Sept. 1, 1942. J. P. MENTZER 2,294,416

EXAMINATION GRADER

Filed Nov. 18, 1940 3 Sheets-Sheet 1

Fig. 1

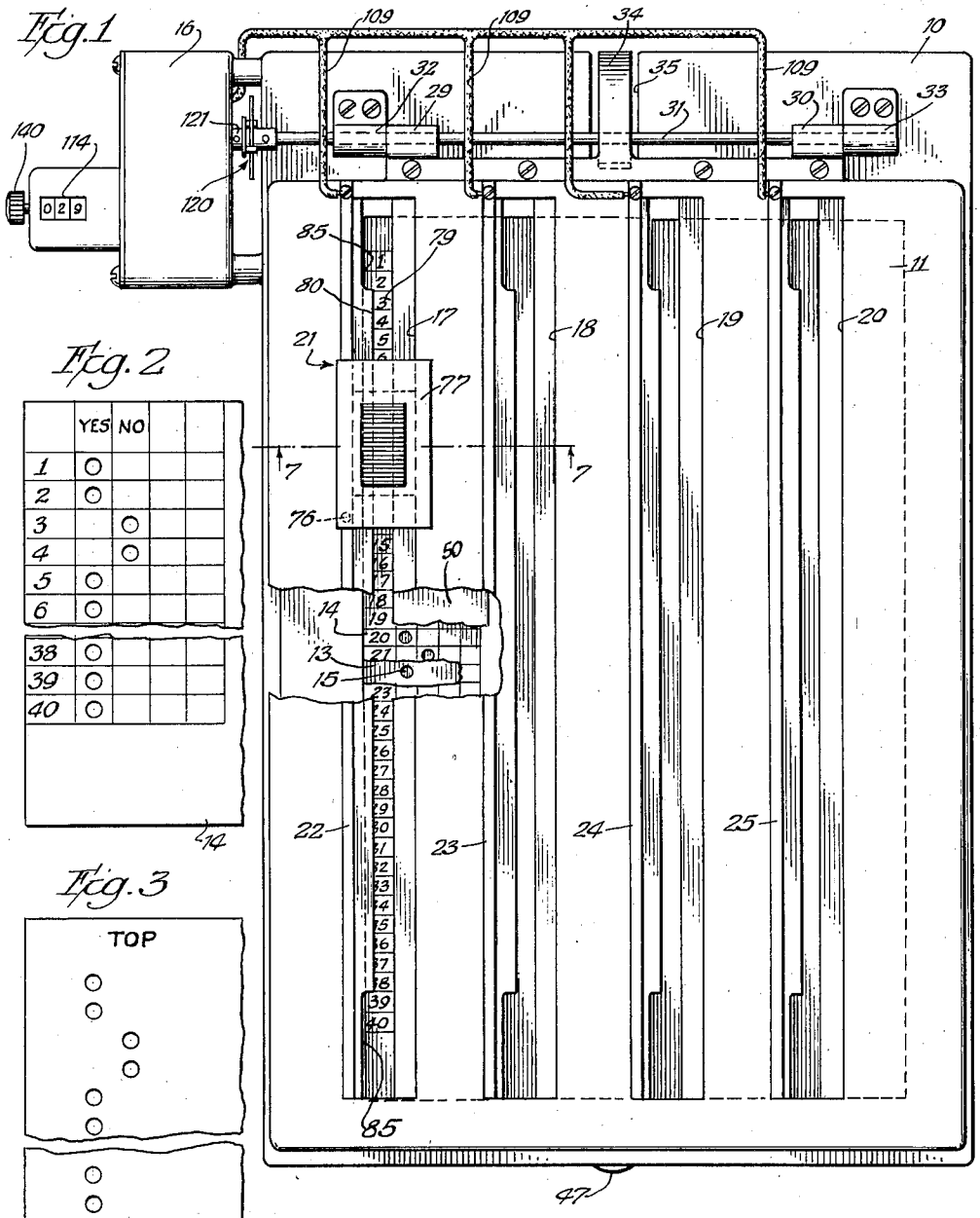


Fig. 2

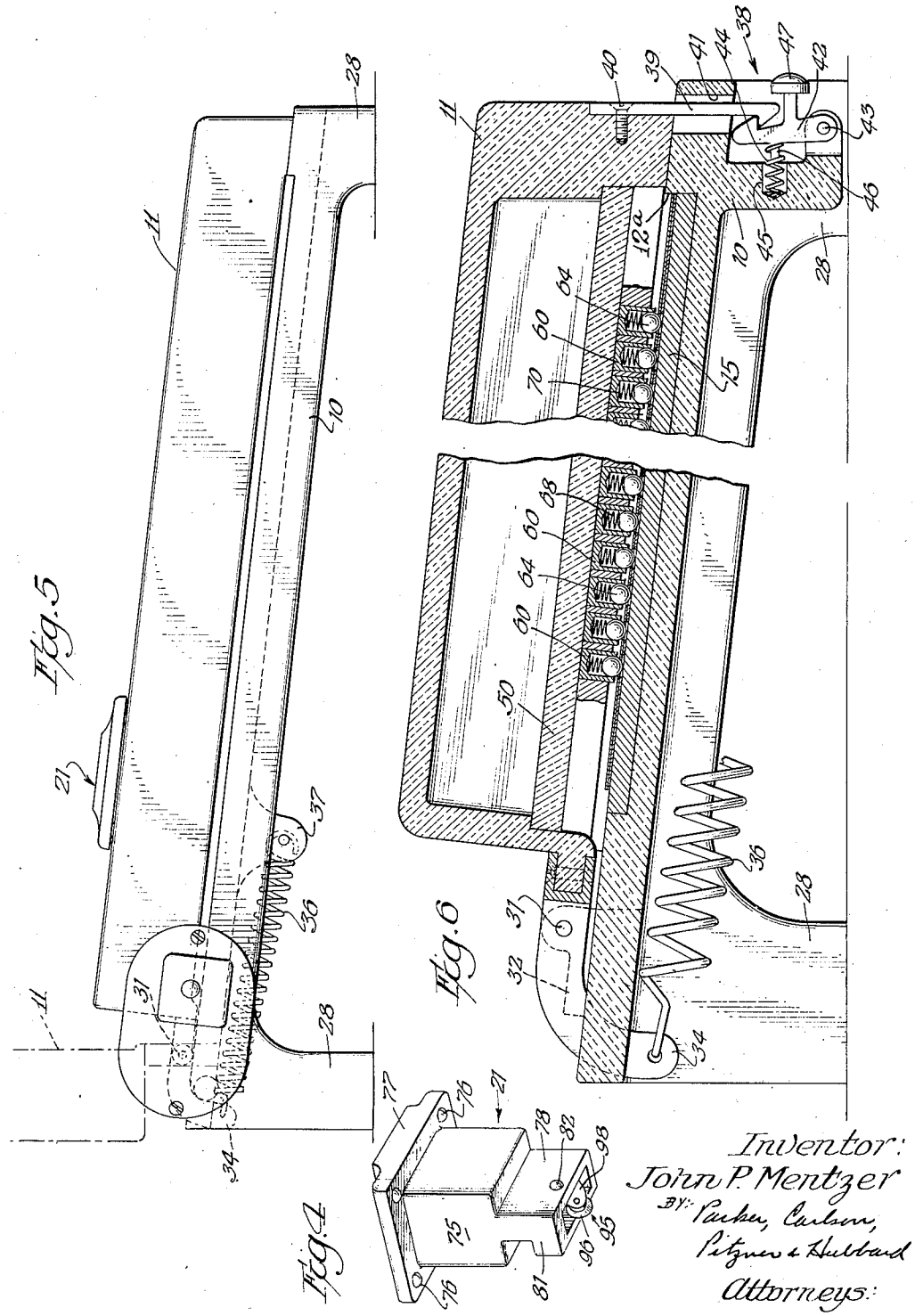
Fig. 3

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Sept. 1, 1942. J. P. MENTZER 2,294,416

EXAMINATION GRADER

Filed Nov. 18, 1940 3 Sheets-Sheet 2



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EXAMINATION GRADER

Filed Nov. 18, 1940 3 Sheets-Sheet 3

Fig. 7

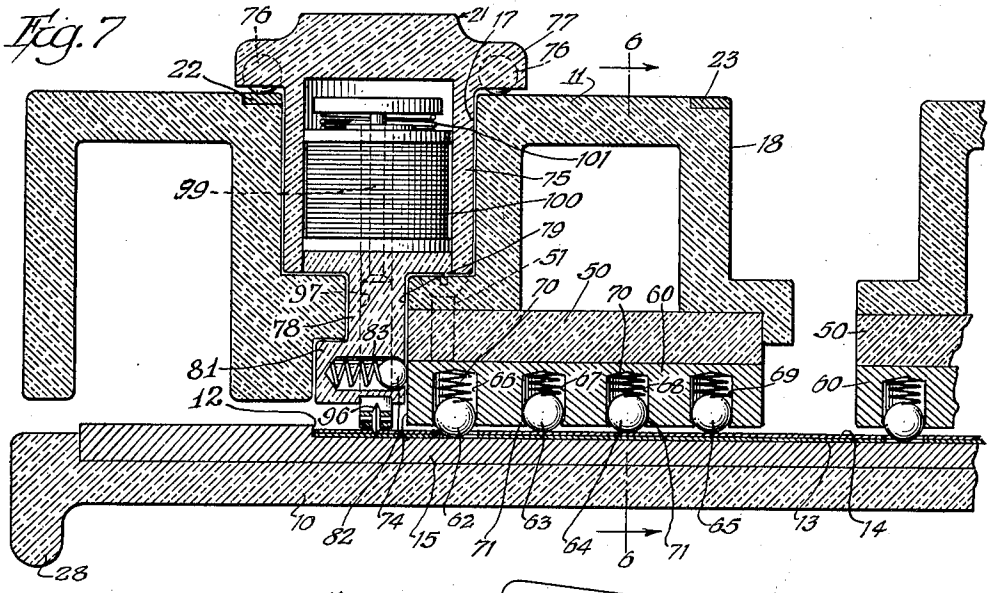


Fig. 8

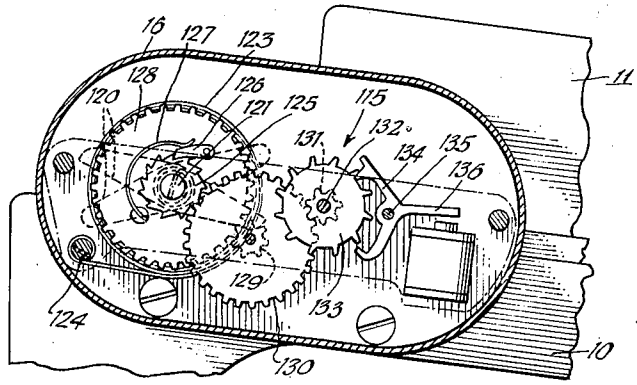
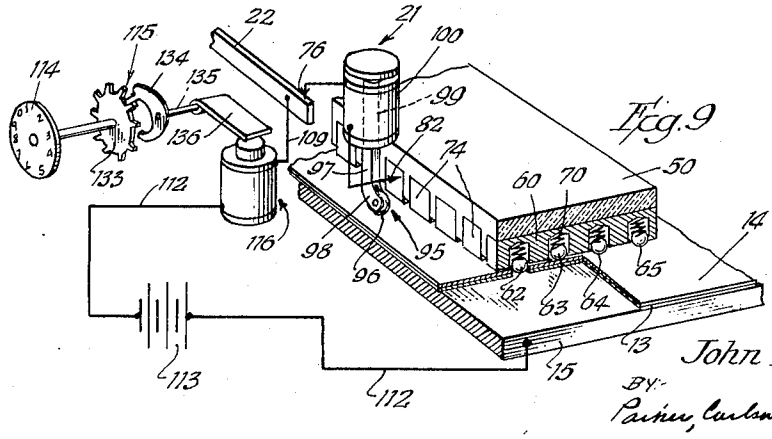


Fig. 9



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UNITED STATES PATENT OFFICE

2,294,416

EXAMINATION GRADER

John P. Mentzer, Chicago, Ill.

Application November 18, 1940, Serial No. 366,125

17 Claims. (Cl. 35—48)

The invention relates to improvements in so-called examination graders of the general type in which a sheet, punched by a student or other examinee, to indicates his selection of answers to a series of questions, is superimposed with a correctly perforated master sheet, and the grader operated to totalize the number of correct answers.

It is an object of the invention to provide an examination grader of the type set forth in which, though the operation of the apparatus entails the successive completion of a plurality of electric circuits, the structure is of such character as to permit a wide tolerance in dimensions of the parts as well as location and size of the holes in the answer sheet, without impairing the accuracy of operation.

Another object is to provide such an examination grader, embodying means for completing successive electric circuits to effect successive actuations of a totalizer, which effectually obviates corrosion of the circuit contacts due to sparking, throughout an extended period of use.

Another object is to provide a device of the type set forth embodying a totalizer which is notched around in response to successive electrical impulses but in which such impulses may be comparatively feeble since they are used merely to release a spring-actuated totalizer rather than to operate it directly, and in which provision is made for automatically retensioning the driving spring of the totalizer as an incident to inserting fresh sheets into the device.

Still another object is to provide an examination grader of the type indicated which is rugged in construction and low in cost though very precise in operation, all by virtue of the novel arrangement, construction and combination of its parts as hereinafter more particularly characterized.

Further objects and advantages of the present invention will become apparent as the following description proceeds taken in connection with the accompanying drawings in which:

Figure 1 is a plan view of an examination grader, embodying the features of the present invention, a portion of the cover structure being broken away to reveal the underlying construction.

Figs. 2 and 3 are fragmentary views, on an enlarged scale, of an answer sheet and a master sheet, respectively, of the character intended to be used in the grader of Fig. 1.

Fig. 4 is a perspective view of a manually operated slider included in the grader of Fig. 1.

Fig. 5 is a side elevation of the grader showing the cover plate closed, its open position being indicated in dotted lines.

Fig. 6 is a fragmentary longitudinal sectional view, on an enlarged scale, taken on line 6—6 of Fig. 7.

Fig. 7 is a fragmentary transverse sectional view, on an enlarged scale, taken on line 7—7 of Fig. 1.

Fig. 8 is a detail sectional view of the counter mechanism.

Fig. 9 is a generally schematic wiring diagram of the electrical circuit employed.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail, the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Although the invention has been illustrated and will hereinafter be described in connection with an examination grader merely for purposes of illustration, it is to be understood that the features of the present invention might well be applied in numerous devices wherein the main or ancillary purpose is to grade or totalize a series of perforate indicia in accordance with perforate indicia on a master sheet. Thus, for example, the present invention might well be employed in connection with the totalizing and recording of a wide variety of business data assembled and embodied in the form of perforate indicia on file cards.

Briefly, the apparatus of the present invention is employed for totalizing the correct answers on examination sheets in the following manner: Each examinee is provided with one of a series of question sheets and a hand punch. The questions are customarily of the "yes" or "no" type, or so-called multiple choice type, and at indicated points after each question the examinee punches a hole under either the word "yes" or "no" in the case of a sheet like that shown (Fig. 2). The examiner has a master sheet which is punched correctly and in grading the papers with the apparatus of the present invention the master sheet and the answer sheet are laid on the device in superimposed relation. The holes which have been punched to indicate correct answers will therefore register with the holes in the master sheet, but in the event that there

are any punches indicating incorrect answers there will be no such registry of these punches. In general, advantage is taken of this registry relation to complete electric circuits successively through the registering holes. As the circuit is completed for each such point of registry, a counter mechanism is actuated one step. In this way the number of correct answers is totalized. Desirably a marking device is suitably connected for energization upon the completion of each successive circuit and is arranged for indicating on the question sheet itself the correct answers which have been totalized. In this way the person examined is protected in that the answer sheet itself bears a positive record of the precision of operation of the grader.

The procedure outlined generally above has heretofore been used. The present invention has primarily to do with improvements in the apparatus by means of which various advantages herein indicated are achieved.

Referring more particularly to Fig. 1 of the drawings, the illustrative apparatus comprises generally a baseboard or frame **10** on which a a cover **11** is hinged. A master sheet **13** and an answer sheet **14** are arranged in superimposed relation on an electrically conductive plate **15** on the base and clamped in position by the cover. It will be noted that in the present illustrative embodiment, provision is made for simultaneously clamping a pair of superimposed master and answer sheets having four separate columns of perforate answer indicia, though obviously any suitable or desired number of columns may be provided for. A housing **16** on the base **10** is arranged to contain a counter mechanism, and if desired batteries for actuating the system may be conveniently located beneath the base **10**, or if the device is to be used when an alternating current supply is available, such as an ordinary lighting system, a step-down transformer may be mounted on the device and plugged into the supply circuit to step its voltage down to a suitably low value for the device. Formed in the cover are four deep slots **17**, **18**, **19** and **20** designed to receive a slider **21** adapted for longitudinal sliding movement therein. A series of metal rails **22**, **23**, **24** and **25** extend longitudinally of the slots and are adapted to complete a sliding contact connection with the slider in all of its longitudinal positions. As will become apparent hereinafter, during movement of the slider from one extreme end of each slot to the other, it completes successive circuits through only the registered perforations in the master and answer sheets, which circuits actuate the counter mechanism.

The base frame **10** itself is made of a suitable insulating material such as Bakelite or the like and is formed with four short supporting legs **28** at its four corners, which dispose the upper face of the baseboard on an inclined plane. The upper surface of the conductive plate **15** is recessed, as at **12** (Fig. 7), to receive the superimposed sheets **13**, **14** in correctly alined perforation-registering position and the plate itself is recessed within the baseboard, so that the bottom edges of the superimposed sheets may be alined against the baseboard recess **12a** (Fig. 6). The cover **11** is similarly formed of a suitable insulating material and is provided with a pair of hinge members **29** and **30** in which a shaft **31** is fixed. The shaft is journaled in a second pair of cooperating hinge members **32** and **33** secured to the base frame so that the cover may be raised from its closed position, as shown in full outlines in Fig. 5, to an upright open position, as shown in dotted outlines. To yieldably bias the cover to open position, it is provided with a depending arm **34** extending through a slot **35** in the base frame for attachment to one end of a tension spring **36**, the other end of which is anchored on a bracket **37** on the under side of the base frame.

Latch means, generally indicated at **38**, are provided for holding the cover in a clamped relationship with the base frame. In the present instance the latch comprises a strike **39** secured, as by a screw **40**, to the front face of the cover, and depending through a slot **41** in the base frame for cooperation with a spring pressed keeper **42**, pivoted as at **43** for engagement and disengagement with the strike. The spring **44** seats in a bore **45** and projects therefrom for cooperation with a boss **46** on the keeper **42**. A manual releasing knob **47** projects outwardly from the keeper and past the front face of the base.

One of the features of the present invention resides in the provision of means for preliminarily setting up a series of partially completed circuits through respective ones of the registering pair of perforations in the master and answer sheets, and thereafter completing these circuits sequentially at points remote from the registering perforations. The advantages of such an arrangement over the customary design wherein the circuit for actuating the counter mechanism is finally completed in the registering pair of holes are several. In the first place substantially greater tolerances are permitted in the locations of the parts, registry of the holes, size and position of holes, etc. In the second place, any danger of piercing the answer sheet, in the event that a question has been incorrectly answered, is obviated as contrasted with devices wherein the circuit is sought to be completed within the perforations by a stylus or other movable contact member. Furthermore, the instant construction overcomes the disadvantages of such a device arising from corrosion and wear of the contacting means after continued use for a period of time, eventually resulting in sparking at the point of contact.

Accordingly, I have provided a series of electrically separate contact units, one for each question, adapted for several registration with all perforations in the master sheet and movable as a unit to contact the conductor plate **15** wherever the perforations in the two sheets coincide. Since each of the four sets of contacting devices illustrated in Fig. 1 are substantially identical in construction, a description of one will suffice for all, like reference numerals being applied to each set. Thus, referring to the left hand column of Fig. 1, and in particular to Figs. 6 and 7, a longitudinally extending insulating plate **50** is secured as by screws **51** on the under side of the cover and carries a series of electrically separate transverse contact units **60**. In the present instance, this assembly comprises forty contact units, one for each question. These units are set in a suitable electrically non-conductive material, such as hard rubber or Bakelite, for permanent mounting on the plate **50** on the under side of the cover. Each of the contact units comprises a metal bar carrying a plurality of spring pressed contactors, the number corresponding with the number of possible answers to the questions. In other words, as-

suming that there are four possible answers to any given question, the contact unit is provided with four yieldable contacts adapted to coincide with four corresponding master sheet positions, only one of which is perforated. If the answer sheet has been correctly punched there will, obviously, be registration permitting one of the yieldable elements to contact the underlying conductor plate 15. Thus, in the present instance four contact balls 62, 63, 64 and 65, seated in bores 66, 67, 68 and 69 in each contact bar 60, are adapted for yieldable extension therefrom under the influence of coil springs 70. Each bore opening has an internal retaining lip 71 which limits the outward movement of the contactor balls 62—65.

Referring more particularly to Figs. 6 and 7, when the cover plate is swung to its closed position, one of the balls of each unit will contact the underlying plate 15 in the event that there are registering perforations in the master and answer sheets which permit such contact. Thus, as seen in Fig. 7, the question has been correctly answered and the ball 62 contacts the underlying plate. Had the question been incorrectly answered, the perforations in the master and answer sheets would not be registered as shown and accordingly no contact between the ball and the underlying plate 15 would be permitted. It will be understood, of course, that the sheets 13, 14 are made of heavy paper or other insulating material. Thus, it will be apparent that, as the cover plate is pressed down over the superimposed sheets, a series of preliminary circuits are set up through the registered perforations only.

Associated with the apparatus thus far described is the slider 21 adapted for successively closing these preliminary partially completed circuits by successive contact with the alined end portions 74 of the contact units 60. The slider is completely separable from the rest of the device and yet, when associated therewith, it is positively guided in its traversing movement along the contact units. It comprises a housing 75 formed of suitable molded insulating material and is supported for sliding movement on the cover by means of ball bearings 76 at the four corners of its top flanged portion 77. One side pair of ball bearings is adapted for rolling contact engagement with one of the rails 22—25 depending upon which column is being graded. Each slot 17—20 is formed generally in a U shape and the slider is provided with a lower depending portion 78 which extends through a counter slot 79 in the U-slots. The base of each slot is provided with a projecting flange portion 80 which cooperates with a ledge 81 on the slider for guiding the latter in its sliding movement and, in particular, for holding it against any tendency to rise out of the slot. The slider is provided with a contactor 82, in the present instance in the form of a spring pressed ball adapted for yielding projection from a bore 83 in the lower side face of its depending portion 78. In the aseembly, as shown in Fig. 7, the ball 82 rides in contact with the alined end portions 74 of the units 60 as the slider traverses the slots. Referring to Fig. 1, it will be apparent that the flange 80 has a longitudinal extent such that it is operative to maintain the spring pressed conductor ball 82 alined with the end portions 74 of the units 60 during the entire operative range of longitudinal slider movement. At each end of the flange, however, a recess 85 is formed for insertion and removal of the slider. Thus, answer and master sheets having a plurality of columns may be placed in the grader, the cover clamped in position and the slider traversed longitudinally of each slot quickly and easily to grade a plurality of columns or papers with only one setting of the cover.

A solenoid operated marking device 95 (Figs. 4 and 9) is mounted within the slider housing 75 and suitably connected in the circuit for actuation by separate electrical impulses whenever one of the series of preliminarily established circuits is closed. The marking mechanism includes a marking wheel 96 (see Figs. 4 and 7) journaled on a plunger 97 to extend from the bottom of the slider housing for contact with the answer sheet. In this connection, it will be noted that, where a marker is employed the answer sheet is superimposed on top of the master sheet. The plunger is formed with a gooseneck 98 to avoid the contactor 82 and is rigid with an armature 99. The armature is actuated by a solenoid coil 100 and is spring biased, as at 101, to an upward position in which the marker is out of contact with the answer sheet. As seen in Fig. 9, the solenoid coil is connected in series in the circuit between the contactor 82 and the ball contactor 76 so that the armature will be depressed to mark the answer sheet for each correctly answered question. Each conductor rail (22—25) is connected by a conductor 109 with one terminal of the counter mechanism, the other terminal being connected by a conductor 112 through a battery 113 to the plate 15.

The counter mechanism comprises generally a spring actuated registering dial 114, an escapement mechanism 115, permitting step movement of the dial by the spring, and a solenoid operated mechanism 116 responsive to the separate electrical impulses to release the escapement mechanism 115. One of the features of the invention is the provision of means for tensioning the spring as the cover 11 is swung from closed to open positions so that when the cover is released for upward swinging movement under the influence of the spring 36 to remove one set of sheets, the counter mechanism is conditioned for operation on the succeeding set.

Thus, in the instant embodiment (see Figs. 1 and 8) the shaft 31 carries at its extreme left end, as seen in Fig. 1, a crank mechanism 120 for rotating a coaxially alined shaft 121 journaled in the counter housing 16 upon each movement of the cover from closed to open positions. A coil spring 123 is wound on the shaft 121 and has its inner end fixed thereon. The remote end of the spring is anchored on a rigid portion 124 of the housing. Rigid on the shaft 121 is a ratchet wheel 125 engaged by a pawl 126 spring pressed, as at 127, for preventing reverse action under the influence of the spring 123. Freely rotatable on the shaft 121 is a gear 128 which carries the pawl 126 and which is meshed for actuation of a gear train comprising meshed gears 129, 130 and 131. Rigid with the gear 131 on a shaft 132 is an escapement wheel 133 controlled by an escapement pallet 134 which oscillates on its pivotal axis 135 on the counter frame. The pallet carries rigid therewith an armature 136 positioned for actuation by the solenoid 116 which is connected in the circuit, as illustrated diagrammatically in Fig. 9.

It will be seen that upon momentary completion of the circuit by the slider 21, the solenoid 116 actuates the escapement mechanism one step, permitting rotation of the dial 114 under the in-

fluence of the spring 123 to record one correct answer. A series of such actuations effected by a complete traverse of the slider over a series of questions, records the number of correct answers given to the questions. A means for zeroizing the dial 114, after each set of questions has been graded, includes a manually operable knob 140.

It will be apparent from a consideration of the foregoing that I have provided a novel apparatus for correcting, grading, and marking examination papers which is characterized by extreme simplicity of operation and at the same time is positively accurate in recording every correct answer given, a feature of essential importance to the use of such a device. Furthermore, the apparatus of the present invention is capable of wide ranges of tolerance in the location of parts, registry of holes, size of holes, etc., in that a series of partially completed circuits are initially established through the registering perforations of the master and answer sheets which circuits are thereafter sequentially completed at a point remote from the registered perforations. Such construction also lends greater durability and safety to the apparatus for the reason that the circuits are not finally completed within the registered holes. In addition I have provided a slider for successively completing the circuits which is completely separable from the rest of the device and yet at the same time is positively guided in its traversing movement thereon.

I claim as my invention:

1. An examination grader for totalizing the number of correctly located perforations in an answer sheet superimposed with a perforated master sheet so that such correctly located perforations register with corresponding ones in the master sheet comprising, in combination, a pair of plates adapted to receive the sheets therebetween, one of said plates being conductive and the other nonconductive, said nonconductive plate having a plurality of separate contactors thereon corresponding with all perforations in the master sheet and adapted to contact severally the conductive plate wherever the perforations in said sheets coincide, a slider adapted for movement along one of said plates and having means for successively contacting said contactors, a counter adapted to be actuated by separate electrical impulses, and an electrical circuit connecting said conductive plate, counter and slider in series with each other to a source of current.

2. An examination grader for totalizing the number of correctly located perforations in an answer sheet superimposed with a perforated master sheet so that such correctly located perforations register with corresponding ones in the master sheet comprising, in combination, a counter, actuating means operable in response to successive electrical impulses for correspondingly advancing said counter step-by-step, a pair of members adapted to clamp the sheets therebetween, means including a plurality of conductors mounted in insulated relation with respect to each other on said members for preliminarily establishing a plurality of partially completed individual energizing circuits for said actuating means, one for each registering pair of holes in the two sheets, and means movable in relation to said members for sequentially completing successive ones of said preliminarily established circuits in the course of its movement relative to said members.

3. In apparatus for totalizing the number of registered perforations in a pair of superimposed perforated sheets, the combination of a counter responsive to successive electrical impulses, a series of electrically separate conductors movable as a unit to set up a series of separate partially completed energizing circuits with said counter through only the registering holes in said pair of superimposed sheets, and electrically conductive means for successively contacting said separate conductors to complete said circuits sequentially.

4. An examination grader for totalizing the number of correctly located perforations in an examination sheet superimposed with a perforated master sheet so that such correctly located perforations register with corresponding ones in the master sheet comprising, in combination, a counter, actuating means operable in response to successive electrical impulses for correspondingly advancing said counter step-by-step, a metal plate connected with said actuating means and adapted for supporting said sheets, a series of metal bars mounted transversely and in insulated relation with respect to each other and movable as a unit for severally contacting said plate whenever the perforations in the two sheets coincide, whereby a plurality of partially completed individual energizing circuits for said actuating means are initially established, and a slider connected with said actuating means and movable to engage said bars successively for sequentially completing successive ones of said preliminarily established circuits.

5. In apparatus for grading examination sheets wherein the answers to a series of questions are indicated by perforations, the combination of a master sheet having a correctly placed perforation for each answer; an answer sheet superimposed on said master sheet for registration of master-sheet and correct answer-sheet perforations; an electric circuit including a source of electric energy, a counter adapted to be actuated by separate electrical impulses, a conductor plate, and a conductor rail; and means for closing the circuit between said rail and said plate successively through the registered apertures only in said sheets, said means including a removable electrically conductive slider having a sliding contact connection with said rail.

6. An examination grader wherein a perforated answer sheet and a correctly perforated master sheet are superimposed to register correctly located answer sheet perforations with the perforations in the master sheet; the combination of a pair of members adapted to clamp the sheets therebetween, a partially completed electric circuit including a source of electric energy and a counter adapted to be actuated by separate electrical impulses supplied to said counter through said circuit; and means for completing the circuit successively through only the registered perforations in said sheets, said means including a removable bridge conductor having a sliding contact connection with one of said members and movable in relation to said sheets for making and breaking the circuit once for each pair of registered perforations to create separate electrical impulses for said counter.

7. An examination grader for totalizing the number of correctly located perforations in an answer sheet superimposed with a perforated master sheet so that such correctly located perforations register with corresponding ones in the master sheet comprising, in combination, a counter, a partially completed electrical circuit including actuating means operable in response to

successive electrical impulses for correspondingly advancing said counter step by step, members adapted to clamp therebetween superimposed sheets having several columns of perforations side by side, means for completing such circuit successively through the registered perforations in each column to create successive electrical impulses to actuate said counter, said last named means including a bridge having means for slidably contacting said members for traversing movement longitudinally of each column and being completely separable from said members for repositioning preparatory to traversing each column.

8. An examination grader for marking the correctly located perforations on an examination sheet superimposed with a perforated master sheet so that such correctly located perforations register with corresponding ones in the master sheet comprising, in combination, a marker, means operable in response to separate electrical impulses for actuating said marker, a pair of members for clamping said sheets therebetween, means on said members providing an energizing circuit for said actuating means, and means for closing said circuit successively through the registered perforations in said sheets, said last named means including a removable bridge having a sliding contact connection with said circuit on said members and supporting said marker in position for successively marking the correctly located perforations on said examination sheet in the course of its movement relative to said sheets.

9. In an apparatus for grading examination sheets wherein a perforated answer sheet and a correctly perforated master sheet are superimposed to register master-sheet and correct answer-sheet perforations, the combination of an electric circuit including a source of electric energy, a solenoid operated pencil marker operable in response to separate electric impulses, and a conductor rail; and means for closing the circuit successively through the registered perforations only in said sheets, said means including a separate movable conductor carrying said pencil marker and having a sliding contact connection with said rail for manipulation along said superimposed sheets to automatically mark correct answers on said answer sheet.

10. An apparatus for grading examination sheets wherein a perforated answer sheet and a correctly perforated master sheet are superimposed to register master-sheet and correct answer-sheet perforations comprising, in combination, an electric circuit including a source of electric energy and a conductor rail; means for closing the circuit successively through only the registered perforations in said sheets, said means including a separate electrically conductive bridge manually slidable along said rail; and an answer sheet marker carried by said bridge and connected in said circuit for actuation in response to separate successive electric impulses.

11. An examination grader for totalizing the number of correctly located perforations in an examination sheet superimposed with a perforated master sheet so that such correctly located perforations register with corresponding ones in the master sheet comprising, in combination, a base for supporting said sheets, a cover mounted on said base for swinging movement from a closed position overlying said sheets to an open position for inserting fresh sheets, spring means tensioned as an incident to movement of the cover to closed position and releasable to swing the cover to an open position, a counter, spring means for actuating said counter and tensioned as an incident to movement of the cover to open position, escapement means responsive to separate electrical impulses for correspondingly releasing the counter to the force of its spring means step by step, and means for completing energizing circuits for said escapement means sequentially through the registered perforations in said sheets.

12. An examination grader for totalizing the number of correctly located perforations in an examination sheet superimposed with a perforated master sheet so that such correctly located perforations register with corresponding ones in the master sheet comprising, in combination, a base for supporting said sheets, a cover mounted on said base for movement from a closed positon overlying said sheets to an open position for the insertion of fresh sheets, a counter, spring means tensioned as an incident to cover movement for actuating said counter, escapement means responsive to separate electrical impulses for correspondingly releasing said spring means to advance said counter step-by-step, and means for completing energizing circuits for said escapement means sequentially through the registered perforations in said sheets.

13. An examination grader wherein a perforated answer sheet and a correctly perforated master sheet are superimposed to register correctly located answer sheet perforations with perforations in the master sheet comprising, in combination, means for supporting said sheets in superimposed position; a partially completed electrical circuit including a source of electrical energy and a counter adapted to be actuated by separate electrical impulses supplied to said counter by said circuit; and means for completing the circuit successively through only the registered perforations in said sheet, said last-mentioned means including a separate removable electrically-conductive slider mounted for sliding contact with said circuit on the supporting means and movable in relation to said sheets for making and breaking the circuit once for each pair of registered perforations to create separate electrical impulses for said counter.

14. An examination grader for totalizing the number of correctly located perforations in an examination sheet superimposed with a perforated master sheet so that such correctly located perforations register with corresponding ones in the master sheet comprising, in combination, a pair of members adapted to clamp the sheets therebetween, a counter, spring means for actuating said counter, escapement means responsive to separate electrical impulses for correspondingly releasing said spring means to advance said counter step by step, and means for completing energizing circuits for said escapement means sequentially through the registered perforations in said sheets.

15. An examination grader for totalizing the number of correctly located perforations in an answer sheet superimposed with a perforated master sheet so that such correctly located perforations register with corresponding ones in the master sheet comprising, in combination, a counter responsive to successive electrical impulses, a plurality of electrically separate conductors movable as a unit to establish a series of preliminary partially completed energizing circuits with said counter through only the registering perfo-

rations in said master and answer sheets, and electrically conductive means movable to successively contact said separate conductors to complete said circuits sequentially.

16. In an apparatus for grading examination sheets wherein a perforated answer sheet and a correctly perforated master sheet are superimposed to register master sheet and correct answer sheet perforations, the combination of a pair of members for supporting said sheets therebetween, means on said members providing an energizing circuit, means for closing said circuit successively through the registered perforations in said sheets to create separate electrical impulses, said means including a removable bridge having a sliding contact connection with said circuit on said members for manipulation along said superimposed sheets, means actuatable to mark on the answer sheet the correctly located perforations, and means carried by said bridge and connected in said circuit for operation in response to said separate electrical impulses for actuating the marking means in the course of the manipulation of said bridge along said sheets.

17. An examination grader for totalizing the number of correctly located perforations in an examination sheet superimposed with a perforated master sheet so that such correctly located perforations register with corresponding ones in the master sheet comprising, in combination, a base for supporting the superimposed sheets, a counter, power actuating means for said counter, escapement means responsive to separate electrical impulses for correspondingly releasing said power octuating means to advance said counter step by step, and means for completing energizing circuits for said escapement means sequentially through only the registered perforations in said sheets.

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