

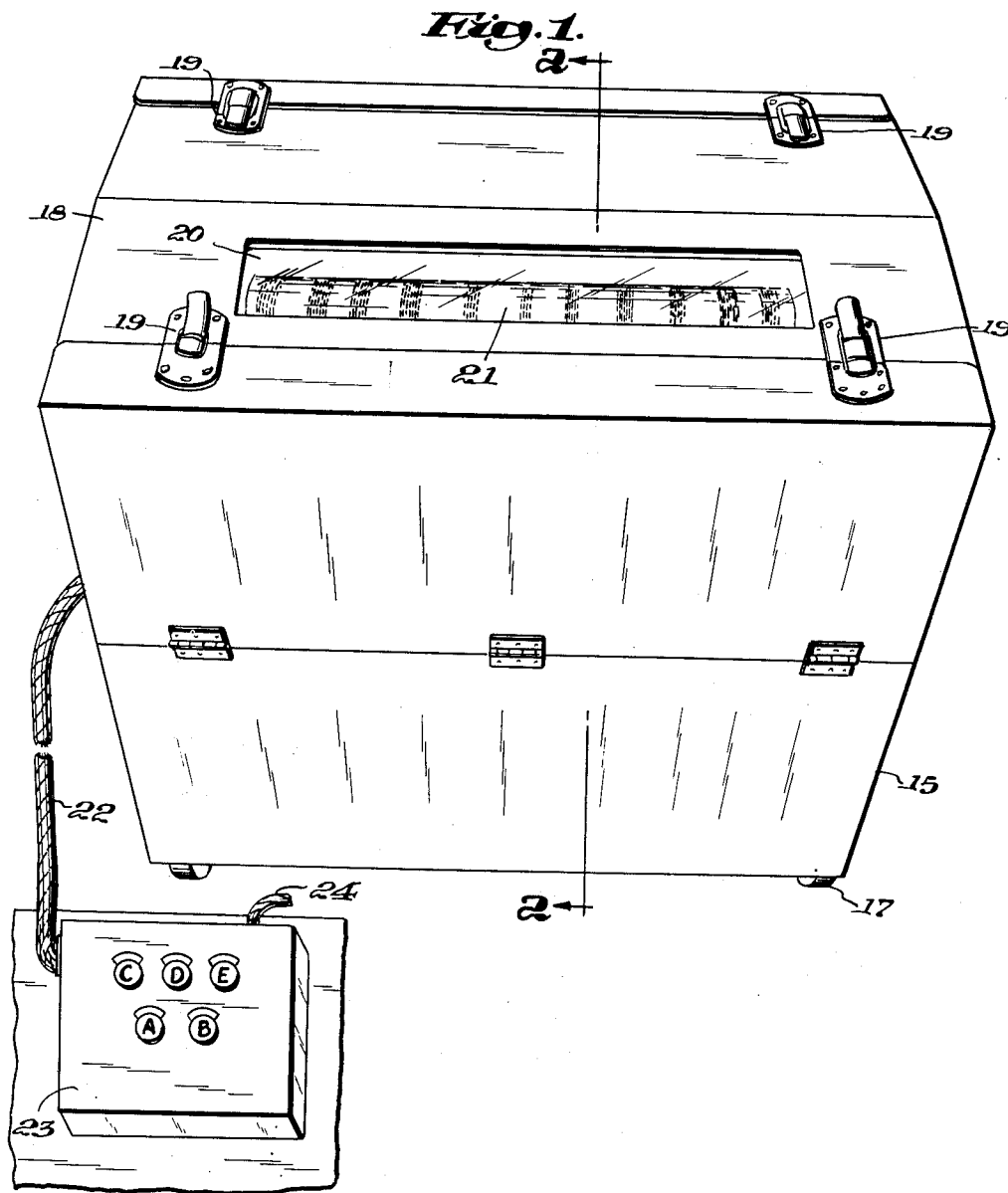
Sept. 9, 1952

E. D. CHAPPLE
INTERACTION RECORDER

2,609,618

Filed Nov. 27, 1948

16 Sheets-Sheet 1



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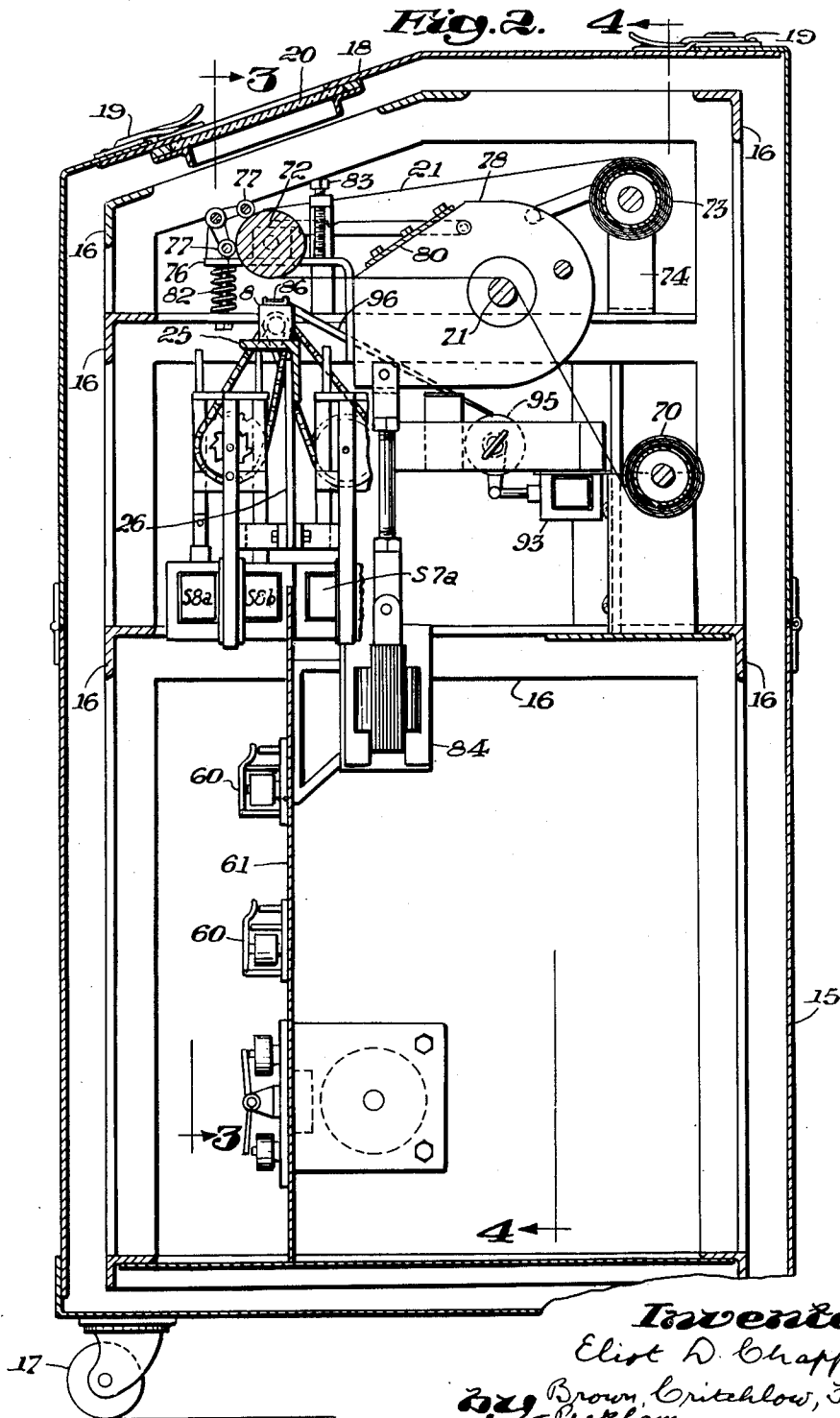
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16 Sheets-Sheet 2



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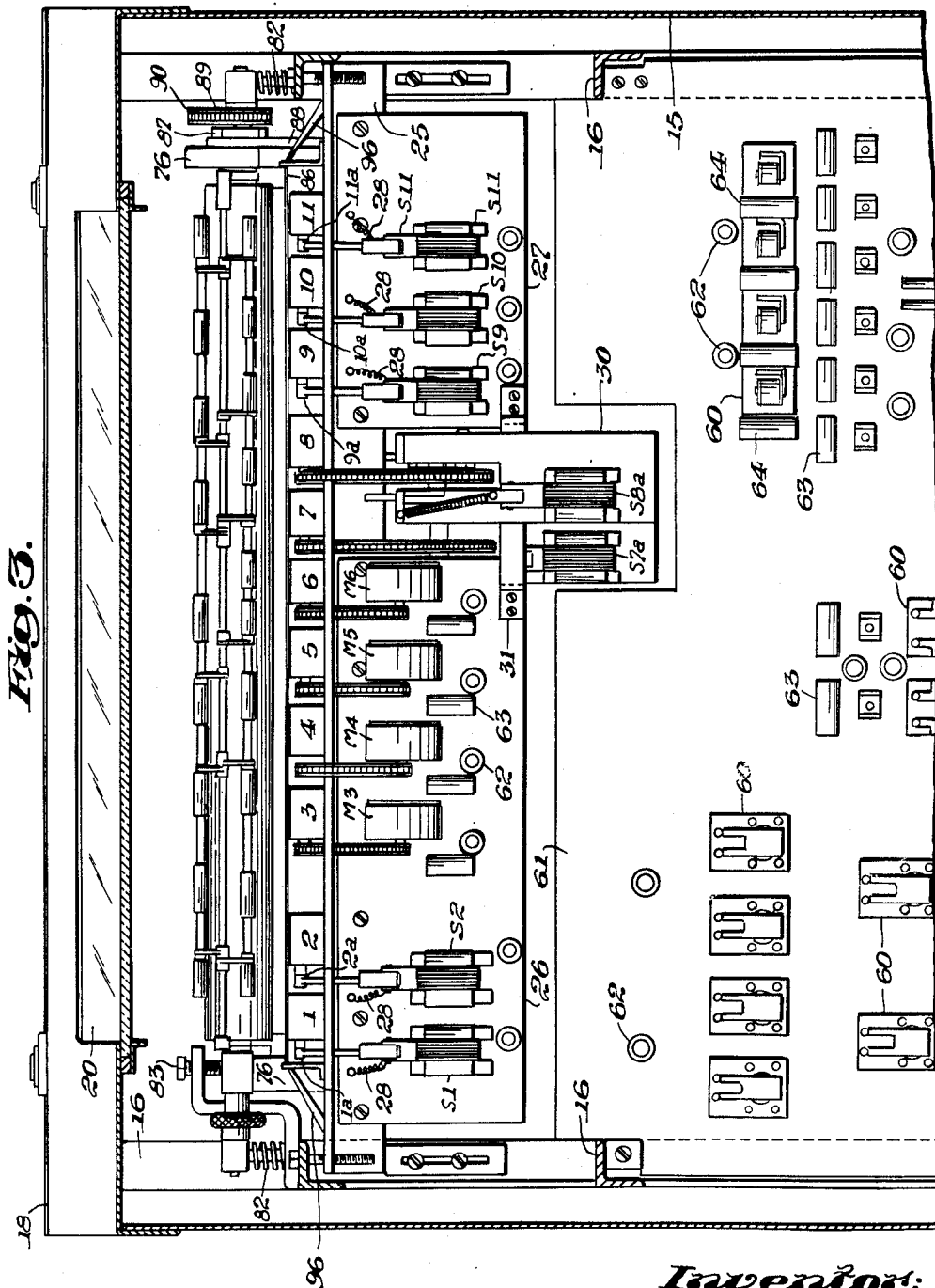
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16 Sheets-Sheet 3



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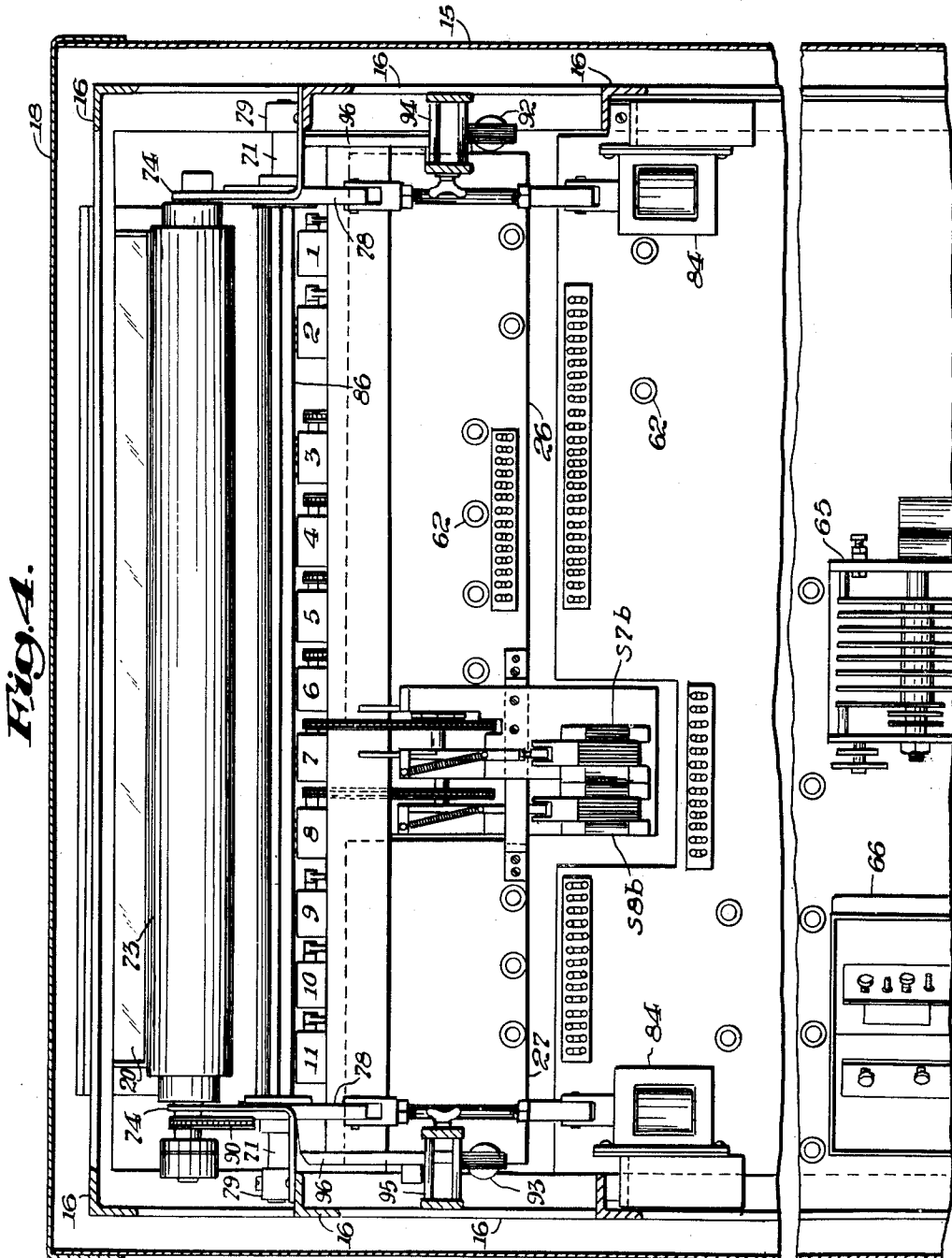
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16 Sheets-Sheet 4



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Sept. 9, 1952

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INTERACTION RECORDER

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16 Sheets-Sheet 5

Fig. 5.

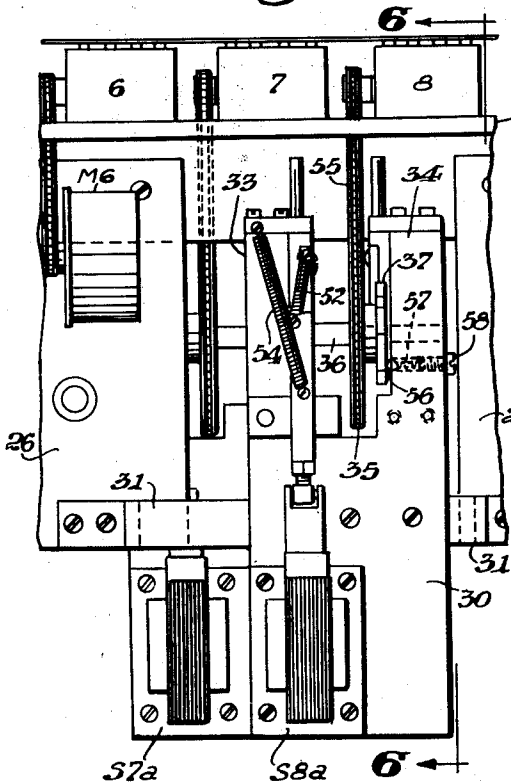
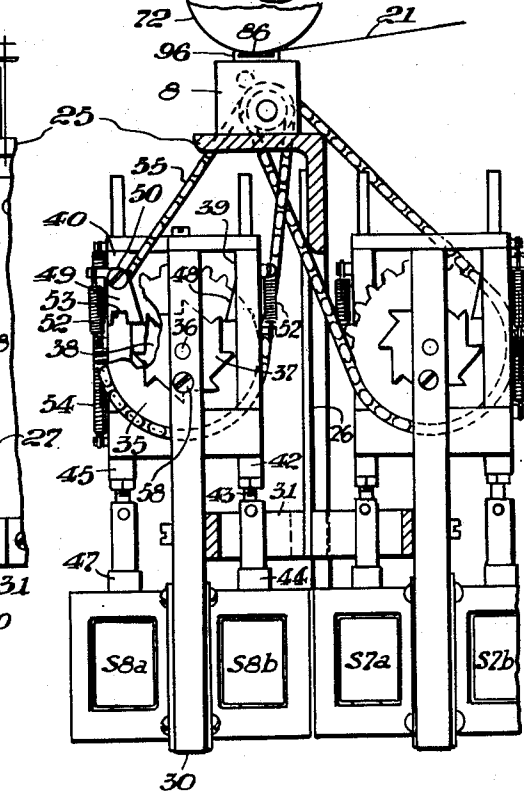


Fig. 6.



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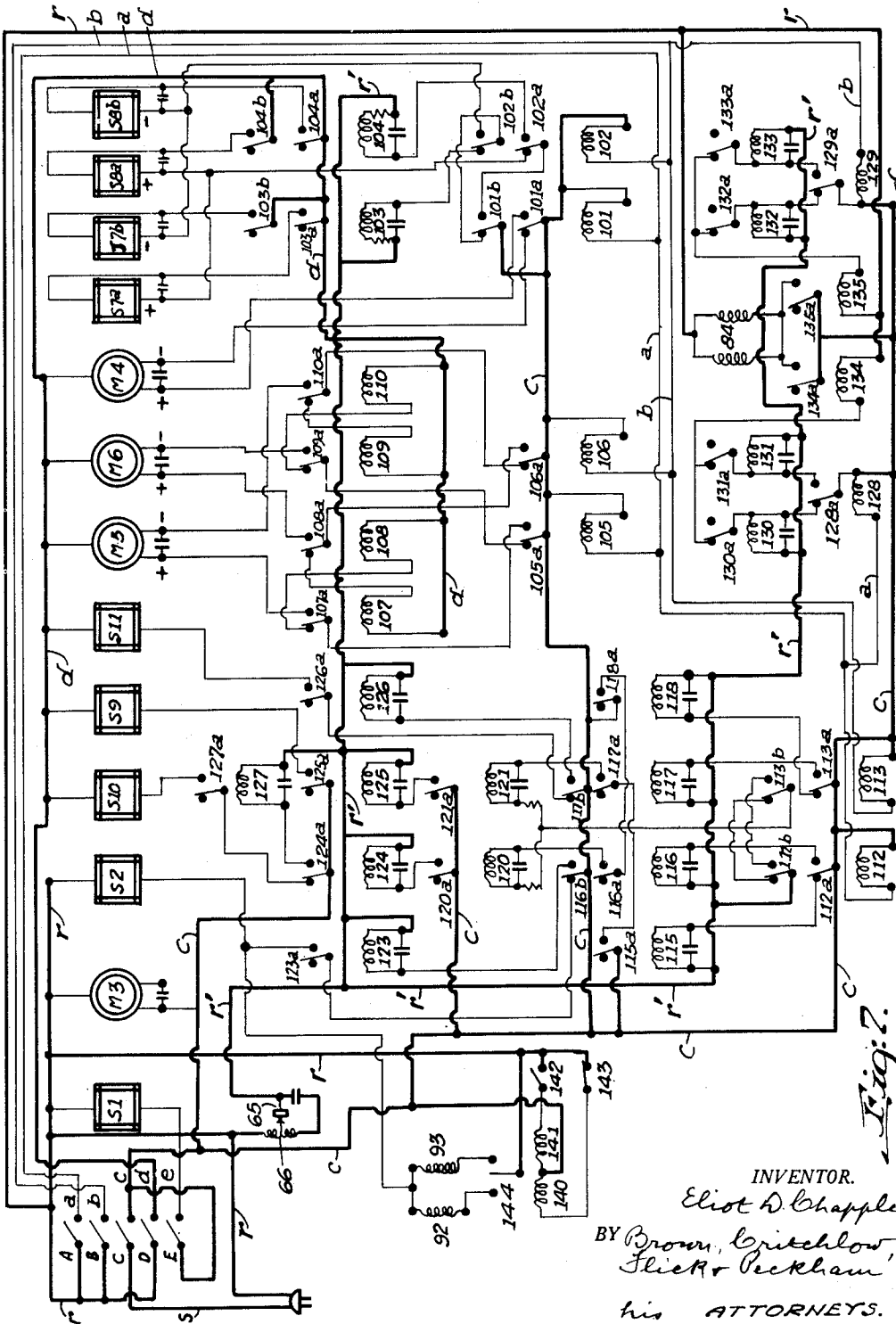
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E. D. CHAPPLE
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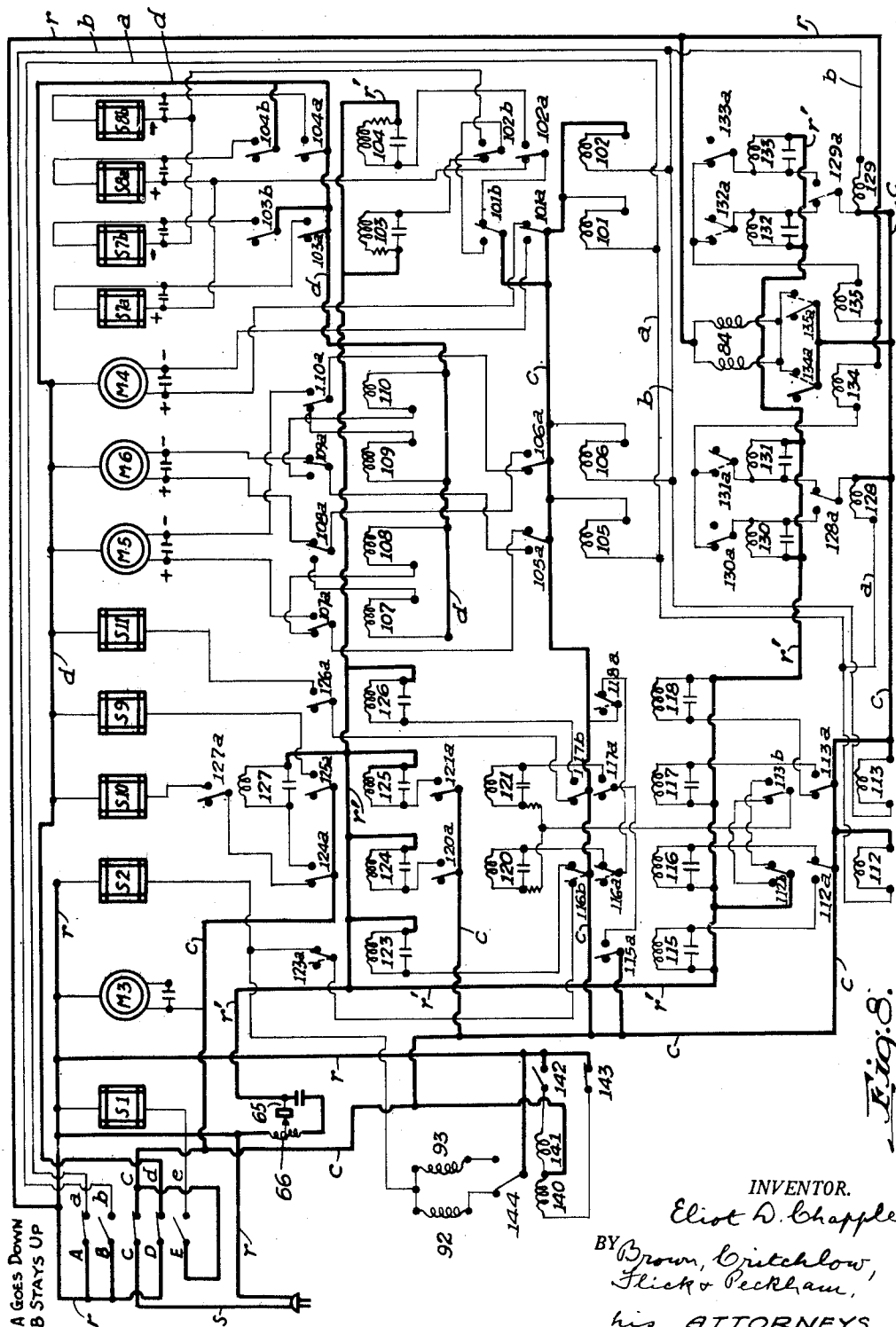
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16 Sheets-Sheet 7



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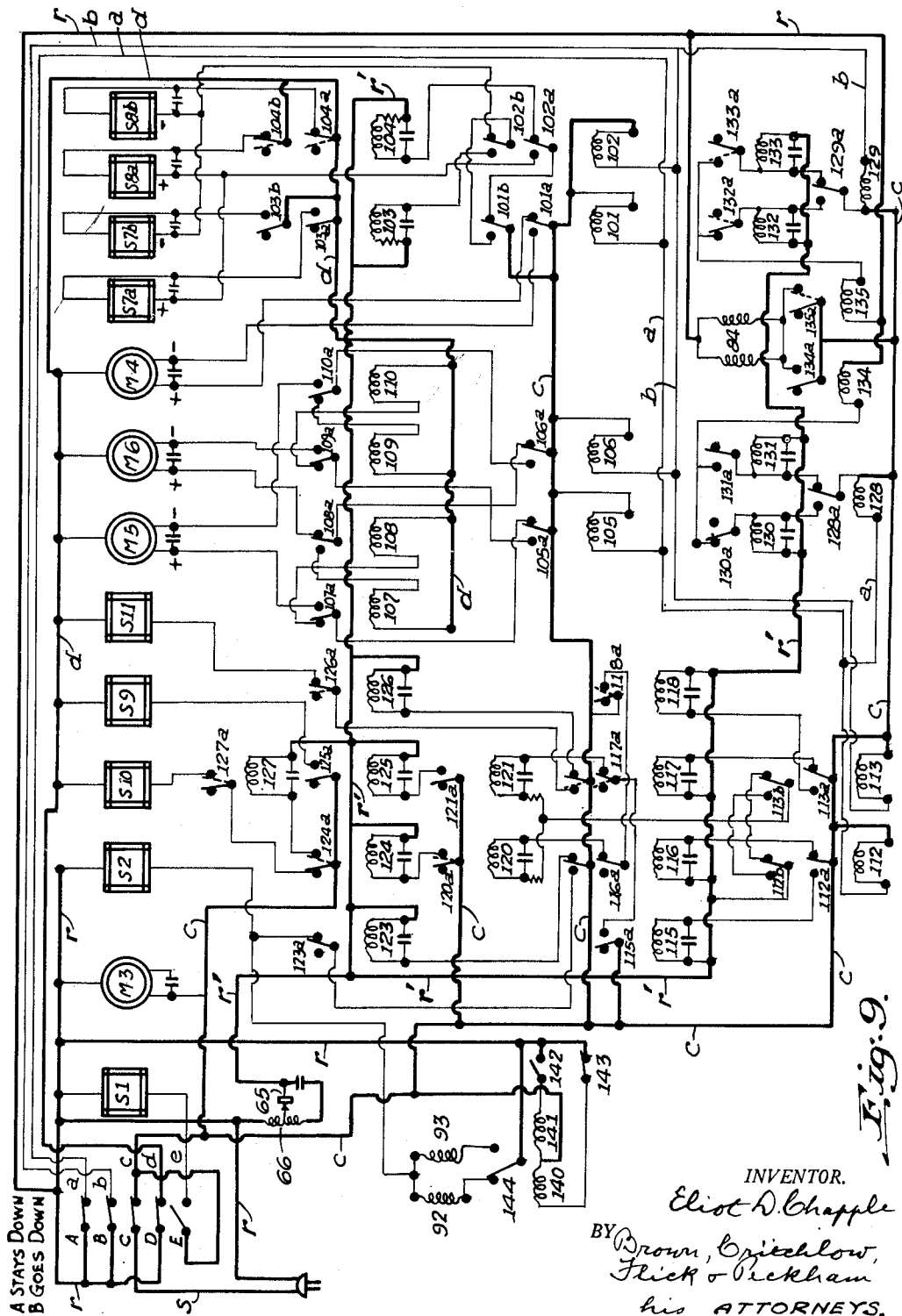
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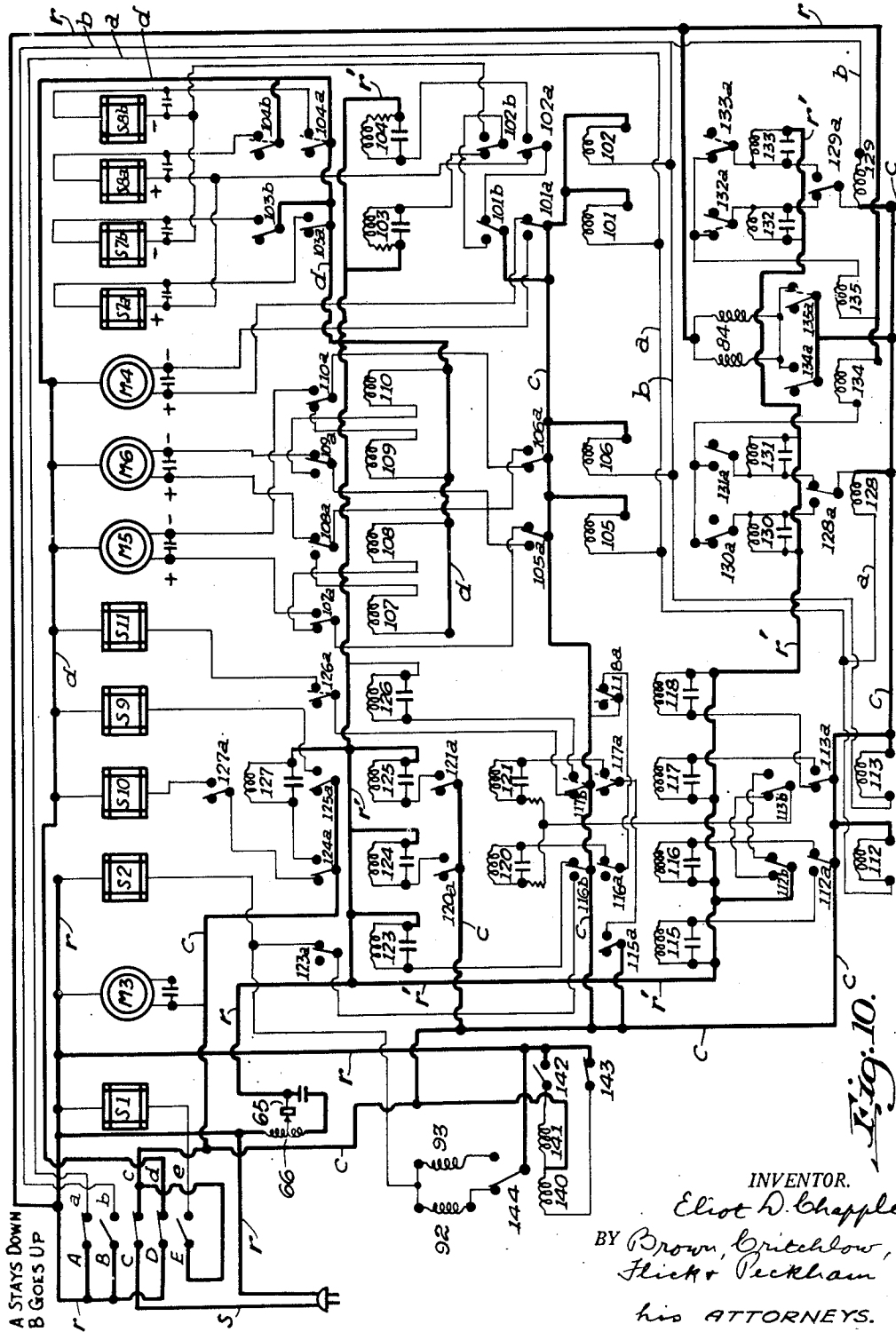
E. D. CHAPPLE

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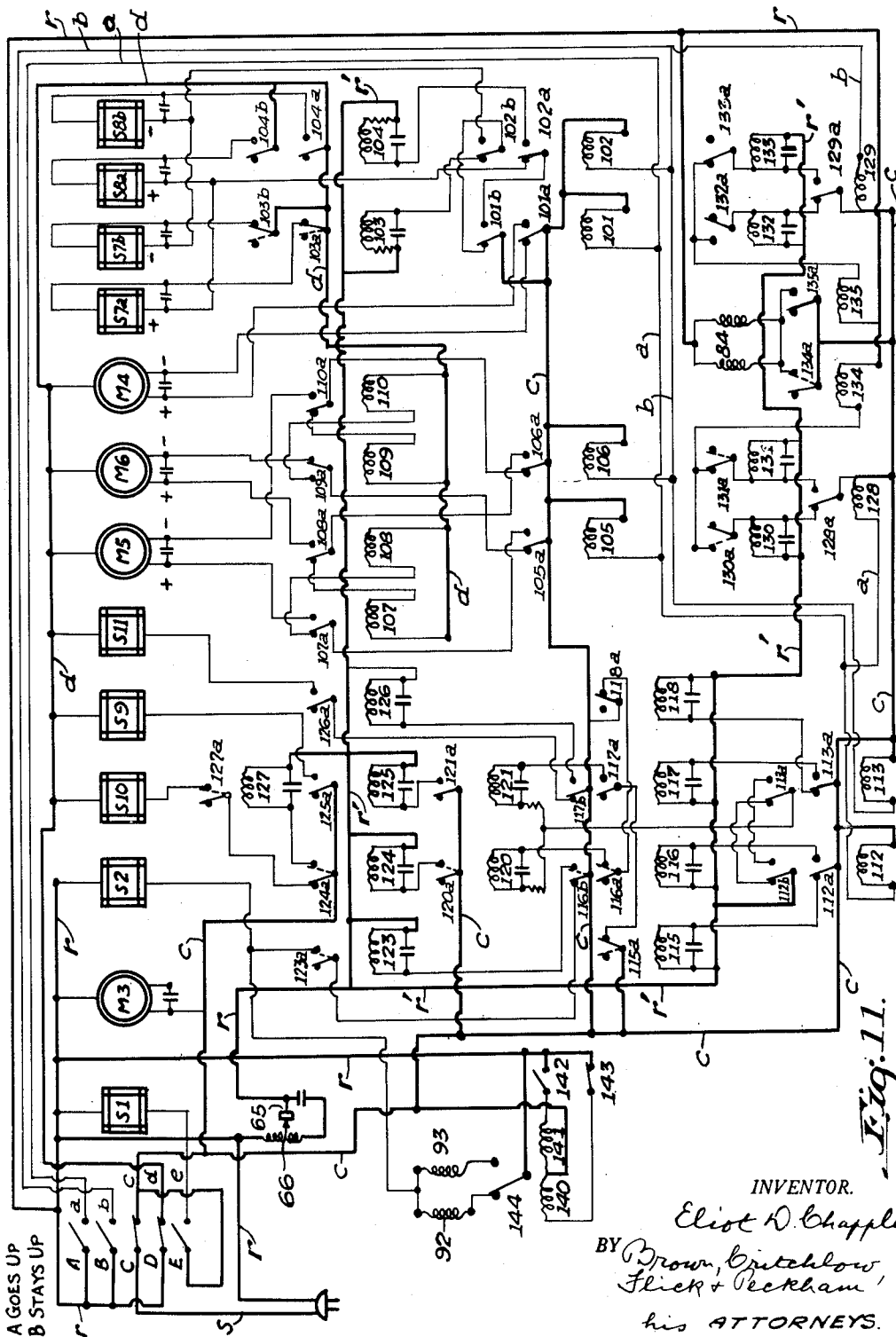
E. D. CHAPPLE

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INTERACTION RECORDER

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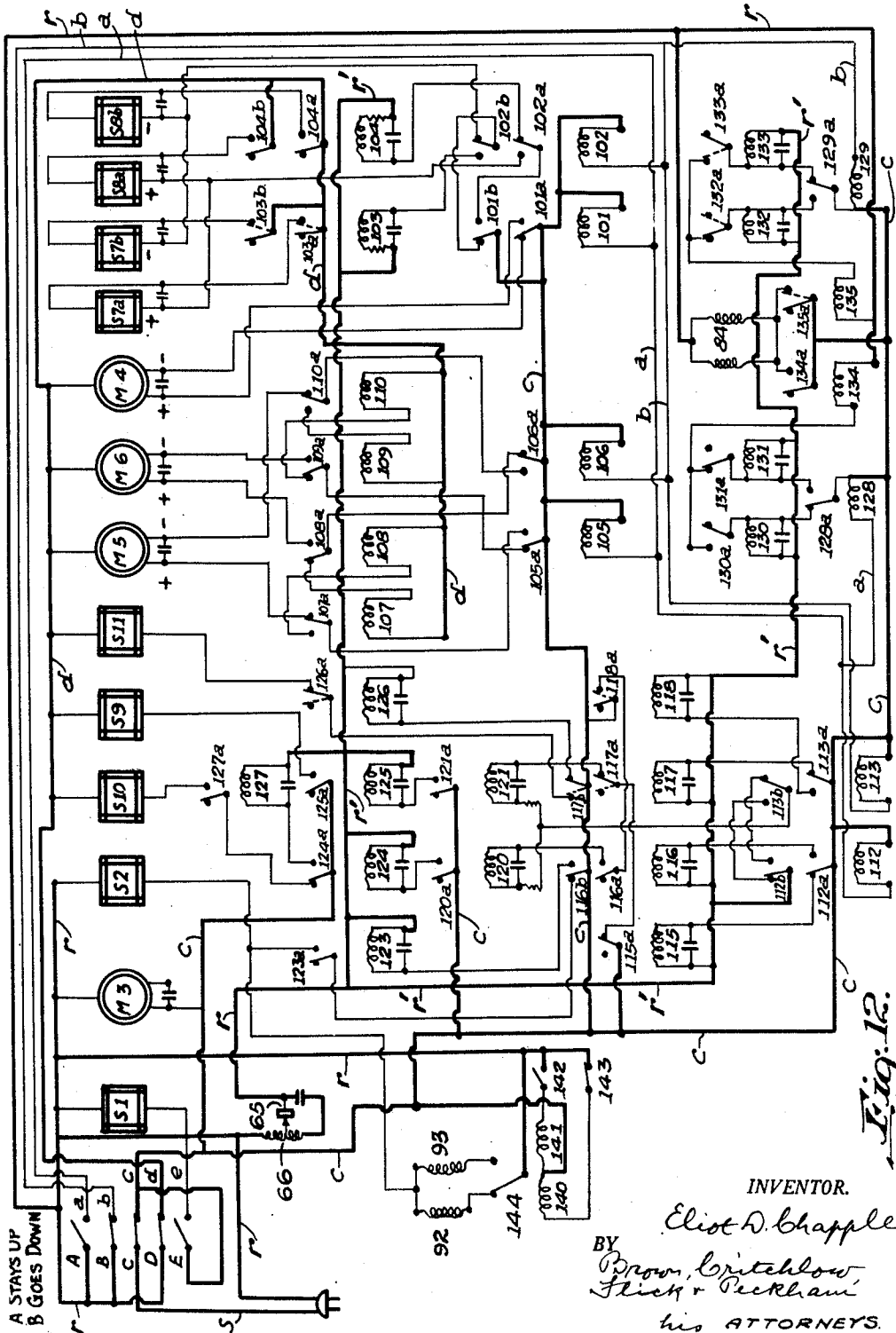
E. D. CHAPPLE

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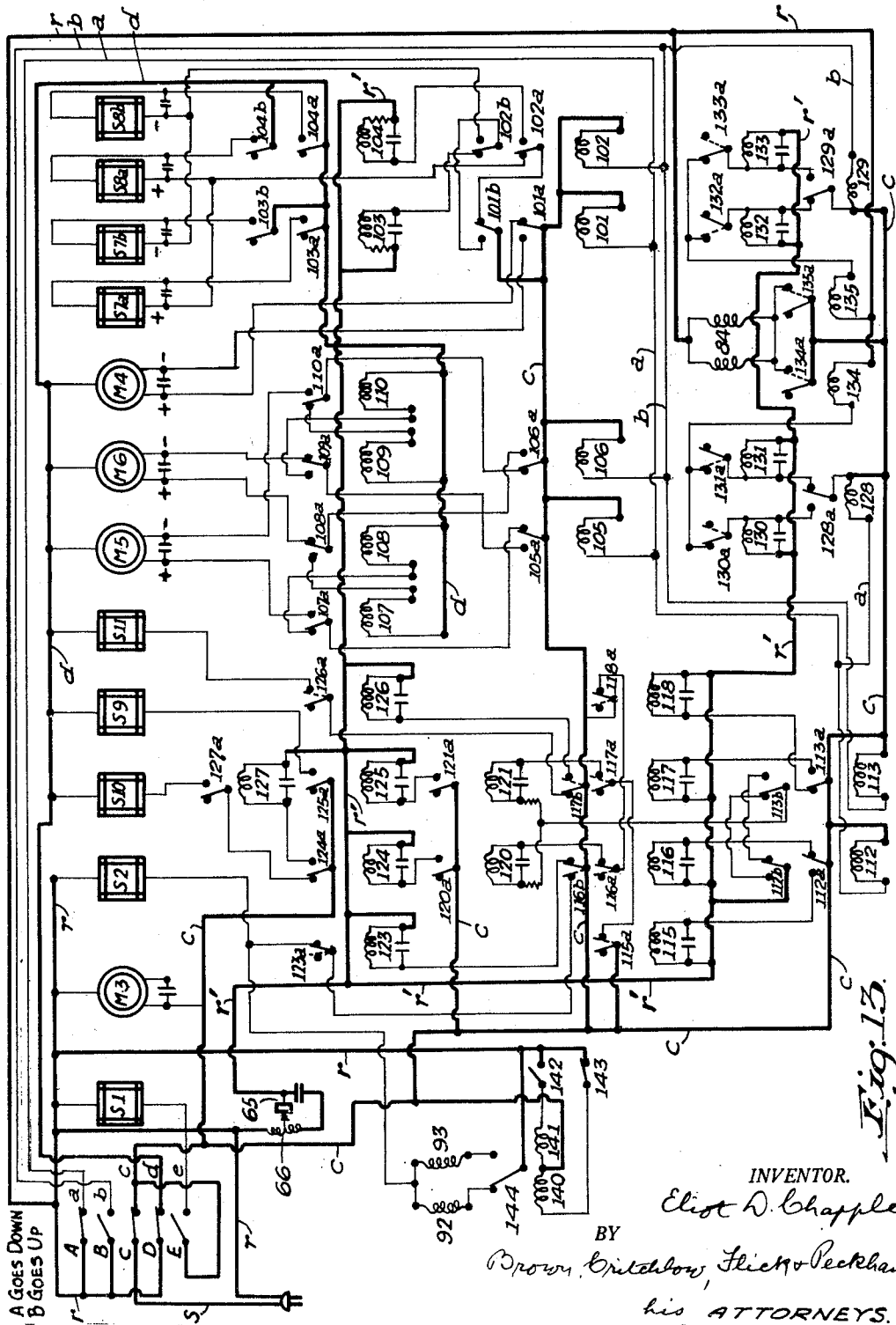
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16 Sheets-Sheet 12



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E. D. CHAPPLE
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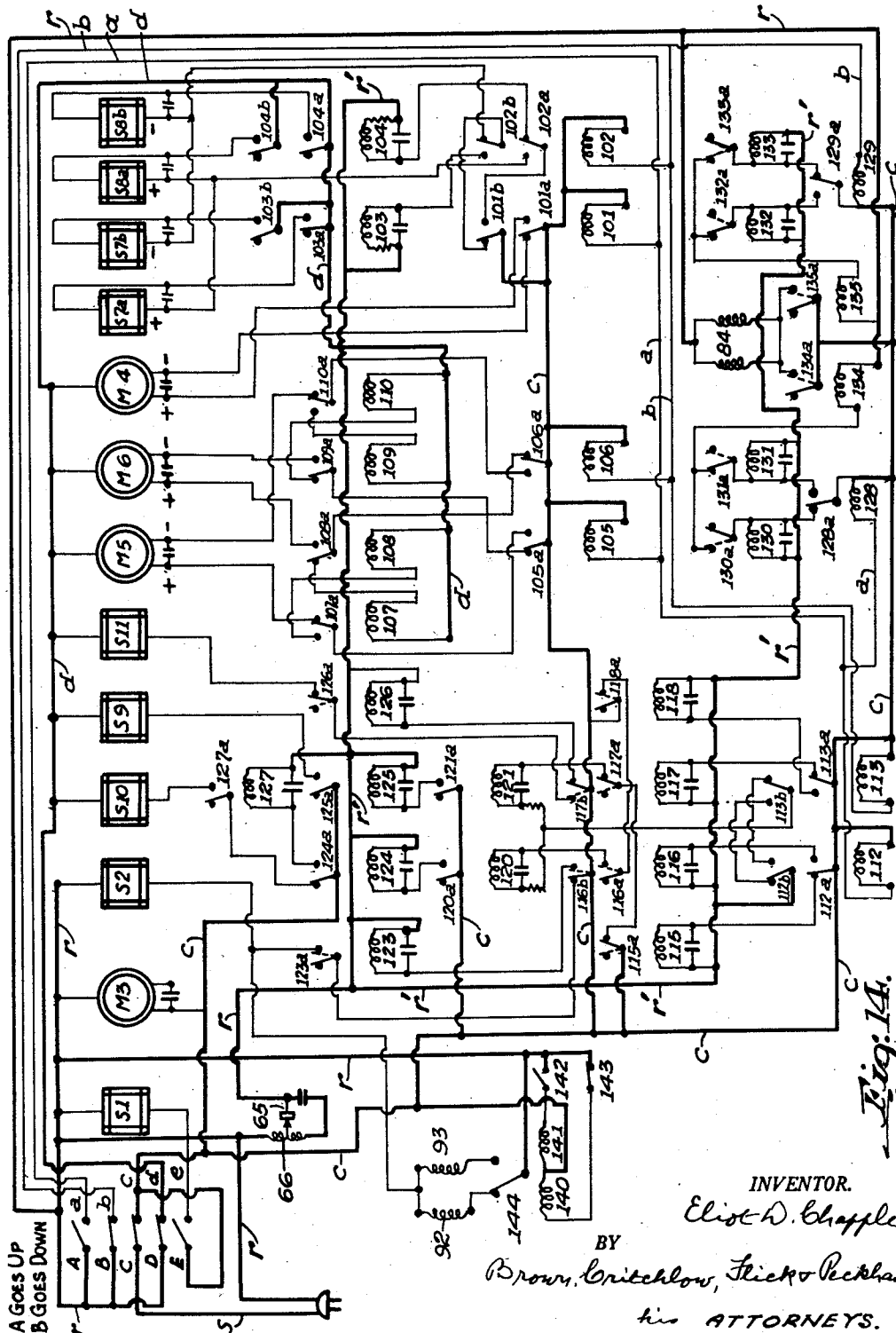


Fig. 14.

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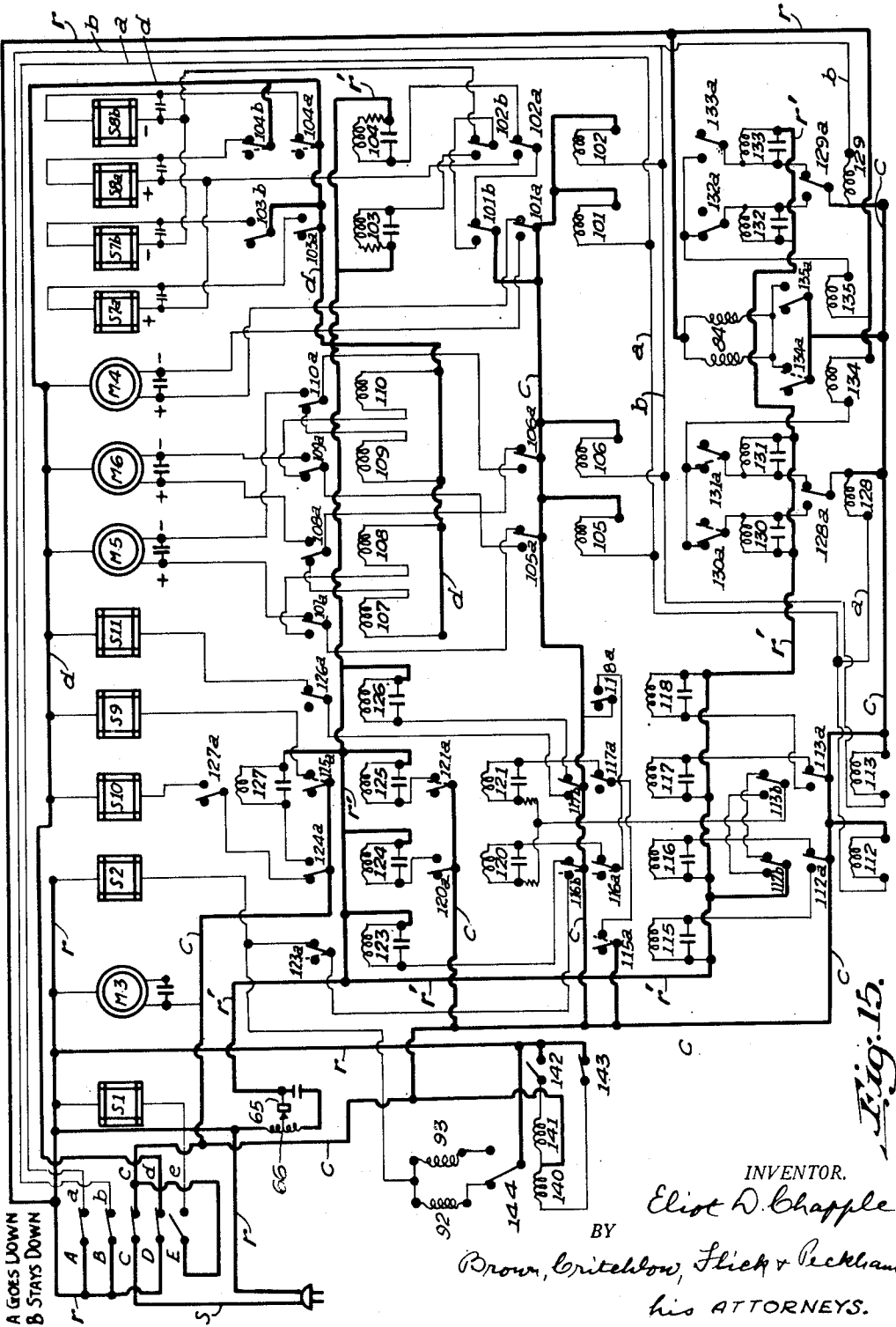
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16 Sheets-Sheet 14



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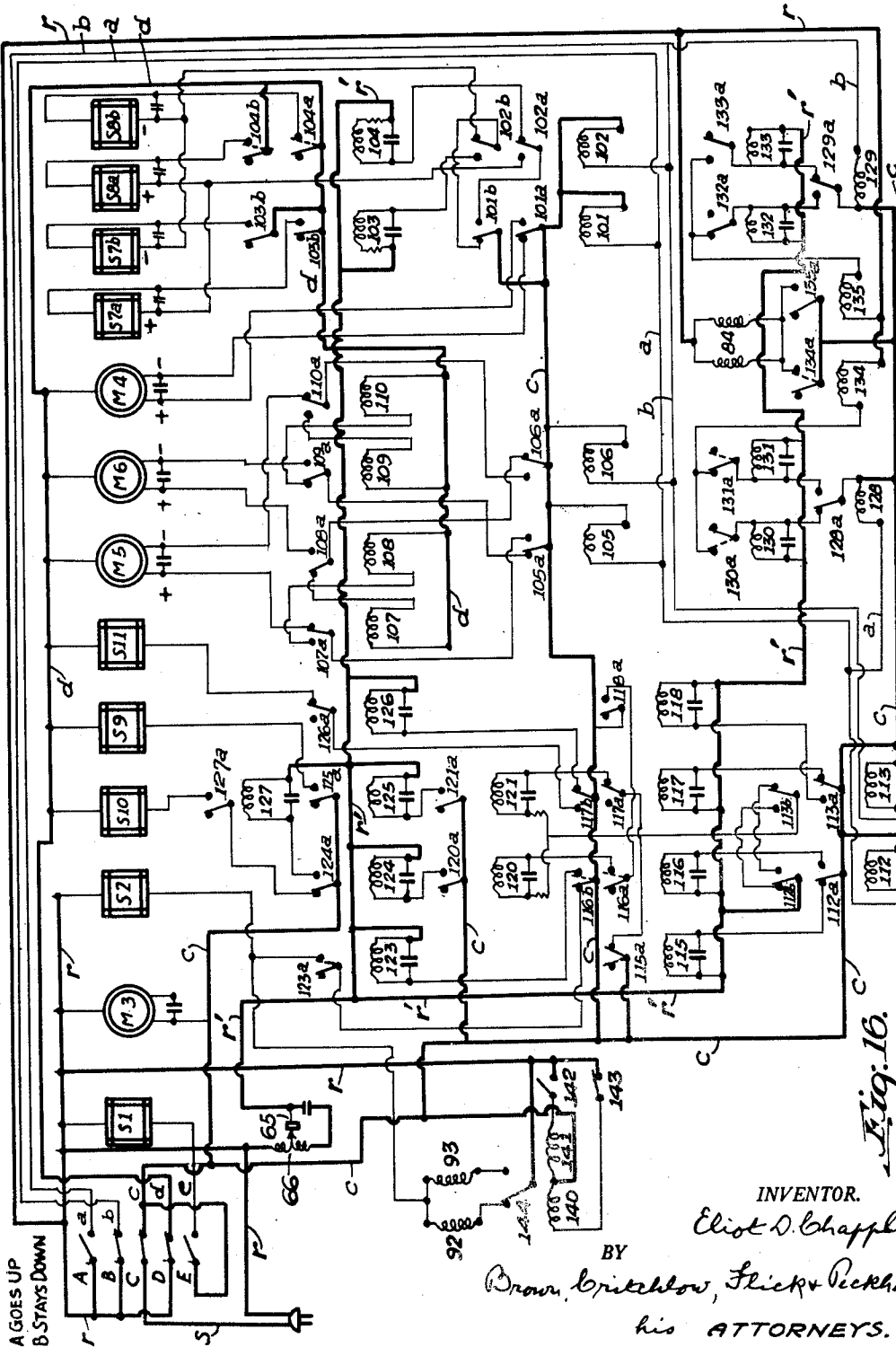
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16 Sheets-Sheet 15



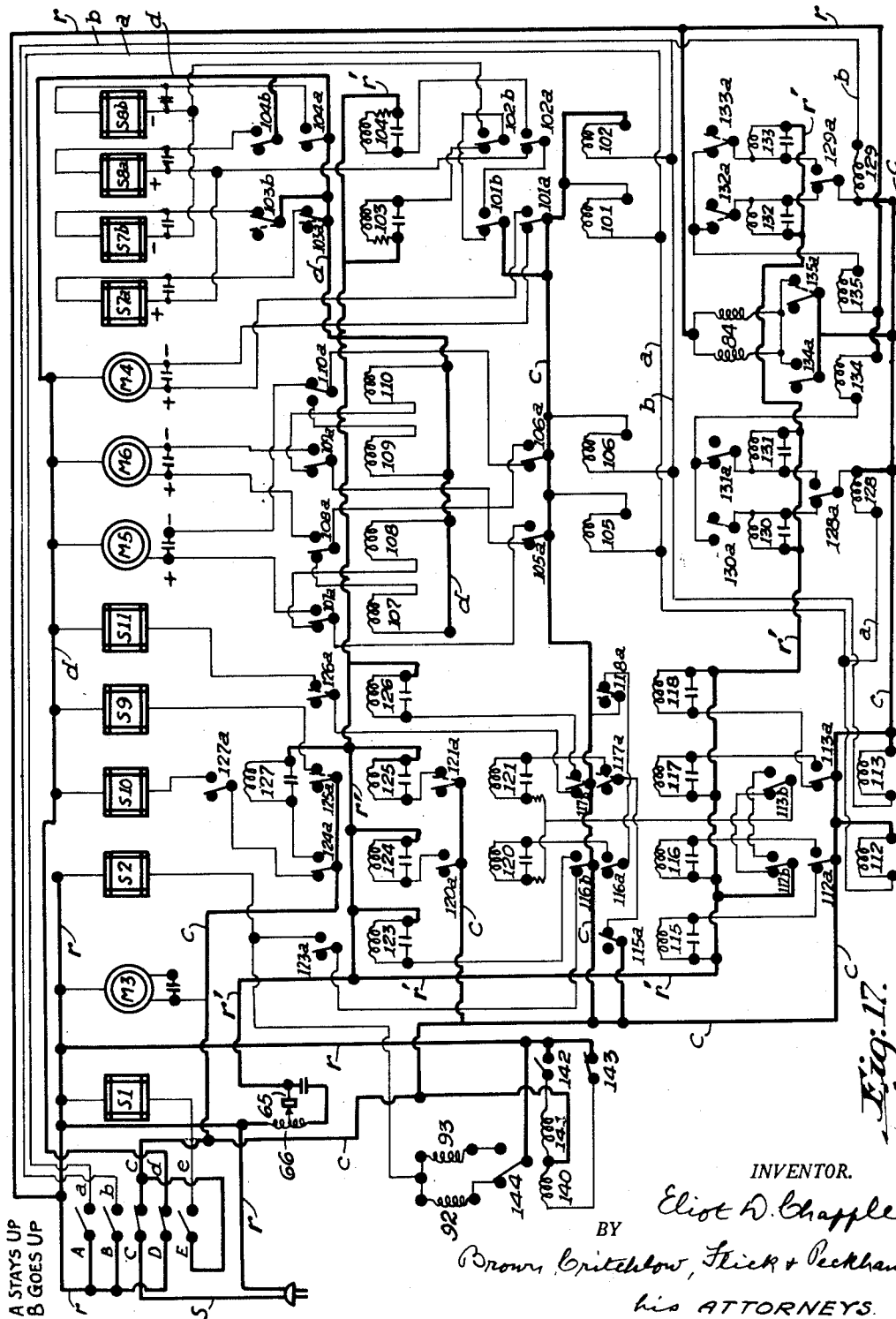
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E. D. CHAPPLE
INTERACTION RECORDER

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16 Sheets-Sheet 16



UNITED STATES PATENT OFFICE

2,609,618

INTERACTION RECORDER

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Application November 27, 1948, Serial No. 62,384

18 Claims. (Cl. 35—22)

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This invention relates to recording apparatus and, more particularly, to apparatus for recording the behavior of individuals in interaction. It is an improvement of the Interaction Recorder described in my U. S. Patent No. 2,387,563, issued October 23, 1945.

It is a matter of observation and induction from experience that, when two individuals come together, the actions of one individual are followed in some fashion by actions of the other. Interaction may be defined as sequences of such stimulus and response, in which the initial stimulus or action is manifested by one individual, and in which the response or action of the second individual may, and very frequently does, become a stimulus for the first. We can describe such interaction objectively by the duration of the successive actions and inactions of each individual and by the order in which they act; and it is evident that a description limited to those observable phenomena is susceptible of precise measurement and analysis. Data of this kind obtained from numerous observations of interaction has made it possible to develop reliable methods of measuring human behavior in interaction that are being successfully applied, for example, to certain aspects of personnel work and to the diagnosis of various mental disorders.

When we observe two individuals in interaction, the actions or inactions of one may or may not overlap those of the other at any given time; but there are only four possible static conditions (those having a measurable duration in time) that can occur. (a) Individual A talks or acts while individual B is silent. (b) Both talk or act at the same time (double action). (c) Individual B talks or acts while individual A is silent. (d) Both are silent or inactive (double silence).

All interaction necessarily involves a dynamic transition from one static condition to another, and each of the four static conditions above can be reached by a transition from any one of the three other static conditions. Each of those transitions is different, involving a different sequence or order of action between the two individuals. For example, the static condition of double action defined in (b) above, in which both A and B are talking at the same time, can result from any one of the following different transitional sequences: A interrupts B, a transition from static condition (c) above; B interrupts A, a transition from static condition (a) above; or A and B commence talking at the same time, a transition from static condition (d) above. Likewise, each of the other static con-

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ditions can result from any one of three other and different transitional sequences, so that it is possible to have a total of twelve different transitional sequences, or permutations of the order of action between A and B. Two of those permutations (where A and B start talking at exactly the same time, and where A and B become silent at exactly the same time) are so seldom encountered in interaction situations limited to two persons that they can be ignored. The remaining ten permutations or transitional sequences should, however, be differentiated and recorded in order to obtain reliable data on the behavior of two persons in interaction.

It is apparent from the foregoing analysis that apparatus for recording interaction between two persons should be able not only to differentiate between the ten transitional sequences that are normally encountered and to record the occurrence of each of those sequences, but also to record the duration of the interval between successive transitions (i. e. the duration of each static condition). To be of greatest use, the apparatus should record the foregoing data in a form that will make it possible to differentiate between occurrences of the same static condition resulting from two or more different transitional sequences. It should also combine the data in a form that will give a convenient summary of the more important sequences and durations for the entire period of interaction.

The Interaction Recorder described in my patent above referred to is capable of recording only six different combinations for all of the ten transitional sequences normally encountered in the interaction of A and B; and only four of those combinations precisely differentiate separate transitional sequences. Each of the other two combinations is responsive to any one of three different sequences, but can not differentiate between them. Those undifferentiated transitions include the ones that are particularly important in determining the relative qualities of initiative and dominance on the part of the two persons in interaction. For example, if A and B are both talking at the same time and B becomes silent while A continues to talk (i. e., A outtalks B), there has occurred a transition from static condition (b) to static condition (a). It has been found that frequent occurrences of this particular transition during a period of interaction between A and B may properly be interpreted as indicating that A has a more dominating personality than B. An accurate measurement of the relative dominance of the two persons is quite important in personnel placement work, as for example, in the selection

of foremen or of others who are to act in a supervisory capacity. However, in the apparatus described in the above patent, this particular transition is recorded in exactly the same way as (1) the transition from static condition (c) to static condition (a), in which A begins to talk as B becomes silent, indicating synchronization between the two persons; and (2) the transition from static condition (d) to static condition (a), in which A begins to talk after both have been silent, indicating initiative on the part of A.

It is among the objects of this invention to provide recording apparatus that will record in convenient and usable form each occurrence of the ten different transitional sequences from one static condition to another that normally occur in interaction situations limited to two individuals, and that will at the same time record in convenient and usable form the duration of the interval between each successive transition from one static condition to another.

Another object is to provide apparatus, for use in measuring the behavior of two individuals A and B in interaction, that will record in convenient and usable form upon each change from activity to inactivity, or vice versa, on the part of either A or B during the entire period of interaction between them (1) the duration of each of the following:

- (a) The actions of each individual;
- (b) The inactions of each individual;
- (c) Their concurrent actions (double actions), where A has interrupted B;
- (d) Their concurrent actions (double actions), where B has interrupted A;
- (e) Their concurrent inactions (double silences), where A has failed to respond promptly to B; and
- (f) Their concurrent inactions (double silences), where B has failed to respond promptly to A; and (2) the number of the occurrences of each of the following sequences of action and inaction between the individuals A and B:
 - (a) A's interruptions of B;
 - (b) B's interruptions of A;
 - (c) A's failures to respond promptly to B;
 - (d) B's failures to respond promptly to A;
 - (e) A's initiations of action after both have been inactive (i. e., when A breaks a silence);
 - (f) B's initiations of action after both have been inactive (i. e., when B breaks a silence);
 - (g) A's continuation of action alone after both have been active (i. e., when A outtalks B); and
 - (h) B's continuations of action alone after both have been active (i. e., when B outtalks A).

A further object is to provide apparatus satisfying the foregoing objects that will record the desired data solely in response to the movement of two control switches, one for each of the individuals under observation, each switch having two operative positions and being adapted to assume one of those positions during a period of activity on the part of one individual and to assume the other position during a period of inactivity on the part of the same individual.

A still further object is to provide apparatus that, in addition to fulfilling the foregoing conditions, will record the number and duration of the units of interaction for each of the individuals under observation, i. e., the number of times he ends (or starts) a discriminable period of activity.

Other objects will appear from the following specification.

The preferred embodiment of the invention will be described with reference to the accom-

panying drawings, in which Fig. 1 is an exterior perspective view of the assembled apparatus; Fig. 2, a vertical section along the line 2—2 in Fig. 1; Figs. 3 and 4, additional sectional views along the lines 3—3 and 4—4, respectively, in Fig. 2; Fig. 5, an enlarged view of a portion of the apparatus shown in Fig. 3; Fig. 6, a sectional view along the line 6—6 in Fig. 5; Fig. 7, a wiring diagram of the control mechanism of the machine; and Figs. 8 to 17 inclusive, the same wiring diagram, showing the different operative positions assumed by the various relay mechanisms following each of the ten different transitional sequences normally encountered in interaction situations limited to two persons.

Referring first to Figs. 1 to 4, which are limited to illustrating the physical structure of the preferred embodiment of the invention, the operative mechanisms are enclosed within a casing 15 formed of sheet metal attached to a frame, which is made of a plurality of interconnected angle members 16 to form a rigid structure. The casing and its supporting frame are mounted on casters 17. To make the enclosed apparatus readily accessible, the upper halves of the front and back of the casing are hinged to the lower halves and are normally secured to the top 18 of the casing by clasps 19. This top is provided with a window 20, through which may be observed a portion of the data printed by the recording mechanism on a strip of paper 21.

Electrical conductors 22 lead from the apparatus within the casing to a control box 23, which has a plurality of switches or keys, including two control switches A and B, for making and breaking electrical circuits as hereinafter described. Electrical conductors 24 lead from the control box to a source of alternating current not shown in the drawings. The number of the electrical conductors 24, their connections to various electrical devices within the casing, and their connections to the switches in control box 23 can not be properly shown in the structural drawings; but they are shown in the wiring diagram of Fig. 7 and will be fully described in connection with that diagram.

Within the casing and extending lengthwise of it is a supporting angle member 25, attached at either end to one of the side frames. Mounted on the upper surface of this member at spaced intervals are eleven counters, numbered 1 to 11. These counters are provided with type faces for printing and are adapted to indicate numerical values in unit increments, preferably from zero to 9,999. Counters 1, 2, 9, 10, and 11 are of conventional ratchet type that register unit increments in only one direction upon the downward movement of their respective lever arms 1a, 2a, etc., attached to their shafts. The remaining counters are also of conventional type but register unit increments in either (positive or negative) direction, depending upon the direction of rotation of their shafts.

The power mechanisms for operating the counters are mounted on two panels 26 and 27 supported by the member 25. Those mechanisms include solenoids S1, S2, S9, S10, and S11, the armatures of which are attached by appropriate linkages to the lever arms of the correspondingly numbered counters. These lever arms and the armatures connected thereto are normally held in an elevated position by springs 28 fastened between the armatures and the panel on which the solenoids are mounted. Each time that one of the solenoids is energized its armature is pulled

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downward, causing its associated counter to register a unit increment. The pairs of solenoids, *S7a* and *S7b*, and *S8a* and *S8b*, operate the counters 7 and 8, respectively, in either direction as described in detail below. Counters 4, 5 and 6 are adapted to be driven in either direction by reversible synchronous motors *M4*, *M5*, and *M6*, respectively; each motor being appropriately connected, as by a chain and sprocket drive, with the correspondingly numbered counter. The remaining counter 3 is likewise driven by a synchronous motor *M3*, but only in one direction. Each synchronous motor rotates continuously when started, until stopped or reversed by the control mechanisms hereinafter described. Its speed is preferably such that it will cause its associated counter to register one unit for each second of time that the motor is operating, those units being positive when the motor and counter rotate in one direction and negative when the direction of their rotation is reversed.

The mechanisms for operating counters 7 and 8 are best illustrated in Figs. 5 and 6. Since each of those counters is operated by similar means, the operation of counter 8 alone will be described. The power mechanisms for counter 8, the solenoids *S8a* and *S8b*, are fastened in staggered relation on opposite sides of a plate 30. This plate is attached to a bracket 31, which is secured to panels 26 and 27. The top of plate 30 has a deep recess, so that the upper part of the plate (from the view in Fig. 5) is U-shaped, with upwardly extending leg portions 33 and 34. Within that recess, a sprocket wheel 35 is rigidly mounted on a rotatable shaft 36 that is supported by both leg portions. Rigidly mounted on the same shaft adjacent to leg portion 34 is a ratchet wheel 37 adapted to be driven in a clockwise direction (looking at Fig. 6). A second ratchet wheel 38 adapted to be driven in the opposite direction is rigidly mounted on the same shaft on the other side of the sprocket wheel adjacent to leg portion 33 (a portion of this ratchet wheel is shown in the cut-away of Fig. 6). The leg portion 34 supports a slide housing 39 adjacent to ratchet wheel 37. A similar slide housing 40 is supported by leg portion 33 adjacent to ratchet wheel 38. Slidably disposed within housing 39 is a slide rod 42, the lower end of which is attached by a threaded coupling 43 to armature 44 of solenoid *S8b*. A similar slide rod 45 is slidably received within the housing 40 and is similarly attached to armature 47 of solenoid *S8a*. The inner surface of each housing directly opposite the adjacent ratchet wheel is slotted to permit the protrusion of the lower edges of two dogs 48 and 49 mounted on slide rods 42 and 45, respectively. Each dog is pivotally attached to its slide rod by a pivot screw 50 and is normally held by a tension spring 52 attached to the side of the housing so that the lower edge of the dog protrudes from the housing to engage and rotate the adjacent ratchet wheel upon downward movement of the slide rod but to slip past the ratchet wheel without rotating it when returned to its normal position by upward movement of the slide rod. The rotation of each dog about its pivot screw is limited by a pin 53, which is adapted to engage either side of a notch on the bottom edge of the dog. Each slide rod is normally held in the elevated position shown in the drawings by a tension spring 54, so that the dog carried by the slide is normally out of engagement with the adjacent ratchet wheel.

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When either of the solenoids *S8a* or *S8b*, is energized by an electric current, its armature and the connected slide rod are pulled downward against the tension of spring 54, and the dog carried by the slide rod engages and rotates the adjacent ratchet wheel through a fixed angular distance. When the current to the solenoid is interrupted, the spring 54 raises the armature, slide rod, and dog to their normal elevated position; during this operation, the dog turns on its pivot screw 50 against the tension of spring 52 and slips past the next succeeding tooth of the ratchet wheel without turning the wheel. The movement of either ratchet wheel (they rotate in opposite directions) rotates sprocket wheel 35 a corresponding amount; the rotation of the latter is in turn transmitted to counter 8 through a chain 55 and a sprocket wheel on the shaft of that counter. The ratio between those two sprocket wheels is such that counter 8 registers one unit plus (+) each time that solenoid *S8a* is energized and one unit minus (—) each time that solenoid *S8b* is energized.

In order to prevent any undesired rotation of sprocket wheel 35, either from vibration in the apparatus or from the friction of the dogs when moving upward to their normal positions, an adjustable friction brake is provided by a friction ball 56 that is urged against ratchet wheel 37 by a compression spring 57 held by an adjusting screw 58.

The various solenoids and motors previously mentioned for operating the eleven counters are controlled by a plurality of inter-connected relays designated by the general number 60 in Figs. 2, 3, and 4. The relays are shown mounted on a third panel 61, the ends of which are attached to side frames below panels 26 and 27. All three panels have a number of grommets 62 for the purpose of passing through the panels various electrical conductors not shown on the structural drawings. Similarly, there are shown on these panels a plurality of condensers 63 associated with each of the motors and with some of the relays, and a plurality of resistances 64 associated with some of the relays alone. There is also mounted on panel 61 a rectifier 65 and a transformer 66 associated with it. The condensers 63 that are associated with each of the motors (see the wiring diagrams in Fig. 7) are the usual condensers supplied with synchronous motors to smooth out variations in current.

The mechanism for printing at predetermined intervals the values indicated by the various counters includes a web of paper 21 that is unwound from a supply roll 70 removably secured to the end frames. The paper passes over a shaft 71 and around a platen roll 72 to a rewind roll 73. The latter is removably supported by brackets 74 attached to the end frames. The platen roll 72 is rotatably supported at either end on brackets 76, and the paper is pressed tightly against this roll by conventional feed rolls 77, which are pivotally supported and urged by springs against the platen roll. The brackets 76 holding the platen roll are attached to two rocker arms 78 mounted on shaft 71. This shaft is free to rotate in bearings 79 supported by the side frames (see Figure 4). The rocker arms 78 are connected together by a reinforcing strip 80 to give them the necessary rigidity to act as one unit. The platen roll 72, which is supported by the rocker arms, is normally held a spaced distance above the row of counters on member 75 by two compression springs 82 mounted be-

tween the side frames and lateral extensions of the brackets 76. This spaced distance may be varied by raising or lowering an adjusting screw 83.

In order to print the values registered by the various counters, two solenoids 84, which are attached to the side frames of the apparatus, have their armatures connected to the rocker arms 78. When these solenoids are energized, as hereinafter explained, their armatures are pulled downward, thereby turning the rocker arms about their shaft 71 and bringing the paper 21 on the underside of the platen roll downward into forceful contact with an inked ribbon 86 that is stretched above the type faces of the counters (see Fig. 6). The values indicated by the counters are thereby printed on the paper. When the solenoids are deenergized, the rocker arms, platen roll, and paper return to their normal elevated position, as shown in Fig. 2.

The upward movement of the rocker arms 78 after the solenoids 84 are deenergized is used to actuate the paper feeding mechanism. On one end of the shaft of the platen roll 72 is rigidly mounted a ratchet wheel 87 that is adapted to be turned upon upward movement of the platen roll by a dog (not shown) pivotally supported on a bracket 88 attached to support member 25 (see Fig. 3). A sprocket wheel 89 is also rigidly mounted on the platen roll shaft and connected by a chain 90 to a sprocket wheel on the shaft of rewind roll 73 (see Fig. 4). Accordingly, after each printing operation, when the platen roll is carried upward by the rocker arms, the platen and rewind rolls are turned through a small angle and move the web of paper a short distance in preparation for the next printing operation.

The inked ribbon 86 is moved intermittently by one of two solenoids 92 and 93, which turn the ribbon spools 94 and 95, respectively, through conventional ratchet-pawl mechanisms within those spools. The ribbon is led through guides 96 to a position above the row of counters where it can cooperate in the printing operation as previously described. When the ribbon is unwound from either spool, limit switches are tripped to cut one of the solenoids out of the control circuit, so that the other solenoid can wind the ribbon back on the empty spool. The control circuit for operating solenoids 92 and 93 are described below in connection with the various wiring diagrams.

The motors and solenoids previously described for operating the various counters are all connected into a common control circuit, which includes a plurality of interconnected electromagnetic relays and the two control switches A and B in control box 23. The control circuit is illustrated in Fig. 7, in which the numerous relays are represented for clarity as simple inductance coils. Each relay operates one or more pivoted relay arms, which are placed just above their associated relay and are identified by the same number as the relay, plus the letter *a* or *b*. The free ends of those arms are adapted to move between two electrical contacts. Normally, the arms are held away from the relay in the usual manner by a spring and rest against the left hand contact points as shown in Fig. 7. When a relay coil is energized by an electric current, its associated arm or arms move to the right against the right hand contact points.

Some of the relays (103, 104, 115—118, 120, 121, 123—127, and 133—133) have condensers of appropriate capacity shunted across their terminals to provide a slight delay, of the order of

one-quarter second, when those relays are either energized or deenergized. In addition, four of the relays (103, 104, 120, and 121) have small inductances connected in series to reduce sparking. All of the delayed action relays operate on direct current from conductor *r'*. One purpose of interposing delays in these particular relays is to permit the apparatus to suppress slight overlaps of interaction that could not in any event be differentiated from accidental overlaps caused by delayed reactions on the part of the observer. Another purpose, more fully adverted to below, is to permit momentary pulses of electric current to flow through the arms associated with those relays after the circuits to those relays are either closed or opened but before the arms have moved in response thereto.

The operation of all of the relays, except sequence relays 140 and 141, is controlled directly or indirectly by the two control switches A and B, which may be push buttons, keys, or other appropriate electrical switches adapted to make and break an electrical circuit. Each switch or key is directly connected to and controls four primary relays (shown along the bottom of Fig. 7). Key A controls primary relays 101, 105, 112, and 128; key B controls primary relays 102, 106, 113, and 129. When either key is in its open (up) position, no current flows to its associated primary relays, and the arms of those relays remain in their normal left hand positions. When either key is in its closed (down) position, its associated primary relays are energized, and the arms of those relays immediately swing over to their right hand positions and remain there for as long as the key remains down. In other words, each of the keys A and B, through the primary relays associated with it, has two operative positions: certain circuits (those connected through the primary relay arms in their left hand positions) are closed when the key is up; other circuits (those connected through the primary relay arms in their right hand positions) are closed when the key is down. Each key is normally held in its up position by a spring.

Keys A and B can be operated by various means that are responsive to the actions of the individuals under observation; in the embodiment here illustrated they are adapted to be operated manually, preferably by an observer who watches the two persons whose behavior in interaction is to be recorded. When individual A acts, as by talking, gesturing, etc., the observer pushes down key A and holds it down for as long as A remains active. When A's activity ceases, the observer releases key A, which immediately assumes its up position. In the same way, key B is held down during the periods when B is active and is returned to its up position when B's activity ceases. It will be readily understood that, under some conditions of interaction between A and B, both keys may occupy the same operative positions at the same time, as when both A and B are silent (both keys up) or when one interrupts the other (both keys down).

Referring to Fig. 7, in the upper left hand corner is shown a plug 100, which can be connected to a source of alternating current and delivers that current through conductors *r* and *s* to the various switches in control box 23. Those switches consist of the control switches, or keys, A and B previously described, an interaction switch C, a power switch D, and a signal switch E. Interaction switch C and power switch D supply current through conductors *c* and *d*,

respectively, to different parts of the circuit. In recording interaction, both of those switches are closed at the beginning of the interaction period and remain closed until manually opened at the end of that period. Signal switch E controls through conductor *e* the operation of solenoid S1 for the special purpose hereinafter described; this switch is normally held by a spring in its up or open position until manually or otherwise closed. The remainder of the wiring diagram shows various operating mechanisms, previously referred to, including the solenoids and motors that operate the eleven counters of the machine, the rectifier 65 and its associated transformer 66, the printing solenoids 84, and a plurality of interconnected relays numbered 101 to 135 comprising the primary relays already mentioned and a plurality of secondary or dependent relays that energize the various power mechanisms. There is also shown on the left hand side of Fig. 7, limit switches 142 and 143 that are operated by the unwinding of the inked ribbon from its spools, as previously described. These switches control the two sequence relays 140 and 141, energizing one or the other of them. An arm 144, above those relays and responsive to each, connects into the circuit solenoids 92 and 93 for turning the inked ribbon spools as previously described. Arm 144 is in its left hand position when relay 140 is energized and in its right hand position when relay 141 is energized.

To make it easier to follow a description of the control circuit, the various conductors interconnecting the electrical mechanisms have been differentiated as follows. Conductor *r* leading from plug 100 to switches A, B, and D and to the terminals of various electrical devices, and conductor *s* leading from the same plug to switch C, are represented by lines of extra thickness. These conductors are always "hot" when the plug is connected to a source of current supply, regardless of the position of any switch in control box 23. Conductor *r'*, which carries a rectified component of *r*, is also "hot" under similar conditions and is similarly represented. Conductors *c* and *d* leading from switches C and D, respectively, to terminals of other electrical devices are also represented by like lines of extra thickness. These conductors are always "hot" when plug 100 is connected and when both of the switches C and D are in their closed position (as normally they are during the operation of the apparatus), regardless of the positions of the other switches in control box 23. All other conductors, including conductors *a* and *b* that vary terminals to keys A and B, respectively, are represented by light lines. They carry current only intermittently during the operation of the apparatus, depending upon the operative positions of keys A and B and the sequence in which those keys are operated.

Because of the complexity of the control circuit and the difficulty in following on one wiring diagram the successive changes in the positions of the various relay arms (especially those associated with the delayed action relays), the operation of the apparatus in recording interaction between two persons will be described in connection with the wiring diagrams in Figs. 8 to 17. Each of those diagrams is identical with that in Fig. 7, with the following exceptions: (1) the switches in control box 23 are all shown in Fig. 7 as open; in each of the subsequent figures, switches C and D are closed, and keys A and B are in one or the other of their two operative

positions following different sequences in the movement of those keys corresponding to each of the ten transitional sequences that are normally encountered in interaction situations limited to two persons; and (2), while the relay arms in Fig. 7 are shown in their normal left hand positions, in each of the subsequent figures the relay arms associated with delayed action relays (and with relays 134 and 135) are shown in their initial or temporary positions (represented by broken lines), which they hold only momentarily, and also in their final positions (represented by solid lines); and the other relay arms, which move immediately in response to movements of keys A and B, are shown in their final positions (represented by solid lines).

When interaction between A and B is to be recorded, plug 100 is first connected to a source of alternating current. Conductors *r*, *r'*, and *s* (thick lines) are then "hot"; but none of the relays (except one of the two sequence relays 140 and 141) is energized, and none of the power mechanisms are actuated. Now, suppose that interaction between A and B is commenced by activity on the part of A alone. As soon as this activity is observed, key A, interaction switch C, and power switch D are simultaneously pushed down or closed. All of the conductors that are represented by thick lines (*c*, *d*, *r*, *r'*, and *s*) are now "hot"; so also is conductor *a*.

The initial and final positions of the various relay arms following the closing of the above switches are shown in Fig. 8; in this, as in subsequent figures, the initial positions of the arms are represented by broken lines and their final positions by solid lines. The initial positions are held only momentarily, of the order of one-quarter second.

Primary relays 101, 105, 112, and 128 that are controlled directly and exclusively by key A are all energized as that key goes down. When primary relay 128 is energized, its arm 128a swings immediately to the right and remains there. In this position, current from conductor *c* passes through arm 128a to the left terminal of relay 131, the other terminal of which receives current from conductor *r'*. Relay 131 is thereby energized, but not immediately so, due to the delay imposed by the condenser across its terminals. In the short interval before it is energized and before its arm 131a moves to the right, current flows through that arm in its initial left hand position to relay 134, immediately energizing the latter (it has no condenser) and causing its arm 134a to move to its initial right hand position. While arm 134a momentarily remains in that initial position, a pulse of current flows through it from conductor *c* to the lower terminals of the two printing solenoids 84, the upper terminals of which receive current from conductor *r*.

Relay 132 is energized at the same time as relay 131, by current flowing from conductor *c* through arm 129a (primary relay 129 is inactive when key B is up) to the right terminals of relay 132. Before arm 132a moves from its initial left hand position, it delivers a pulse of current to relay 135. Arm 135a then swings to its initial right hand position and holds that position momentarily, so as to deliver in turn a pulse of current from conductor *c* to the lower terminals of solenoids 84. In other words, these solenoids are energized by the simultaneous actions of relays 134 and 135 as soon as key A goes down. The values indicated by the various counters at

the moment key A went down are then printed on the paper 21, in the manner previously described.

The circuit is adapted to actuate the printing mechanism upon the movement of either key from one of its operative positions to the other. Even though there may be a very slight mechanical (not electrical) delay in the operation of the printing mechanism, the values that are recorded on each printing operation are those indicated by the counters at the time one of the keys is moved. This will be so for counters 3, 4, 5, and 6, which are operated by motors, because they change their values only every second, while the printing mechanism requires but a fraction of a second to operate. It will likewise be so for counters 2, 7, 8, 9, 10, and 11, which are operated by solenoids, because each solenoid has interposed somewhere in the circuit connecting it to keys A and B electrical delays (condensers) that are at least sufficient to compensate for any slight mechanical delay in printing. Counter 1, which is controlled exclusively by switch E, is operated only at infrequent intervals, as will be explained below; and that switch can be manually operated so as to record any change of value by counter 1 at the same time as changes of value are recorded by the counters.

As will later be made clear, those values relate to the preceding static condition of interaction and to the particular transitional sequence resulting in that static condition. Of course, all that is recorded at the beginning of the interaction period, when key A alone is first pushed down (along with switches C and D), are the initial values indicated by the various counters before interaction has begun. Those values may or may not be zero, depending upon whether the counters have been reset since the previous operation of the machine.

After the printing mechanism has operated, delayed action relays 131 and 132 will have been energized; and arms 131a and 132a will have moved to their final right hand ("dead") positions, cutting off current to relays 134 and 135. Arms 134a and 135a then return to their normal left hand (final) positions, cutting off in turn the momentary pulse of current to solenoid 84. Upon the upward movement of the solenoid armatures, the paper feed mechanism is operated in the manner already described, moving the paper in preparation for the next printing operation.

The energization of primary relay 101 causes current to flow from conductor c through arm 101a to the lower left (+) terminal of motor M4. Since the upper terminal of that motor receives current from conductor d, M4 rotates and turns its associated counter 4 in a positive direction. M4 continues to rotate and its counter continues to register elapsed time (+) as long as key A is held down. No other relays or power mechanisms are actuated by relay 101 under the conditions prevailing in Fig. 8. The fact would be otherwise, however, if those conditions should prevail (as they normally will) at any other time than at the beginning of the interaction period, i. e., if switches C and D are already closed before key A comes down. In that case, relay 103 would be energized, while keys A and B are still both up, by current from conductor c flowing through arms 101b and 102b (in their normal left hand positions) and by current from conductor r'. Relay arms 103a and 103b would then be in their right hand positions, permitting current to flow from conductor d to the upper terminals of solenoids S7a and S7b (their lower terminals

would be dead). If key A should now come down (while key B remained up), M4 would rotate as already described; and, in addition, S7a would be energized and turn counter 7 one unit in a positive direction. As key A came down, primary relay 101 would be energized as before, and the resulting movement of arm 101b to the right would cut off the current previously flowing from conductor c to relay 103. But before that relay was deenergized (it is a delayed action relay) and before its relay arm 103a moved to the left to cut off current to the upper terminal of S7a, a pulse of current would flow from conductor c through arm 101b (in the position shown in Fig. 8) to the lower terminal of S7a, thereby energizing it.

Since primary relay 105 is also energized when key A is pushed down, current flows from conductor c through arm 105a, then through arm 107a to the left terminal of relay 108. Since the right terminal of that relay receives current from conductor d, the relay is energized and moves its arm 108a to its right hand position. Relay 109 is also energized at the same time, and its arm 109a likewise moves to its right hand position. Neither of those movements, however, causes current to flow through motors M5 or M6, because none of the lower terminals of those motors are supplied with current (the same would be true if the conditions prevailing in Fig. 8 occurred at any other time than at the beginning of the interaction period).

Primary relay 112 is also energized, causing current to flow from conductor c through arm 112a to the right terminal of relay 116, the left terminal of which receives current from conductor r'. The arms 116a and 116b accordingly move to their right hand positions, and current flows from conductor c through arm 116b to the left terminal of relay 123. Since the right terminal of that relay receives current from conductor r', the relay is energized; and arm 123a moves to its right hand position, but without affecting any of the other electrical devices. Relay 118 is also energized by current from conductor c flowing through arm 113a and by current from conductor r'; arm 118a moves to its right hand position, but without affecting other portions of the circuit. (The results described in this paragraph would be the same if the conditions prevailing in Fig. 8 occurred at any other time than at the beginning of the interaction period.)

The only other power mechanism that is actuated is motor M3. Since it is controlled exclusively by interaction switch C, it continues to rotate during the remainder of the interaction period, indicating elapsed time from the beginning of interaction.

The sequence relay 140 is energized (and remains so as long as limit switch 143 stays closed), holding arm 144 in its left hand position. The latter supplies current from conductor r to the lower terminal of solenoid 92, but the upper terminal of that solenoid is supplied with current only when solenoid S2 is energized as subsequently explained.

The mechanisms that are operated at the beginning of interaction, when key A goes down and key B stays up (i. e., A becomes active, after A and B have both been inactive) may be summarized as follows:

(1) The printing mechanism records the initial values indicated by the counters;

(2) M3 and counter 3 are rotating, indicating elapsed time since the beginning of interaction;

(3) M4 and counter 4 are rotating in a positive direction, indicating the duration of continued activity (+) on the part of A.

(4) If the foregoing movements of the keys had occurred at any other time than at the beginning of the interaction period, S7a would have moved counter 7 one unit in a positive direction, indicating the occurrence of the transitional sequence in which A initiated action after A and B had both been inactive.]

The foregoing static condition (A active, B inactive) will end when one (or both) of the individuals changes from activity to inactivity, or vice versa. Of the three possible transitions that might occur, assume that B interrupts A, so that both are now active. The corresponding movement of the keys is that key A stays down and key B goes down. The initial and final positions of the various relay arms following this transitional sequence are shown in Fig. 9.

The primary relays that are controlled by key A (i. e., relays 101, 105, 112, and 128) remain energized as in Fig. 8, and their associated relay arms remain in their right hand positions. In addition, the primary relays that are controlled by key B are now energized; they are relays 102, 106, 113, and 129.

With relay 129 energized, its arm 129a moves to its right hand position (cutting off current from relay 132, so that arm 132a returns, after an interval, to its normal left hand position) and delivers current from conductor c to the left terminal of relay 133, the right terminal of which receives current from conductor r'. That relay, like relays 131 and 132 previously described, is a delayed action relay; and, before its arm 133a moves from its initial left hand position to its final right hand position, a pulse of current flows from conductor c to the right terminal of relay 135, so the relay is momentarily energized as before, causing the printing mechanism to operate as previously described.

Primary relay 102 is also energized when key B comes down, and its relay arms 102a and 102b assume their right hand positions. Relay 104 is thereby energized by current from conductor c flowing through arms 101b and 102a, and by current from conductor r'. Arms 104a and 104b accordingly move to the right (after a slight delay); but neither of the solenoids S8a and S8b is energized, because the lower terminals of those solenoids are not supplied with current.

When primary relay 106 is energized by the coming down of key B, the current previously flowing to relay 109 through arm 106a in its left hand position (see Fig. 8) is immediately cut off as that arm swings to the right as shown in Fig. 9. Relay 108, however, remains energized; and current now flows from conductor c through arms 106a and 108a to the lower left (+) terminal of motor M6. The upper terminal of that motor receives current from conductor d, and the motor rotates in a positive direction as long as keys A and B both remain down.

The remaining primary relay that is energized by the coming down of key B is relay 113, the arms of which immediately move to their right hand positions. The movement of arm 113a cuts off the current previously flowing to delayed action relay 118, but its arm 118a momentarily holds its initial (previous) position before swinging back to the left. During this holding interval, current continues to flow momentarily to the right terminal of delayed action relay 120 from conductor c through arms 118a and 116a (relay

116, being responsive to key A alone, remains energized while that key stays down). Current also flows to the left terminal of relay 120 from conductor r' through arms 112b and 113b, and that relay is momentarily energized. As a result, arm 120a moves to the right and remains there momentarily, delivering a pulse of current from conductor c to the left terminal of delayed action relay 124, the right terminal of which receives current from conductor r'. Arm 124a, in turn, then swings to the right and remains there momentarily, delivering a pulse of current from conductor c to the left terminal of delayed action relay 127, the right terminal of which receives current from conductor r'. The resulting energization of relay 127 causes arm 127a to move to the right and remain there momentarily. It will be noted that each of the relays 120, 124 and 127 is energized only momentarily and that each is energized at a slightly later time than the preceding one (the entire sequence, however occurs in a fraction of a second). They are deenergized in reverse order. In other words, relay 120 is first cut off, when arm 118a returns to its final left hand position; then relay 124 is cut off, and its arm returns to its final left hand position before arm 127a has left its initial right hand position. This permits a pulse of current to flow from conductor c through arm 124a (now in its final position) then through arm 127a (while it remains in its initial position) to the lower terminal of solenoid S10. The upper terminal of that solenoid receives current from conductor d; and the solenoid is energized, moving counter 10 one unit.

As can be easily traced from the wiring diagram in Fig. 9, relay 123 remains energized as in Fig. 8, and relay 117 is for the first time energized. The latter in turn energizes relay 126. Although the arms of those relays are now in their right hand positions, they carry no current to the lower terminals of the power mechanisms S2 and S11 to which they are, respectively, connected.

The mechanisms that are operated when key A stays down and key B goes down (i. e., when B interrupts A) may be summarized as follows:

(1) The printing mechanism records the values indicated by the counters at the moment key B went down; those values (on this and subsequent printings) include (a) the duration of the preceding static condition of interaction and (b) the particular transitional sequence resulting in that static condition (here the beginning of interaction).

(2) M3 and counter 3 are rotating, indicating total elapsed time since the beginning of interaction.

(3) M4 and counter 4 are rotating in a positive direction, indicating the duration of continued activity (+) on the part of A.

(4) M6 and counter 6 are rotating in a positive direction, indicating the duration of concurrent activity (+) on the part of A and B, where B has interrupted A.

(5) S10 has moved counter 10 one unit, indicating the occurrence of a transitional sequence in which B has failed to synchronize with A (here B interrupted A).

If the preceding static condition (both A and B active) is terminated by B becoming inactive (i. e., A outtalks B), key A will remain down, and key B will go up. The initial and final positions of the various relay arms following this transitional sequence are shown in Fig. 10.

The printing mechanism again records the val-

ues indicated by the counters at the time key B went up. Relay 128 remains energized, since key A is still down; and relay arms 130a, 131a, and 134a remain in the same positions as in Fig. 9. Relay 129, however, is immediately deenergized as key B goes up, and arm 129a immediately swings back to its normal left hand position, delivering a pulse of current from conductor c to relay 135 through arm 132a before the latter moves from its initial position upon the delayed energization of relay 132. Relay arm 135a immediately moves to its initial right hand position, remaining there long enough to actuate the printing solenoids 84.

In addition, as key B goes up, while key A remains down, primary relays 101, 105, and 112 (responsive to key A) remain energized, while primary relays 102, 106, and 113 (responsive to key B) become deenergized. The resulting movement of relay arm 102a to the left immediately cuts off the current previously flowing from conductor c to relay 104; but arms 104a and 104b momentarily hold their right hand positions. During this holding interval, current continues to flow from conductor d through arm 104b to the upper terminal of solenoid S8a. The lower terminal of that solenoid now receives current from conductor c through relay arms 101b and 102a (the latter arm having moved to the left), and the solenoid moves counter 8 one unit in a positive direction.

Motor M4 continues to rotate in a positive direction, since current is still supplied to its lower left (+) terminal from conductor c through relay arm 101a.

Relay 108 remains energized as in Fig. 9; but the current previously flowing to motor M6 through relay arm 108a is immediately cut off as relay arm 106a moves to its left hand position upon the deenergization of primary relay 106. Although relay 109 becomes energized, its arm 109a carries no current to motor M6.

With the deenergization of primary relay 113, the current previously flowing to relay 117 is cut off, but its associated relay arms remain momentarily in their right hand positions. Accordingly, current continues to flow for a brief interval from conductor c through arm 117b to relay 126, and arm 126a continues momentarily to hold its right hand position even after arm 117b returns to its normal left hand position. Upon the latter movement, a pulse of current flows from conductor c through arm 117b thence through arm 126a to the lower terminal of solenoid S11, the upper terminal of which receives current from conductor d. This solenoid moves counter 11 one unit, and is then deenergized when relay arm 126a moves to its final position.

The only other change from the final positions of the relay arms as they are shown in Fig. 9 is the movement of relay arm 118a to the right (after a slight delay), without affecting, however, any other operative mechanisms.

The mechanisms that are operated when key A stays down and key B goes up (i. e., when A outtalks B) may be summarized as follows:

(1) The printing mechanism records the values indicated by the counters at the moment key B went up; those values include the counter movements described in the preceding summary.

(2) M3 and counter 3 are rotating, indicating total elapsed time since the beginning of interaction.

(3) M4 and counter 4 are rotating in a posi-

tive direction, indicating the duration of continued activity (+) on the part of A.

(4) S8a has moved counter 8 one unit in a positive direction, indicating the occurrence of the transitional sequence in which A outtalked B.

(5) S11 has moved counter 11 one unit, indicating the occurrence of cessation of activity on the part of B (i. e., the occurrence of a unit of interaction on the part of B).

The foregoing static condition (A active, B inactive) is the same as that following the beginning of interaction, which was described in connection with Fig. 8. Those two static conditions resulted, however, from different transitional sequences in the order of action between A and B; and different counters have accordingly been moved in each case, permitting two occurrences of the same static condition to be differentiated.

Assuming that A now ceases to be active while B remains inactive (i. e., B fails to respond promptly to A), the corresponding movement of the keys is that key A goes up and key B stays up. The initial and final positions of the various relay arms following this transitional sequence are shown in Fig. 11.

All of the primary relays are now deenergized since conductors a and b carry no current when their respective keys are up. Relay arm 123a associated with primary relay 123 immediately returns to its normal left hand position, from which it delivers a pulse of current to arm 130a before that arm moves to its right hand position upon the delayed energization of relay 130. Relay 134 is therefore momentarily energized; and its arm 134a delivers a pulse of current from conductor c to the lower terminals of the printing solenoids 84. The values indicated by the counters at the time key A went up are then recorded.

Motor M4 now receives current at its lower right (-) terminal from conductor c through relay arm 101a, so that M4 and counter 4 rotate in a negative direction and continue to do so for as long as key A stays up.

Relay 109 remains energized as in Fig. 10, but relay 105 is deenergized when key A goes up. As a result current now flows to the lower right (-) terminal of motor M6 from conductor c through arms 105a and 109a. M6 and counter 6 therefore rotate in a negative direction.

Solenoid S2 is now energized for the first time in the following manner. As key A goes up, relay 116 is deenergized after a slight delay; this, in turn, causes relay 123 to be deenergized after a slight additional delay. While relay arm 123a is still holding its right hand position, relay arm 116b will have returned to its normal left hand position, permitting a pulse of current to flow from conductor c through arm 116b then through arm 123a to the lower terminal of solenoid S2. The upper terminal of that solenoid receives current from conductor r, and the solenoid moves its associated counter 2 one unit.

At the same time as solenoid S2 is energized (and through the same circuit), solenoid 92 is likewise energized. The latter solenoid operates one of the inked ribbon spools in the manner previously described. Solenoid 93 will be energized in the same way, after the inked ribbon has been unwound from one spool and mechanically reversed the positions of limit switches 142 and 143, thereby causing sequence relay 141, instead of relay 140, to be energized and moving relay arm 144 to its right hand position.

Solenoid S10 is energized (and moves counter 10 one unit) in the same manner as has been

previously described in connection with Fig. 9, with the exception that relay 120 is now energized by the movement of arm 112b to the left (instead of arm 113b to the right) and is de-energized by the movement of arm 116a to the left (instead of arm 118a to the left).

Other changes in the operative positions of the various relay arms from the final positions that they occupied in Fig. 10 are shown in Fig. 11, but none of them affects any of the power mechanisms, other than those referred to above.

The mechanisms that are operated when key A goes up and key B stays up (i. e., when B fails to respond promptly to A) may be summarized as follows:

(1) The printing mechanism records the values indicated by the counters when key A went up.

(2) M3 and counter 3 are rotating, indicating total elapsed time since the beginning of interaction;

(3) M4 and counter 4 are rotating in a negative direction, indicating the duration of inactivity (—) on the part of A;

(4) M6 and counter 6 are rotating in a negative direction, indicating the duration of concurrent inactivity (—) on the part of A and B, after B has failed to respond promptly to A;

(5) S2 has moved counter 2 one unit, indicating the occurrence of cessation of activity on the part of A (i. e., the occurrence of a unit of interaction on the part of A);

(6) One of the inked ribbon solenoids is energized, moving the inked ribbon; and

(7) S10 has moved counter 10 one unit, indicating the occurrence of a transitional sequence in which B has failed to synchronize with A (here B failed to respond promptly to A). When B interrupted A, as previously discussed in connection with Fig. 9, that too indicated a failure to synchronize on the part of B; and S10 also moved counter 10 one unit. While the occurrence of these two different sequences (B interrupts A; B fails to respond promptly to A) are both indicated by movements of the same counter 10 (because it is convenient to have on one counter the total occurrences in which B failed to synchronize), the two sequences may be differentiated on the printed record of interaction by the fact, among others, that counter 2 registers a unit increment at the same time as counter 10 only when the latter indicates a failure on the part of B to respond promptly to A.

If the preceding static condition (both A and B inactive) is terminated by B becoming active while A remains inactive (i. e., B finally breaks the silence), key A will stay up, and key B will go down. The initial and final positions of the various relay arms following this transitional sequence are shown in Fig. 12.

The printing mechanism operates in response to the energization of primary relay 129, in the same manner as previously described in connection with Fig. 9 (where key A stayed down, and key B went down).

Motor M4 continues to rotate in a negative direction, as described above in connection with Fig. 11.

Primary relay 102 is now energized, and current flows from conductor c through arms 101b and 102b to the lower terminal of solenoid S7b. The upper terminal of that solenoid receives a pulse of current from conductor d through relay arm 103b, while the latter remains momentarily in its right hand position before delayed action relay 103 is deenergized by the movement of relay

arm 102b to the right. Solenoid S7b is accordingly energized and moves counter 7 one unit in a negative direction.

Motor M6, which had been rotating in a negative direction during the conditions prevailing in Fig. 11, ceases to rotate when key B goes down. The current previously supplied to its lower right (—) terminal through relay arm 109a is cut off by the immediate deenergization of relay 109 as soon as key B goes down.

The initial and final positions of the other relay arms are shown in Fig. 12; they will not be further described, since they do not actuate any power mechanisms.

The mechanisms that are operated when key A stays up and key B goes down (i. e., when B initiates action after both have been inactive) may be summarized as follows:

(1) The printing mechanism records the values indicated by the counters at the moment key B went down;

(2) M3 and counter 3 are rotating, indicating total elapsed time since the beginning of interaction;

(3) M4 and counter 4 are rotating in a negative direction, indicating the duration of continued inactivity (—) on the part of A;

(4) S7b has moved counter 7 one unit in a negative direction, indicating the occurrence of the transitional sequence in which B initiated action after both A and B had been inactive.

If the foregoing static condition (A inactive, B active) is terminated by A becoming active at the same time as B becomes inactive (i. e., B ceases activity and A responds promptly, indicating perfect synchronization in their mutual interaction), key A goes down as key B goes up. The initial and final positions of the various relay arms following this transitional sequence are shown in Fig. 13.

The printing mechanism records the values indicated by the counters at the end of the preceding static condition shown in Fig. 12. The lower terminals of the solenoids 84 will be supplied with current from conductor c through both of the relay arms 134a and 135a, in the same manner that has been previously described in connection with Fig. 8.

Motor M4 now rotates in a positive direction, as a result of the movement of relay arm 101a to its right hand position.

Solenoid S11 is actuated in the same manner as previously explained in connection with Fig. 10. It moves counter 11 one unit.

None of the other power mechanisms are actuated by the foregoing transitional sequence or the continuation of the static condition resulting therefrom. The final positions of the various relay arms in Fig. 13 are the same as in Fig. 8.

The mechanisms that are operated when key A goes down at the same time as key B goes up (i. e., when A responds promptly to B) may be summarized as follows:

(1) The printing mechanism records the values indicated by the counters when key A goes down and key B goes up;

(2) M3 and counter 3 are rotating, indicating total elapsed time since the beginning of interaction;

(3) M4 and counter 4 are rotating in a positive direction indicating the duration of activity (+) on the part of A; and

(4) S11 has moved counter 11 one unit, indicating the occurrence of a cessation of activity

on the part of B (i. e., the completion of one unit of interaction on the part of B).

In Fig. 14 are shown the initial and final positions of the various relay arms, where the transitional sequence from the static condition of Fig. 13 (A active, B inactive) is that A becomes inactive at the same time that B becomes active, again indicating the perfect synchronization between the two persons in interaction. The corresponding movement of the keys is that key A goes up at the same time as key B goes down.

The printing mechanism operates upon the simultaneous energization of relays 134 and 135 (as in Fig. 13), those relays being energized by pulses of current delivered through arms 130a and 133a, respectively, as is clearly shown in Fig. 14.

Motor M4 and counter 4 are now rotating in a negative direction, because of the return of relay arm 101a to its normal left hand position upon the upward movement of key A.

Solenoid S2 is actuated in the same manner as previously explained in connection with Fig. 11 (this will be clear from a comparison of Figs. 11 and 14) and moves counter 2 one unit. Likewise, as in Fig. 11, the inked ribbon solenoid 92 is energized, since it is connected in the same circuit as solenoid S2.

None of the other power mechanisms are actuated by the foregoing movement of the keys.

The mechanisms that are operated when key A goes up at the same time as key B goes down (i. e., when B responds promptly to A) may be summarized as follows:

- (1) The printing mechanism records the values indicated by the counters when key A goes up as key B goes down;
- (2) M3 and counter 3 are rotating, indicating total elapsed time since the beginning of interaction;
- (3) M4 and counter 4 are rotating in a negative direction indicating the duration of inactivity (—) on the part of A;
- (4) S2 has moved counter 2 one unit, indicating another unit of interaction on the part of A; and
- (5) One of the inked ribbon solenoids is energized, moving the inked ribbon.

Suppose that A now becomes active, while B remains active (i. e., A interrupts B). Key A will go down, while key B stays down; and the initial and final positions of the various relay arms following this transitional sequence are shown in Fig. 15.

The printing mechanism again operates, this time by a pulse of current delivered through arm 134a in response to the energization of relay 128.

The direction of rotation of motor M4 and counter 4 are again reversed, and they move in a positive direction as long as key A is down.

Motor M5 is now actuated for the first time. Its upper terminal receives current from conductor d. Since relay 107 remains energized as in Fig. 14, the lower left (+) terminal of M5 receives current from conductor c through relay arms 105a and 107a. Motor M5 and counter 5 accordingly rotate in a positive direction.

Solenoid S9 is also actuated for the first time. Primary relays 112 and 113 are both energized, since both keys are down. Relay 117 remains energized as it was in Fig. 14, and relay 116 becomes energized by current flowing from conductor c through relay arm 112a. Relay 115, however, is deenergized (after a slight delay), because current from conductor c is cut off by the

movement of relay arm 112a to the right; but arm 115a momentarily holds its right hand position. Current from conductor c continues to flow momentarily through arm 115a, then through relay arm 117a to the right terminal of relay 121. The left terminal of the latter is supplied with current from conductor r', through relay arms 112b and 113b, so that relay 121 is momentarily energized. Its arm 121a moves momentarily to the right, momentarily energizing relay 125. Arm 125a associated with that relay moves to its right hand position and remains there momentarily. A pulse of current, accordingly, is delivered from conductor c through relay arm 125a to the lower terminal of solenoid S9, the upper terminal of which receives current from conductor d. The solenoid is thereby energized and moves counter 9 one unit.

None of the other power mechanisms are actuated.

The mechanisms that are operated when key A goes down and key B stays down (i. e., when A interrupts B) may be summarized as follows:

- (1) The printing mechanism records the values indicated by the counters when key A goes down;
- (2) M3 and counter 3 are rotating, indicating total elapsed time since the beginning of interaction;
- (3) M4 and counter 4 are rotating in a positive direction, indicating the duration of activity (+) on the part of A;
- (4) M5 and counter 5 are rotating in a positive direction, indicating the duration of concurrent activity on the part of A and B, after A has interrupted B; and
- (5) S9 has moved counter 9 one unit, indicating the occurrence of a transitional sequence in which A has failed to synchronize with B (here A interrupted B).

In the preceding static condition, both A and B were active at the same time. If B now out-talks A (i. e., B remains active while A becomes inactive), key A will go up and key B will stay down. The initial and final positions of the various relay arms resulting from this transitional sequence are shown in Fig. 16.

The printing mechanism operates as previously described in connection with Fig. 11, recording the values indicated by the various counters at the moment when key A went up.

Before this last transitional sequence occurred, relay 104 was energized, and its arms 104a and 104b were in their right hand positions as shown in Fig. 15. As key A goes up, the current previously flowing to relay 104 from conductor c is cut off by the return of relay arm 101b to its normal left hand position. Arm 104a, however, remains momentarily in its right hand position, and current continues to flow momentarily from conductor d to the upper terminal of solenoid S8b. The lower terminal of the same solenoid is now supplied with current from conductor c through relay arms 101b and 102b. The solenoid is thereby energized and moves counter 8 one unit in a negative direction.

Motor M4 is now rotating in a negative direction, due to the return of relay arm 101a to its normal left hand position.

Although relay 107 remains energized as in Fig. 15, the current previously flowing to the lower left (+) terminal of motor M5 through relay arms 107a and 105a is cut off by the return of the latter arm to its normal left hand position. Motor M5 therefore ceases to rotate.

Solenoid S2 is actuated in the manner pre-

viously described in connection with Fig. 11, and the inked ribbon solenoid 92 connected into the same circuit is likewise energized.

No other power mechanisms are actuated by this last transitional sequence, although relays 110, 115, 117, and 126 are energized, as illustrated in Fig. 16, in addition to the primary relays controlled by key B.

The mechanisms that are operated when key A goes up and key B stays down (i. e., when B outtalks A) may be summarized as follows:

(1) The printing mechanism records the values indicated by the counters when key A goes up;
(2) M3 and counter 3 are rotating, indicating total elapsed time since the beginning of interaction;

(3) M4 and counter 4 are rotating in a negative direction, indicating the duration of inactivity (—) on the part of A;

(4) S2 has moved counter 2 one unit, indicating the occurrence of another unit of interaction on the part of A;

(5) S8b has moved counter 8 one unit in a negative direction, indicating the occurrence of the transitional sequence in which B outtalked A; and

(6) One of the inked ribbon solenoids is energized, moving the inked ribbon.

The only one of the ten transitions normally occurring in interaction situations limited to two persons that has not so far been discussed is where A fails to respond promptly to B after the latter ceases his activity. This sequence follows the static condition previously described, if B becomes inactive while A remains inactive (i. e., both are silent after B ceases activity). The corresponding movement of the keys is that A key stays up, and key B goes up. The initial and final positions of the various relay arms resulting from this transitional sequence are shown in Fig. 17.

The printing mechanism operates to record the values indicated by the various counters, in the same manner as has been described in connection with Fig. 10.

Motor M4 continues to rotate in a negative direction, as in Fig. 16, since there has been no change in the position of key A.

Motor M5 and counter 5 now rotate in a negative direction. Current is supplied to its lower right (—) terminal from conductor c through relay arms 106a and 110a, the latter being in the same position as is shown in Fig. 16.

Solenoid S9 is actuated (and moves counter 9 one unit) in the same manner as has been previously described in connection with Fig. 15, with

the exception that relay 121 is now energized by the movement of arm 113b to the left (instead of arm 112b to the right) and is deenergized by the movement of arm 117a to the left (instead of arm 115a to the left).

Solenoid S11 is actuated (and moves counter 11 one unit) in the same manner as has been previously described in connection with Fig. 10.

None of the other power mechanisms are actuated by this last transitional sequence.

The mechanisms that are operated when key A stays up and key B goes up (i. e., when A fails to respond promptly to B) may be summarized as follows:

(1) The printing mechanism records the values indicated by the counters when key B goes up.

(2) M3 and counter 3 are rotating, indicating total elapsed time since the beginning of interaction.

(3) M4 and counter 4 are rotating in a negative direction, indicating the duration of inactivity (—) on the part of A.

(4) M5 and counter 5 are rotating in a negative direction, indicating the duration of concurrent inactivity on the part of A and B, after B has ceased activity (i. e., the duration of the silence following A's failure to respond promptly to B);

(5) S9 has moved counter 9 one unit, again indicating the occurrence of a transitional sequence in which A has failed to synchronize with B (this time A has failed to respond promptly to B). When A interrupted B, as previously discussed in connection with Fig. 15, that too indicated a failure to synchronize on the part of A; and S9 then moved counter 9 one unit. While the occurrences of these two different sequences (A interrupts B; A fails to respond promptly to B) are both indicated by movements of the same counter 9 (because it is convenient to have on one counter the total occurrences in which A failed to synchronize), the two sequences may be differentiated on the printed record of interaction by the fact, among others, that counter 11 registers a unit increment at the same time as counter 10 only when the latter indicates that A has failed to respond promptly to B; and

(6) S11 has moved counter 11 one unit, indicating the occurrence of another unit of interaction on the part of B.

The movements of the various counters in response to the different sequences in which keys A and B are operated, as just described in detail in connection with Figs. 8 to 17, are tabulated below. In this table, the first column shows the four initial positions of the two keys correspond-

Initial Position	Operational Sequence	Final Position	Counter Movement
(a) — {A down, B up	A goes up	A up	{ 4 (—); 6 (—); 2 one unit; 10 one unit. (Fig. 11).
	B stays up	B up	
	A goes down	A up	{ 4 (—); 2 one unit. (Fig. 14).
	B goes down	B down	
(b) — {A down, B down	A stays down	A down	{ 4 (+); 6 (+); 10 one unit. (Fig. 9).
	B goes down	B down	
	A goes up	A up	{ 4 (—); 2 one unit; 8 one unit (—). (Fig. 16).
	B stays down	B down	
(c) — {A up, B down	A stays down	A down	{ 4 (+); 8 one unit (+); 11 one unit. (Fig. 10).
	B goes up	B up	
	A goes down	A down	{ 4 (+); 5 (+); 9 one unit. (Fig. 15).
	B stays down	B down	
(d) — {A up, B up	A goes up	A up	{ 4 (+); 11 one unit. (Fig. 13).
	B goes up	B up	
	A stays up	A up	{ 4 (—); 5 (—); 9 one unit; 11 one unit. (Fig. 17).
	B goes up	B up	
(e) — {A down, B up	A goes down	A down	{ 4 (+); 7 one unit (+). (Fig. 8).
	B stays up	B up	
	A stays up	A up	{ 4 (—); 7 one unit (—). (Fig. 12).
	B goes down	B down	

ing to the four static conditions of interaction that have already been referred to. In the second column are the operational sequences in which either or both of the keys may be moved from each of their initial positions; those operational sequences correspond to the ten transitional sequences normally encountered in interaction situations limited to two persons. The third column shows the final position of the keys after each operational sequence, while the fourth column indicates what counters are moved as a result of each operational sequence and the continuation of the final position resulting therefrom. The particular sequence, in which key A goes down while key B stays up, that was discussed above in connection with Fig. 8 is treated in the table as though it had occurred at any other time than at the beginning of the interaction period, which was a special and limiting example of its occurrence.

It will be evident from the foregoing table that the length of time in which the two keys remain in each of the final positions shown (i. e., the duration of each static condition of interaction) is measured by counter 4 in either positive or negative units of time. In some cases, it is additionally measured in the same way by either counter 5 or counter 6. It will be observed that each of the ten different operational sequences in the movement of the two keys is followed either by the operation of different counters or (in two cases) by the operation of the same counters in different directions. In other words, the counters are operated in ten different predetermined combinations, depending upon the sequence in which the two keys, or control switches, are moved. It is apparent, therefore, that the apparatus will record the occurrence of each of the ten different transitional sequences from one static condition to another that normally occur in interaction situations limited to two persons and will at the same time record the duration of the interval between successive transitions.

Some of the counters (4, 5, 6, 7, and 8) move in either a positive or negative direction, depending upon the sequence in which keys A and B are operated. At any given time, therefore, each of those counters indicates the algebraic sum of its previous movements. While it is entirely practicable to have two separate counters for each of those mentioned above, one indicating values in a positive direction and the other indicating values in a negative direction, it has been found more convenient in analyzing the data recorded by the machine to combine the counters in the manner shown. When so combined, they give a convenient summary of the behavior of each person during the interaction. In the event a more detailed analysis is desired, the discrete movements of those counters in each direction can be determined from the printed record.

It will also be evident from the foregoing table and from the wiring diagrams previously discussed that one or more of the counters are controlled exclusively by each key and other counters are controlled by particular sequences in the operation of those keys. Counter 2 is controlled exclusively by key A and registers a unit increment whenever that key goes up. Counter 4, likewise, is controlled exclusively by key A, continuing to register positive increments of time while that key remains down and negative increments of time while that key remains up. Counter 11 alone is controlled exclusively by key B and registers a unit increment whenever that

key goes up. All of the remaining counters that are controlled by the two keys operate in accordance with the sequence in which those keys are moved.

Counter 8 registers one unit, either plus or minus, depending upon which key (plus for A, minus for B) goes up after both keys have been down. Counter 7 registers one unit, either plus or minus, depending upon which key (plus for A, minus for B) goes down after both keys have been up. Counter 9 registers a unit increment when either key alone moves after key A has been up and key B has been down. Counter 10 registers a unit increment when either key is moved after key A has been down and key B has been up. Counter 5 continues to register positive increments of time while both keys remain down after key A goes down, and negative increments of time while both keys remain up after key B goes up. Counter 6 continues to register positive increments of time while both keys remain down after key B goes down, and negative increments of time while both keys remain up after key A goes up.

A typical use of the interaction recorder herein described is in personnel interviews to record the behavior of employees or applicants for employment. There is a marked difference to be found in the capacity of individuals for interaction. Psychotic and psychoneurotic individuals have extreme rates of interaction; they cannot adjust to others, and it is very difficult for normal persons to adjust them. Even normal persons differ widely between themselves. Some are slow and deliberate, others quick and talkative; some can lead, others only follow. Some people can adjust to a wide variety of types; others must interact within narrow limits. There are those who constantly initiate action, running from one person to the other; there are others who must ordinarily wait to be spoken to, who cannot speak to a group, or dominate the interaction. These differences in the interaction rates of individuals can be measured by the apparatus embodying the present invention; and, as a result, employees can be selected for those positions in an organizational structure for which they are most suited. This and other applications of the machine have been successfully demonstrated in actual use.

During the interview, the keys are manually operated by an observer who can watch the actions of the interviewer and the subject. All the observer has to do is press down the keys designated as the interviewer's (assume that it is key B) or the subject's (key A) when that person talks, nods, smiles, or gestures (these all being part of the response pattern and included as activity) and then release the key when that activity ends. The interviewer may follow a standardized behavior pattern that includes some "change of pace" for different periods of the interview. The change from one period to another is indicated on the printed record by momentarily closing switch E in control box 23 at the beginning of each period. This energizes solenoid S1 and causes counter 1 to register one unit, as will be clear from any of the wiring diagrams in Fig. 7 to 17.

One form of interview that has been successfully used is divided into five periods. In the first period, the interviewer tries to adjust to the subject and limits his activity to encouraging phrase, such as "Isn't that interesting," or "Can you give me an example of that." When

the second period begins, the interviewer does not respond when the subject stops talking, and if necessary waits for fifteen seconds before beginning activity himself; and this procedure is repeated twelve times. The third period is an adjustment period similar to the first. In the fourth period, the interviewer interrupts the subject twelve consecutive times and tries to talk him down, using a normal voice. The final period is another one of adjustment. The entire interview lasts about twenty-five minutes.

During the entire interview, the apparatus records the interaction that takes place, indicating the duration of each static condition of interaction and the occurrence of each transitional sequence from one static condition to another. For most purposes, the final cumulative values indicated by the counters afford sufficient data to classify the subject's behavior pattern. In some cases, it is desirable to refer to and compare those values at the end of each period of the interview. For even more precise analysis of behavior patterns, the detailed information on each static condition and the transitional sequences before and after it can be studied on the printed record made by the machine.

If the value indicated by counter 3 (which rotates continuously during the interview and indicates elapsed time in seconds from the beginning or interaction) is divided by the value indicated by counter 2 (A's units of interaction), the quotient represents the mean duration of the subject's (A's) units of interaction, or his tempo. This gives some idea of the rate at which the interaction took place during the interview, or during any one or more of its periods.

Counter 4 (which rotates in a positive direction when the subject is active, and in a negative direction when he is inactive) measures the preponderance of his activity over his inactivity; the more the subject talks, the higher will be the numerical value registered. If the value indicated by counter 4 is divided by the subject's units of interaction (counter 2), the quotient represents the activity rate of the subject.

If the value indicated by counter 7 (which represents the relative frequency of the subject's initiations of action and those of the interviewer) is divided by the subject's units of interaction (counter 2), the quotient is a measure of the subject's initiative. Similarly, if the value indicated by counter 8 (which indicates the number of times that the subject outtalked

The ability of the subject to adjust to the interviewer is measured by dividing the value indicated by counter 5 (the duration of the subject's interruptions, less the duration of his failures to respond promptly) by the value indicated by counter 2. The interviewer's adjustment to the subject is similarly measured by dividing the value indicated by counter 6 by that indicated by counter 2.

The ability of the subject to synchronize with the interviewer is given by dividing the value of counter 3 by that of counter 2. Similarly, the measure of the interviewer's synchronization (in terms of the subject) is given by the quotient of the values indicated by counter 10 and counter 2.

In some cases, it is desirable to compare the foregoing measurements of the subject's behavior with those of the interviewer's; or, in other applications of the machine, it may be desirable to measure the behavior of both A and B, as for example, in analyzing a particular work situation by recording the actual interaction that takes place between a foreman and one of the workmen under him. The tempo, activity rate, etc., of A, in accordance with the convention herein used, are measured by the different ratios given above. The comparable measurements for B (the interviewer, or the other person in the interaction) are based on similar ratios, in which B's units of interaction (indicated by counter 11) are substituted for A's units of interaction (indicated by counter 2). However, since there is no counter which directly and cumulatively registers the duration of B's activity and inactivity (although it is recorded separately for each static condition), it is necessary to calculate the preponderance (or deficiency), of B's activity over his inactivity to obtain a value for B equivalent to that indicated by counter 4 for A. This calculation is a simple one and is given by the algebraic sum of the following: twice the sum of the values indicated by counters 5 and 6, minus the value indicated by counter 4. In other words, if A has been active more than he has been inactive during the interaction (i. e., counter 4 has a plus value), the foregoing algebraic sum will be a negative value, unless the sum of the values indicated by counters 5 and 6 is a plus value and is equal to at least one half of the value indicated by counter 4.

A comparison of the comparable measurements for A and B are given in the following table:

	Ratios for A	Ratios for B
Tempo.....	Counter 3 Counter 2 Counter 4	Counter 3 Counter 11 Twice (Counters 5+6)-(Counter 4)
Activity.....	Counter 2 Counter 7	Counter 11 -(Counter 7)
Initiative.....	Counter 2 Counter 8	Counter 11 -(Counter 8)
Dominance.....	Counter 2 Counter 9	Counter 11 Counter 10
Synchronization.....	Counter 2 Counter 9	Counter 11 Counter 10
Synchronization (in terms of the other person in interaction).....	Counter 11 Counter 5	Counter 2 Counter 6
Adjustment.....	Counter 2 Counter 5	Counter 11 Counter 6
Adjustment (in terms of the other person in interaction).....	Counter 11	Counter 2

the interviewer, less the number of times the interviewer outtalked the subject) is divided by the subject's units of interaction (counter 2), the quotient is a measure of the subject's dominance.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment.

75 However, I desire to have it understood that,

within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. An interaction recorder for recording interaction between two individuals, comprising two control switches (herein differentiated as key A and key B), one for each individual, each switch having two operative positions and each switch being adapted to occupy its first operative position (herein designated as down) during a period of observed activity on the part of one of the individuals and to occupy its second operative position (herein designated as up) during a period of observed inactivity on the part of the same individual; at least one primary electrical circuit that is opened and closed by at least one of the control switches depending upon its operative position; relay means included in the primary circuit; at least one dependent electrical circuit that is opened and closed by the relay means and by the control switches, depending upon the operational sequence in which those switches are moved from one operative position to the other; electrical counter actuating means included in the dependent circuit and adapted to move a counter only one unit when the dependent circuit is closed; the dependent circuit being closed upon the occurrence of only one of the following operational sequences in the movement of the two control switches: key A goes down while key B stays up, key A stays up while key B goes down, key A goes up while key B stays down, key A stays down while key B goes up, either key moves from one of its operative positions to the other after key A is up and key B is down, either key moves from one of its operative positions to the other after key A is down and key B is up, key A goes up regardless of the position or movement of key B, key B goes up regardless of the position or movement of key A.

2. An interaction recorder for recording interaction between two individuals (herein differentiated as A and B), comprising two control switches (herein differentiated as key A and key B), one for each individual, each switch having two operative positions and each switch being adapted to occupy its first operative position (herein designated as down) during a period of observed activity on the part of one of the individuals and to occupy its second operative position (herein designated as up) during a period of observed inactivity on the part of the same individual; a primary electrical circuit that is opened and closed by the control switches; a delayed action relay that is included in the primary circuit and that is initially energized only when both control switches are up, but remains momentarily energized after either control switch goes down; a first dependent electrical circuit that is opened and closed by the relay and by the control switches; a first counter actuating mechanism included in the first dependent circuit and adapted to move a counter one unit upon receiving a pulse of current when the relay remains momentarily energized after key A moves from its up to its down position while key B remains up, thereby indicating that individual A initiated activity after both individuals were inactive; a second dependent electrical circuit that is opened and closed by the relay and by the control switches; and a second counter actuating mechanism included in the second dependent circuit and adapted to move a counter one unit upon receiving a pulse of current when

the relay remains momentarily energized after key B moves from its up to its down position while key A remains up, thereby indicating that individual B initiated activity after both individuals were inactive.

3. An interaction recorder according to claim 2, in which the first counter actuating mechanism is adapted to move a counter one unit in one direction and the second counter actuating mechanism is adapted to move the same counter one unit in the opposite direction.

4. An interaction recorder for recording interaction between two individuals (herein differentiated as A and B), comprising two control switches (herein differentiated as key A and key B), one for each individual, each switch having two operative positions and each switch being adapted to occupy its first operative position (herein designated as down) during a period of observed activity on the part of one of the individuals and to occupy its second operative position (herein designated as up) during a period of observed inactivity on the part of the same individual; a primary electrical circuit that is opened and closed by the control switches; a delayed action relay that is included in the primary circuit and that is initially energized only when both control switches are down but remains momentarily energized after either control switch goes up; a first dependent electrical circuit that is opened and closed by the relay and by the control switches; a first counter actuating mechanism included in the first dependent circuit and adapted to move a counter one unit upon receiving a pulse of current when the relay remains momentarily energized after key A moves from its down to its up position while key B remains down, thereby indicating that individual A ceased activity after both individuals were active; a second dependent electrical circuit that is opened and closed by the relay and by the control switches; and a second counter actuating mechanism included in the second dependent circuit and adapted to move a counter one unit upon receiving a pulse of current when the relay remains momentarily energized after key B moves from its down to its up position while key A remains down, thereby indicating that individual B ceased activity after both individuals were active.

5. An interaction recorder according to claim 4, in which the first counter actuating mechanism is adapted to move a counter one unit in one direction and the second counter actuating mechanism is adapted to move the same counter one unit in the opposite direction.

6. An interaction recorder for recording interaction between two individuals (herein differentiated as A and B), comprising two control switches (herein differentiated as key A and key B), one for each individual, each switch having two operative positions and each switch being adapted to occupy its first operative position (herein designated as down) during a period of observed activity on the part of one of the individuals and to occupy its second operative position (herein designated as up) during a period of observed inactivity on the part of the same individual; a first primary electrical circuit that is opened and closed by key A alone; a first delayed action relay that is included in the first primary circuit and that is initially energized only when key A is up; a second primary electrical circuit that is opened and closed by key B alone; a second delayed action relay that

is included in the second primary circuit and that is initially energized only when key B is down, each of the relays remaining momentarily energized when its respective control switch moves from said energizing position; a dependent electrical circuit that is momentarily closed only after both relays have been simultaneously energized at the same time as both control switches have occupied the same operative positions; a counter actuating mechanism included in the dependent circuit and adapted to move a counter one unit upon receiving a pulse of current after either control switch has moved from one of its operative positions to the other after key A has been up and key B has been down, thereby indicating that individual A has failed to synchronize his activity with that of individual B, either by interrupting individual B or by failing to respond promptly when individual B has ceased his activity.

7. An interaction recorder according to claim 6, in which a third and fourth delayed action relays are interposed between the first and second primary circuits on the one hand and the dependent circuit on the other hand, the third relay being initially energized only when both said first and second delayed action relays are simultaneously energized at the same time as both control switches occupy the same operative positions but remaining momentarily energized after either control switch moves from said operative position, the fourth relay being initially energized only when the third relay is energized but remaining momentarily energized thereafter, and the dependent circuit being opened and closed by the fourth relay and being closed only when that relay is energized.

8. An interaction recorder for recording interaction between two individuals (herein differentiated as A and B), comprising two control switches (herein differentiated as key A and key B), one for each individual, each switch having two operative positions and each switch being adapted to occupy its first operative position (herein designated as down) during a period of observed activity on the part of one of the individuals and to occupy its second operative position (herein designated as up) during a period of observed inactivity on the part of the same individual; a first primary circuit that is opened and closed by key A alone; a first delayed action relay that is included in the first primary circuit and that is initially energized only when key A is down; a second primary electrical circuit that is opened and closed by key B alone; a second delayed action relay that is included in the second primary circuit and that is initially energized only when key B is up, each of the relays remaining momentarily energized when its respective control switch moves from said energizing position; a dependent electrical circuit that is momentarily closed only after both relays have been simultaneously energized at the same time as both control switches have occupied the same operative positions; a counter actuating mechanism included in the dependent circuit and adapted to move a counter one unit upon receiving a pulse of current after either control switch has moved from one of its operative positions to the other after key A has been down and key B has been up, thereby indicating that individual B has failed to synchronize his activity with that of individual A, either by interrupting individual A or by failing to respond promptly after individual A has ceased his activity.

9. An interaction recorder according to claim 8, in which a third, fourth, and fifth delayed action relays are interposed between the first and second primary circuits on the one hand and the dependent circuit on the other hand, the third relay being initially energized only when both said first and second delayed action relays are simultaneously energized at the same time as both control switches occupy the same operative positions, the fourth relay being initially energized only when the third relay is energized, the fifth relay being initially energized only when the fourth relay is energized, each of said interposed relays remaining momentarily energized after its energizing relay is deenergized, and the dependent circuit being opened and closed by both the fourth and fifth relays and being closed only when the fifth relay remains momentarily energized after the fourth relay has been deenergized.

10. An interaction recorder for recording interaction between two individuals (herein differentiated as A and B), comprising two control switches (herein differentiated as key A and key B), one for each individual, each switch having two operative positions and each switch being adapted to occupy its first operative position (herein designated as down) during a period of observed activity on the part of one of the individuals and to occupy its second operative position (herein designated as up) during a period of observed inactivity on the part of the same individual; a primary electrical circuit that is opened and closed by key A alone; a first delayed action relay that is included in the primary circuit and that is initially energized only when key A is down but remains momentarily energized after key A goes up; a first dependent electrical circuit that is opened and closed by the first relay; a second delayed action relay that is included in the first dependent circuit and that is initially energized only when the first relay is energized but remains momentarily energized after the first relay is deenergized; a second dependent circuit that is opened and closed by both relays and that is closed only when the second relay remains momentarily energized after the first relay has been deenergized; a counter actuating mechanism included in the second dependent circuit and adapted to move a counter one unit upon receiving a pulse of current whenever key A goes up, thereby indicating that individual A has completed a unit of interaction.

11. An interaction recorder for recording interaction between two individuals (herein differentiated as A and B), comprising two control switches (herein differentiated as key A and key B), one for each individual, each switch having two operative positions and each switch being adapted to occupy its first operative position (herein designated as down) during a period of observed activity on the part of one of the individuals and to occupy its second operative position (herein designated as up) during a period of observed inactivity on the part of the same individual; a primary circuit that is opened and closed by key B alone; a first delayed action relay that is included in the first primary circuit and that is initially energized only when key B is down but remains momentarily energized after key B goes up; a first dependent electrical circuit that is opened and closed by the first relay; a second delayed action relay that is included in the first dependent circuit and that is initially energized only when the first relay

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is energized but remains momentarily energized after the first relay is deenergized; a second dependent circuit that is opened and closed by both relays and that is closed only when the second relay remains momentarily energized after the first relay has been deenergized; a counter actuating mechanism included in the second dependent circuit and adapted to move a counter one unit upon receiving a pulse of current whenever key B goes up, thereby indicating that individual B has completed a unit of interaction.

12. An interaction recorder for recording interaction between two individuals, comprising two control switches (herein differentiated as key A and key B), one for each individual, each switch having two operative positions and each switch being adapted to occupy its first operative position (herein designated as down) during a period of observed activity on the part of one of the individuals and to occupy its second operative position (herein designated as up) during a period of observed inactivity on the part of the same individual; a plurality of primary electrical circuits that are opened and closed by the control switches, depending upon the operative positions of those switches; delayed action relay means included in each primary circuit; a plurality of dependent electrical circuits that are opened and closed by the relay means and by the control switches, depending upon the operational sequence in which those switches are moved from one operative position to the other; an electrical counter actuating means included in one of the dependent circuits and adapted to move a counter only one unit when its including dependent circuit is closed by the occurrence of only one of the following operational sequences in the movement of the two control switches: key A goes down while key B stays up, key A stays up while key B goes down, key A goes up while key B stays down, key A stays down while key B goes up, either key moves from one of its operative positions to the other after key A is up and key B is down, and either key moves from one of its operative positions to the other after key A is down and key B is up; a counter moved by said actuating mechanism to indicate values in unit increments; a power mechanism included in one of the dependent circuits that is closed when one of the control switches moves from one of its operative positions to the other; and a web of paper supported in recording relationship to the counter and fed past the counter by the power mechanism, the counter being adapted to cooperate with the web of paper to record a series of values thereon.

13. An interaction recorder for recording interaction between two individuals (herein differentiated as A and B), comprising two control switches (herein differentiated as key A and key B), one for each individual, each switch having two operative positions and each switch being adapted to occupy its first operative position (herein designated as down) during a period of observed activity on the part of one of the individuals and to occupy its second operative position (herein designated as up) during a period of observed inactivity on the part of the same individual; a plurality of simple relays, each having a coil and at least one associated switch arm with two operative positions; a first electrical control circuit including key A in series with the coil of a first relay, the circuit being open and the switch arm associated with said coil assum-

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ing its first operative position when key A is up and the circuit being closed and said switch arm assuming its second operative position when key A is down; a second electrical control circuit including key B in series with the coil of a second relay having two associated switch arms, said circuit being open and both of said switch arms assuming their first operative positions when key B is up and said circuit being closed and both of said switch arms assuming their second operative positions when key B is down; a primary electrical circuit including when closed the switch arm of the first relay and the second switch arm of the second relay connected in series in their first operative positions (i. e., when both keys are up), said circuit being broken when either of said switch arms moves from its first to its second operative position (i. e., when either key moves down); a delayed action relay having a winding and an associated switch arm with an open and closed position, the winding of the delayed action relay being connected in the primary circuit in series with said interconnected switch arms of the simple relays, said winding being energized and its associated switch arm assuming its closed position when the primary electrical circuit is closed (i. e., when both keys are up) and said winding remaining momentarily energized and its associated switch arm remaining momentarily in that closed position after the primary circuit is broken (i. e., after either key moves down); a first dependent electrical circuit including (1) the switch arm of the delayed action relay when that arm is in its closed position, (2) the switch arm of the first simple relay when this latter arm is in its second operative position (i. e., when key A has moved to its down position), and (3) the first switch arm of the second simple relay when this last arm is in its first operative position (i. e., while key B remains up); so that the first dependent circuit is closed only when key A moves from its up to its down position while key B remains up and stays energized only momentarily during the holding period of the delayed action relay; a first counter actuating mechanism included in the first dependent circuit and adapted to move a counter one unit upon receiving a pulse of current when that circuit is momentarily closed after key A moves from its up to its down position while key B remains up, thereby indicating that individual A initiated activity after both individuals were inactive; a second dependent electrical circuit including (1) the switch arm of the delayed action relay when that arm is in its closed position, (2) the second switch arm of the second simple relay when this latter arm is in its second operative position (i. e., when key B has moved to its down position), and (3) the switch arm of the first simple relay when this last arm is in its first operative position (while key A remains up), the second dependent circuit being closed only when key B moves from its up to its down position while key A remains up and stays closed only momentarily during the holding period of the delayed action relay; a second counter actuating mechanism included in the second dependent circuit and adapted to move a counter one unit upon receiving a pulse of current when that circuit is momentarily closed after key B moves from its up to its down position while key A remains up, thereby indicating that individual B initiated activity after both individuals were inactive.

14. An interaction recorder according to claim 13, in which the first counter actuating mech-

anism is adapted to move a counter one unit in one direction and the second counter actuating mechanism is adapted to move the same counter one unit in the opposite direction.

15. An interaction recorder for recording interaction between two individuals (herein differentiated as A and B), comprising two control switches (herein differentiated as key A and key B), one for each individual, each switch having two operative positions and each switch being adapted to occupy its first operative position (herein designated as down) during a period of observed activity on the part of one of the individuals and to occupy its second operative position (herein designated as up) during a period of observed inactivity on the part of the same individual; a plurality of simple relays, each having a coil and at least one associated switch arm with two operative positions; a first electrical control circuit including key A in series with the coil of a first relay, the circuit being open and the switch arm associated with said coil assuming its first operative position when key A is up and the circuit being closed and said switch arm assuming its second operative position when key A is down; a second electrical control circuit including key B in series with the coil of a second relay having two associated switch arms, said circuit being open and both of said switch arms assuming their first operative positions when key B is up and said circuit being closed and both of said switch arms assuming their second operative positions when key B is down; a primary electrical circuit including when closed the switch arm of the first relay and the first switch arm of the second relay connected in series in their second operative positions (i. e., when both keys are down), said circuit being broken when either switch arm moves from its second to its first operative position (i. e., when either key moves up); a delayed action relay having a winding and an associated switch arm with an open and closed position, the winding of the delayed action relay being connected in the primary circuit in series with said interconnected switch arms of the simple relays, said winding being energized and its associated switch arm assuming its closed position when the primary electrical circuit is closed (i. e., when both keys are down) and said winding remaining momentarily energized and its associated switch arm remaining momentarily in that closed position after the primary circuit is broken (i. e., after either key moves up); a first dependent electrical circuit including (1) the switch arm of the delayed action relay when that arm is in its closed position, (2) the first switch arm of the second simple relay when this latter arm is in its first operative position (i. e., when key B has moved to its up position), and (3) the switch arm of the first simple relay when this last arm is in its second operative position (i. e., while key A remains down); so that the first dependent circuit is closed only when key B moves from its down to its up position while key A remains down and stays energized only momentarily during the holding period of the delayed action relay; a first counter actuating mechanism included in the first dependent circuit and adapted to move a counter one unit upon receiving a pulse of current when that circuit is momentarily closed after key B moves from its down to its up position while key A remains down, thereby indicating that individual B ceased ac-

tivity after both individuals were active; a second dependent electrical circuit including (1) the switch arm of the delayed action relay when that arm is in its closed position, (2) the switch arm of the first simple relay when this latter arm is in its first operative position (i. e., when key A has moved to its up position), and (3) the second switch arm of the second simple relay when this last arm is in its second operative position (while key B remains down), the second dependent circuit being closed only when key A moves from its down to its up position while key B remains down and stays closed only momentarily during the holding period of the delayed action relay; a second counter actuating mechanism included in the second dependent circuit and adapted to move a counter one unit upon receiving a pulse of current when that circuit is momentarily closed after key A moves from its down to its up position while key B remains down, thereby indicating that individual A ceased activity after both individuals were active.

16. An interaction recorder according to claim 15, in which the first counter actuating mechanism is adapted to move a counter one unit in one direction and the second counter actuating mechanism is adapted to move the same counter one unit in the opposite direction.

17. An interaction recorder for recording interaction between two individuals (herein differentiated as A and B), comprising two control switches (herein differentiated as key A and key B), one for each individual, each switch having two operative positions and each switch being adapted to occupy its first operative position (herein designated as down) during a period of observed activity on the part of one of the individuals and to occupy its second operative position (herein designated as up) during a period of observed inactivity on the part of the same individual; a plurality of simple relays, each having a coil and at least one associated switch arm with two operative positions; a first electrical control circuit including key A in series with the coil of a first relay, the circuit being open and the switch arm associated with said coil assuming its first operative position when key A is up and the circuit being closed and said switch arm assuming its second operative position when key A is down; a second electrical control circuit including key B in series with the coil of a second relay having two associated switch arms, said circuit being open and both of said switch arms assuming their first operative positions when key B is up and said circuit being closed and both of said switch arms assuming their second operative positions when key B is down; a first primary electrical circuit including when closed the switch arm of the first relay and the second switch arm of the second relay connected in series in their first operative positions (i. e., when both keys are up), said circuit being broken when either of said switch arms moves from its first to its second operative position (i. e., when either key moves down); a first delayed action relay having a winding and an associated switch arm with an open and closed position, the winding of the delayed action relay being connected in the first primary circuit in series with said interconnected switch arms of the simple relays, said winding being energized and its associated switch arm assuming its closed position when the first primary electrical circuit

is closed (i. e., when both keys are up) and said winding remaining momentarily energized and its associated switch arm remaining momentarily in that closed position after the first primary circuit is broken (i. e., after either key moves down); a first dependent electrical circuit including (1) the switch arm of the first delayed action relay when that arm is in its closed position, (2) the switch arm of the first simple relay when this latter arm is in its second operative position (i. e., when key A has moved to its down position), and (3) the first switch arm of the second simple relay when this last arm is in its first operative position (i. e., while key B remains up); so that the first dependent circuit is closed only when key A moves from its up to its down position while key B remains up and stays energized only momentarily during the holding period of the first delayed action relay; a first counter actuating mechanism included in the first dependent circuit and adapted to move a counter one unit upon receiving a pulse of current when that circuit is momentarily closed after key A moves from its up to its down position while key B remains up, thereby indicating that individual A initiated activity after both individuals were inactive; a second primary electrical circuit including when closed the switch arm of the first simple relay and the first switch arm of the second simple relay connected in series in their second operative positions (i. e., when both keys are down), said circuit being broken when either switch arm moves from its second to its first operative position (i. e., when either key moves up); a second delayed action relay having a winding and an associated switch arm with an open and closed position, the winding of the second delayed action relay being connected in the second primary circuit in series with said interconnected switch arms of the simple relays, said winding being energized and its associated switch arm assuming its closed position only when the second primary electrical circuit is closed (i. e., when both keys are down), and said winding remaining momentarily energized and its associated switch arm remaining momentarily in that closed position after the second primary circuit is broken (i. e., after either key moves up); a second dependent electrical circuit including (1) the switch arm of the second delayed action relay when that arm is in its closed position, (2) the first switch arm of the second simple relay when this latter arm is in its first operative position (i. e., when key B has moved to its up position), and (3) the switch arm of the first simple relay when this last arm is in its second operative position (i. e., while key A remains down); so that the second dependent circuit is closed only when key B moves from its down to its up position while key A remains down and stays energized only momentarily during the holding period of the delayed action relay; a second counter actuating mechanism included in the second dependent circuit and adapted to move a counter one unit upon receiving a pulse of current when that circuit is momentarily closed after key B moves from its down to its up position while key A remains down, thereby indicating that individual B ceased activity after both individuals were active.

18. An interaction recorder for recording interaction between two individuals (herein differentiated as A and B), comprising two control

switches (herein differentiated as key A and key B), one for each individual, each switch having two operative positions and each switch being adapted to occupy its first operative position (herein designated as down) during a period of observed activity on the part of one of the individuals and to occupy its second operative position (herein designated as up) during a period of observed inactivity on the part of the same individual; a plurality of simple relays, each having a coil and at least one associated switch arm with two operative positions; a first electrical control circuit including key A in series with the coil of a first relay, the circuit being open and the switch arm associated with said coil assuming its first operative position when key A is up and the circuit being closed and said switch arm assuming its second operative position when key A is down; a second electrical control circuit including key B in series with the coil of a second relay having two associated switch arms, said circuit being open and both of said switch arms assuming their first operative positions when key B is up and said circuit being closed and both of said switch arms assuming their second operative positions when key B is down; a first primary electrical circuit including when closed the switch arm of the first relay and the second switch arm of the second relay connected in series in their first operative positions (i. e., when both keys are up), said circuit being broken when either of said switch arms moves from its first to its second operative position (i. e., when either key moves down); a first delayed action relay having a winding and an associated switch arm with an open and closed position, the winding of the delayed action relay being connected in the first primary circuit in series with said interconnected switch arms of the simple relays, said winding being energized and its associated switch arm assuming its closed position when the primary electrical circuit is closed (i. e., when both keys are up) and said winding remaining momentarily energized and its associated switch arm remaining momentarily in that closed position after the primary circuit is broken (i. e., after either key moves down); a first dependent electrical circuit including (1) the switch arm of the first delayed action relay when that arm is in its closed position, (2) the second switch arm of the second simple relay when this latter arm is in its second operative position (i. e., when key B has moved to its down position), and (3) the switch arm of the first simple relay when this last arm is in its first operative position (while key A remains up), the first dependent circuit being closed only when key B moves from its up to its down position while key A remains up and stays closed only momentarily during the holding period of the first delayed action relay; a first counter actuating mechanism included in the first dependent circuit and adapted to move a counter one unit upon receiving a pulse of current when that circuit is momentarily closed after key B moves from its up to its down position while key A remains up, thereby indicating that individual B initiated activity after both individuals were inactive; a second primary electrical circuit including when closed the switch arm of the first relay and the first switch arm of the second relay connected in series in their second operative positions (i. e., when both keys are down), said circuit being broken when either switch arm moves from its second to its first operative position (i. e., when either key moves up); a second

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delayed action relay having a winding and an associated switch arm with an open and closed position, the winding of the second delayed action relay being connected in the second primary circuit in series with said interconnected switch arms of the simple relays, said winding being energized and its associated switch arm assuming its closed position only when the second primary electrical circuit is closed (i. e., when both keys are down) and said winding remaining momentarily energized and its associated switch arm remaining momentarily in that closed position after the second primary circuit is broken (i. e., after either key moves up); a second dependent electrical circuit including (1) the switch arm of the second delayed action relay when that arm is in its closed position, (2) the switch arm of the first simple relay when this latter arm is in its first operative position (i. e., when key A has moved to its up position), and (3) the second switch arm of the second simple relay when this last arm is in its second operative position (while key B remains down), the second dependent circuit being closed only when key A moves from its down to its up position while key B remains

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down and stays closed only momentarily during the holding period of the second delayed action relay; a second counter actuating mechanism included in the second dependent circuit and adapted to move a counter one unit upon receiving a pulse of current when that circuit is momentarily closed after key A moves from its down to its up position while key B remains down, thereby indicating that individual A ceased activity after both individuals were active.

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