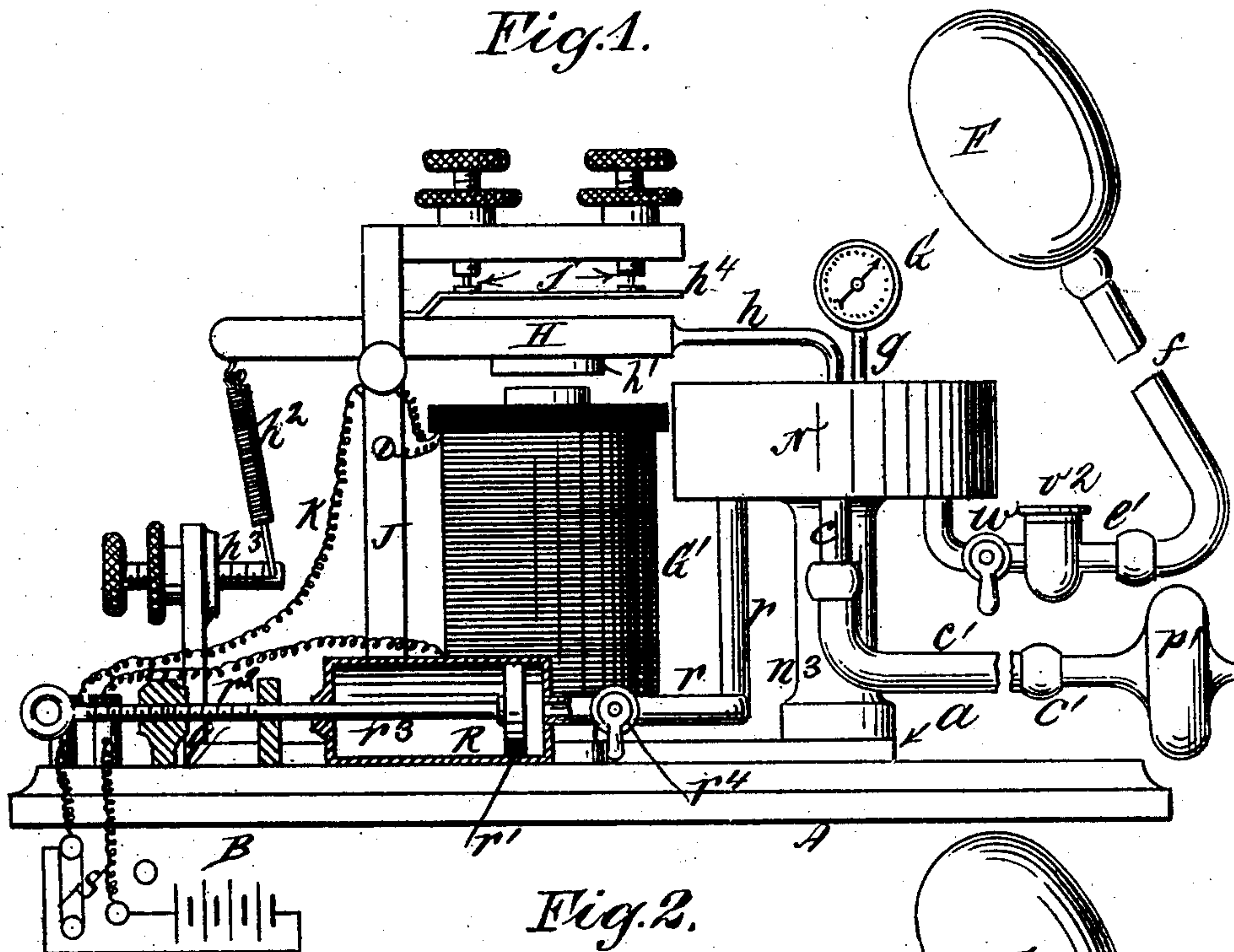


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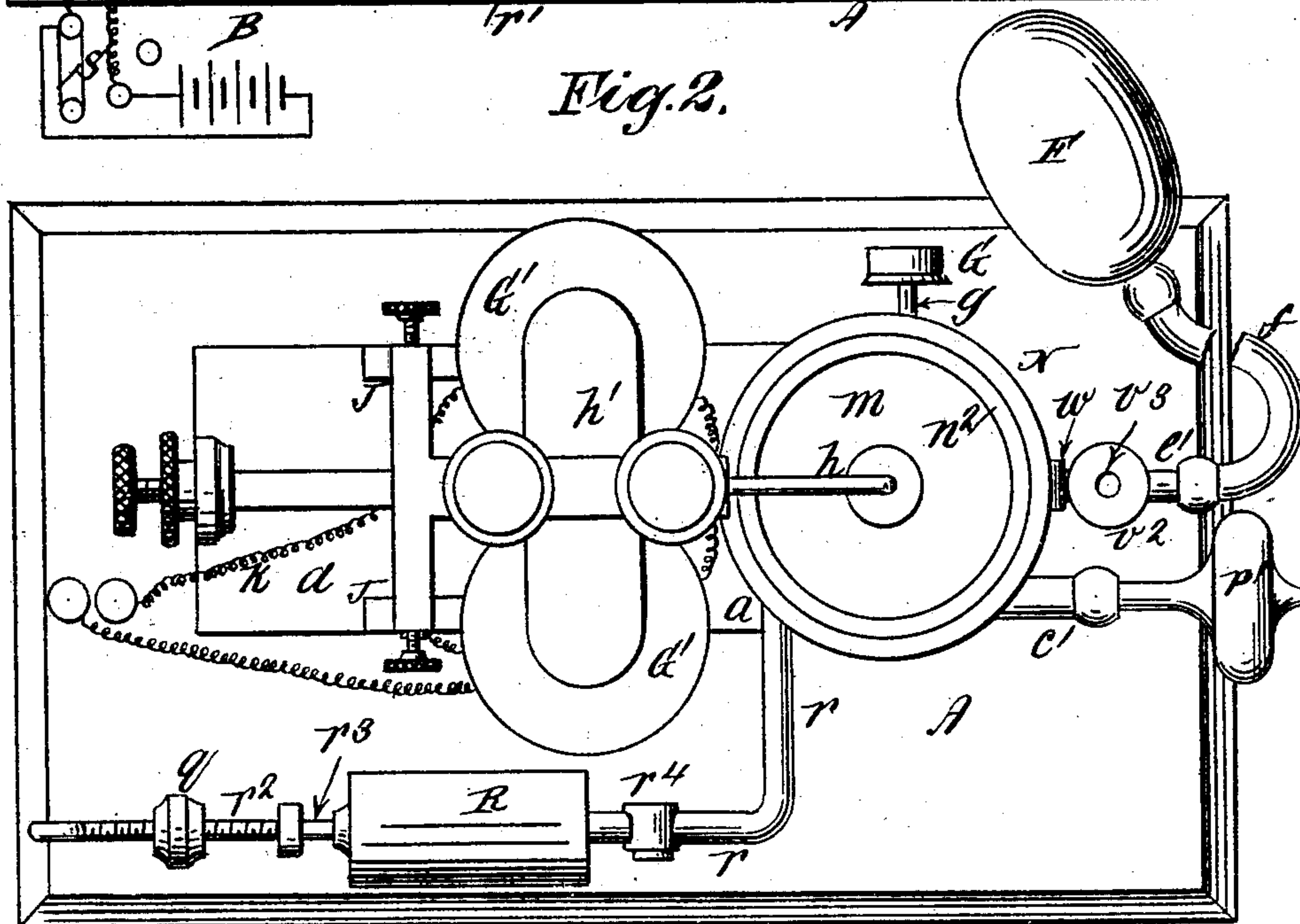
Patented Nov. 24, 1908.

2 SHEETS--SHEET 1.

*Fig.1.*



*Fig. 2.*



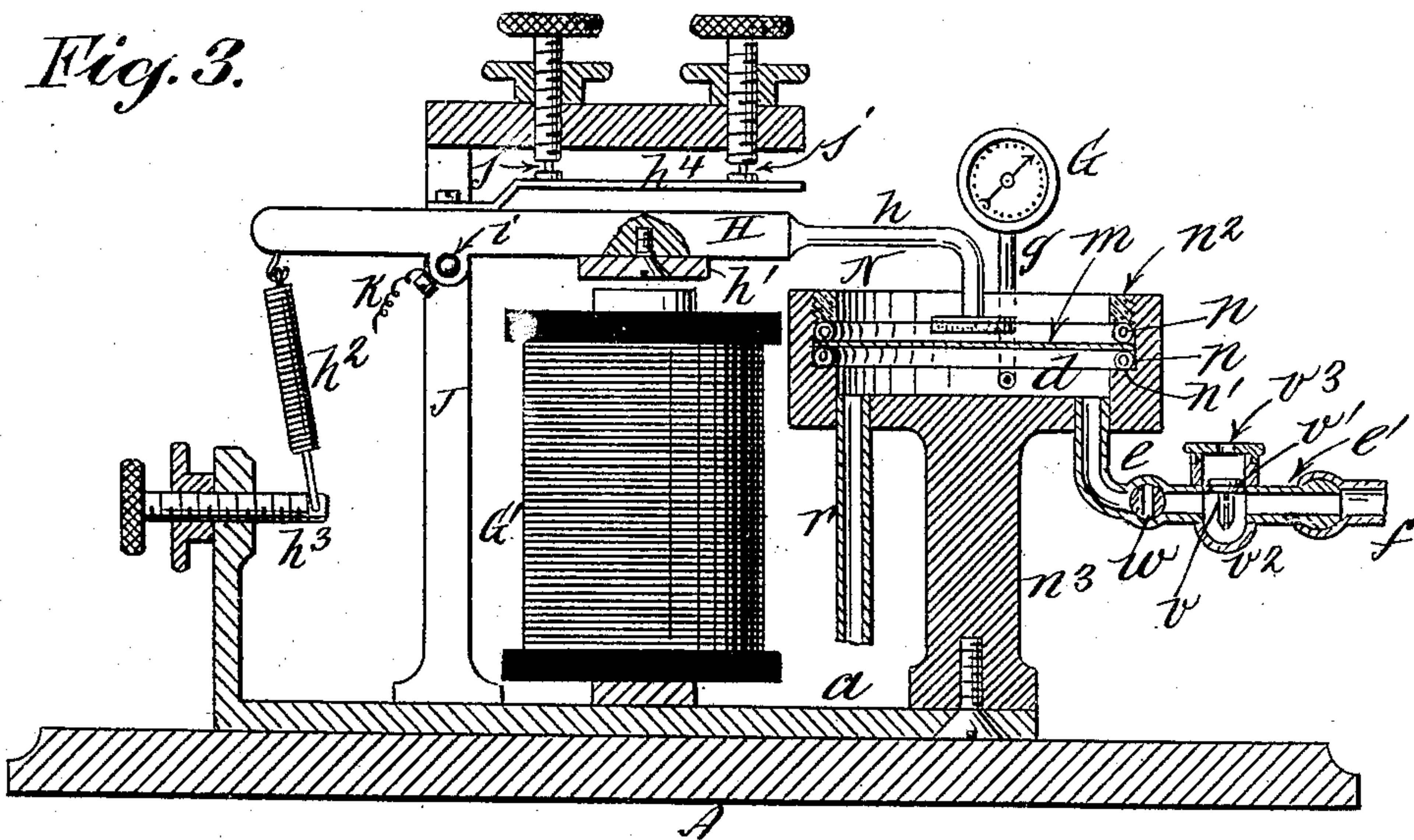
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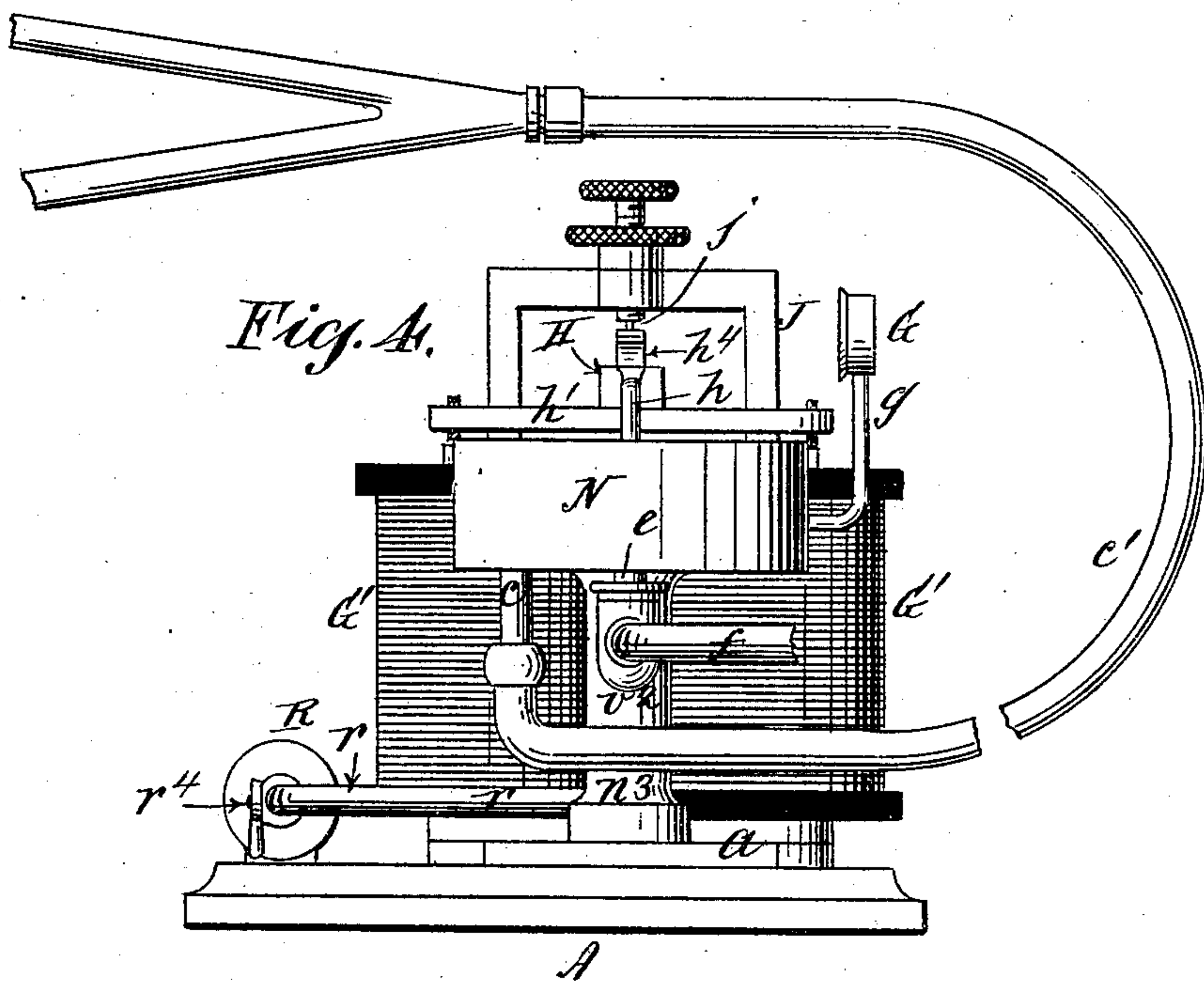
904,632.

2 SHEETS—SHEET 2.

*Fig. 3.*



*Fig. A.*



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# UNITED STATES PATENT OFFICE.

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## VIBRATORY APPARATUS FOR EAR TREATMENT.

No. 904,632.

Specification of Letters Patent.

Patented Nov. 24, 1908.

Application filed February 24, 1908. Serial No. 417,249.

*To all whom it may concern:*

Be it known that I, EUGENE MEYER, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Vibratory Apparatus for Ear Treatment, of which the following is a specification.

My improvements relate to apparatus for treating the tympanum of the ear to ear pulsations or vibrations for remedial purposes as set forth in Letters Patent No. 853,645 issued to me May 14th, 1907, and are designed to afford means whereby a relatively high degree of air tension or pressure may be attained and maintained as the case may require, and whereby greater delicacy and accuracy of tension or pressure may be achieved in adapting the apparatus to the requirements of individual patients.

The invention consists in the special construction and arrangement of parts described and claimed, a distinguishing feature being the use of an auxiliary tension and pressure regulating chamber connected with the vibratory air chamber as hereinafter set forth.

In the accompanying drawings, Figure 1, is a side elevation of my apparatus; Fig. 2, is a plan of the same; Fig. 3, a central longitudinal sectional elevation upon plane of line 3—3—Fig. 2; Fig. 4, is an end elevation.

The diaphragm *m*, is preferably, though not necessarily made of mica on account of its resilience, durability and unchangeability under changes of temperature and atmospheric conditions. It is preferably of circular form and its edges are supported by and between annular gaskets *n*, *n*, which may consist of rubber tubing as indicated in Fig. 3, the lower gasket resting upon an annular shoulder *n'*, in the air chamber *d*, and the upper gasket being confined by an annular peripherally threaded ring *n*<sup>2</sup>, screwing into the upper edge of the air cup *N* in which the air or diaphragm chamber *d*, is formed. The air cup *N* is shown as supported upon a standard *n*<sup>3</sup>, attached to the plate *a*, which is in turn rigidly secured to the base *A*.

*c*, is a pipe or nipple extending through the bottom of the air cup *N* and communicating with the air chamber *d*. To this nipple *c*, is attached a rubber tube *c'*, or equivalent for conveying the air pulsations created by the vibration of the diaphragm *m*, to the ear or ears, or nostril or nostrils of

the patient, as the case may require. Obviously the outer end of this tube *c'*, may be bifurcated, and it may be provided with a nozzle *p'*, for direct and air tight contact with the ear or nasal passages. Another tube *e*, protrudes from the bottom of the air cup *N*, communicating with the diaphragm chamber *d*, therein, as shown in Fig. 3, and in this tube *e*, and between the air cup *N* and the nipple *c'*, of the tube *e*, is interposed a small puppet valve *v*, resting normally on a seat *v'*, in the casing *v*<sup>2</sup>, and movable between said seat *v'*, and the aperture *v*<sup>3</sup>, in the top of the casing *v*<sup>2</sup>. A stop cock *w*, is interposed in the pipe *e*, between the air cup *N* and the valve *v*, so that the latter may be cut out when desired. Attached to the nipple *c'*, is a flexible tube *f*, upon the other end of which is a rubber bulb or equivalent device *F*. It will be seen that the valve *v*, may be designed as a double acting, since it performs the double function of a relief and a check valve.

A pipe *r*, connects the vibratory air chamber *d*, with the auxiliary regulating chamber *R* consisting preferably of a cylinder provided with a piston or diaphragm *r'*, which may be advanced or retracted by suitable means as by a screw thread *r*<sup>2</sup>, on the piston rod *r*<sup>3</sup>, engaging with a stationary nut *q*. A valve *r*<sup>4</sup>, is interposed in the pipe *r*, between the vibratory air chamber *d*, and the regulating chamber *R*.

*G* is a pressure gage of any suitable or well known construction communicating with the vibratory air chamber *d*, through the medium of the pipe *g*, and indicating visually to the operator the exact degree of pressure or tension existing within said vibratory air chamber *d*. This is an important feature in conjunction with the regulator *R* since it assists the operator in manipulating the regulator to attain a prescribed degree of either tension or pressure in the vibratory air chamber *d*.

As shown in the drawings the hammer *h*, is made to reciprocate by electromagnetism,—said hammer being attached to the free end of a lever *H* carrying an armature *h'*, opposed to the cores of two electro-magnets *G'*, *G'*. The rear end of the armature lever *H*, is connected with a spring *h*<sup>2</sup>, which is in turn connected with an adjusting screw *h*<sup>3</sup>, by which the tension of the spring may be regulated. The lever *H* is insulated from its fulcrum by a sleeve or bushing of insulating



material  $i$ , shown in Fig. 3, and carries a contact breaker  $h^4$ , of any desired or well known construction.

B is a battery or other source of electrical energy controlled by a switch S. The current, when turned on passes through the coils of the electro-magnets  $G'$ ,  $G'$ , to the standard J and through the latter to the contacts  $j$ ,  $j$ , and through them to the contact breaker  $h^4$ , and lever H from which the circuit is completed through the connection  $k$ ,—the current being alternately opened and closed by the action of the electro-magnets in the usual and well known manner. As a result the air within the chamber  $d$ , is alternately compressed and relaxed and the pulsations or variations in density or pressure are transmitted through tubing  $c'$ , to the nozzle or nozzles  $p'$ , the cock  $w$ , being preferably closed.

Under ordinary conditions of use where no special skill or delicacy of treatment is necessary, when it is desired to vary the pressure above or below normal or atmospheric pressure the valve  $v^4$ , is closed and the cock  $w$  is opened, so as to render the valve  $v$  available. Under these conditions, if the bulb F is collapsed slowly the excess of air will raise the valve  $v$  slightly from its seat  $v'$ , and allow such excess to escape without perceptibly affecting the air in the diaphragm chamber  $d$ . If now the bulb be released its automatic expansion will cause suction which will hold the valve  $v$ , on its seat  $v'$ , and create a partial vacuum within the air chamber  $d$ , which of course, creates suction in the tube  $c'$ . If, on the contrary, it is desired to create an excess of pressure within the diaphragm chamber  $d$  and tube  $c'$ , the bulb F is compressed forcibly and rapidly, immediately driving the valve  $v$ , upward, closing the aperture  $v^3$ , and forcing an excess of air into said diaphragm chamber  $d$  and tubing  $c$ . By these various manipulations I am enabled to adapt and modify the action of my apparatus to the special requirements of patients under treatment. Thus if the ear drum is collapsed or drawn inward, the partial vacuum or suction treatment is resorted to through the external ear passages, whereas if the tympanum is distended outward for any reason an excess of pressure is utilized in like manner. Or the reverse treatment may be resorted to in like cases where the treatment is administered through the nasal passages and eustachian ducts.

Where from the nature of the case under treatment a relatively high or low degree of pressure or tension is desirable, and where the degree of pressure or tension is to be maintained with accuracy, the valve  $v^4$ , is opened, establishing communication between the regulator chamber R and the vibratory air chamber. Under these conditions, it being understood that the nozzle or nozzles P'

are held in contact with the ear or ears, or nostril or nostrils of the patient as the case may be, so as to virtually seal the tube  $c'$ , the bulb F used as above set forth to either increase or decrease the internal pressure in the vibratory chamber  $d$ , above or below that of the atmosphere to the degree desired, when the valve  $w$  is closed. It is obvious that under these conditions the movement of the piston or diaphragm  $r'$ , within the regulating chamber R will either increase or diminish the degree of pressure or tension within the vibratory air chamber  $d$ , according to the direction of such movement. Thus if the diaphragm  $r'$  is adjusted inward toward the pipe  $r$ , the pressure in the vibratory chamber  $d$ , will be augmented, and if it is adjusted in the opposite direction the degree of tension will be increased. Hence the extent to which the air pressure or tension in the vibratory chamber  $d$  may be increased or diminished is only limited by the capacity of the regulator chamber R. By this means a degree of pressure or tension may be attained and maintained above and beyond the capacity of the flexible bulb F, since all possibility of leakage in that direction is prevented by the closing of the valve  $w$ . Furthermore, by watching the gage G, a skilled operator can manipulate the diaphragm  $r'$ , so as to regulate the pressure or tension with accuracy with relation to the special requirements of the patient under treatment, maintaining a prescribed degree of pressure or tension or varying the same as may be found most expedient.

I have found by actual experience that my apparatus may be effectually used to relieve tinnitus aurium or "head noises", to exercise and strengthen the tympanum and remedy or correct its position &c. It has been found efficient in returning and even curing partial and prolonged deafness; and may be used advantageously in loosening waxy deposits within the inner ear. In fact, owing to the elasticity and resilience of the air it may be thus used where resort to more positive rigid means would be inexpedient or dangerous.

My apparatus is especially advantageous and useful in substituting elastic fluid air in lieu of liquids in the treatment of the ear, since the practically incompressible liquids are apt to cause inflammation or even rupture unless skilfully used, and in cases where the eustachian tube is wholly or partially closed my apparatus furnishes the only available means of effective treatment.

What I claim as my invention and desire to secure by Letters Patent is,

1. In apparatus of the character designated, the combination of a vibratory air chamber, a diaphragm therein, a supplemental regulating chamber connected with said vibratory air chamber, a valve inter-



posed between said vibratory air chamber and said supplemental regulating chamber, a movable partition in the latter, means for adjusting said partition, means for forcing  
 5 air under pressure into said vibratory air chamber, means for vibrating said diaphragm in said vibratory air chamber consisting of a vibratory lever provided with an armature actuated by electro-magnetism,  
 10 and means for transmitting the resultant vibrations of air to a patient, substantially in the manner and for the purpose described.

2. In apparatus of the character designated, the combination of a vibratory air  
 15 chamber, a diaphragm therein, a supplemental regulating chamber connected with said vibratory air chamber, a valve interposed between said vibratory air chamber and said supplemental regulating chamber,  
 20 a movable partition in the latter, means for adjusting said partition, a collapsible bulb connected with said vibratory air chamber, a relief and check valve interposed between said vibratory air chamber and said bulb,  
 25 means for vibrating said diaphragm in said vibratory air chamber, consisting of a vibratory hammer lever provided with an armature actuated by electro-magnetism, and means for transmitting the resultant vibrations of air to a patient, substantially in the  
 30 manner and for the purpose described.

3. In apparatus of the character designated, the combination of a vibratory air chamber, means for exhausting air therefrom, a relief and check valve interposed  
 35 between said air chamber and said means of exhaust, a diaphragm in said vibratory air chamber, means for vibrating said diaphragm consisting of a vibratory hammer lever provided with an armature actuated by electro-magnetism, means for transmitting the resultant vibrations to a patient, a supplemental regulating chamber connected with said vibratory air chamber, a valve interposed between said vibratory air chamber and said supplemental regulating chamber, a movable partition in the latter and means for adjusting said partition for the purpose described.

4. In apparatus of the character designated, the combination of a vibratory air chamber, a diaphragm therein, a supple-

mental regulating chamber connected with  
 55 said vibratory air chamber, a valve interposed between said vibratory air chamber and said supplemental regulating chamber, a movable partition in the latter, means for adjusting said partition, means for vibrating the diaphragm in said vibratory air chamber, consisting of a vibratory hammer lever provided with an armature actuated by electro-magnetism, and means for transmitting the resultant vibrations of air to a  
 60 patient, for the purpose described.

5. In apparatus of the character designated, the combination of a vibratory air chamber, a collapsible bulb connected with said vibratory air chamber, a check valve  
 70 interposed between said vibratory air chamber and said bulb, a stop cock interposed between said vibratory air chamber and said check valve, means for vibrating said diaphragm, means for transmitting the resultant vibrations of air to a patient, a supplemental regulating chamber connected with said vibratory air chamber, a valve interposed between said vibratory air chamber and said supplemental regulating chamber,  
 80 a movable partition in the latter, and means for adjusting said partition for the purpose described.

6. In apparatus of the character designated, the combination of a vibratory air  
 85 chamber, means for exhausting air therefrom, a relief valve interposed between said vibratory air chamber and said means of exhaust, a stop cock interposed between said vibratory air chamber and said relief valve,  
 90 a diaphragm in said vibratory air chamber, means for vibrating said diaphragm, means for transmitting the resultant vibrations of air to a patient, a supplemental regulating chamber connected with said vibratory air chamber, a valve interposed between said vibratory air chamber and said supplemental regulating chamber, a movable partition in the latter and means for adjusting said partition therein, for the purpose described.

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Witnesses:

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