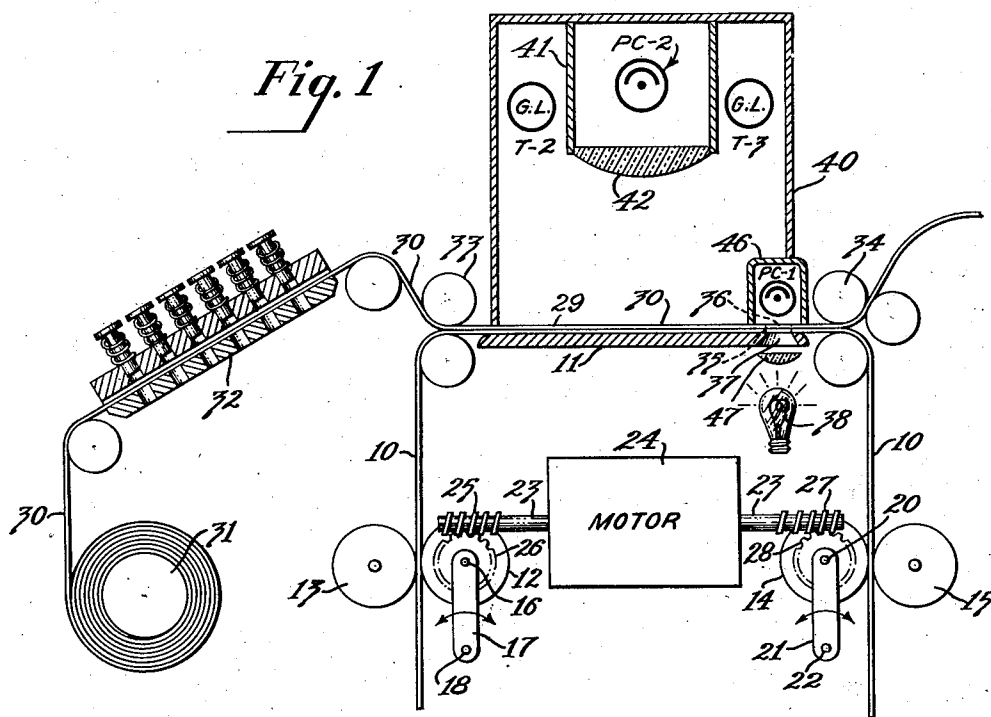
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2,438,588

SYSTEM FOR COMPARISON OR ANALYSIS OF INFORMATION

Filed Sept. 14, 1946

2 Sheets-Sheet 1



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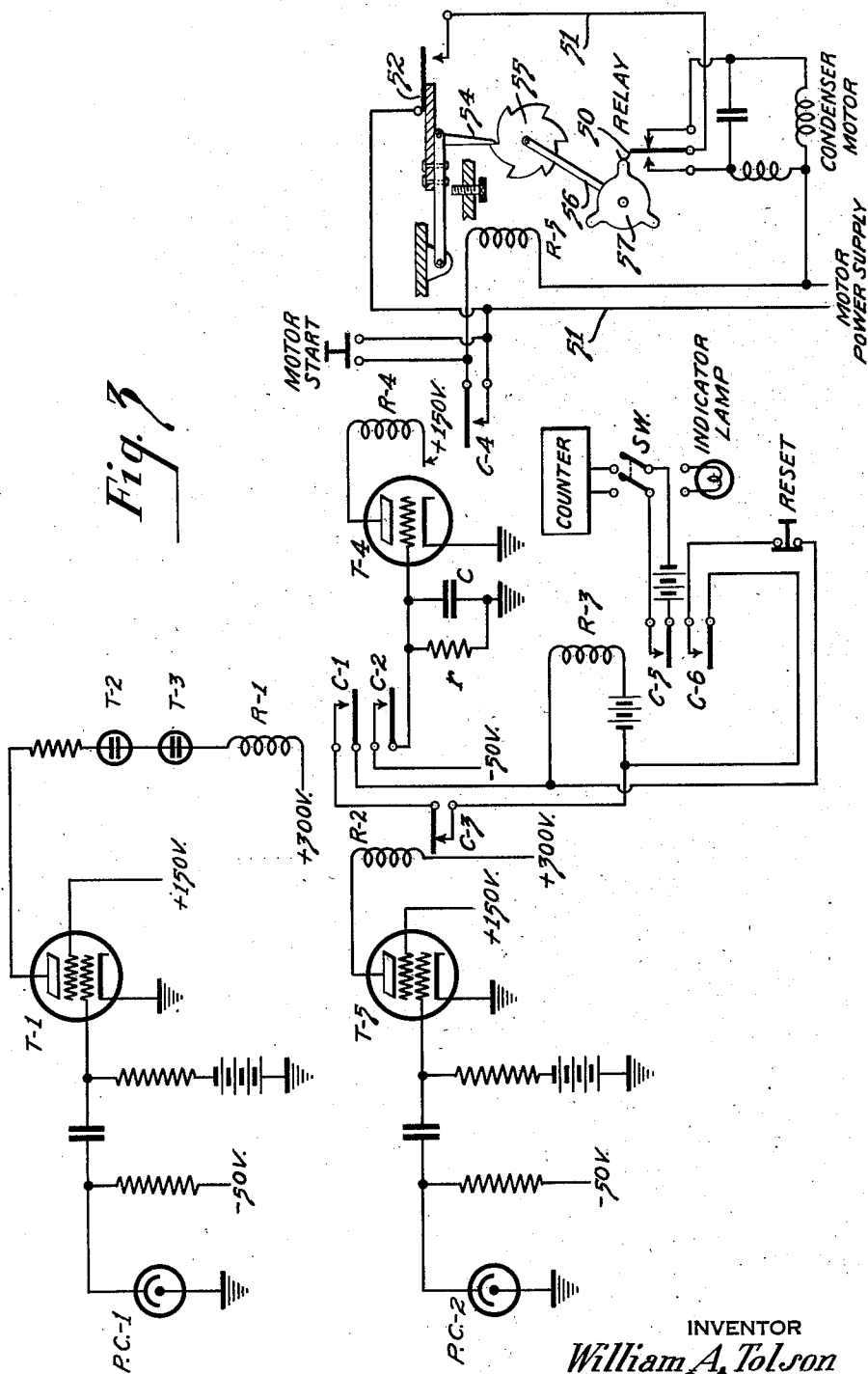
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SYSTEM FOR COMPARISON OR ANALYSIS OF INFORMATION

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2 Sheets-Sheet 2



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SYSTEM FOR COMPARISON OR ANALYSIS
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15 Claims. (Cl. 250—41.5)

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The present invention relates to recorded statistical information and more particularly to a system for the comparison or analysis of information which has been represented on a tape or the like in the form of punched holes so arranged as to identify a particular piece of informative data. Thus, for example, a continuous strip of material may be utilized for keeping records of checks passing through a bank, each check being represented by perforations punched in the strip and serving to identify the number of the check, the amount of the check or any other information required in connection therewith. After such a tape has been perforated with the desired information it becomes a permanent record from which any check recorded can be found or the number of checks by the same payer can be integrated.

In comparison systems heretofore in use it has been the practice to employ individual punched cards for each check, transaction or collection data, each such card having an identifying perforation whereby when mixed in with a batch of other cards it can be readily found by running the batch through a sorting machine, or if the identifying perforation serves as a class designation the cards can be counted by running them through a tabulation machine. Such sorting and tabulating depends upon electrical circuits controlled by contacts operated by pins passing through the perforations.

Some of the objects of the present invention are: to provide an improved system for comparing and analyzing information previously punched on cards, tape or other medium for recording information in the form of arranged perforations; to provide a system for automatically selecting one data unit from a plurality of data units; to provide a comparison and analyzing system for data punched on a card or tape wherein a non-reflecting material is associated with a reflecting medium and serves as a selecting means for locating certain information mingled with other information; to provide a comparison and analyzing system for data punched on a record strip, card or the like, wherein a photo-electric assembly is arranged to function in conjunction with reflecting and non-reflecting surfaces; to provide comparison means in which the recorded information moves through the comparator continuously and at high speed; and to provide other improvements as will hereinafter appear.

In the accompanying drawings, Figure 1 represents a schematic assembly of an information comparator embodying one form of the present invention; Figure 2 represents a portion of a tape

showing a group of perforations for identifying one unit of information; Figure 3 is a schematic diagram showing one form of circuit control; and Figure 4 represents an enlarged sectional detail showing the respective control registration perforations in register.

Referring to the drawings, the preferred form of the invention comprehends the reflection method as a comparison means for obtaining information from a prepared tape or strip 10, which, in the present instance, is a white paper having a succession of group perforations therein, each group representing the record of certain informative data different from some or all of the remaining group. While white paper preferably serves as a light-reflecting medium, other material may be used as long as one surface thereof is capable of reflecting light.

For positioning the tape 10 for analyzing the recorded data thereon and feeding it past a sensing station, a support plate or background 11 is provided having a non-reflective upper surface over which the tape is fed in one direction through the medium of a driven roller 12 and opposed idle roller 13, adjacent one end of the support plate 11, and in the opposite direction through the medium of a driven roller 14 and opposed idle roller 15, adjacent the other end of the support plate 11. The roller 12 has its shaft 16 journaled in links 17 suitably pivoted at 18 to swing towards or away from the tape 10 between the roller 12 and the idle roller 13. The roller 14 has its shaft 20 journaled in links 21 suitably pivoted at 22 to swing forwards or away from the tape 10 between the roller 14 and idle roller 15. Motion is alternately transmitted to the respective rollers 12 and 14 by the projecting ends of a shaft 23 of a reversible type motor 24, one end of the shaft 23 carrying a worm gear 25 meshing with a gear 26 on the shaft 16, and the other end of the shaft 23 carrying a worm gear 27 meshing with a gear 28 on the shaft 20. When the motor 24 is running in one direction the thrust of the shaft will press the proper feed roller against the tape and idle roller to feed the tape in the selected direction while the opposite feed roller is withdrawn from the tape, and when the motor is running in the opposite direction the reverse action of the feed rollers will take place so that the tape is fed in the opposite direction. This provision eliminates the necessity of rewinding the white tape 10 after each operation.

For sensing information as to a particular group of the group of data on the tape 10, a strip 29 having a non-reflecting surface 30, is fed from a

reel 31, through a key punch 32 and thence across and superposed with respect to the tape 10 on the plate 11. The reflecting surface of the tape 10 is juxtaposed to the strip 29, and the latter has its non-reflecting surface 30 uppermost and exposed. Positioning pairs of rollers 33 and 34, respectively located at opposite ends of the plate 11 serve to hold the tape 10 and strip 29 in contact with each other and also with the plate 11.

In Figure 2 one arrangement of punched perforations in the tape 10 is shown as representative of one group of the several groups of data, in this instance, being Number 6,829,547, and as this is the group to be located, or to be counted on the tape 10, the black strip 29 will be punched to correspond to this number, in order to register for comparison with the selected group. Also, a registration or control perforation 35 is provided on the tape 10 in association with the group, this aperture being in relatively close proximity to the margin of the tape 10. The black strip 29 also is punched with a control perforation 36 at the proper location to register with the control perforation 35. When the black strip 29 is in position for analyzing, its control perforation 36 thereon will register with the perforation 35, while the latter will register with a hole 37, through the plate 11 and in alignment with a lamp 38 arranged to be lighted, as will be explained.

In order to analyze the data on the tape 10, as it travels across the plate 11, below the stationary strip 29, an open bottom housing 40 is mounted above the plate 11 in close proximity to the strip 29, and encloses a casing 41 having a photo-electric cell PC-2 therein upon which light reflected from the reflecting surface of the tape 10 is focussed by a lens 42. Two sources of light in the form of glow lamps T-2 and T-3 are arranged respectively at opposite sides of the casing 41 and concealed from the cell 42 but serving to illuminate those portions of the tape 10 reflecting surface which are exposed by non-registering perforations of the tape 10 and strip 29.

A control photo-electric cell PC-1 is mounted in an open bottom receptacle 46 in alignment with the hole 37 and above the strip 29 so that light beams from the lamp 38 can be focussed thereon by a lens 47. Both the housing 40 and receptacle 46 are arranged to prevent stray light beams from entering the respective photo-electric chambers.

Generally considered, the circuit controlled by the registration perforation 35 includes the photo-electric cell PC-1, a detector tube T-1, preferably of the grid bias type, wherein the grid is normally biased to cut-off, and two glow lamps T-2 and T-3 in the plate circuit of T-1 and in series with a relay R-1. This relay R-1 controls contacts C-1 and C-2, the former serving to control a circuit of the operating motor through the medium of a tube T-4 and relay R-4, while the latter serves to control a circuit having a lamp or counter through the medium of a relay R-3, which controls a pair of locking contacts C-5 of the circuit selectively common to the lamp and counter. Selection of the lamp or counter may be made at will by a switch SW. The closing of the circuit for the relay R-3 is by way of a relay operated contact C-3 which is controlled by a relay R-2 in the plate circuit of a detector tube T-5 in the circuit controlled by the photo-electric cell PC-2. As long as a signal is received by the tube T-5 due to the light reflected from the tape 10 through

the perforations in the strip 29, the relay R-2 maintains the contact C-3 open and consequently the indicating lamp or counter is not operated. However, when all perforations in both the tape 10 and the strip 29 are in register, the black background of the plate 11 causes no reflection and in consequence the relay R-2 is deenergized and the contact C-3 closed to thereby close contact C-5 to operate the counter or the indicating lamp. A contact C-6 of the locking type is in a shunt circuit of R-3 so that when closed by the energization of R-3 it will maintain the R-3 circuit energized and the lamp lighted under the reset is manually operated to break the R-3 circuit.

The operation of the system is as follows: assuming the apparatus is to be used for checking the presence of a particular number in a list of numbers previously punched in the white surface tape 10, the tape 10 will be threaded through the feed rolls 14 and 15 and brought across the top of the background plate 11. The number to be checked is then punched in the black strip 29 by means of the keyboard punch 32 and is then indexed forward to the correct position above the white surfaced tape 10 on the plate 11. This operation of indexing the paper forward is arranged to start the motor which thereafter continuously feeds the white tape across the plate 11. The black strip 29 is so positioned that the registration aperture 36 lies directly above the aperture 37 in the plate 11 in register with the lamp 38. As the motor driven white tape 10 moves across the comparator plate 11 the registration aperture or perforation of each number passes the registration aperture in the black tape and allows a pulse of light from the lamp 38 to be projected into the photo-cell PC-2. This operates to drive the grid of the tube T-1 positive. Thus, the pulse of light on the photo-cell PC-2 serves to produce a corresponding flash of light from the glow tubes T-2 and T-3 and at the same time closes the pairs of contacts C-1 and C-2 of relay R-1. If the perforations in both tapes are identical, no light will be reflected into photo-cell PC-2 since all light passing through the perforations in the black tape is absorbed by the black background of plate 11 below the white tape. Under this condition, relay R-2 does not operate and contact C-3 remains closed. Since contacts C-1 have been closed, by the operation of relay R-1, the relay R-3 is operated to thereby close the circuit of the indicating lamp or to operate a counter as the case may be. Relay R-3 also carries a pair of locking contacts C-5 which maintain the indicating lamp in operation until the reset button is pushed. On the other hand, if any perforation in the black tape does not register with a similar perforation in the white tape, then the light from T-2 and T-3 is reflected from the white tape and operates photo-cell PC-2, thereby opening contact C-3 by means of the relay R-2 and preventing the energization of the relay R-3 and consequently operation of the indicator lamp. As long as light is reflected from the tape 10 by non-registering perforations, both PC-1 and PC-2 will operate the respective circuits of tubes T-1 and T-5 to hold contact C-1 closed and contact C-3 open.

In order that the motor operation may be made automatic, the relay R-1 also controls the pair of contacts C-2, which serve to charge condenser c shunted by resistor r. The time constant of this circuit will be in the order of $\frac{1}{2}$

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second. Thus, as long as the white tape is being driven through the comparator head and registration pulses are driving relay R-1, contacts C-2 serve to maintain the grid of T-4 below cutoff, and contacts C-4 remain closed, thereby maintaining the motor in continuous operation. The motor-start contactor would be operated by the lever which indexes the tape into position in the comparator head. Thus, the motor would be started by the act of positioning the tape in the comparator head and it would continue to run until all information punched on the white tape has been checked. Under the foregoing condition the motor will run continuously, which is the desired condition when counting a plurality of the same pattern of perforations and at this time the switch SW will be thrown to bring the counter under control of the R-3 circuit.

In case it is desired to re-run the tape, provision is made for running the tape in the reverse direction for counting or locating other recorded data, by including in the motor circuit a relay having a contactor 50 in one motor lead 51 which includes a pivoted contactor 52 arranged to be controlled by a relay R-5 in the motor lead 53 by either the motor start button or the contact C-4. The contactor 52 carries a pawl 54 so positioned as to actuate a six point star wheel 55 whenever the contactor 52 is moved to closed position, thereby turning shaft 56 of a three point cam 57, which is positioned to control the motor reversing contactor 50 and retain the motor running continuously in one direction as long as the motor start button is closed. When the tape has reached the end of its travel, or whenever its direction requires reverse travel, the motor start button is momentarily opened and then closed again, whereupon the star wheel 55 turns the cam 57 to the position where the contactor 50 is between two of the cams and the motor circuit is closed to run the motor in the opposite direction.

From the foregoing it will be apparent that a complete unitary statistical system has been devised wherein either a single pattern group of a series of varied pattern groups on a tape can be automatically located or the number of like patterns on the tape totalled by means of a counter. In the former instance, the single pattern when located is indicated by a lamp, buzzer, or other indicating means, and in the latter instance by setting the control to operate a counter.

I claim as my invention:

1. In a statistical comparator apparatus, the combination of a background having a non-reflecting surface, a length of tape having a light reflecting surface and a plurality of groups of perforations, each group representing certain informative data different from some or all the remaining groups, a strip of non-reflecting material juxtaposed to said tape and having perforations corresponding in number and arrangement with one group on said tape, means for feeding said tape across said background and relative to said strip, an indicator, and light controlled means for operating said indicator when said tape and strip perforations are in register.

2. In a statistical comparator apparatus, the combination of a background having a non-reflecting surface, a length of tape having a light reflecting surface and a plurality of groups of perforations, each group representing certain informative data different from some or all the remaining groups, a strip of non-reflecting mate-

rial juxtaposed to said tape and having perforations corresponding in number and arrangement with one group on said tape, means for feeding said tape across said background and relative to said strip to alternately expose reflecting and non-reflecting surfaces according to non-registration and registration of the two sets of perforations, an indicator, and sensing means responsive positively or negatively as a function of the reflection characteristics of said surfaces for controlling said indicator.

3. In a statistical comparator apparatus, the combination of a background having a non-reflecting surface, a length of tape having a light reflecting surface and a plurality of groups of perforations, each group representing certain informative data different from some or all the remaining groups, a strip of non-reflecting material juxtaposed to said tape and having perforations corresponding in number and arrangement with one group on said tape, means for feeding said tape across said background and relative to said strip, an indicator, and means operating as a function of reflection and non-reflection of said surfaces to control operation of said indicator whereby light reflection prevents operation of said indicator and non-reflection of light operates said indicator.

4. In a statistical comparator apparatus, the combination of a background having a non-reflecting surface, a length of tape having a light reflecting surface and a plurality of groups of perforations, each group representing certain informative data different from some or all the remaining groups, a strip of non-reflecting material juxtaposed to said tape and having perforations corresponding in number and arrangement with one group on said tape, means for feeding said tape across said background and relative to said strip, an indicator, and means operating as a function of reflection and non-reflection of said surfaces to control operation of said indicator, whereby in one light condition said indicator is inoperative and in the other condition the indicator is operated.

5. In a statistical comparator apparatus, the combination of a background having a non-reflecting surface and a registration hole, a length of tape having a light reflecting surface, a plurality of groups of perforations and a registration control perforation positioned to register with said hole, each of said groups representing certain informative data different from some or all the remaining groups, a strip of non-reflecting material juxtaposed to said tape and having perforations corresponding in number and arrangement with one group on said tape, and also having a registration control perforation positioned to register with said hole, means for feeding said tape across said background and relative to said strip, an indicator, an electrical circuit including a light sensitive means responsive to light reflected from said tape for controlling said indicator, and a second electrical circuit including a light sensitive means responsive to register of said control perforations with said hole for initiating operation of said indicator control circuit.

6. In a statistical comparator system, the combination of a source of light, a background having a non-reflective surface disposed toward said light source, a tape having a light-reflecting surface also disposed toward said light source when on said background, said tape having groups of perforations therein, each group representing

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different statistical data different from some or all of the remaining groups, a strip superposed on said tape having a non-reflective surface disposed toward said light source and also having a plurality of perforations corresponding in number and arrangement with one of said tape groups, means for moving said tape relative to said strip, an indicator, and means operated by said light source for operating said indicator when said tape perforations are in register with said strip perforations.

7. In a statistical comparator system in combination of a light source, a background having a non-reflecting surface disposed toward said source, a strip superposed on said surface having a non-reflective surface disposed toward said light source, said strip having perforations therethrough arranged in a predetermined relation, a tape interposed between said strip and said background having a light-reflecting surface juxtaposed to said strip, said tape having a plurality of groups of perforations therethrough with at least one group corresponding in number and arrangement to said strip perforations, means for feeding said tape relative to said strip and background, an indicator, and means operated by said light source for operating said indicator when said one perforated group on said tape comes into register with said strip perforations.

8. In a statistical comparator system the combination of a light source, a background having a non-reflecting surface disposed toward said source, a strip superposed on said surface having a non-reflective surface disposed toward said light source, said strip having perforations therethrough arranged in a predetermined relation, a tape interposed between said strip and said background having a light reflecting surface juxtaposed to said strip, said tape having a plurality of groups of perforations therethrough with at least one group corresponding in number and arrangement to said strip perforations, means for feeding said tape relative to said strip and background, an indicator, means operated by said light source for operating said indicator when said one perforated group on said tape comes into register with said strip perforations, and means associated with said light source for sensing a prelocated perforation of said tape as a control for said indicator operating means.

9. In a statistical comparator system comprising three elements having respectively a non-reflecting surface, a second non-reflecting surface, and a reflecting surface, said reflecting surface element being interposed between said non-reflecting surface elements, one of said elements having perforations arranged in a predetermined pattern and another element having perforations arranged in groups at least one of which corresponds in number and arrangement to the said predetermined pattern, means for moving said group element relative to the other two elements, a source of light, an indicator, and sensing means controlled positively or negatively by said light source as a function of the reflective characteristics of said surfaces for controlling operation of said indicator.

10. In a statistical comparator system comprising three elements having respectively a non-reflecting surface, a second non-reflecting surface, and a reflecting surface, said reflecting surface element being interposed between said non-reflecting surface elements, one of said elements having perforations arranged in a predetermined pattern and another element having perforations

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arranged in groups at least one of which corresponds in number and arrangement to the said predetermined pattern, means for moving said group element relative to the other two elements, a source of light, a counter, and sensing means controlled positively or negatively by said light source as a function of the reflective characteristics of said surfaces for controlling operation of said counter.

11. In a statistical comparator system, the combination of a non-reflective background having a registration hole, means for projecting light rays through said hole, a source of light, a length of tape having a reflecting surface disposed towards said light source and a registration perforation located to register with said hole in one position of said tape on said background, said tape also having groups of perforations, each group forming a pattern representing informative data different from some or all of the remaining groups, a strip having a non-reflective surface juxtaposed to said light source when said strip is on said tape, and having a registration perforation located to register with said tape and hole registration perforation when the latter are in registration, said strip also having perforations arranged in a pattern similar to at least one of said tape group patterns, an electrical circuit, means responsive to the projected light rays passing through said two registration perforations and said hole for closing said circuit to energize said light source, an indicator, and sensing means responsive to said light source and operative only when said strip pattern registers with a like group pattern for actuating said indicator.

12. In a statistical comparator system, the combination of a non-reflective background having a registration hole, means for projecting light rays through said hole, a source of light, a length of tape having a reflecting surface disposed towards said light source and a registration perforation located to register with said hole in one position of said tape on said background, said tape also having groups of perforations, each group forming a pattern representing informative data different from some or all of the remaining groups, a strip having a non-reflective surface juxtaposed to said light source when said strip is on said tape, and having a registration perforation located to register with said tape and hole registration perforation, when the latter are in registration, said strip also having perforations arranged in a pattern similar to at least one of said tape group patterns, an electrical circuit, means responsive to the projected light rays passing through said two registration perforations and said hole for closing said circuit to energize said light source, an indicator, and means controlled by said light source for sensing the registration of said tape pattern with a like group pattern for actuating said indicator.

13. In a statistical comparator system, the combination of a non-reflective background having a registration hole, means for projecting light rays through said hole, a source of light, a length of tape having a reflecting surface disposed towards said light source and a registration perforation located to register with said hole in one position of said tape on said background, said tape also having groups of perforations, each group forming a pattern representing informative data different from some or all of the remaining groups, a strip having a non-reflective

surface juxtaposed to said light source when said strip is on said tape, and having a registration perforation located to register with said tape and hole registration perforation, when the latter are in registration, said strip also having perforations arranged in a pattern similar to at least one of said tape group patterns, an electrical circuit, means including a photo-electric cell responsive to the projected light rays passing through said two registration perforations and said hole for closing said circuit to energize said light source, an indicator, and sensing means responsive to said light source and operative only when said strip pattern registers with a like group pattern for actuating said indicator.

14. In a statistical comparator system, the combination of a non-reflective background having a registration hole, means for projecting light rays through said hole, a source of light, a length of tape having a reflecting surface disposed towards said light source and a registration perforation located to register with said hole in one position of said tape on said background, said tape also having groups of perforations, each group forming a pattern representing informative data different from some or all of the remaining groups, a strip having a non-reflective surface juxtaposed to said light source when said strip is on said tape, and having a registration perforation located to register with said tape and hole registration perforation, when the latter are in registration, said strip also having perforations arranged in a pattern similar to at least one of said tape group patterns, an electrical circuit, means responsive to the projected light rays passing through said two registration perforations and said hole for closing said circuit to energize said light source, an indicator, and means including a photo-electric cell controlled by said light source for sensing the registration

of said tape pattern with a like group pattern for actuating said indicator.

15. In a statistical comparator system, the combination of a non-reflective background having a registration hole, means for projecting light rays through said hole, a source of light, a length of tape having a reflecting surface disposed towards said light source and a registration perforation located to register with said hole in one position of said tape on said background, said tape also having groups of perforations, each group forming a pattern representing informative data different from some or all of the remaining groups, a strip having a non-reflective surface juxtaposed to said light source when said strip is on said tape, and having a registration perforation located to register with said tape and hole registration perforation, when the latter are in registration, said strip also having perforations arranged in a pattern similar to at least one of said tape group patterns, an electrical circuit, means including a photo-electric cell responsive to the projected light rays passing through said two registration perforations and said hole for closing said circuit to energize said light source, an indicator, and means including a photo-electric cell controlled by said light source for sensing the registration of said tape pattern with a like group pattern for actuating said indicator.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,294,720	Dickinson	Sept. 1, 1942
2,294,734	Bryce	Sept. 1, 1942