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APPARATUS FOR RECORDING AND REPRODUCING SOUND.

APPLICATION FILED JAN. 8, 1908.

1,166,925.

Patented Jan. 4, 1916.

3 SHEETS—SHEET 1.

Fig. 1.

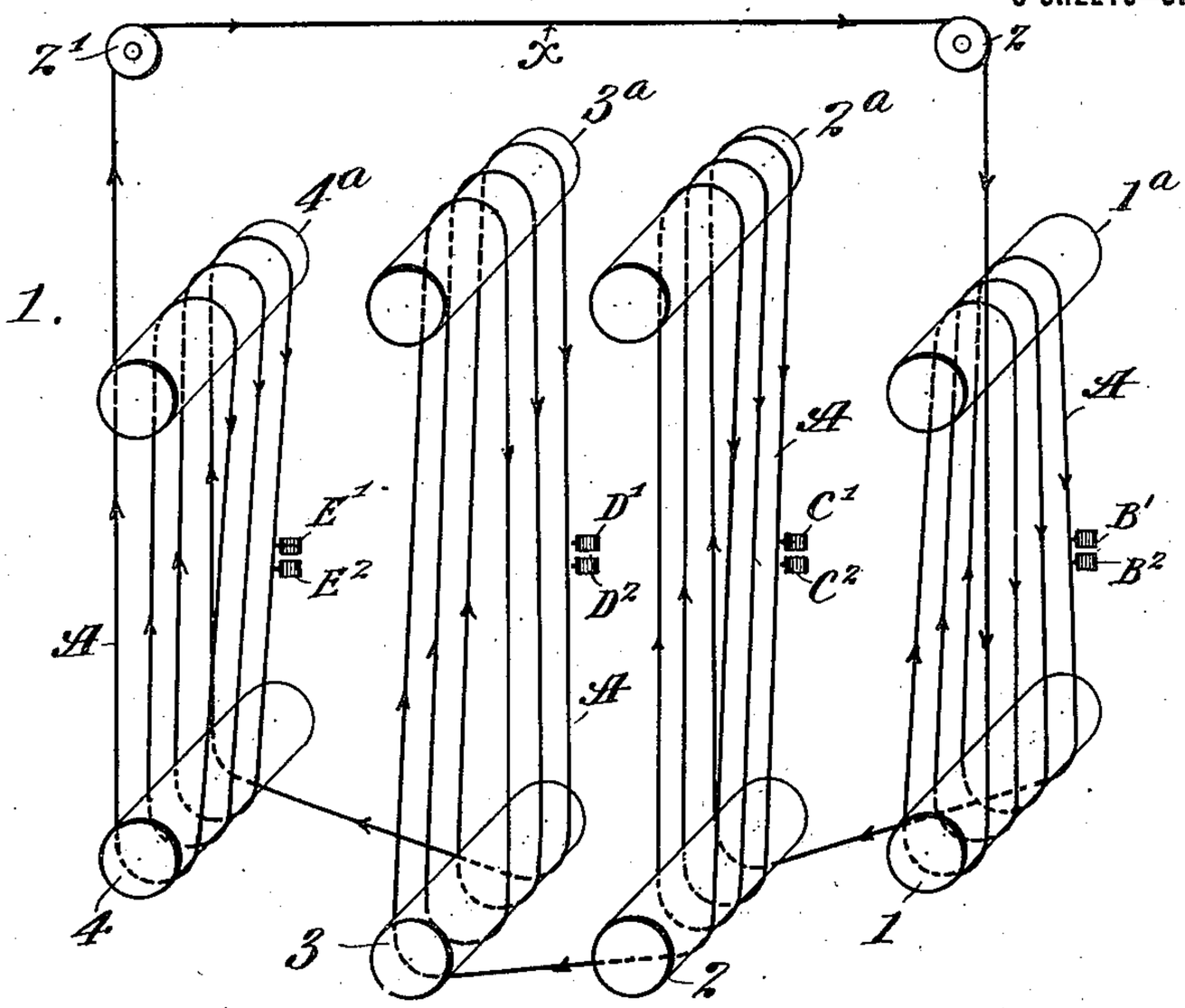
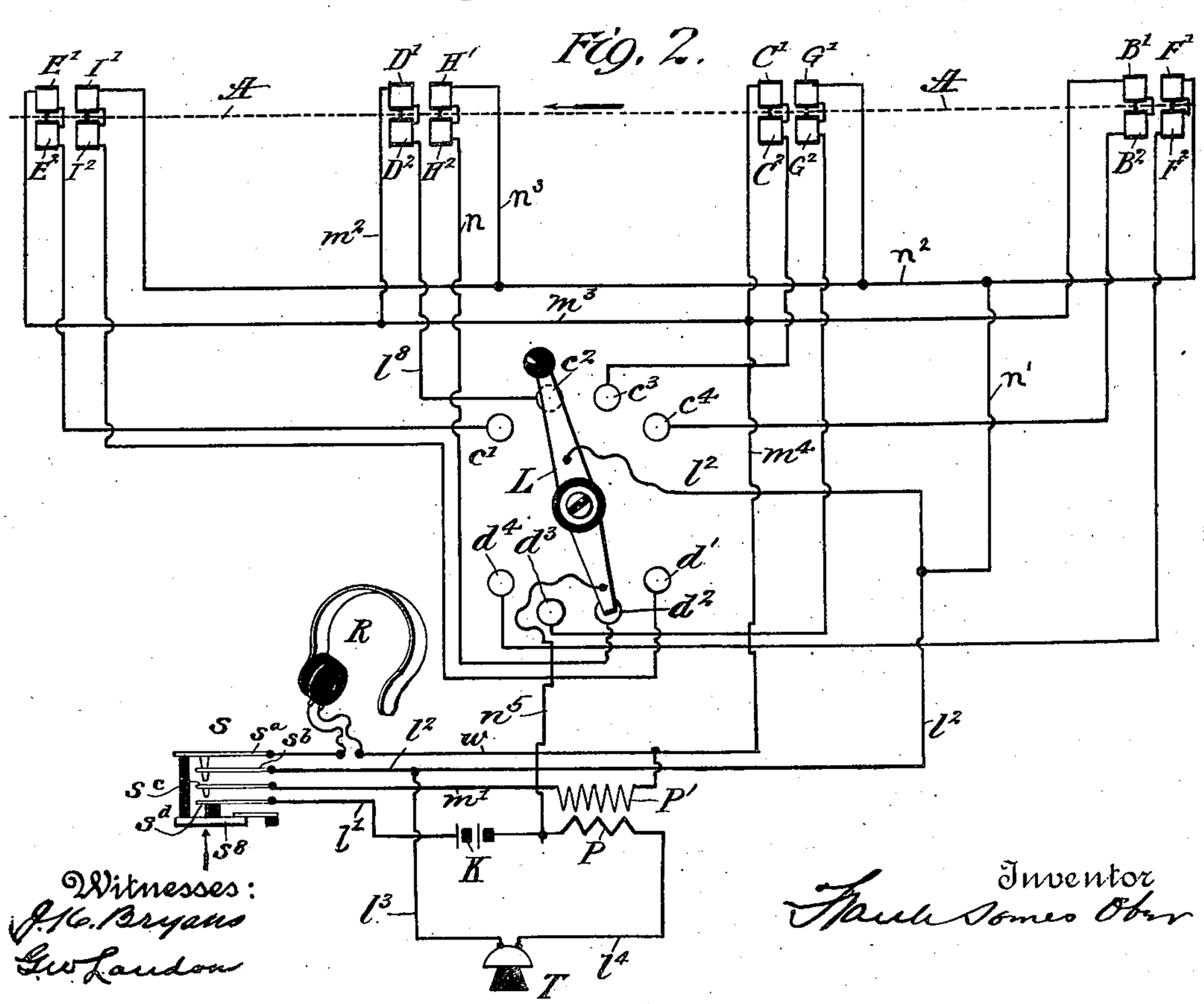


Fig. 2.



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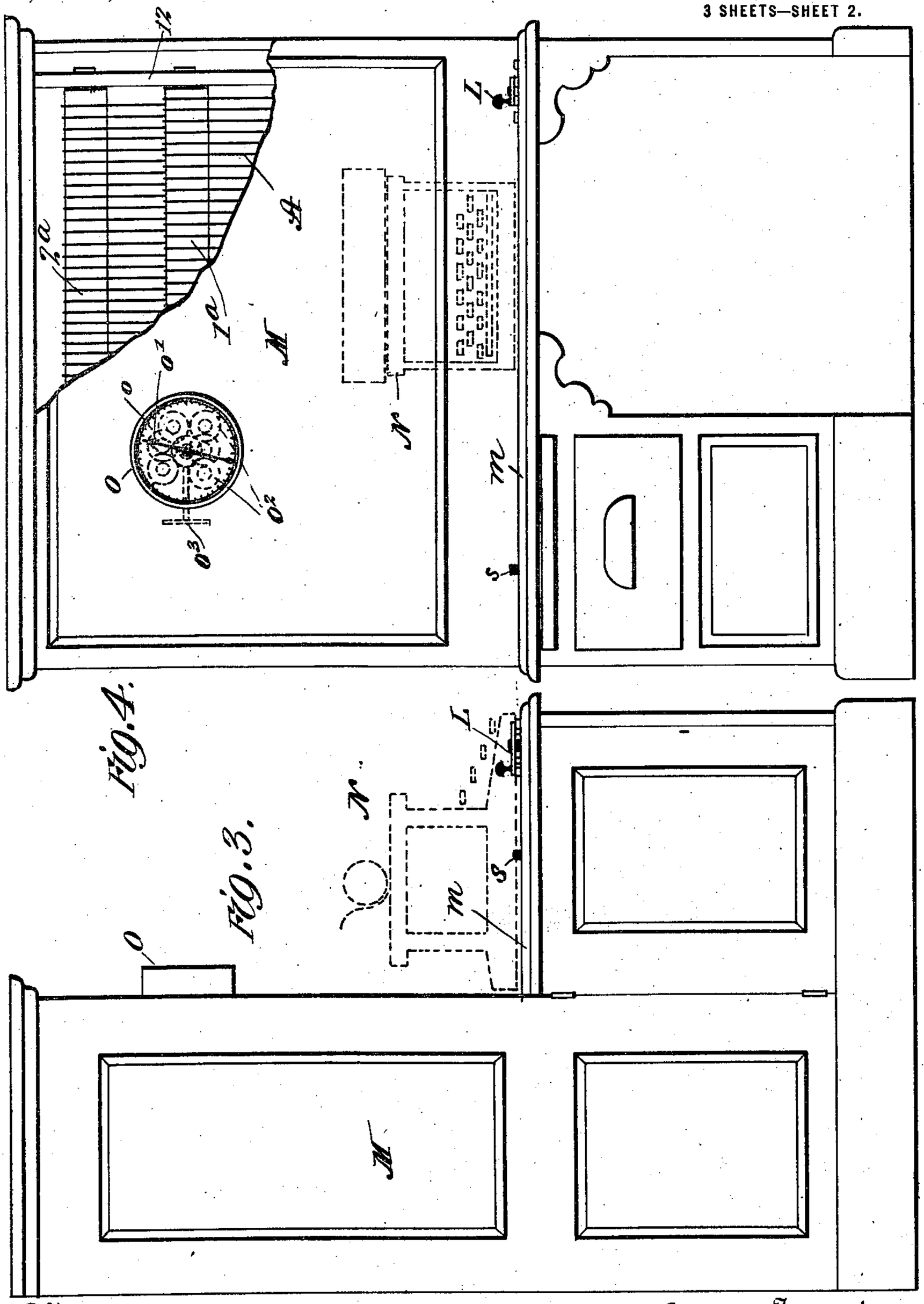

Fig. 4.

Fig. 3.

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3 SHEETS—SHEET 3.

Fig. 5.

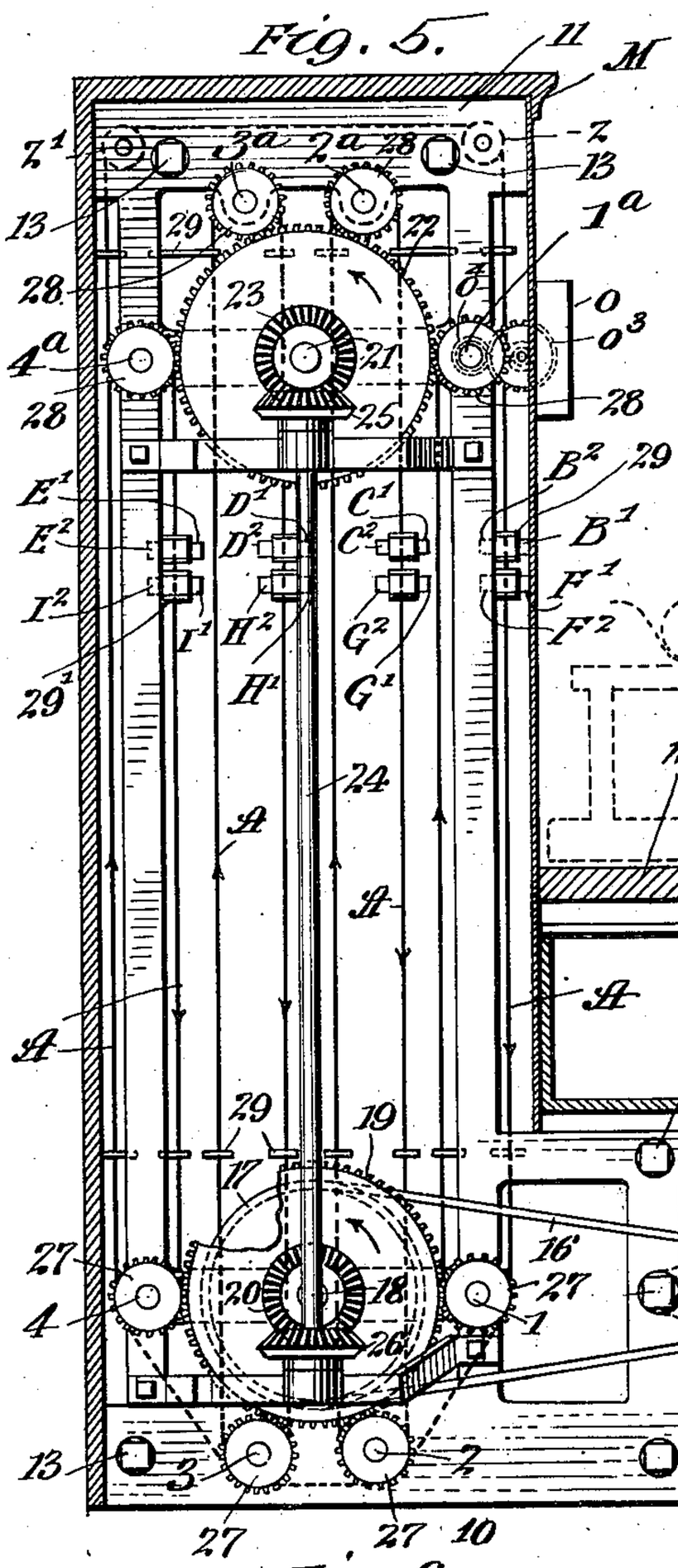


Fig. 6.

Fig. 7.

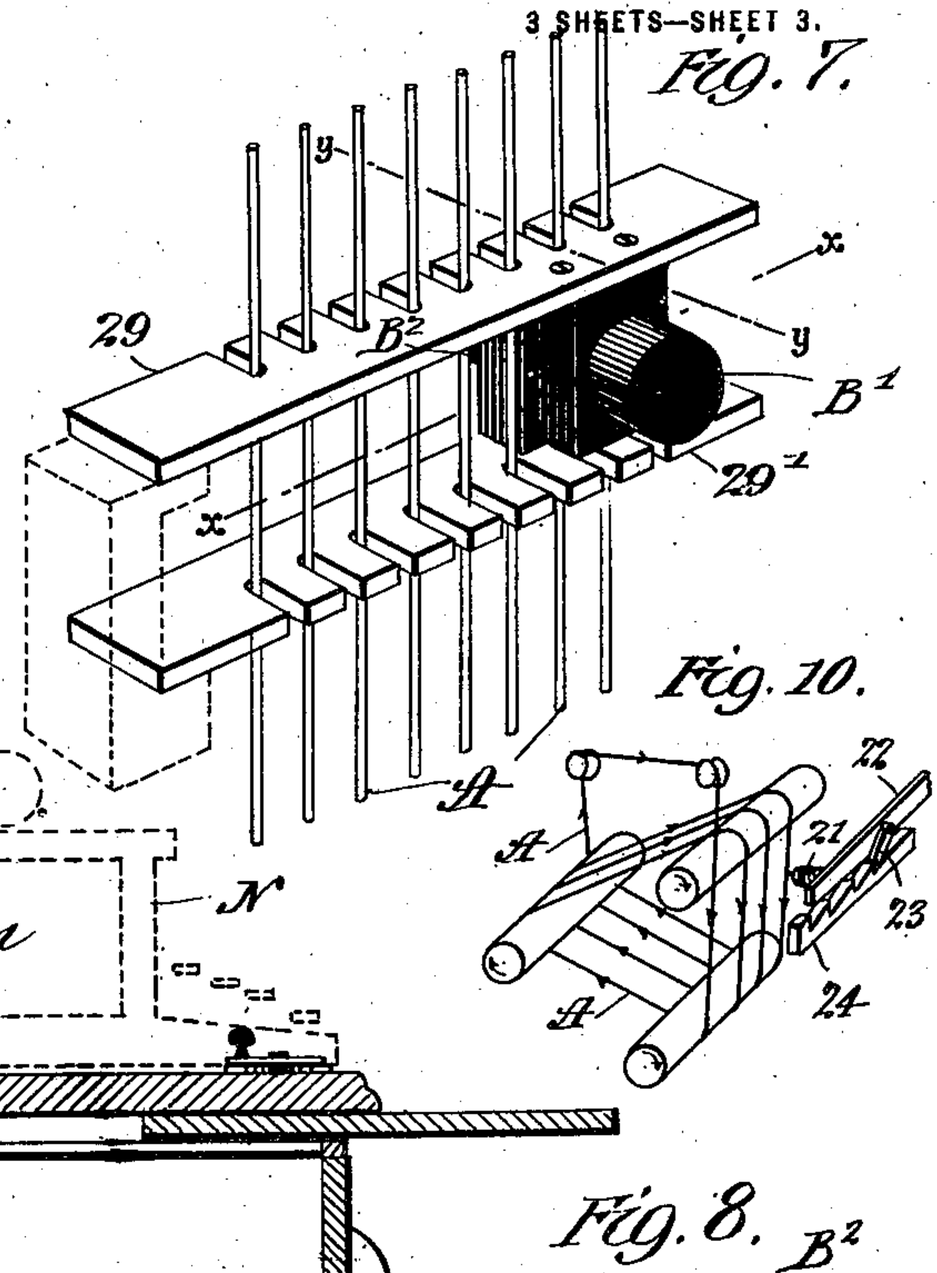


Fig. 10.

Fig. 8.

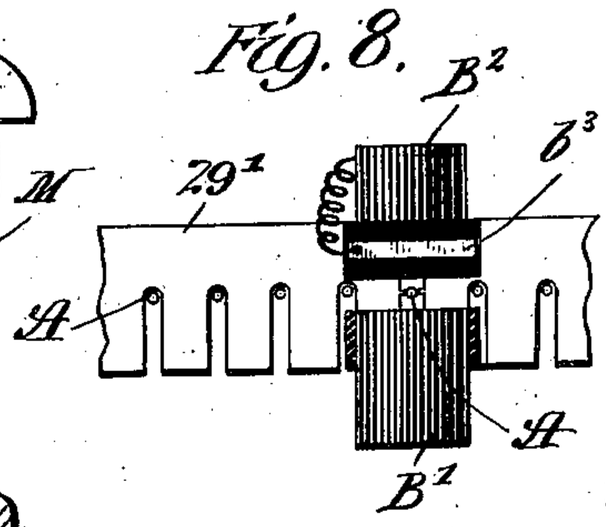
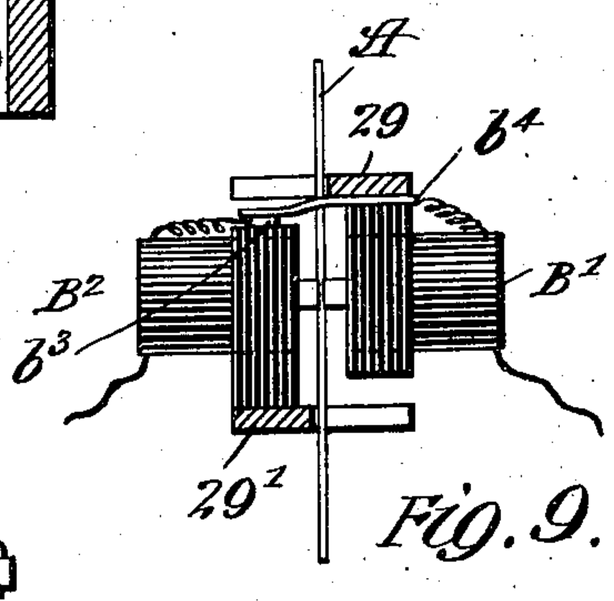
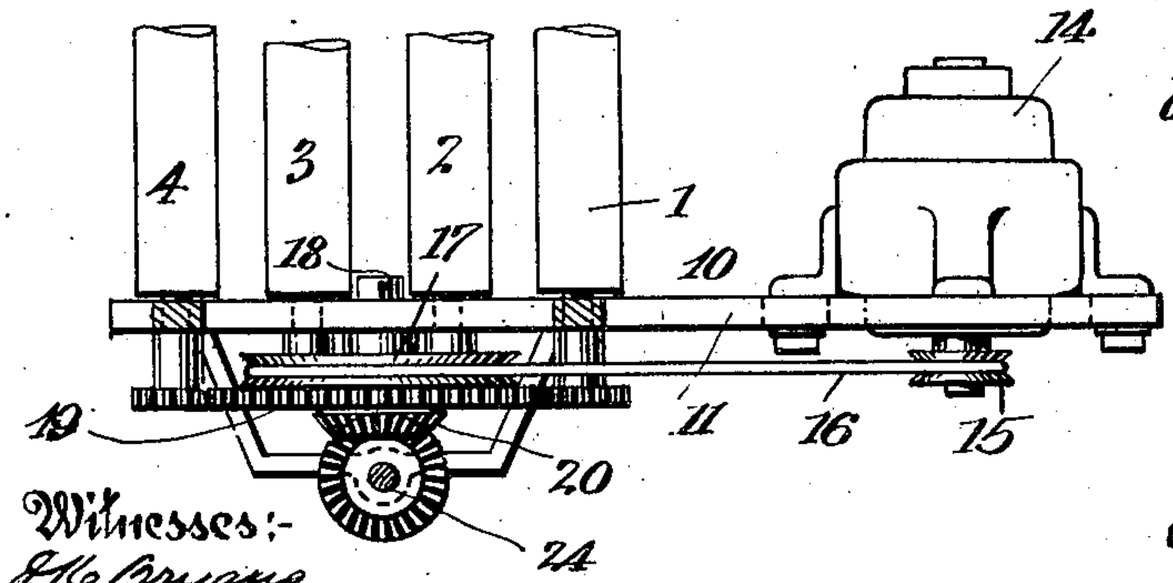


Fig. 9.





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UNITED STATES PATENT OFFICE.

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APPARATUS FOR RECORDING AND REPRODUCING SOUND.

1,166,925. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed January 8, 1908. Serial No. 409,744.

To all whom it may concern:

Be it known that I, FRANK SOMES OBER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Apparatus for Recording and Reproducing Sound, of which the following is a full, clear, and exact description.

My invention relates to apparatus for recording and reproducing sound and has particular reference to machines of this character commonly known as telegraphones.

One of the well-known forms of telegraphone is that in which the record medium is a steel wire upon which the record is impressed magnetically while said wire is traveling from one reel to another. In reproducing the record it is necessary to backwind the wire to the point thereon where the magnetically impressed record begins, and then start ahead again with the reproducing devices in circuit.

The primary object of the present invention is to produce a novel form of telegraphone which shall provide for a traveling flexible record medium of great capacity and in which no backwinding will be required in order to reach the beginning or any part of any record impressed thereon; and which shall further provide means whereby the active effect of certain recording and reproducing devices may be transferred from point to point along the extent of the traveling medium and so enable an operator to overtake parts of said medium that have passed a given point or to drop behind in order to more quickly engage parts that are approaching a given point.

Broadly stated the invention consists of the combination of a traveling record medium of novel form, recording and reproducing devices, and novel means for establishing coöperative relations between said medium and said devices at preferred locations on the surface of said medium without reversing the movement of the latter.

More specifically the invention consists of an endless length of paramagnetic material such as steel wire arranged in successive loops upon and adapted to travel over the surfaces of two or more rollers, and having a plurality of recording and reproducing magnets arranged at suitable intervals along the length of said wire, and means controllable by the operator whereby any of such magnets may be thrown into or out of operative relation with said traveling wire at will.

The invention will be better understood by reference to the accompanying drawings in which:

Figures 1 and 2 are diagrammatic representations of my invention; Fig. 3 is a side view of a complete machine; Fig. 4 is a front view of the same, parts being broken away; Fig. 5 is a sectional view through the casing, the inner mechanism being shown in elevation; Fig. 6 is a detailed plan view showing certain driving devices; Fig. 7 is a detailed perspective view; Fig. 8 is a section on line x—x of Fig. 7; Fig. 9 is a section on line y—y of Fig. 7, and Fig. 10 is a modification.

Referring to the drawings by letters and numerals in which like characters designate similar parts throughout the several views, let us first consider Fig. 1, which presents the most graphic view of the invention. For the sake of simplicity and clearness only the salient features of the invention appear in this figure, namely an endless steel wire record-medium A, a plurality of supporting and driving rollers, and a plurality of recording and reproducing magnets B′ and B^2, C^1, C^2, D^1, D^2, and E^1, E^2 located at rather widely separated intervals along the length of said medium. The supporting and driving rollers are eight in number and are arranged in four pairs and are designated 1, 1^a, 2, 2^a, 3, 3^a; and 4, 4^a.

Starting at the point x the steel wire passes over a guide pulley z down to and around roller 1, thence up to and around roller 1^a, back to and around roller 1, and so on in successive loops or spiral turns from end to end of the first pair of rollers. The last turn around roller 1, as will be observed, is led over to and around the lower roller 2 of the next pair, thence up to and around roller 2^a, back to and around roller 2, and so on in successive loops or spiral turns until the capacity of this pair is exhausted. From rollers 2 and 2^a, the wire is led to rollers 3 and 3^a, and from that pair of rollers 4 and 4^a, the same looping or spiral arrangement being maintained throughout. The last turn around roller 4 is carried up past roller 4^a to guide pulley z', thence to point x, where

the two ends of the wire are joined together, preferably by welding.

Figs. 4, 5 and 6 show the manner of mounting and driving the rollers. 10 represents a frame consisting of the side pieces 11 and 12 and cross rods or bars 13, the side pieces being L-shaped. In the lower forward portion of the frame is hung an electric motor 14, having a pulley 15 connected by a belt 16 to a pulley 17 on a shaft 18, mounted in the frame 10. Shaft 18 also carries a spur wheel 19, and a bevel-gear wheel 20. In the upper part of the frame is a second shaft 21, also carrying a spur wheel 22 and a bevel gear wheel 23; the two bevels being connected together by a vertical shaft 24 carrying bevel gears 25 and 26 at opposite ends thereof; the arrangement being such that rotation of the motor shaft will cause both spur wheels 19 and 22 to turn in the same direction. Rollers 1, 2, 3, and 4 are each provided with reduced ends which enter bearings in the side pieces of the frame 10. Each of such rollers is further provided with a pinion 27; the several pinions each engaging a spur wheel 19. Similarly, rollers 1^a, 2^a, 3^a, and 4^a are each provided with reduced ends which are supported in the extreme upper part of frame 10, and with pinions 28 which severally engage the spur wheel 22.

All of the rollers are of precisely the same diameter and all travel at the same speed and in the same direction. It is obvious therefore that operation of the motor will cause the wire to travel in an endless path about the rollers in the same direction as, and at a speed equal to, the surface speed of said rollers.

In order to retain the wire in place, that is, to confine it to an approximately fixed path of travel, and particularly to prevent deflection of the same as it passes between the poles of magnets hereinafter described, I employ a number of combs or slotted bars 29, which are arranged transversely across the machine at suitable points and serve to separate and guide the several strands of the traveling wire. In Fig. 7 there is shown a pair of such combs or bars which are arranged rather closely together and which serve the double function of supporting a pair of recording and reproducing magnets and guiding the wire accurately between the poles thereof. One of said magnets B′ is supported by the upper bar or comb 29 and lies on one side of the wire A, while the other, B^2, is supported by the lower comb 29′ and lies on the opposite side of said wire. The poles of the magnets extending at right angles to the wire and contacting with or very closely approaching the same. Magnet B^2 is provided with a strip of metal b^3 to which one end of its coil is attached, while the coil of magnet B′ is connected with a spring terminal b^4, which, when the magnets are in operative position (see Fig. 9) engages the strip b^3 and connects the magnets in series. This arrangement provides for the easy removal of the magnets for inspection or repair, the magnet B^2 being withdrawn by moving the upper bar first to the right (Fig. 9) and then endwise, and the magnet B′ by moving the lower bar first to the left and then endwise. C^1, C^2; D^1, D^2 and E^1, E^2, are additional recording and reproducing magnets arranged and supported in precisely the same manner as magnets B′ and B^2, and located at suitable intervals along the length of the wire A. F^1, F^2; G^1, G^2; H^1, H^2; and I^1, I^2 are erasing magnets also arranged and supported in the manner above described and serving to obliterate all previous records on the record medium when in action. A pair of erasing magnets is located just ahead of each pair of recording and reproducing magnets.

I have shown four pairs of supporting rollers simply as a matter of convenience of illustration. Obviously any other number may be employed and they may be of any desired axial length and diameter. The number and dimensions and arrangement of rollers and the number of turns of wire around them will be determined by whatever "capacity" of machine is aimed at.

Preferably the mechanism above described will be inclosed in a suitable dust proof casing as indicated at M, which may be so designed as to afford a supporting shelf or table *m*, for a typewriting machine N, as well as for certain switching and controlling devices hereinafter referred to. There is also mounted on the outside of the casing an indicating device O, consisting of a graduated dial *o*, and an index hand *o′* connected to a suitable train of gearing o^2, one of the wheels o^3 of which is engaged by a pinion o^4, on the roller 1^a. The ratio of gearing is such that the index hand will travel once around the dial with each complete cycle of the record medium.

Referring to Fig. 2, *s* indicates a spring switch having blades s^a, s^b, s^c and s^d. These blades are arranged and connected in such a way that in the normal position of the switch, the blades s^a and s^b are in electrical contact with one another, but in the alternate position of the switch corresponding to the recording operation of the machine the blades s^a and s^b are separated, while s^b, s^c and s^d are brought into contact.

K is a battery, P the primary of an induction coil, and P′ the secondary thereof, the latter being adapted to be connected with the recording and reproducing magnets before referred to in a manner presently to be described.

R is an ordinary telephone receiver; T a transmitter, and L a double-ended pivoted

switch arm having its ends insulated from each other, and having one end thereof adapted to make electrical contact with any one of four terminals c', c^2, c^3 or c^4, while the other end makes contact with similar terminals d', d^2, d^3 or d^4, respectively.

When a record is to be made, the operation is as follows: The motor being started, the wire A will be caused to travel bodily over the rollers in an endless path, but inasmuch as all of the rollers travel at the same surface speed and in the same direction and pay out wire precisely as fast as they take it on, the driving force will be distributed evenly to all parts of the wire throughout, and there will be no inordinate pulls or strains at any particular point. This reduces the chances of breakage to a minimum. Having started the motor, it is unnecessary that the operator begin delivering matter for record to the transmitter at once merely in order to conserve record space. The record medium being endless, a beginning may be made at any point thereon without sacrifice of space. When, however, the operator does begin to use the transmitter, he will note the position of the index hand o' on the dial. When the hand has made a complete circuit and returns to that position, he will know that the record medium has also made a complete circuit.

When making a record, the switch s is moved to the alternate position of that shown by sustained pressure on the part s^8, in the direction of the arrow, and a circuit is completed from battery K through wire l', blade s^d, to blade s^c, and from thence to blade s^b, wire l^2, wire l^3, transmitter T, wire l^4, primary winding P and back to battery K. The voice or other sound currents in this circuit under the influence of the transmitter induce currents in the secondary winding P' which traverse the following circuit: wire m', blade s^c, blade s^b, wire l^2, switch arm L, contact c^2, wire l^8, magents D', D^2, wire m^2, common return wire m^3, wire m^4, back to the secondary winding. A record is accordingly made on the traveling wire A. At the same time the erasing magnets are constantly energized from the battery in advance of the recording and reproducing magnets by the following circuit: battery K, wire l', blade s^d, blade s^c, blade s^b, wire l^2, wire n', common wire n^2, wire n^3, magents H', H^2, wire n, terminal d^2, switch arm L, wire n^5, back to battery. The record having been made, the reproduction thereof is accomplished by relieving pressure on the button s^8, and allowing switch to resume normal conditions with blades s^a and s^b, in contact so that a direct circuit is formed from magnets D', D^2, or other reproducing magnets according to the position of the switch arm L, through wire l^8, terminal c^2, lever arm L, wire l^2, blade s^b, blade s^a, receiver R, wire w, wire m^4, back to magnets. In this position of switch s, the circuit through the erasing magnets is broken between blades s^d and s^c.

The advantages of a record medium arranged and operated in accordance with the invention described are important and numerous. Being endless it becomes unnecessary to backward in order to change from recording to reproducing condition. In fact it is intended in practice that the wire travel always in one direction, although it is quite capable of reverse movement if for any reason reversal is desired.

The invention is particularly adaptable for use as a dictating machine for commercial purposes. In ordinary business dictation a straight-away uninterrupted flow of language is rare. There are apt to be many breaks in the delivery due to outside interruptions or pauses for thought, during which intervals of silence the record medium travels many feet. In certain well known forms of telegraphones the usefulness of long lengths of the record medium are lost because of these pauses, and they can be recovered only by back-winding, which entails considerable loss of time, or prevented only by stopping the motor, which is inconvenient. By my invention unused spaces on the record medium may be recovered simply by throwing the switch arm L ahead and cutting in other magnets. In other words, when there is a pause in the delivery, the operator is enabled to overtake the point on the traveling wire where the impression or record leaves off by cutting out the magnets he had been using, and cutting in others located ahead. For instance, if during dictation the switch arm L stands in the position shown in Fig. 2 the wire A will be acted upon by the magnets B', B^2, since they are the only ones in circuit in that position of the switch L. Now suppose there should be a pause in the delivery of such duration that the index hand o' travels half a revolution. The operator observing this would know that half of the length of the record medium had passed by magnets B', B^2, and to recover this lost space he would simply move switch arm L to the full line position and resume dictation; magnets B', B^2, being cut out then, and magnets D', D^2, which are located a distance ahead equal to half the length of the record medium, being cut in.

Should the operator be dissatisfied with, or for any reason wish to alter matter delivered to the machine, he simply throws lever L sufficiently far ahead to overtake the beginning of such matter and repeats it in amended form.

For convenience and simplicity of illustration I have shown but four sets of operating magnets, but of course a greater number could be used to advantage. In practice I purpose to use many magnets, say one to

every 200 or 300 feet of wire. Obviously the greater the number of magnets, the greater the flexibility of operation.

Instead of a number of fixed magnets operating as described above, I may employ a single movable magnet as in the manner illustrated in Fig. 10, in which 21 is the recording and reproducing magnet supported on a shifting frame 22, which is provided with a pawl 23, engaging teeth of rack 24. There are as many teeth as there are vertical strands to the endless wire A, so that when frame 22 is moved to a desired position, accurate alinement of magnets and wire may be assured.

What I claim, is:—

1. In sound recording and reproducing machines, an elongated flexible record medium of paramagnetic material arranged in a series of loops and having its ends joined together, means for moving said medium in the direction of its length, magnetic recording and reproducing devices, and means whereby a record may be effected at any one of a definite selected number of predetermined points.

2. In sound recording and reproducing machines, a plurality of rotating supports and an elongated flexible paramagnetic record medium mounted thereon in successive convolutions extending from support to support; said record medium having its ends joined together whereby any point thereon will be caused to travel in an endless path, magnetic recording devices, and means for rendering said devices effective to produce a record at any one of a number of predetermined points.

3. In recording machines, rollers arranged in a series of pairs, an elongated flexible record medium wound back and forth from roller to roller of each of said pairs successively and having its ends joined together, means for moving said medium in the direction of its length, a plurality of reproducers, and means for shifting from one reproducer to another reproducer by which the record end has yet to pass.

4. In recording machines, supporting rollers spaced apart, and an elongated flexible record medium arranged thereupon in zig-zag fashion from roller to roller, means for moving said medium in the direction of its length, and means for advancing the effective record-receiving point on the medium at the will of the operator.

5. In recording machines, an endless flexible traveling record medium arranged in a series of loops, coöperating recording devices, and means whereby such devices may be caused to become active and effect a record on the medium at any one of a definite selected number of predetermined points.

6. In recording machines, an endless flexible traveling record medium arranged in a series of loops, a plurality of recording devices located at intervals along the length of said medium, and means for throwing any individual of such devices into operative relation with said medium at will.

7. In sound recording and reproducing machines, an endless traveling paramagnetic record medium arranged in a series of loops, a plurality of magnetic recording and reproducing devices located at intervals in the path of travel of said medium, and a selecting switch for throwing any of such magnetic devices into an electric circuit.

8. In sound recording and reproducing machines, an endless traveling paramagnetic record medium arranged in a series of loops, a plurality of magnetic recording and reproducing magnets located at intervals along the path of travel of said medium, and a selecting switch for throwing any of such magnetic devices into an electric circuit.

9. In recording and reproducing machines, an endless flexible paramagnetic record medium arranged in a series of loops or convolutions, means for moving the same, devices for separating and guiding the several convolutions of said record medium, a plurality of magnetic devices supported by said separating and guiding devices, and means whereby operative relations may be established between said wire and any of said magnetic devices.

10. In recording and reproducing machines, an endless paramagnetic record medium arranged in a series of loops, means for moving the same, devices for separating and guiding the several convolutions of said record medium, a plurality of magnetic devices adjacent said separating and guiding devices, a telephone circuit, and a selecting switch whereby any of said magnetic devices may be connected with said telephone circuit.

11. In recording machines, a group of rollers having pinions, a spur wheel common to all of said pinions of said group of rollers, means for driving said spur wheel, and an endless flexible record medium supported and driven by said rollers.

12. In recording machines, a series of rollers divided into two separated groups, pinions on said rollers, a spur wheel common to all pinions of one group, a similar spur wheel common to all pinions of the other group, an endless flexible record medium supported and driven by said rollers, and common means for driving both spur wheels.

13. In recording machines, a group of rollers divided into two separated groups, mon to all pinions of said group of rollers, means for driving said spur wheel, an endless flexible paramagnetic record medium supported and driven by said rollers, magnetic recording devices, adapted to coöperate

with said medium, and means for transferring the active effect of said magnetic devices from one point on said medium to another.

14. In recording machines, a series of rollers divided into two separate groups, pinions on said rollers, a spur wheel common to all pinions of one of said groups, a similar spur wheel common to all the pinions of the other of said groups, an endless flexible record medium supported and driven by said rollers, common means for driving both of said spur wheels, recording devices adapted to coöperate with said medium, and means for transferring the active effect of said devices from one point on said medium to another.

15. In recording machines, an elongated flexible record medium arranged in a series of loops, means for moving said medium in the direction of its length, and devices for separating and guiding the several strands of the said loops.

16. In recording machines, an elongated flexible record medium arranged in a series of loops, supports therefor, devices for separating and guiding the several loops of said medium, and recording and reproducing devices supported by said separating and guiding devices.

In witness whereof, I subscribe my signature, in the presence of two witnesses.

FRANK SOMES OBER.

Witnesses:
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J. K. BRYANS.