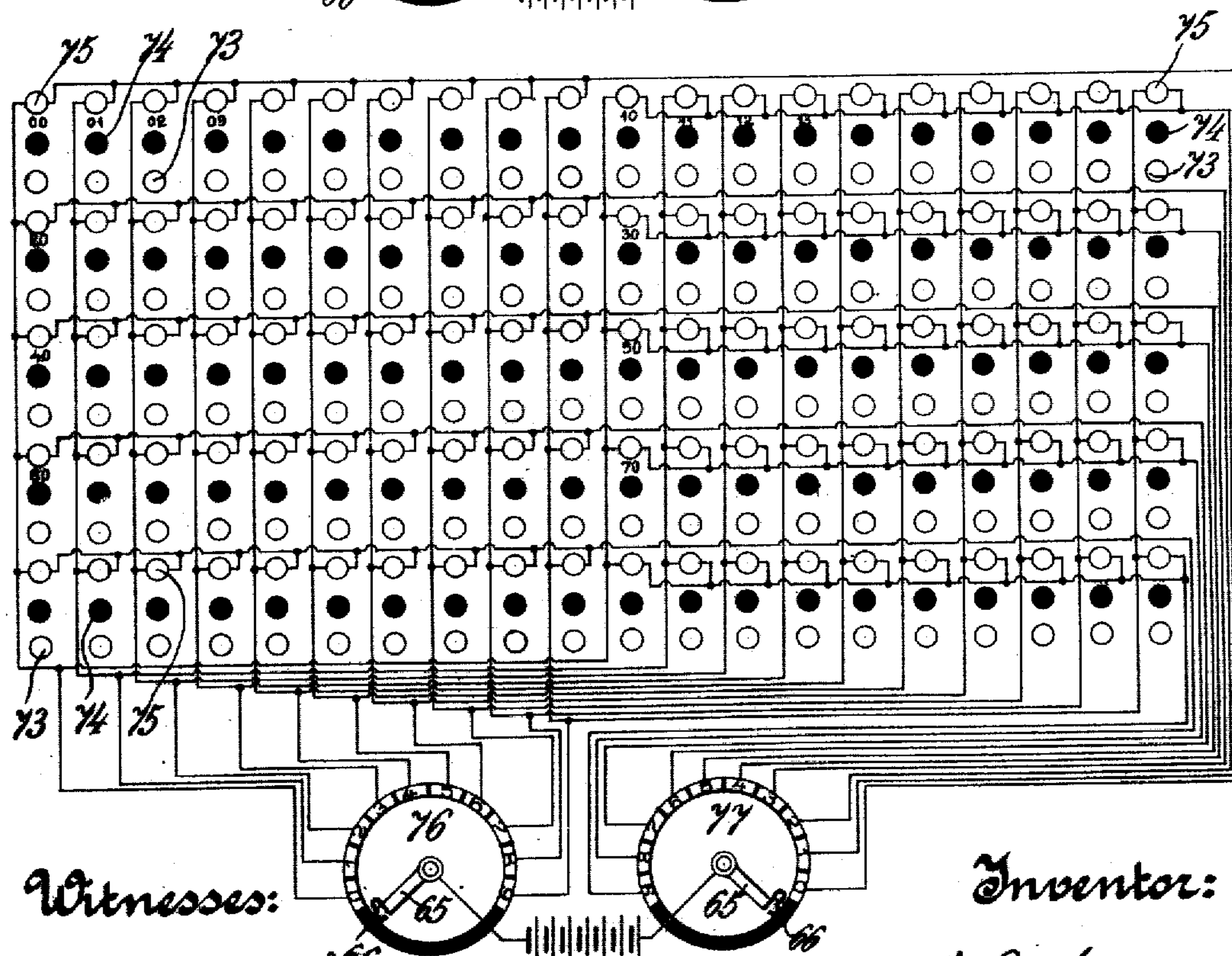
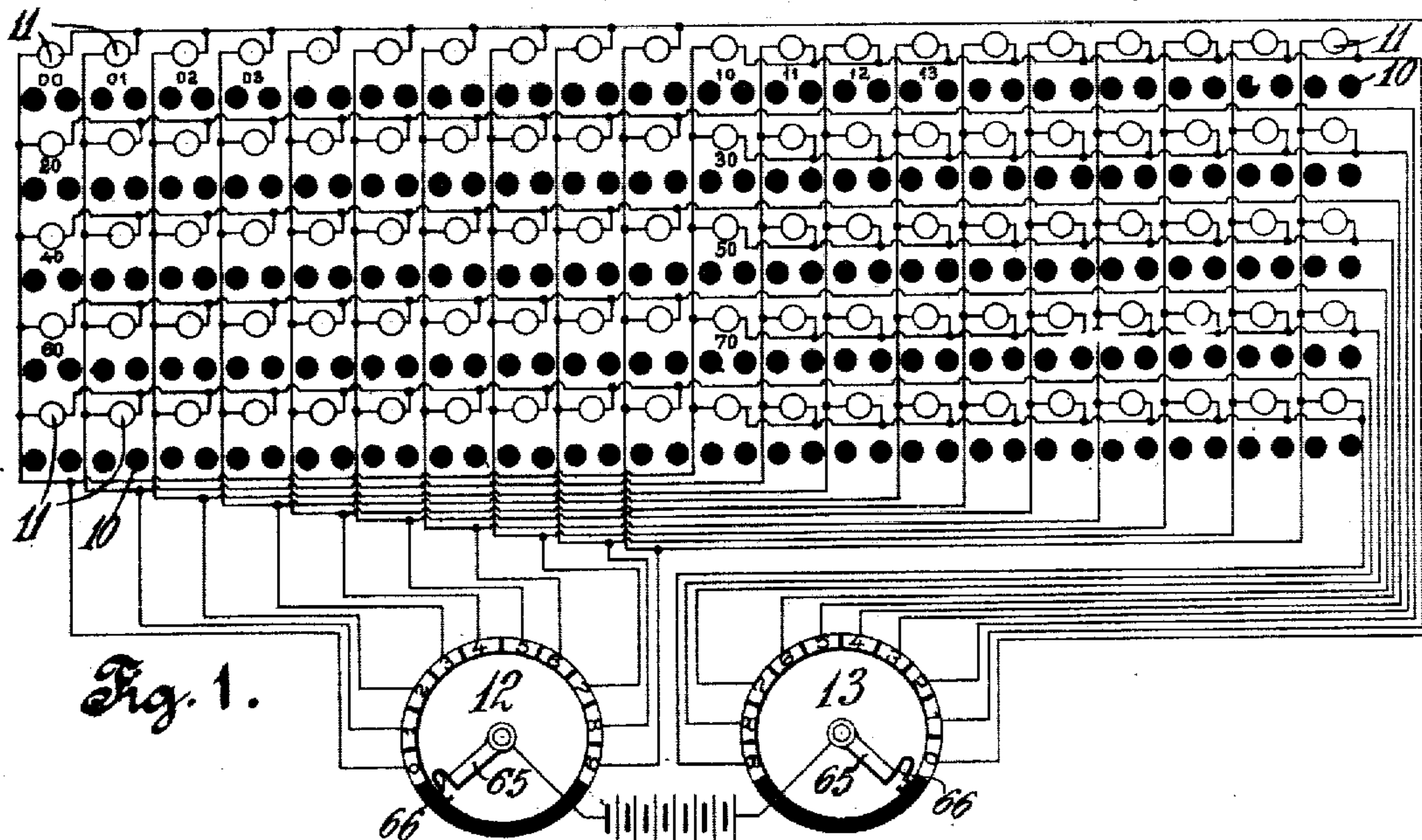


E. A. FALLER.  
VISUAL SIGNAL RECEIVING SYSTEM.

APPLICATION FILED JULY 28, 1903.

5 SHEETS—SHEET 1.



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Fig. 2.

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No. 822,888.

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5 SHEETS—SHEET 2.

Fig. 3.

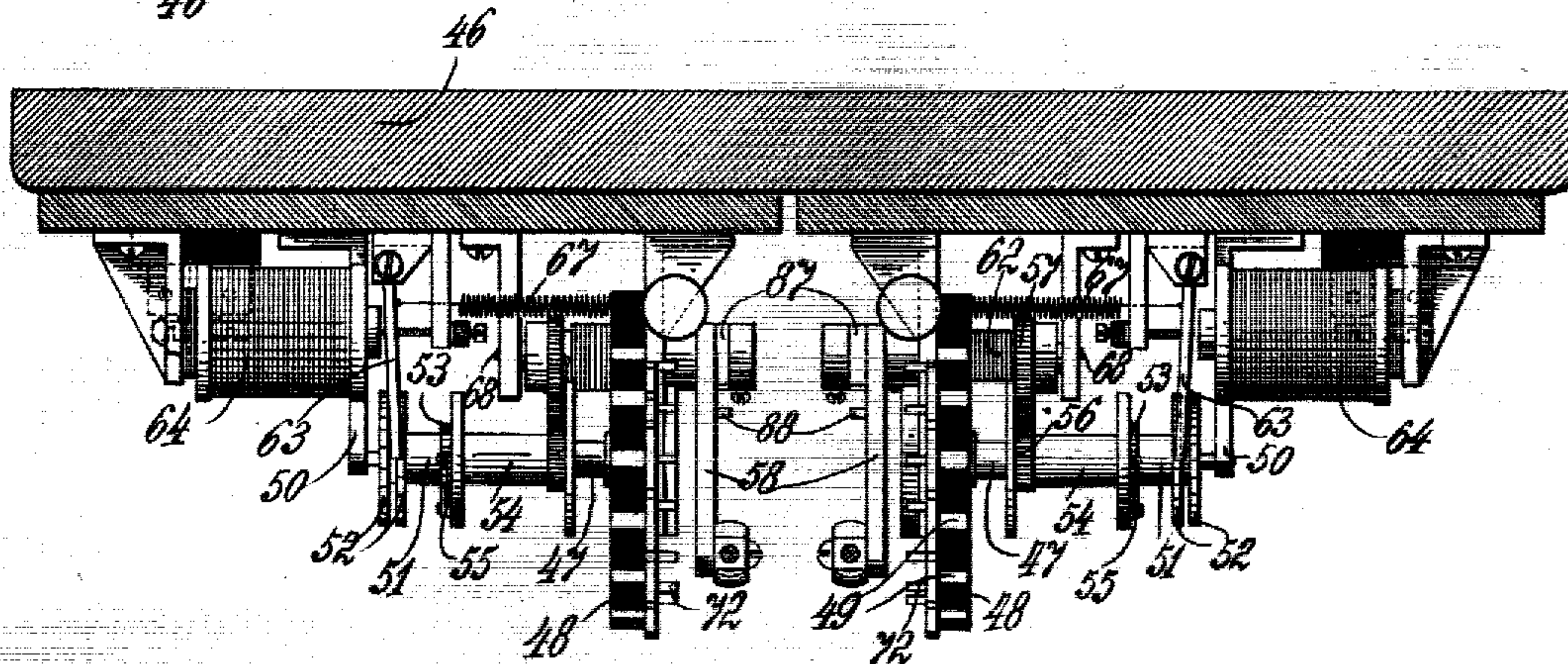
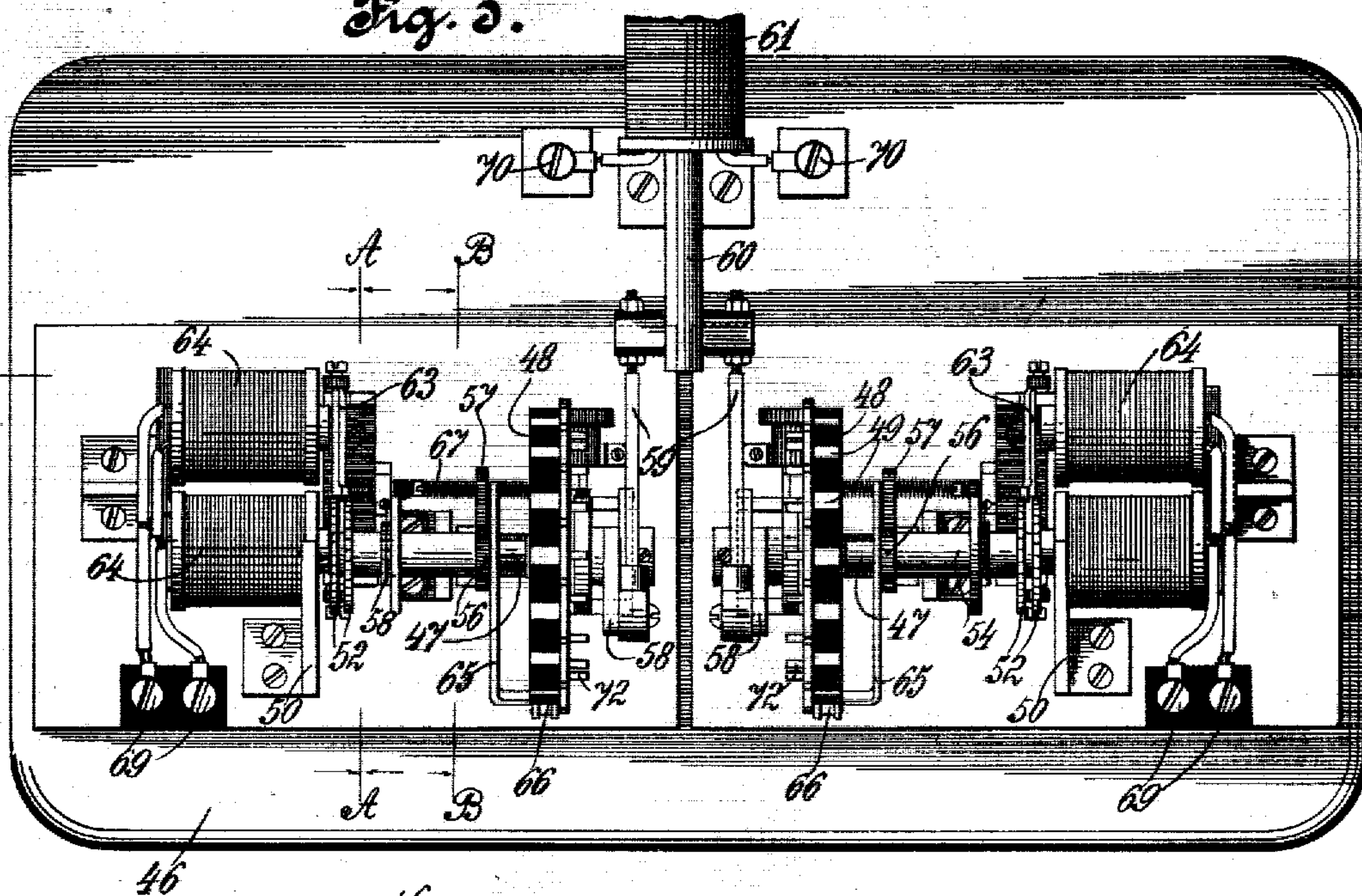


Fig. 4.

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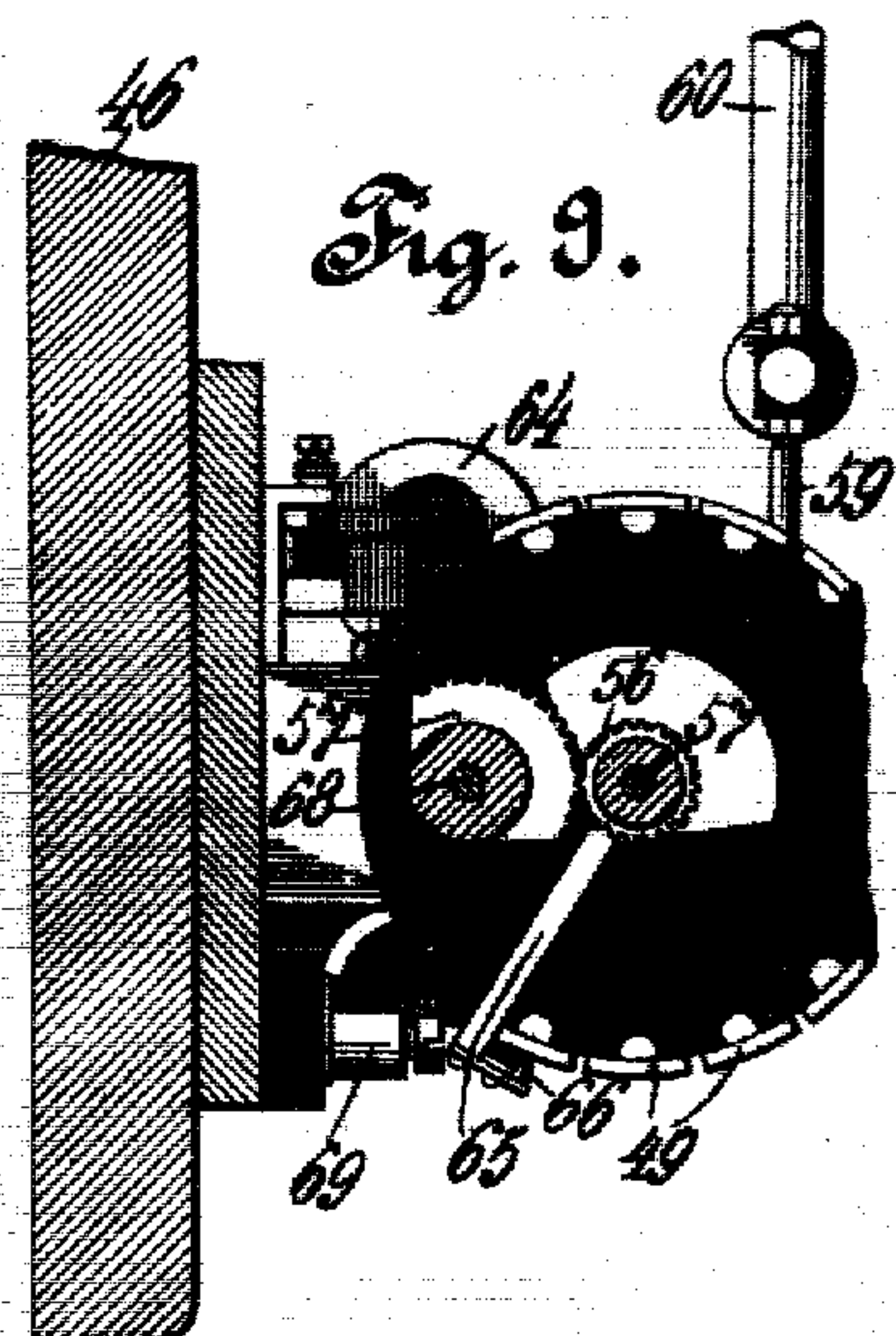
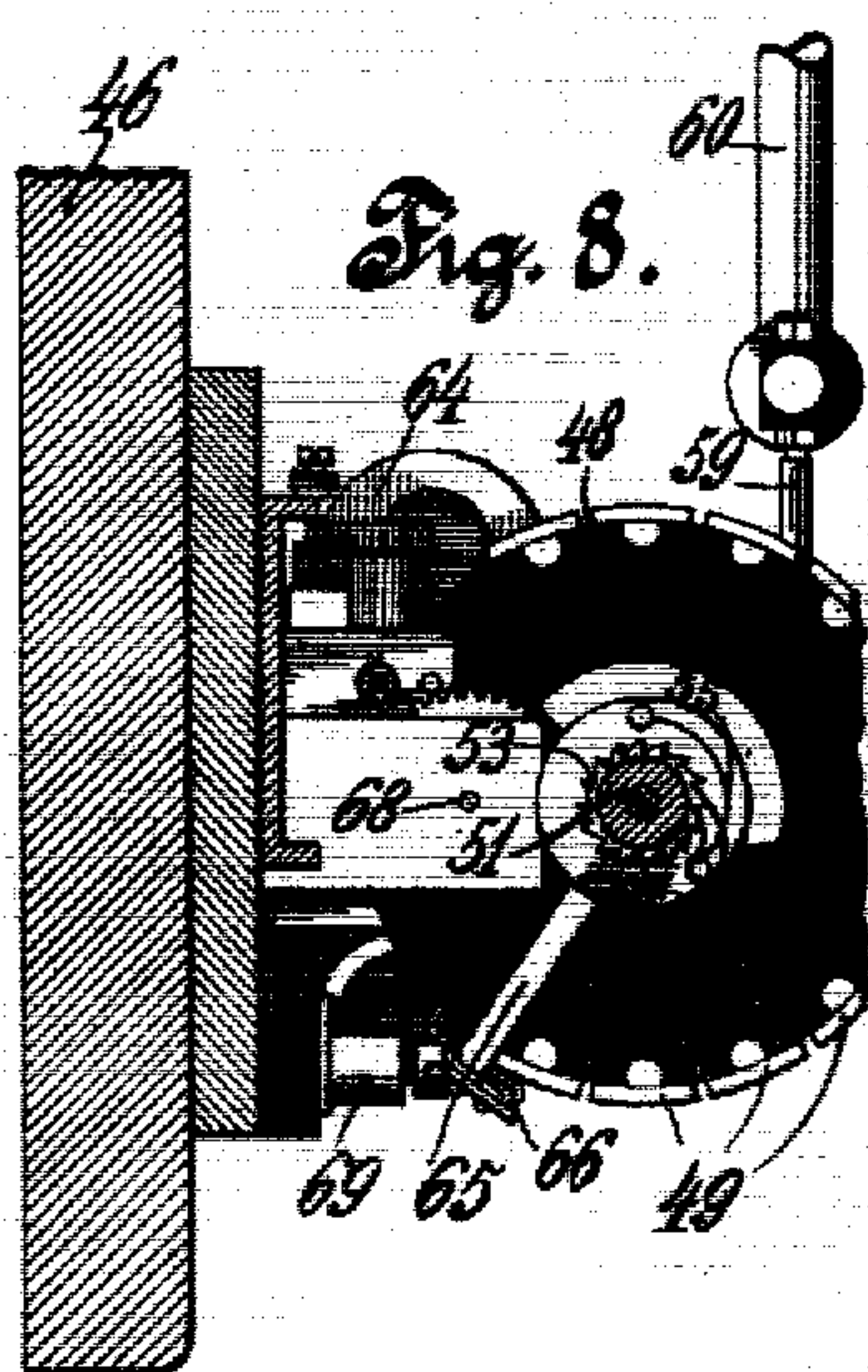
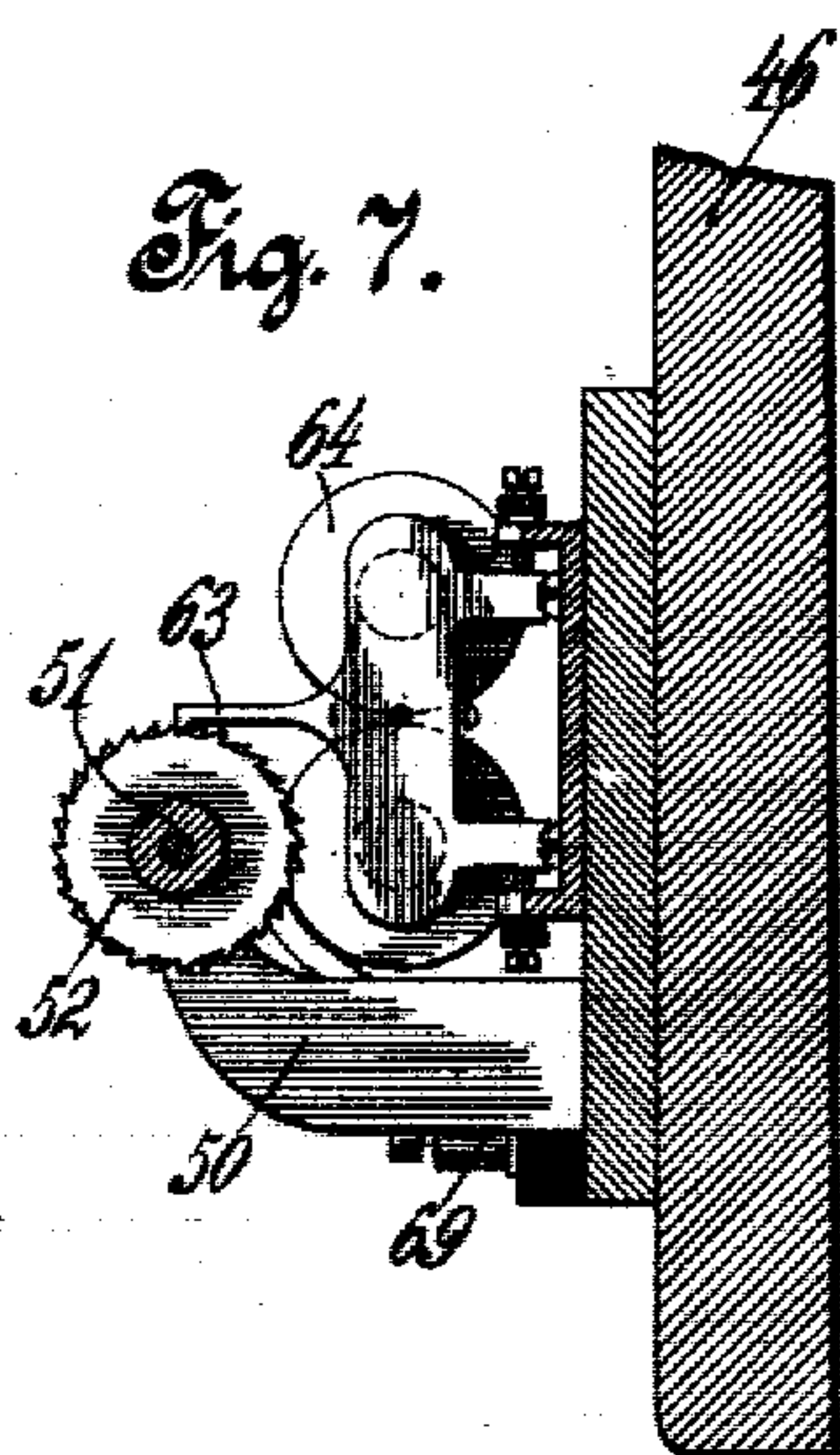
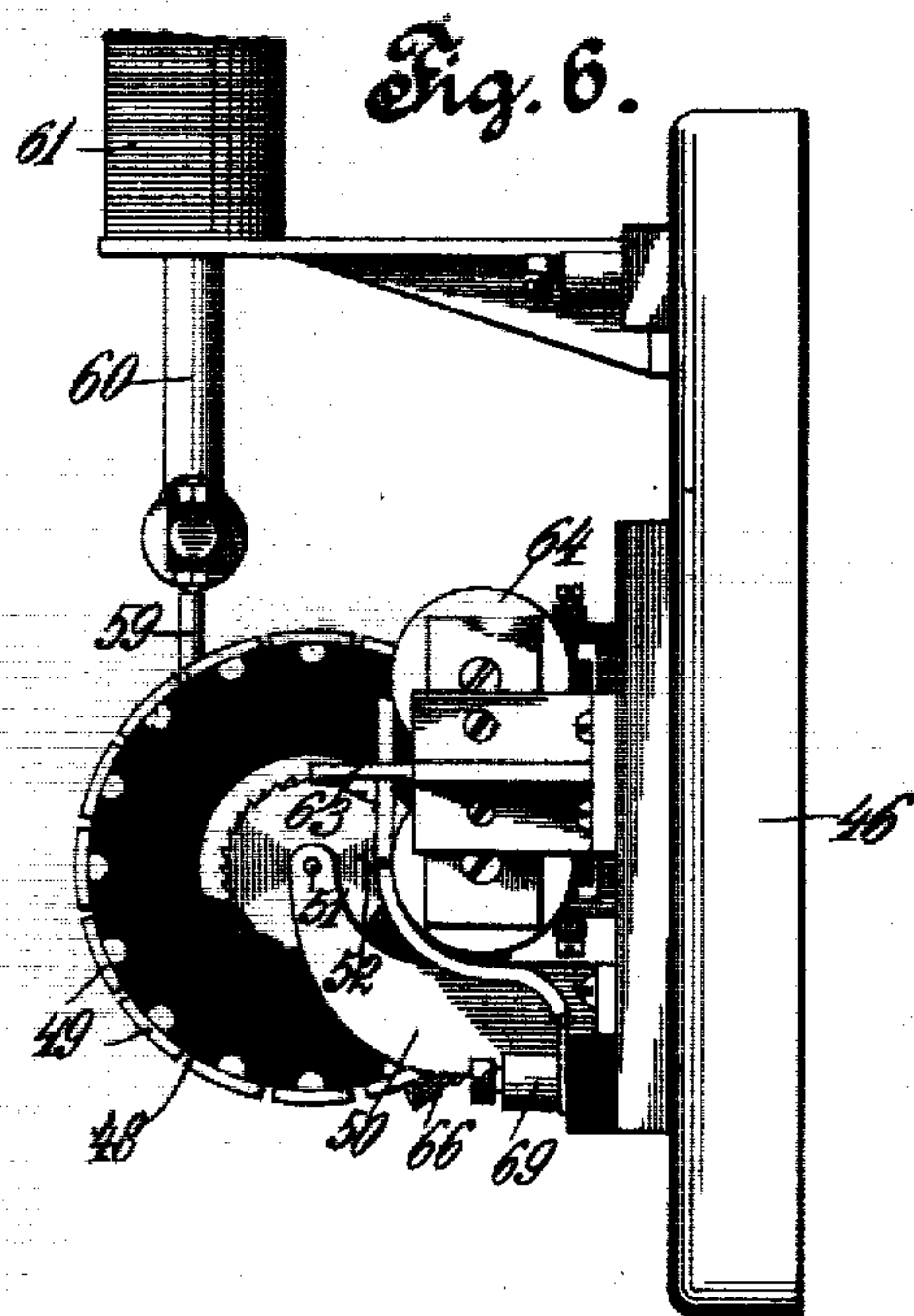
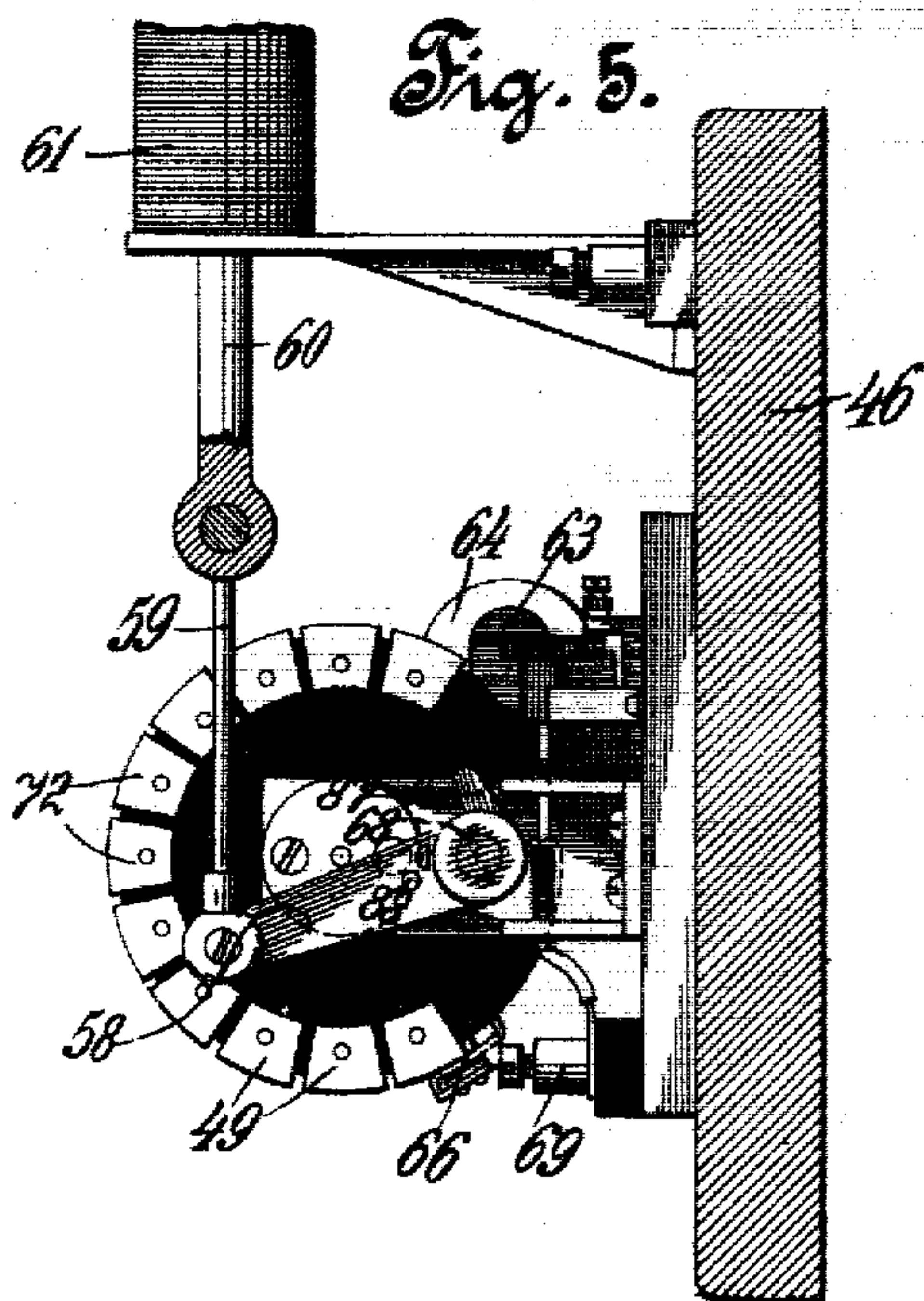


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5 SHEETS—SHEET 3.



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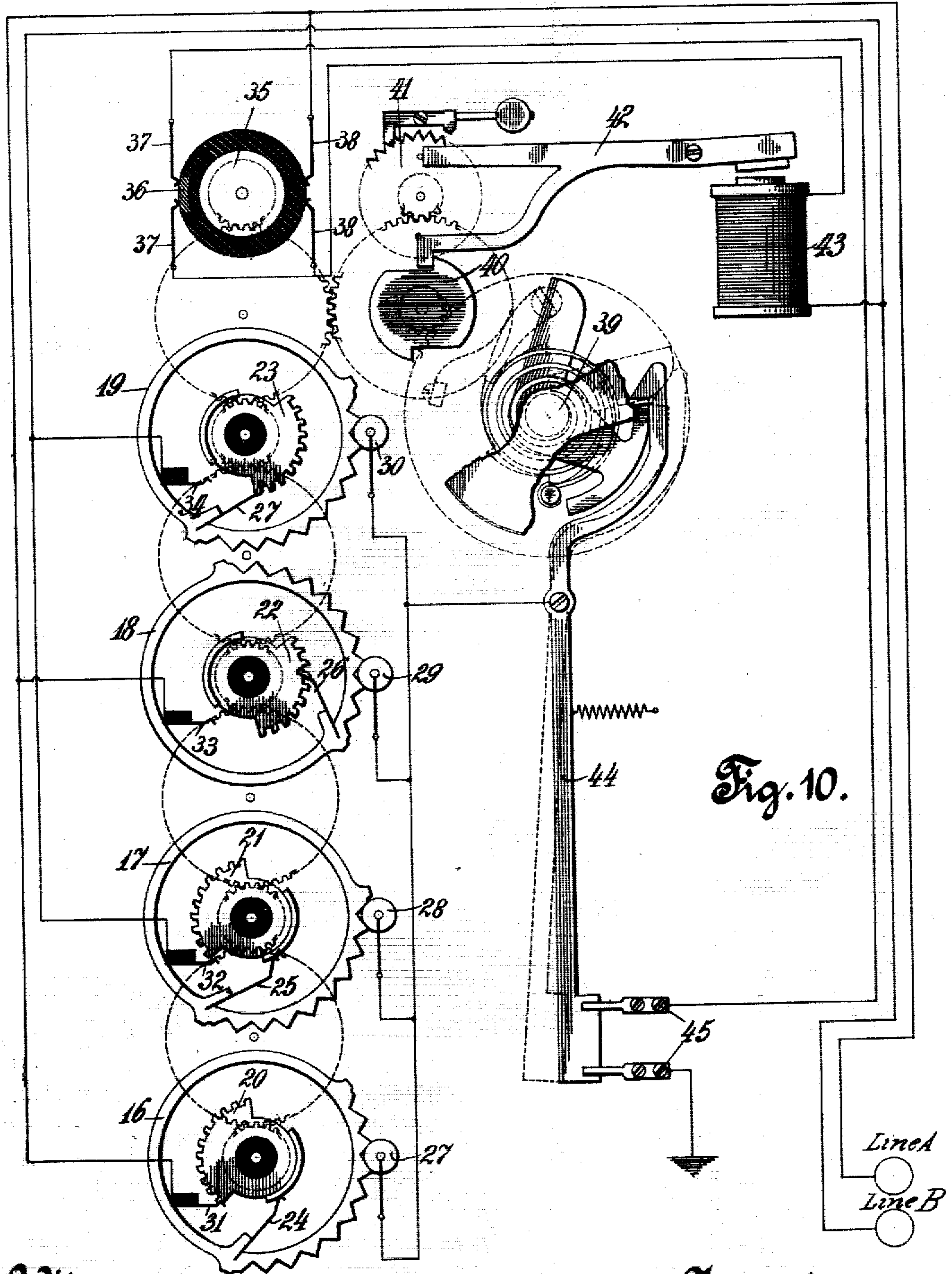
No. 822,888.

PATENTED JUNE 5, 1906.

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VISUAL SIGNAL RECEIVING SYSTEM.

APPLICATION FILED JULY 28, 1903.

5 SHEETS—SHEET 4



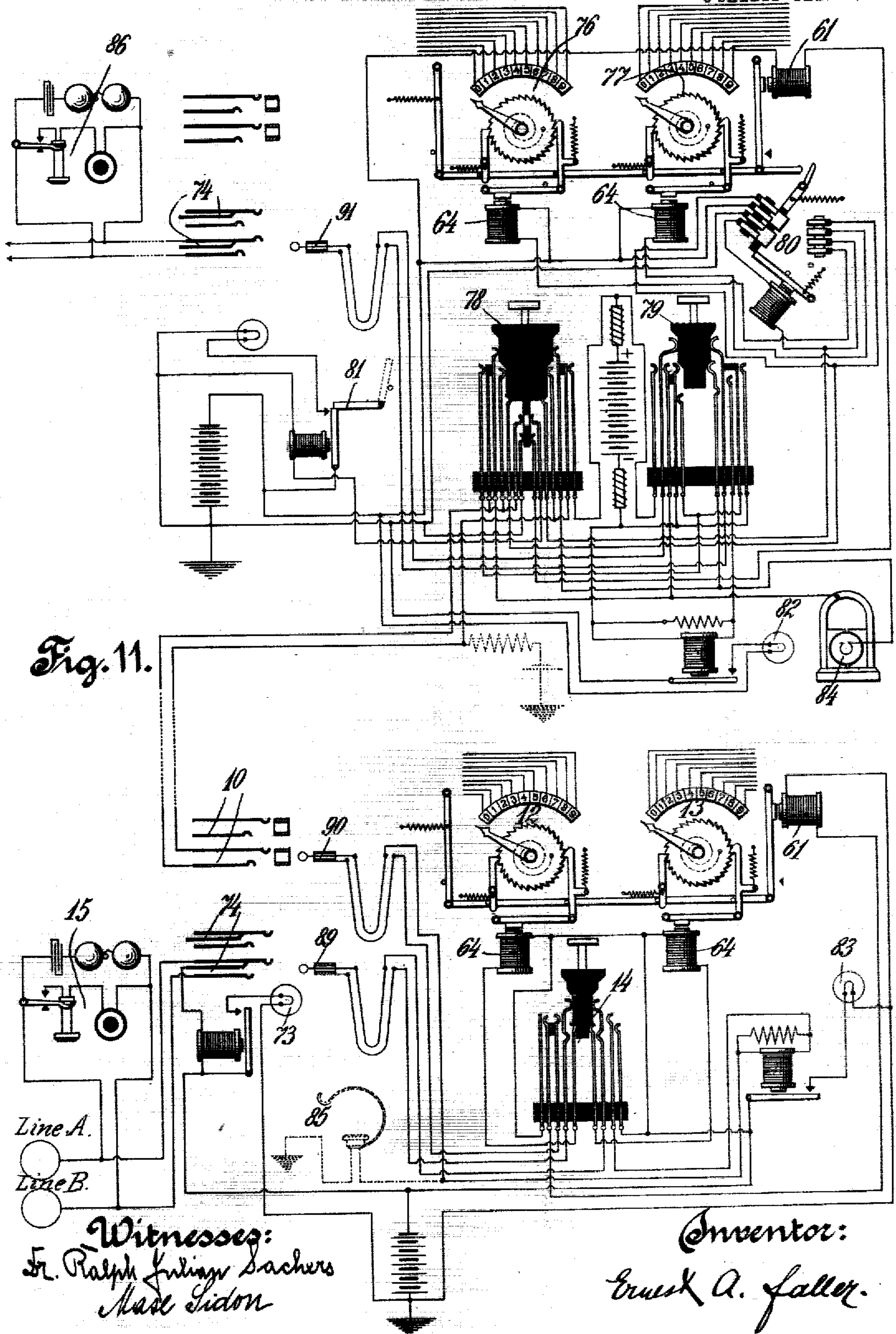
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VISUAL SIGNAL RECEIVING SYSTEM.

APPLICATION FILED JULY 28, 1903.

5 SHEETS—SHEET 5.





# UNITED STATES PATENT OFFICE.

ERNEST A. FALLER, OF NEW YORK, N. Y.

## VISUAL-SIGNAL-RECEIVING SYSTEM.

No. 822,888.

Specification of Letters Patent.

Patented June 5, 1906.

Application filed July 28, 1903. Serial No. 167,311.

*To all whom it may concern:*

Be it known that I, ERNEST A. FALLER, a citizen of the German Empire, residing in the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Visual-Signal-Receiving Systems, of which the following is a specification.

The present invention relates to a visual-signal-receiving system such as may be used in telephone systems, and more particularly in semi-automatic telephone systems—such, for example, as that shown and described in Letters Patent of the United States No. 757,031, granted to me April 12, 1904, for semi-automatic telephone-exchange.

In semi-automatic telephone systems—such, for example, as described in the above-mentioned patent—the work of the operator at the central exchange is greatly diminished by the elimination of the oral transmission of the number of the called subscriber.

It is the principal object of the present invention to further simplify the working of telephone-exchanges by eliminating all functions of the operator at an exchange except those which require the very least mental and intellectual effort.

The modern telephone-switchboard is the result of previous efforts to limit the number of operations taking place when telephonic connection is desired between two subscribers. In this board the lamp-signals or drop-annunciators are located in close proximity, and the operator's eye was guided to the calling-line which was to be plugged by said signal. The next step of the operator was to depress the listening-key and receive the oral instruction of the calling subscriber as to the number desired, whereupon she plugged the multiple jack to make connection with the called subscriber.

The present invention renders it possible to limit the efforts of the operator to the simplicity of the first step in a modern telephone-exchange in seeing a lamp light or an annunciator drop and plug the corresponding jack. All additional steps taken by the operator in making connection are nearly identical with this first step and nearly devoid of mental effort. The operator is guided over the panels of her switchboard by the successive displaying of visual signals, and all she is required to do is to place plugs into any jack whose lamp is lighted and operate the shelf-keys in the process of switching. It is fur-

ther thought to be broadly new to automatically translate a variable electrical signal into a visual or optical signal, as it were, at a certain point in space corresponding to and varying with the components of the electrical signal, each optical signal individually adjacent to its line-terminal.

One of the objects of the present invention, therefore, is to provide means for displaying visual signals in the manner described. It is known that most of the time by the operator in making connection between a calling subscriber and a called subscriber, is consumed in orally receiving the number of the subscriber desired and in associating the location of the jack with the number orally received, but it is also known that the act of transmitting a variable signal by mechanical means takes only a fraction of the time it would take in orally transmitting the same signal.

Another object of the present invention is to materially reduce the amount of human labor required at a telephone-exchange in making connection between the subscribers' stations and the exchange by providing means for guiding the hand of the operator over her switchboard without any oral instruction from or communication with the subscribers, and therefore with a minimum of mental effort.

The invention is fully set forth in the description and illustrated in a preferred form in the drawings, but not intended to be limited to that particular form, as other forms may be chosen without departing from the spirit of the present invention.

In the accompanying drawings, forming part of the present application for Letters Patent, Figure 1 is a diagrammatic view of the trunking-panel of an exchange-section. Fig. 2 is a similar view of the answering-panel of the same. Fig. 3 is a front elevation of one of the impulse-receivers at an exchange-section. Fig. 4 is a top view of the same. Fig. 5 is a similar view of the receiver on the left-hand side of the middle line of Fig. 3. Fig. 6 is a side view of the receiver on the right-hand side of the middle line of Fig. 3 looking to the left. Fig. 7 is a vertical cross-sectional view in the line A A of Fig. 3 looking to the left. Fig. 8 is a similar view in the line A A of Fig. 3 looking to the right. Fig. 9 is a similar view in the line B B of Fig. 3 looking to the right. Fig. 10 is a diagrammatic view of the signal-sending apparatus at a subscriber's station connected to the ex-



change-section. Fig. 11 is a diagrammatic view of the circuit connections between a subscriber's station and an exchange-section.

5 Similar figures of reference indicate corresponding parts throughout the several views.

Fig. 10 of the present application is identical with Fig. 1 of Patent No. 757,031, above referred to. Fig. 11 of the present application is identical with Fig. 2 of the above-mentioned patent. The apparatus illustrated in the drawings of the present application is capable of accommodating ten thousand subscribers.

15 The switchboard of an exchange according to the present invention is very similar to an ordinary switchboard and consists of a series of upright panels carrying the answering-panel and trunking-panel, consisting of the  
20 answering-jacks and trunk-jacks, the line-lamps, line indicating-lamps, and trunk indicating-lamps. The number of answering-jacks, line-lamps, and line indicating-lamps is equal to the number of subscribers connected to the exchange-section. The number of trunk indicating-lamps is equal to the number of exchange-sections connected to the system, and the number of trunk-lines connecting each exchange-section with another exchange-section is based upon the  
30 highest number of connections made at one time between any two exchange-sections.

10 in Fig. 1 of the drawings represents the trunk-jacks of the trunking-panel of an exchange-section, and 11 represents the trunk indicating-lamps. In the drawings two trunk-jacks are shown for each trunk indicating-lamp; but groups of more than two jacks may be apportioned to each lamp, according to the highest number of trunk connections made at one time between two exchange-sections, and an idle trunk-jack in the group may be selected by the operator by employing the well-known busy-test set 85.

45 12 in Figs. 1 and 11 is the hundreds-impulse receiver, and 13 is the thousands-impulse receiver of the trunking-panel.

14 in Fig. 11 is the trunking-key, and 15 is the telephone set of a calling subscriber. The  
50 signal-sending apparatus connected with the telephone set of each subscriber is illustrated in Fig. 10. This signal-sending apparatus forms the subject of United States Letters Patent No. 757,030, granted to me April 12, 1904, for improvements in signaling apparatus, wherein the details of construction and the operation of the apparatus are fully described, and this apparatus is not herein claimed as new.

60 Referring now to Fig. 10, the number-rings provided with numerals, letters, or other characters for identifying each subscriber connected to the telephone system are indicated by 16, 17, 18, and 19. Each of the  
65 number-rings coöperates with a toothed

character-disk 20, 21, 22, and 23 and is provided with a contact-spring 24, 25, 26, and 27. Each ring is also in constant contact with a roller 27, 28, 29, and 30, electrically connected to the frame of the signal-sending apparatus. The toothed portions of each character-disk 20, 21, 22, and 23 are adapted to make contact with one of a set of stationary contact-springs 31, 32, 33, and 34, connected in groups to the metallic lines leading from the subscriber's station to the exchange. The contact-springs 31 and 33 are connected to line A and the contact-springs 32 and 34 to line B. Each of the character-disks is provided with ten teeth capable of sending a number of impulses between one and ten. The character-disk 20 is provided with an additional or eleventh tooth. The signal-sending apparatus is furthermore provided with a rotating contact device 35, having a contact-piece 36 capable of bridging either the stationary contact-springs 37 or 38. A clockwork 39 of the signal-sending apparatus causes the rotation of the character-disks 20, 21, 22, and 23 and the contact device 35. The stop device for the clockwork consists of a double-armed lever 42, operated by a magnet 43, which is suitably connected to the lines leading from the subscriber's section to the exchange. A pair of springs 45 are capable of making electrical connection between ground and the frame of the signal-sending apparatus or ground and the lines by means of a lever 44, coöperating with the winding part 39 of the clockwork.

The impulse-receiver illustrated in Figs. 3 to 9 comprises a base-plate 46 and the operating parts secured thereto. A stationary bearing-shaft 47 carries an insulating-disk 48, provided with contact-segments 49. Supported by the bearing 47 and a second bearing 50 is a rotatable shaft 51, to which are secured a pair of larger ratchet-wheels 52 and a smaller ratchet-wheel 53. Rotatably supported by the shaft 51 is a sleeve 54, having a disk to which is secured the spring-controlled pawl 55, engaging the smaller ratchet-wheel 53. The sleeve 54 is furthermore provided with a pinion 56, in mesh with a segmental gear 57, carried on a shaft 68 parallel to the shaft 51. To this shaft 68 is rigidly connected an arm 87 and rotatably supported a lever 58, having a pin 88, adapted to act against the arm 87. Rods 59 connect the free ends of the levers 58 to the core 60 of a resetting-solenoid 61. On the shaft 68, carrying the segmental gear 57 and the lever 58, is a helical spring 62, one end of which is secured to the segmental gear 57 and the other end to the frame of the apparatus. When the coil of the resetting-solenoid 61 becomes energized, the core 60 is drawn up, the pin 88 of the lever 58 acts against the arm 87, the shaft 68 with the segmental gear 57 is rotated, and the spring 62 is wound up. The



sleeve 54 on the shaft 51 will be rotated by means of the pinion 56, in mesh with the segmental gear 57, and the pawl 55 glides along the teeth of the smaller ratchet-wheel 53; but the rotation of the shaft 51 is prevented by a pawl 63, forming the armature of a magnet 64 and engaging alternately the teeth of one or the other of the larger ratchet-wheels 52. For each energization of the magnet 64 the armature 63 will be attracted and move from one tooth of one of the ratchet-wheels 52 to a tooth of the other, the teeth of the two ratchet-wheels 52 being staggered, and the shaft 51 and the sleeve 54 will be allowed to rotate accordingly the distance of one tooth. The sleeve 54 is provided with a lever-arm 65, having on its free end a contact-brush 66, gliding over the contact-segments 49 of the insulating-disk 48. Spiral springs 67 are provided for to normally hold the armature-pawl 63 away from the magnet 64. Electrical connection is made between the magnets 64 over the binding-screws 69 69 and between the magnet of the solenoid 61 over the binding-screws 70 and 71 to the subscribers' lines. Each of the contact-segments 49 of the insulating-disk 48 is provided with a pin 72 for the purpose of connecting the same with the line indicating-lamps 75 or the trunk indicating-lamps 11, as hereinafter set forth.

Fig. 2 of the drawings illustrates the answering-panel of the exchange-section provided with a number of line-lamps 73 and an equal number of line indicating-lamps 75, one for each subscriber. The line-lamps 73 and the line indicating-lamps 75 are preferably made of different color—for instance, white and red. Each answering-panel is also provided with a units-impulse receiver 76, a tens-impulse receiver 77, a resetting-solenoid 61, and a sender restarting-switch 80. The trunk indicating-lamps 11, the answering-plugs 89, trunk-plugs 90, connecting-plugs 91, trunking-keys 14, ring-back keys 78, connecting-battery keys 79, and target-annunciators 81 are provided in a number corresponding to the highest number of connections taking place at one time from or to any one exchange-section—in other words, according to the so-called "percentage" basis. Clearing-out lamps 82 and 83 are provided in double the number of the connections taking place at one time. Of the thousand, hundred, ten, and unit impulse receivers and the sender-restarter 80 one only is provided for each exchange-section. The trunk indicating-lamps 11, the trunk-jacks 10, the line indicating-lamps 75, the answering-jacks 74, and the line-lamps 73 are arranged in the usual manner on the front part of the upright panels of the switchboard. The thousand, hundred, ten, and unit impulse receivers 12, 13, 76, and 77, with the resetting-solenoids 61 and the sender-restarter 80, are con-

veniently located behind the upright panel. The magneto-generator 84 and the batteries or other source of electrical energy are located as usual and convenient. The clearing-out lamps 82 and 83, answering-plugs 89, trunking-plugs 90, connecting-plugs 91, trunking-keys 14, ring-back keys 78, connecting-battery keys 79, and target-annunciators 81 are located in a number of sets, according to the percentage basis on the key-shelf of the exchange-section.

The individual means adjacent to each terminal for indicating the terminals between which connection is desired are intended to include any device by which the attention of the operator can be called to these terminals, such as drops, targets, lamps, electrolytic annunciators, and any other devices answering the same purpose.

*Operation of the visual-signal-receiving system.*—The operation of the present invention is as follows: The subscriber at his station having preestablished the signal to be sent by setting the number-rings to the proper combination and winding the clockwork 39 has in releasing the winding-knob placed ground on the frame of the apparatus by making contact between one of the springs 45 and the lever 44, and thereby energized the individual relay-magnet controlling his line-lamp 73 at the exchange-section. The operator at the exchange seeing the line-lamp 73 lighted plugs the corresponding jack 74 with one of her answering-plugs 89. Thereupon the line-lamp 73 is extinguished, and the operator presses the trunking-key 14 and causes the thousands and hundreds impulse receivers 12 and 13 to receive the signal of the exchange-section desired. One of the trunk indicating-lamps 11 at the trunking-panel of the exchange-section of the calling subscriber corresponding to the signal received will light up. The operator plugs the trunking-jack 10 belonging to the lighted lamp 11 with one of her trunking-plugs 90, and thereby establishes connection between the calling subscriber and that exchange-section to which the called subscriber is connected. The operator in further manipulating the trunking-key 14 causes thereby one of the target-annunciators 81 at the exchange-section of the called subscriber to drop and at the same time the thousand and hundred impulse receivers 12 and 13 to be reset. The operator at the exchange-section of the called subscriber thereupon operates the ring-back key 78 and causes the balance of the signal representing the tens and units of the subscriber's signal to be received at her exchange-section, which receiving act lights one of the line indicating-lamps 75 corresponding to the called-subscriber's number at the answering-panel of her section. She now plugs the answering-jack 74 corresponding to the lighted lamp 75 with the connecting-plug 91 corre-



sponding to the trunk-line calling and again operates the ring-back key, whereby the magneto-generator 84 is brought in circuit with the calling subscriber, indicating to the same by ringing his bell that connection has been established. The operator at the exchange-section of the called subscriber now operates the connecting-battery key 79 and causes a circuit to be established between the magneto-generator 84 and the called subscriber, indicating to him by ringing his bell that communication with him is desired. The called subscriber thereupon removes his receiver from the receiver-hook, the clearing-out lamp 82 is lighted, and the talking-circuit is now established. Having finished the conversation, the called subscriber by hanging up his receiver extinguishes the clearing-out lamp 82. The operator at the exchange-section of this subscriber thereupon pulls out the connecting-plug 91 and restores the connecting-battery key 79, ring-back key 78, and target-annunciator 81 to their normal position, whereby the clearing-out lamp 83 at the exchange-section of the calling subscriber is extinguished. Means may be provided for restoring the target-annunciator by lifting the connecting-plug 91 from its seat on the shelf. In noticing this the operator at this exchange-section withdraws the trunking-plug 90 and the answering-plug 80 from their jacks, restores the trunking-key 14, and thereby all parts used, to their normal condition.

The circuits established between the subscriber's station and the exchange are as follows: The subscriber at his station in winding the clockwork 39 and by releasing the winding-knob makes contact between the lever 44 and one of the ground-springs 45 and establishes a circuit as follows: from ground at the subscriber's station to one of the ground-springs 45, through the lever 44 to the roller 27 of the thousand-number ring 16, the eleventh tooth of the character-disk 20, over the line A to the answering-panel of the exchange-section of the calling subscriber and a relay-magnet controlling the line-lamp 73 of the calling subscriber. The operator at this exchange-section after putting one of the answering-plugs 89 into the jack 74 corresponding to the lighted lamp 73 presses the trunking-key 14 to its first working position, whereby the magnet 43 at the subscriber's station is energized, releases the clockwork 39, 40, and 41, and the part of the signal representing the thousand and hundred numerals is sent simultaneously over both metallic lines and the ground connection to the exchange-section. The circuit over which the signal representing the thousand-numeral is sent is as follows: commencing at ground at the subscriber's station to the ground-spring 45, the lever 44, the roller 27, the thousand-numeral ring 16, the spring 24,

the thousand-character disk 20, the stationary spring 31, over line A to the exchange, the upper spring of the jack 74, the sleeve of the plug 89, the second spring from the middle line on the left-hand side of the key 14, the first spring on the same side now in contact therewith, the magnet 64 of the thousand-impulse receiver 13 to battery and ground at the exchange. The circuit over which the signal representing the hundred-numeral is sent is as follows: commencing at ground at the subscriber's station to the ground-spring 45, the lever 44, the roller 28, the hundred-numeral ring 17, the spring 25, the hundred-character disk 21, the stationary spring 32, over line B to the exchange, the lower spring of the jack 74, the tip of the plug 89, the second spring from the middle line on the right-hand side of the key 14, the first spring on the same side now in contact therewith, the magnet 64 of the hundred-impulse receiver 12 to battery and ground at the exchange. The impulses originating with the thousand-character disk 20 are received by the thousand-impulse receiver 13, and the impulses originating with the hundred-character disk 21 are received by the hundred-impulse receiver 12 at the exchange-section in the following way: For each impulse sent from the thousand-character disk of the subscriber's station the magnets 64 of the impulse-receivers 12 and 13 become energized, and the pawls 63, forming the armature of these magnets, are moved from one tooth of one of the ratchet-wheels 52 to a tooth of the other wheel 52. Under the tension of the springs 62 the sleeves 54 are rotated and the contact-brushes 66 of the rotating arms 65 from one contact-segment 49 of the insulated disk 48 to another as often as an impulse is originated at the sending apparatus. The contact-brushes 66 finally rest upon the segments corresponding to the thousand and hundred numeral comprising the first part of the signal.

The frames of the thousand and hundred impulse receivers 13 and 12 are insulated from each other, but connected to the two sides of a battery. When now the contact-brushes 66 rest upon the segments 49, selected by the first part of the signal received from the subscriber's station, a local circuit is established from that battery through the frame of the thousand-impulse receiver 13, the brush 66, the segment of the thousand-impulse receiver, one of the trunk indicating-lamps 11 contained in a row of lamps corresponding to the thousand-numeral received and also in a row of lamps corresponding to the hundred-numeral received, the segment of the hundred-impulse receiver 12 corresponding to the signal received from the subscriber's station, through the brush 66 and the frame of the hundred-impulse receiver 12 back to the battery. The effect of this cur-



rent so established is to light one of the trunk indicating-lamps 11. The indicating-lamps of the answering-panel and trunking-panel of the exchange-section are arranged in ten circuits in series—*i. e.*, the lamps indicating, for instance, the subscribers' lines 00, 01, 02, 03, 04, 05, 06, 07, 08, and 09 are in one circuit, the lamps 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19 in another circuit, &c. The contact-brushes 66 in gliding over the contact-segments 49 close any number of these circuits; but the time in keeping the same closed is too short to light the lamps in the circuits closed and only that lamp will be lighted which is included in a circuit containing the contact-segments 49 on which the contact-brushes 66 finally rest. It will be further seen from the arrangement of lamps illustrated in the drawings that each closed circuit containing a lighted lamp has a number of branch phantom circuits, each containing three lamps—for instance, the circuit established by the contact-brushes 66 resting upon the contact-segments No. 1 of the ten-impulse receiver, and the segment No. 0 of the unit-impulse receiver lights up the lamp No. 10, because a sufficient quantity of the battery-current passes through that lamp. The same circuit has also branch circuits, one of the same, for instance, containing the lamps Nos. 11, 31, and 30, or Nos. 12, 32, and 30, or Nos. 11, 51, and 50, &c.; but none of these lamps in said circuits will light, because the quantity of current passing through each of the lamps is not sufficient to light the same. The operator at the exchange-section of the calling subscriber in plugging the trunk-jack 10 corresponding to that lamp with the trunking-plug 90, which forms a cord-circuit with the answering-plug 89, and pressing the trunking-key 14 into the third working position causes connection to be continued to the exchange-section of the called subscriber and the dropping of a target-annunciator 81 at that exchange-section and by energizing the solenoid 61 also the resetting of the thousand and hundred impulse receivers.

The operator at the exchange-section of the called subscriber now in pressing the ring-back key 78 to the first working position establishes a circuit to the magnet 43 of the sending apparatus and also the sender restarting-switch 80 at her exchange-section. This circuit is as follows: commencing on one side of the magnet 43 to the contact-springs 38, now bridged by the contact-piece 36, over line A to the exchange, the upper spring of the jack 74, the sleeve of the plug 89, the second spring from the middle line on the left-hand side of the key 14, the third spring on the same side now in contact therewith, the sleeve of the plug 90, the upper spring of the jack 10, over a trunk-line to the exchange-section of the called subscriber, the

fourth spring from the middle line on the right-hand side of the key 78, the third spring on the same side now in contact therewith, to the magnet of the restarting-switch 80, to the lower contact-spring of the left-hand group of contacts of this switch, the next contact-thereto, to the battery indicated to the left of the annunciator 81, back to the third contact spring of the restarting-switch 80, the fourth contact-spring of the same, to the third spring from the middle line on the left-hand side of the key 78, to the fourth spring on the same side now in contact therewith, over a trunk-line back to the exchange-section of the calling subscriber, the lower spring of the jack 10, the tip of the plug 90, the magnet and resistance shown to the right of the key 14, the third spring from the middle line on the right-hand side of the key 14, the second spring on the same side now in contact therewith, the tip of the plug 89, the lower spring of the jack 74, back over line B to the subscriber's station and the other side of the magnet 43. The restarting-switch 80 is thrown over in its second position, the magnet 43 at the subscriber's station is again energized, releases the clockwork, and the ten- and unit-impulse receivers 77 and 76 are electrically connected to the ten and unit character disks 22 and 23 and receive the impulses representing the second half of the signal in a similar way as the thousand and hundred impulse receivers received the first half of the signal. The contact-brushes 66 of the ten and unit impulse receivers resting upon the segments corresponding to the impulses received from the ten and unit character disks of the subscriber's sending apparatus cause a line indicating-lamp 75 of the answering-panel of the exchange-section of the called subscriber to light. The operator in plugging the corresponding jack and pressing the ring-back key 78 in the second working position brings the magneto-generator 84 in connection with the calling subscriber and causes the ringing of the bell of the calling-subscriber's set 15 and by simultaneously energizing the solenoid 61 resets the ten and unit impulse receivers of her own exchange-section. In pressing the ring-back key in the third or last position a circuit is now established between the calling subscriber and the talking-battery. The operator at the exchange-section of the called subscriber in finally pressing the connecting-battery key 79 into the first working position brings the magneto-generator 84 in connection with the bell of the called subscriber's telephone set 86 and rings his bell, then in pressing the connecting-battery key 79 into the final working position watches the clearing-out lamp 82. If this lamp should not light, the operator brings the connecting-battery 79 back into the first position, and thereby rings again the bell of the called subscriber until finally the clearing-out



lamp 82 is lighted, indicating that the called subscriber has removed his receiver from the hook and talking connection is established between the calling and called subscriber.

5 What is considered new and useful, and intended to be protected by Letters Patent, is—

1. In combination with signal sending and receiving means, line-terminals, means for electrically connecting any two of said line-terminals, and separate means for and adjacent to each line-terminal and operated by the signal-receiving means for directly indicating the location of a terminal to which connection is desired.

15 2. In combination with signal sending and receiving means, line-terminals, means for electrically connecting any two of said line-terminals, and separate automatic means for and adjacent to each line-terminal and operated by the signal-receiving means for directly indicating the location of a terminal to which connection is desired.

20 3. In combination with signal sending and receiving means, line-terminals, means for electrically connecting any two of said line-terminals, and separate visual means for and adjacent to each line-terminal and operated by the signal-receiving means for directly indicating the location of a terminal to which connection is desired.

25 4. In combination with signal sending and receiving means, line-terminals, hand-operated means for electrically connecting any two of said line-terminals, and separate means for and adjacent to each line-terminal and operated by the signal-receiving means adapted to indicate the location of a terminal to which connection is desired.

30 5. In combination with signal sending and receiving means, line-terminals, hand-operated means for electrically connecting any two of said line-terminals, and separate automatic means for and adjacent to each line-terminal and operated by the signal-receiving means adapted to indicate the location of a terminal to which connection is desired.

35 6. In a visual-signal-receiving system, the combination with a plurality of impulse-receivers, of a plurality of circuits each one controlled by the joint action of the impulse-receivers, and translating devices in each circuit, each of the same adapted to operate at a specific condition of the impulse-receivers only.

7. In a visual-signal-receiving system, the combination with a plurality of impulse-receivers having a rotary contact-brush and stationary contact-segments, a plurality of circuits controlled by the relative position of the contact-brushes on the segments, and translating devices in the circuits, each operated only by one of the relative positions of the contact-brushes on the segments.

8. In a telephonic system, the combination with subscribers' terminals at an exchange, a signal device for each subscriber at said exchange, hand-operated connecting means for the subscribers' terminals, and automatic means initially controlled by one subscriber to operate the signal of a second subscriber.

9. In a telephonic system, the combination with subscribers' stations and an exchange, of individual signals for each subscriber at the exchange, signal-sending apparatus at the subscriber's station, and impulse-receivers at the exchange initially controlled by one subscriber and adapted to operate the individual signal of another subscriber.

10. In a telephone-exchange, a plurality of visual signals in proximity to line-terminals and means for actuating a visual signal of one of the line-terminals by an initiating act of a signal-sending apparatus belonging to another line-terminal.

11. The combination of a series of independent line-terminals, one or more branch or loop circuits, means for connecting any two of said line-terminals with each other through one of said loop-circuits, a plurality of signal-receivers, a plurality of local circuits, each one controlled by the joint action of the signal-receivers, and translating devices in each local circuit and adjacent to each line-terminal, adapted to operate at a specific condition of the signal-receivers only, and directly indicating the line-terminal to which connection is desired.

In testimony whereof I have hereunto set my hand, in the presence of two subscribing witnesses, at New York, in the county of New York and State of New York, this 24th day of July, 1903.

ERNEST A. FALLER.

In presence of—

RALPH JULIAN SACHERS,  
K. O. CHISHOLM.