

(No Model.)

2 Sheets—Sheet 1.

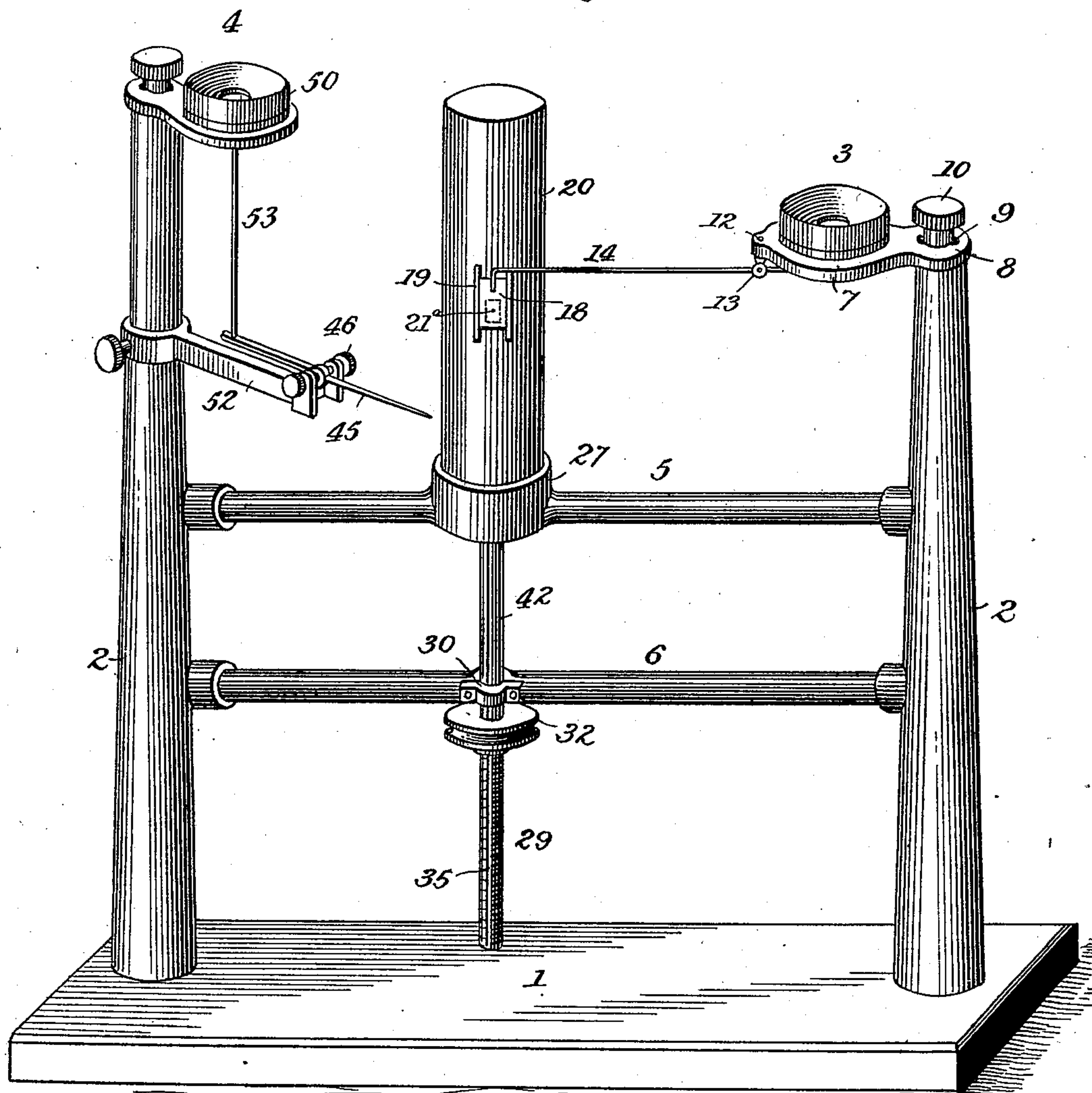
A. C. FERGUSON.

RECORDING AND REPRODUCING SOUND WAVES.

No. 539,254.

Patented May 14, 1895.

Fig. 1.



Witnesses

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(No Model.)

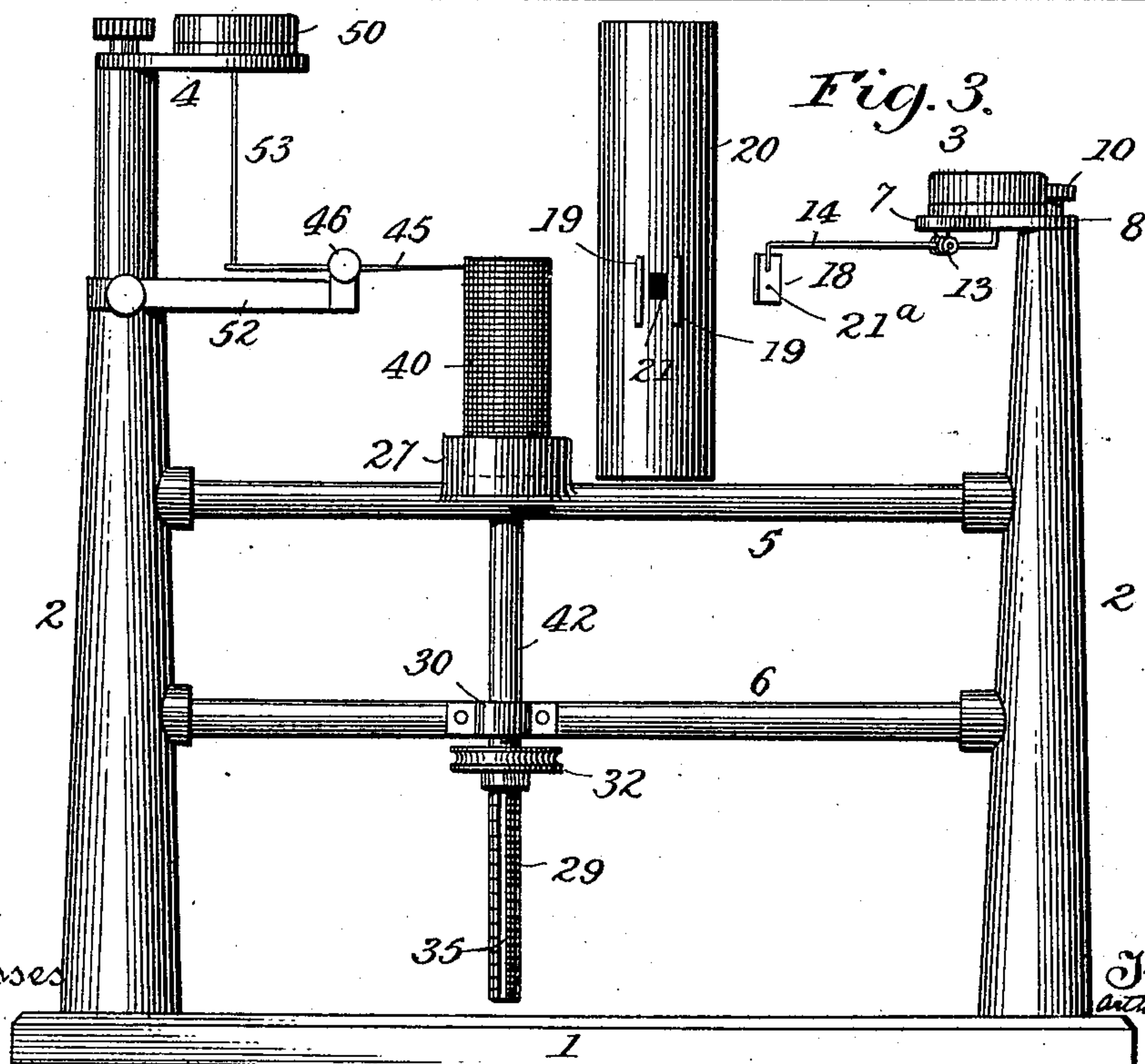
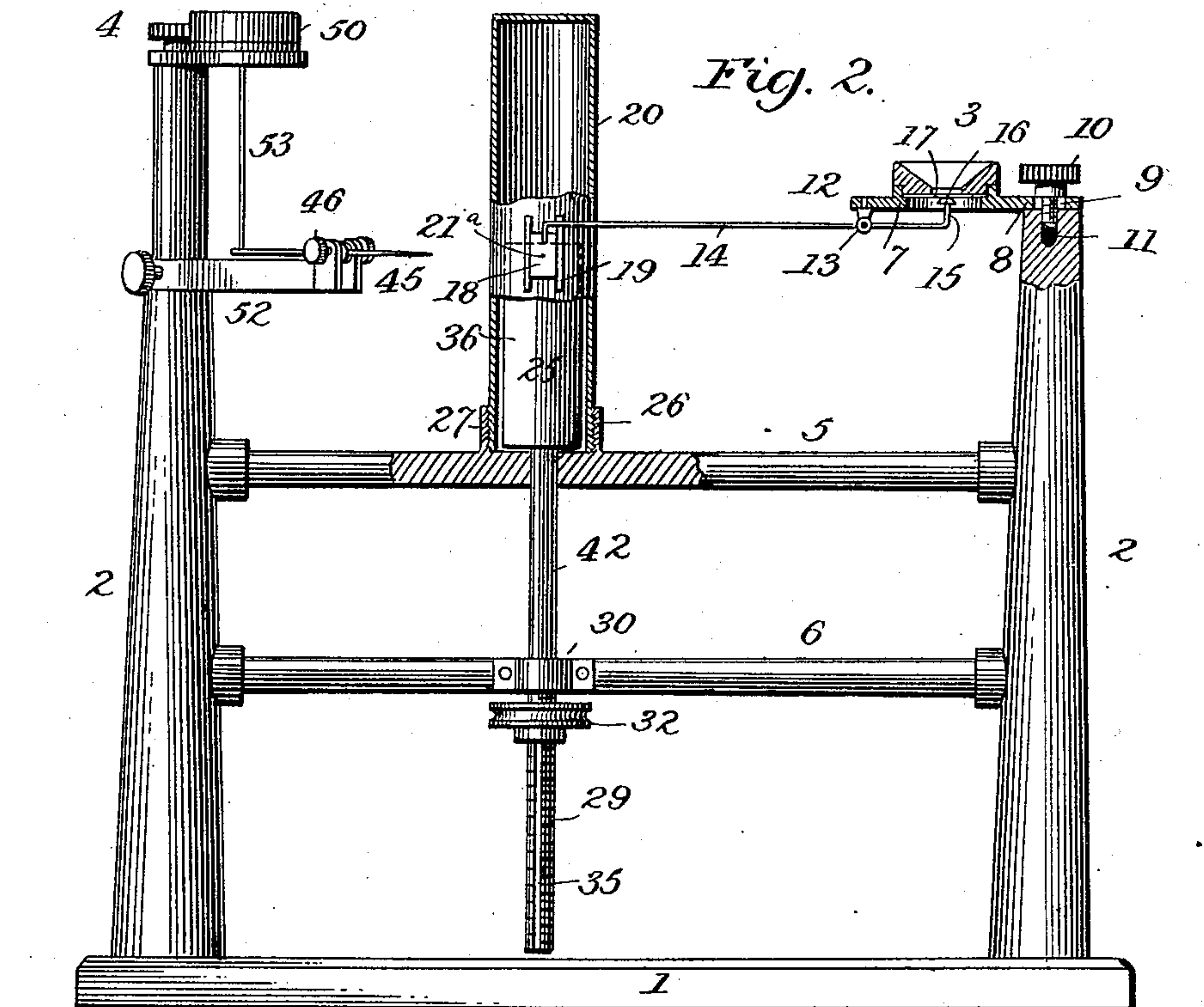
2 Sheets—Sheet 2.

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ARTHUR C. FERGUSON, OF SARATOGA SPRINGS, NEW YORK.

RECORDING AND REPRODUCING SOUND-WAVES.

SPECIFICATION forming part of Letters Patent No. 539,254, dated May 14, 1895.

Application filed March 7, 1895. Serial No. 540,844. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR C. FERGUSON, a citizen of the United States, residing at Saratoga Springs, in the county of Saratoga and State of New York, have invented certain new and useful Improvements in Means for Recording and Reproducing Sound-Waves, of which the following is a specification.

This invention relates to means for recording and reproducing sound waves, and it consists substantially in such features of improvement as will hereinafter be more particularly described.

The invention is adapted for the recording and reproduction of articulate speech and all musical sounds alike, and it has for its object to provide a permanent record, as well as a more faithful reproduction than has heretofore been accomplished.

The invention is distinguished from that class of devices wherein the original impulses or vibrations are photographically recorded and subsequently reproduced either photographically or electrically, in that the sound waves are photographically recorded and the reproduction or retransmission of the same is effected by mechanical means, thereby enabling me to both record and reproduce the sound waves by the use of but one machine.

Generally speaking, the invention comprises photo-mechanical devices by which a beam of light is projected onto a rotating or movable film in sinuous lines, the altitudes of which are in accordance with the amplitudes of the vibrations of the diaphragm, and the number or recurrence of which lines are in accordance with the rates of such vibrations.

In the accompanying drawings, Figure 1 is a view in perspective of a photomechanical sound recording and reproducing device embodying the features of my invention. Fig. 2 is a side elevation, partly in section, representing the recording-needle in position for operation and the reproducing-needle as turned to one side. Fig. 3 is a side view representing the recording-needle as thrown out of operative position and the reproducing-needle in a position for use.

While my invention is capable of being constructed or carried into effect in a great many different ways, for the purpose of simplicity

and cheapness of cost, I provide a machine such as is indicated in the accompanying drawings, wherein 1 designates a suitable base, and 2, 2, each indicates a standard or upright, one of which supports the transmitter 3, and the other the receiver or reproducer 4, the said standards or uprights being connected in any suitable manner by means of the cross pieces 5 and 6. As will be observed on reference to the several figures the said transmitting device is supported so as to be capable of being swung or turned on its support, and while a great many constructions could be resorted to for this purpose, I preferably provide a plate or disk 7 having an offset or projection formed or provided with an opening 9 through which passes a screw 10 which enters or passes into an opening 11 formed in the upper end of the standard or support 2. Thus by loosening the screw, I am enabled to turn the plate or disk in such manner as to carry the recording needle to one side substantially as is shown in Fig. 3 of the drawings. The said plate or disk 7 is also formed or provided with a small projection or offset 12 through which is inserted from beneath an adjusting device or screw 13, to the lower end of which is pivotally suspended the recording needle 14, the latter having at its outer end a small crook 15 having a rounded head 16 which normally bears very lightly against the under side of the diaphragm 17 of the said transmitting device 3; while to the opposite end of the said recording needle is attached in any suitable manner a shutter 18 of any suitable thin opaque material, which shutter, as the recording needle is caused to vibrate by the impulses imparted to the diaphragm, is in like manner made to vibrate or move up and down in guides 19 formed on the outer side of a sheath or casing 20, the latter being provided with an opening 21 before which the movements of the shutter take place. The said shutter is provided with a very fine opening 21^a, which, as is obvious, will cause a beam of light to be projected through the opening 21 of the casing in sinuous lines whenever the said shutter is caused to move up and down by the action of the needle when receiving motion from the vibrations of the diaphragm. The said sheath or casing 20 is for the purpose of closing over or sur-

rounding a rotating cylinder 25, and for the purpose of maintaining the casing stationary, the lower end of the latter is screw threaded at 26 to screw into or fit within a correspond-
 5 ingly screw-threaded socket 27, preferably in this instance formed with or attached to the upper cross piece 5 which connects the standards or uprights 2, 2. It is obvious that other means may be provided for supporting the
 10 said sheathing or casing to inclose the rotating cylinder but the means which I have shown and described are very simple and amply suffice for the purpose.

In order to impart to the cylinder 25 a rotating and gradually progressive movement, I attach the same in any suitable way at its lower end to the upper end of a rotating shaft 42 formed on its lower portion with a screw 29, and which screw threaded portion works
 20 in a screw bearing 30 by which to effect a gradual feed of the cylinder in an upward direction as the said shaft is rotated either by hand or from any suitable motor, a driving pulley 32 being held on the shaft and
 25 provided with a feather, (not shown) working in a groove 35 in the shaft so as to permit of the proper movement of the latter.

Around the rotating cylinder 25 I place in any suitable manner a sensitized photographic film 36, and then by properly inclosing the same by the sheath or casing and swinging the shutter around and placing the same within its guides on the casing, the machine is thus placed in readiness to record
 35 sound waves produced by the vibrations of the diaphragm 17. By talking into the transmitter or producing musical sounds therein, the diaphragm will vibrate, and the pulsations will be imparted to the recording needle which causes the shutter to move up and
 40 down before the opening in the sheath or casing. During this time, the machine is in motion and the cylinder 25 with its film is caused to rotate at the desired rate of speed, and the beam of light which passes through
 45 the opening in the shutter will be projected onto the surface of the film in sinuous lines in exact accordance with the amplitude of vibrations of the diaphragm.

It is to be understood that the opening in the sheath or casing is of sufficient dimensions to permit of recording the deepest sound wave of which the diaphragm is capable of producing, and thus am I enabled to record
 50 all varying degrees of sound in the most perfect manner.

When the entire surface of the film has been utilized in the recording of sound waves in the manner hereinbefore described, I then
 60 remove the entire machine to a photographic dark room and remove the sheath or casing, and then develop the sensitized film by the ordinary photographic process. As thus developed, the said films can of course be kept
 65 as long as desired, but in order to reproduce the sound waves delineated thereon, I trans-

fer the sinuous lines onto either a metal plate or cylinder, preferably in this instance a cylinder 40, and this cylinder is attached in any
 70 suitable manner to the upper end of the shaft 42, whereupon the reproducing needle 45 is swung around in such manner as to engage the lines on the cylinder, and then as the cylinder is rotated an exact reproduction of the sound waves will be produced through
 75 the medium of the diaphragm contained in the receiver 50. The construction of said receiver is in all important respects the same as the transmitter 3 with the exception that a bracket 52 is employed additionally as a
 80 support for the reproducing needle 45, the latter being centrally supported at 46 and operating at its outer end in connection with a fine rod 53 which transmits the sound waves on the cylinder to the diaphragm in the trans-
 85 mitter.

It will be understood, of course, that the transfer of the sinuous lines from the film to the plate or cylinder may be either in intaglio or relief and produce the same effect, and
 90 this transfer is effected either by etching or by any of the well known engraving or photo-engraving processes, it being unnecessary to specifically set forth such process herein.

It is thought that from the foregoing description, the construction and operation of
 95 my invention will be fully understood, and while I have herein set forth certain preferred forms of construction of the several parts of my apparatus, it is evident that various im-
 100 material changes could be resorted to without departing from the principles intended. For instance, I have herein stated that in order to develop the film after its surface has been completely utilized, the entire machine
 105 is removed to the dark room, whereas it is clearly evident that by slightly altering the construction of the machine, the removal of the film alone together with its surrounding sheath could be independently effected. In
 110 connection also with both the recording and reproducing needles, it will be understood that their construction and arrangement is capable of various modifications. For all practical purposes however, I have found the
 115 present construction to answer, and therefore I preferably resort thereto in the practice of my invention.

Without limiting myself to the precise construction and arrangement of parts shown, I
 120 claim as my invention—

1. In means for recording and reproducing sound waves, a gradually progressive rotating sensitized film, a sheath or casing inclosing the same and provided with an opening,
 125 a shutter of opaque material arranged before said opening and perforated, a receiver provided with a diaphragm, and a recording needle operated by the vibrations of said diaphragm and imparting corresponding vibra-
 130 tions to said shutter, substantially as shown and for the purpose described.

2. In means for recording and reproducing sound waves, a receiving or recording diaphragm supported so as to swing to one side, a recording needle pivoted to the frame of
5 said diaphragm with one end bearing lightly on the latter, a shutter carried by the opposite end of said needle, the rotating cylinder adapted to receive the film, means for rotating the said cylinder and gradually feeding
10 ing the same, and a sheath or casing inclosing the cylinder provided with an opening before which the shutter is operated by impulses from the diaphragm, substantially as described.

15 3. In means for recording and reproducing sound waves, the combination of the rotating screw shaft adapted to support a cylinder, the receiving and reproducing diaphragms, the recording and reproducing needles, and
20 means whereby either one or both of said

needles may be swung to one side, substantially as shown and for the purpose set forth.

4. In means for recording and reproducing sound waves, a gradually rotating sensitized film, an inclosure therefor provided with an
25 opening, a shutter perforated and located before said opening, a receiving diaphragm, and devices intermediate of said diaphragm and shutter whereby the latter is operated in accordance with the vibrations of the diaphragm,
30 substantially as shown and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ARTHUR C. FERGUSON.

Witnesses:

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JNO. G. HINKEL.