No. 619,269. Patented Feb. 14, 1899.

F. M. BELL.

ELECTRICAL TRANSMISSION OF SOUND.

(Application filed Oct. 12, 1896.)

(No Model.)

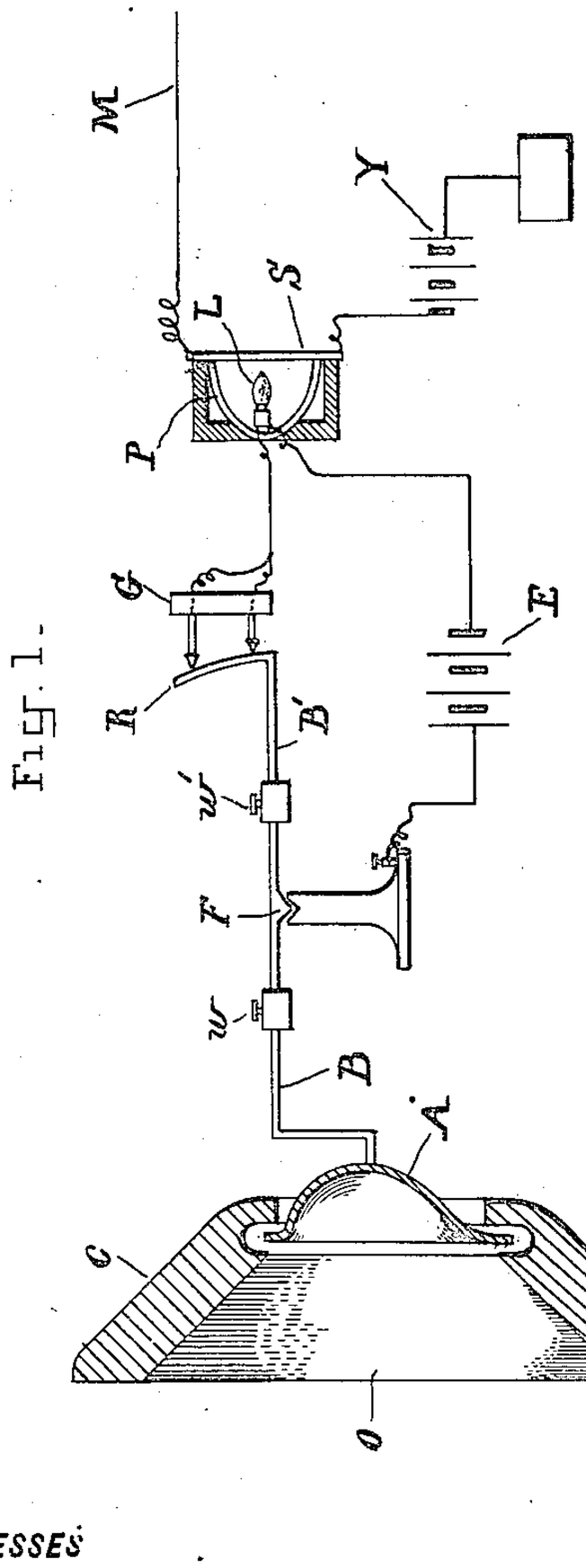

Fig. 1.

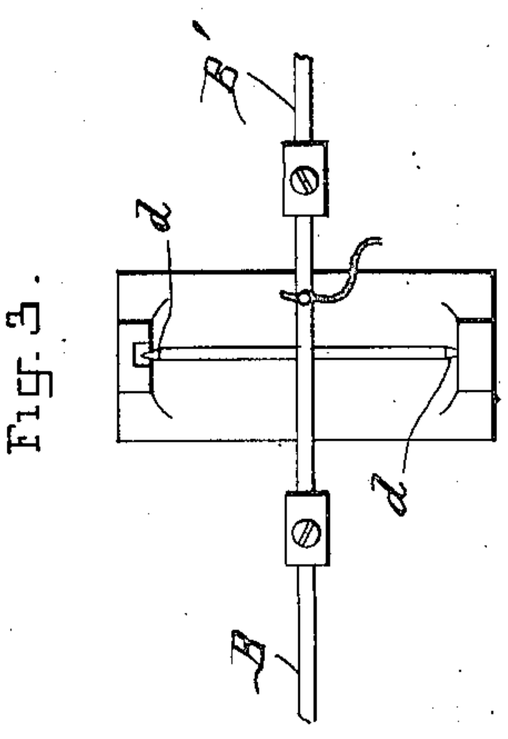

Fig. 3.

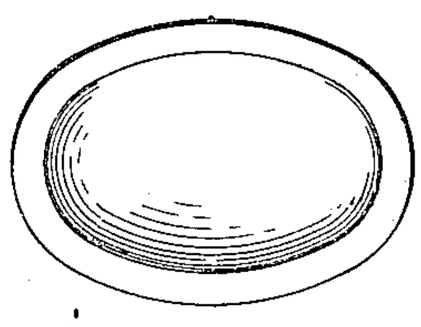

Fig. 2.

WITNESSES

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FRANK MERRILL BELL, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO JOHN DOZIER POU, OF SAME PLACE.

ELECTRICAL TRANSMISSION OF SOUND.

SPECIFICATION forming part of Letters Patent No. 619,269, dated February 14, 1899.

Application filed October 12, 1896. Serial No. 608,558. (No model.)

To all whom it may concern:

Be it known that I, FRANK MERRILL BELL, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in the Electrical Transmission of Sound, of which the following is a specification.

To carry my invention into effect, I employ a system or method particularly described hereinafter, but which system or method is capable of modification in such equivalent essentials as circumstances may determine.

To illustrate my invention, the accompanying schematic diagram Figure 1 is furnished, together with the drawings illustrating in sufficient detail some of the parts of the apparatus employed, as shown in Figs. 2 and 3, like letters indicating like parts. Fig. 2 is an elevation of the sound-receiver as it appears from the front. Fig. 3 is a plan view of the bearings of the balance-beam, showing the situation of the diamond points *d d'*.

A is the sound-receiver. I prefer to construct this receiver of wood and in the shape sectionally more or less closely following the configuration of the external human ear, for I have discovered that such a configuration yields the best results. The elevation of such a receiver is shown in Fig. 2. The receiver A is mounted opposite an orifice O in a suitable screen or case C and is supported upon the offset or cranked end of an arm B of a balance-beam, the other arm of which, B', is provided with a suitable resistance R, hereinafter described. The balance-beam has a fulcrum or bearing F formed of a fine edge or of diamond points *d d'*, the latter being shown in plan at Fig. 3.

The arms B B' are balanced when constructed, and the adjustment of balance to suit different rates of vibration is effected by means of the rider-weights *w w'*, borne by and sliding upon the arms B and B'.

Bearing with gentle friction upon the resistance-piece R is a contact G, to which contact is attached by suitable conductors one terminal of an incandescent electric lamp L, the other terminal of the lamp being connected to a battery or other source of electricity E, the circuit being completed by connecting electrically the remaining pole of the battery to the arm B' of the balance-beam at or near the fulcrum. It is obvious that the beam, therefore, should be of a conducting material or be provided with a conductor to establish a circuit in connection with the resistance R. It is non-essential that and it is preferable that the lamp L should not be of great illuminating power nor be operated at a high voltage. I have found a lamp operated at about eight volts with a current of two amperes to yield good results. This low voltage admits of the resistance R being brought within practicable limits in a small compass. The light in this lamp varies from an orange to a red, being thereby more sensitive to the minute and rapid variations of the current under the control of the sound-waves. The resistance of selenium is found to be more sensitive to the red and orange rays than to white light, and there is no lag in changes of luminosity, as in the case of white light.

The resistance R, I prefer to construct of platinum because the variations it introduces in the circuit of the electrical source E being effected by the sliding contact accruing from the motion of the balance-beam under the influence of the sound-waves impinging upon the receiver A, such a sliding contact is suitably provided by a platinum surface; but it is obvious the resistance R may be constructed of other material, such as carbon, without departing from the essence of my invention, it being understood that the resistance of the circuit is varied not by variation in pressure at the contact-surfaces, but by variation of the length of the resistance R as introduced or removed from the circuit by the determined oscillations or movements of the balance-beam, on which the resistance is borne.

The operation of the method so far as has been described is apparent. The receiver A, being set in motion by the sound-waves impinging upon it, imparts an up-and-down vibratory motion to the balance-beam, which motion becomes that of the resistance R. Variation of this resistance produces variation in the light of the lamp L, and the variation of this light following a high mathematical

power of the current strength is very marked. Also it is obvious that the variation of this light is caused by and follows the variations of its prime source—namely, that of the electric current as regulated and controlled by the sound-waves impinging upon the receiver A. In order to transform these variations of light into variations of electrical energy for transmission by a conductor-circuit having inductive capacity, I employ the following completion of my method: P is a reflector, preferably of parabolic section, because such configuration permits of uniform distribution of the light-rays, and in front of this reflector is placed a plate of selenium S or of similar substance, the electrical resistance of which plate will vary according to the intensity of the light falling upon its surface. It is obvious that other forms of a selenium or like resistance might be employed; but I prefer to use a plate approximately of the dimensions of the opening of the reflector as affording a maximum surface actuated uniformly by the light-rays. To this selenium-plate, along one of its edges, is attached a suitable permanent contact, which is put into connections with one pole of a battery Y, the other pole of the battery being grounded. At the opposite edge of the plate a second similar contact is put into connection with the line or cable M, the distant end of which is grounded through a telephonic receiver of suitable construction. Variations in the resistance of the selenium-plate caused by variations in the light of the lamp L are thus transmitted to the line or cable conductor. When the beam B B′ is balanced to a note—D, for example—and the word "hello" is spoken to the receiver, the arm R will vibrate in a space equal to five-sixteenths of an inch and will cause the light to fluctuate so that it is very perceptible to the eye. To adjust the beam B B′ to a certain note—D, for example—a D-fork is held in front of the sound-receiver and the weights *w w′* are moved until the same note is heard in the receiver.

Although I have described an electrical means of producing light and the means of varying its prime source of production, I do not limit myself to this means of producing light, as it is apparent that my invention may be extended to other means of producing light. For instance, an extension of the arm B′ of the balance-beam may be caused to bear upon a diaphragm set in the walls of a chamber containing an illuminating-gas under a certain pressure, the variations in which pressure caused by the motion of the beam as produced by the sound-waves will be communicated to a light produced by combustion of the gas in a suitable and so-called "sensitive" burner.

Having described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In apparatus for transmitting sounds, the combination of a sound-receiver, a balanced beam arranged in operative relation with the sound-receiver and carrying a resistance, a point contacting with the resistance, a lamp in circuit with the resistance, and a receiving-circuit provided with a resistance variable by light.

2. The combination in a telephone-transmitter, of the sound-receiver, a beam constructed for operation by the sound-receiver and provided with adjustable weights and a movable contact, and an auxiliary sound-transmitter operated by the electric current varied by the receiver and transmitter, substantially as specified.

In witness whereof I have hereunto set my hand this 10th day of October, 1896.

FRANK MERRILL BELL.

Witnesses:
LEONARD PAGET,
C. E. WHITNEY.