

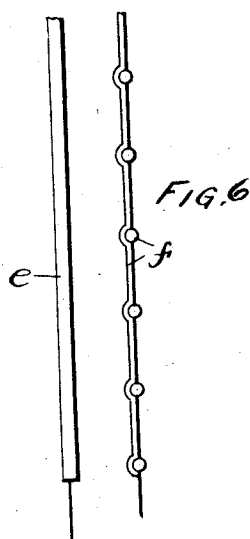
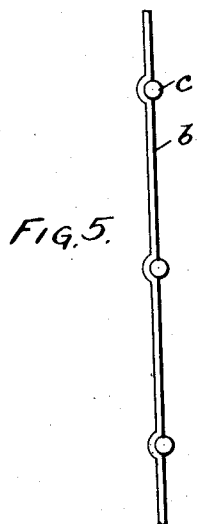
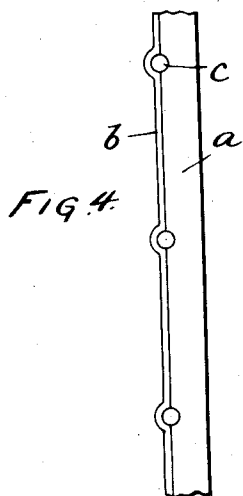
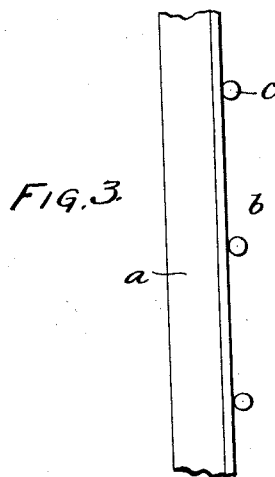
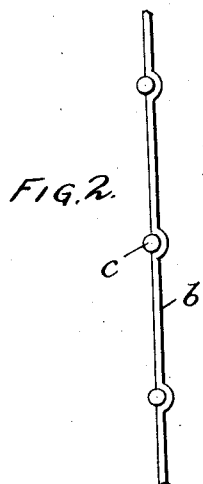
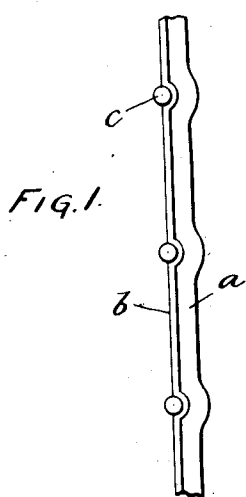
June 23, 1925.

1,543,033

W. O. SNELLING

ELECTRODE

Filed May 20, 1922



Walter O. Snelling.
Inventor:

UNITED STATES PATENT OFFICE.

WALTER O. SNELLING, OF ALLENTOWN, PENNSYLVANIA.

ELECTRODE.

Application filed May 20, 1922. Serial No. 562,526.

To all whom it may concern:

Be it known that I, WALTER O. SNELLING, a citizen of the United States, residing at Allentown, in the county of Lehigh and State of Pennsylvania, have invented certain Improvements in Electrodes, of which the following is a specification.

My invention relates to improvements in electrodes, and more particularly relates to improvements in ionic plates or electrodes for use in photo-electric cells, thermionic or valve bulbs, and like apparatus.

I have discovered that a metal film of such thinness that it is transparent to light, supported on grid or gauze of an electrically conducting material, forms an electrode having many advantages for use in apparatus for the detection of ether vibrations and ionic effects.

As an example of my invention, I will describe the method which I prefer to use in the preparation of an electrode suitable for use in apparatus for the detection of weak impulses. I first deposit upon a thin piece of metallic silver by electrolytic action a film of gold, continuing the deposition or plating of the gold until I have obtained a film of the desired thickness. I then remove the gold-plated piece of silver from my bath, and bring a metallic grid or a piece of fine wire gauze in contact with the gold surface, pressing the two together until suitable contact is secured. The ductility of the gold while supported by the silver backing prevents the thin gold film from rupturing or tearing, and by the use of suitable pressure very perfect contact can be obtained without the aid of any cementing agent. I may however use a cementing agent to better attach my gauze or grid to the gold film, and under certain circumstances this is desirable, while under other circumstances I find it desirable after uniting my grid to my gold film by means of pressure, to give a further short period of electrodeposition, this serving to still further unite the grid to the gold film.

Having thus obtained suitable contact between a very thin and light-transparent film of gold and a grid or gauze intended as the permanent support for the gold film, I next remove the silver backing. I may re-

move the silver backing by solution in an agent such as nitric acid which dissolves silver but not gold, or I may remove the silver backing by electrolytic action.

Upon the removal of the silver backing the gold film, supported by the gauze or grid, is ready after being washed and dried for mounting in any desired type of apparatus. The thin film of gold between the meshes of wire gauze, or between the parallel wires or rods of the grid, has a high degree of light-transparency when the gold film is of proper thickness, and this proper thickness can be readily controlled by the time of electrical deposition and the amount of current used, the gold film being preferably of such thickness that it transmits light freely. The film of gold of such extreme thinness however, has very little mechanical strength and also has very low electrical conductivity, but both of these elements are supplied by the supporting grid or gauze.

In the illustration, Fig. 1 shows in greatly enlarged form a section through one of my electrodes before the silver backing plate is dissolved away, *a* representing the silver backing plate, *b* representing the film of gold deposited upon this silver plate, and *c* representing the wires of the wire gauze or grid, after these have been embedded by pressure in the gold-plated silver. The drawing is diagrammatical only, and is not drawn to scale, the gold film being actually very thin in proportion to the thickness of the silver plate or the diameter of the wires forming the grid or gauze.

Fig. 2 represents a cross section through my electrode, after the silver backing plate has been dissolved, *c* representing the supporting wires of the grid or gauze, and *b* representing the gold film supported by these wires.

In another form of my invention, I prepare a thin film of metal of such thickness as to be transparent to light, and I then support this film on glass or other transparent support by means of shellac or any other suitable cementing agent. I may prepare my film by electrodeposition as previously described, and I may then dissolve away the backing after suitably mounting my film upon the transparent support. In-

stead of using a transparent film prepared by electrodeposition as described, I may use a metal film of sufficient thinness to be transparent to light, prepared by any other means, the essential feature of my invention being the use of metal films of such thinness as to be transparent to light. Having mounted my thin metal film upon glass or other transparent support, I then bring an electrically conducting grid or gauze into contact with a surface of the metal film. An electrode prepared by the method just described is illustrated in Fig. 3, in which *b* represents the thin film of gold, *c* represents the electrically conducting grid or gauze, and *d* represents the supporting plate of glass or other material.

In still another form of my invention, I place a grid or gauze of platinum for example, in contact with a plate of a metal such as silver, and by hydraulic pressure or by passing between rolls, I force the grid or gauze partially into the silver plate, this action also flattening out the grid or gauze and bringing all of its parts into substantially a single plane. I then bring a film of a suitable metal into contact with the mutual surface of contact of the gauze and of the metal plate, this film being preferably formed by electrodeposition, but satisfactory results being obtained by "spattering", or by other known means of obtaining very thin metallic films. Having obtained a suitable film of metal in contact with the surface of the metal plate into which the gauze has been pressed, the film of metal being so thin as to be light-transparent, I remove by solution or by any other suitable means the metal plate, thus leaving my light-transparent film firmly supported by and electrically deposited upon the grid or gauze. This form of my invention is illustrated in Fig. 4 in which *a* represents the metal plate, *c* represents the grid or gauze embedded in this metal plate by rolling or by pressure as described and *b* represents the film of metal applied to the surface of the gauze and of the plate. Fig. 5 shows the appearance of this electrode after dissolving away the metal plate *a*.

Fig. 6 represents diagrammatically an electrode made in accordance with my present invention, in association with a plate electrode of the usual type, *e* representing the plate electrode, and *f* representing my new light-transparent electrode. Electrodes prepared in accordance with my present invention are useful in connection with many forms of electroionic and thermionic devices, and although particularly useful in the construction of detectors or cells sensitive to light waves, may also be used in connection with other forms of electrical devices for the detection, reception or amplification of ionic effects, when suitably ar-

ranged in conjunction with other electrodes in bulbs or other apparatus.

Although I have referred to gold as being the material which I prefer to use for my film of light-transparent material, I do not wish to confine myself to the use of gold, as I may use many other materials with equal success. The wires of my gauze or grid may be made of gold, but platinum and many other metals may be used with equal success. Instead of using a plate of silver on which to plate my thin light-transparent film, I may use a surface of copper or other suitable material. The diameter of the wire used in forming my grid may be varied within wide limits, as may also the distance or spacing between such wires. Instead of a gauze or grid of wire, I may of course use a perforated plate of metal, or thin rods, as equivalents, the essential feature of my invention being an electrode comprising a thin film of light-transparent metal in association with a supporting or reinforcing member, so disposed with relation to the film of light-transparent metal as to compensate for the low electrical conductivity and low strength of such film.

The function of my light-transparent metal film is to receive electroionic and thermionic effects, and the function of the electrically conducting grid or gauze is to afford a suitable measure of mechanical strength to my extremely thin metal film, and also to afford paths of higher electrical conductivity than are offered by the very thin metal film. It will be evident that the electrical conductivity of such extremely thin metal film as I use in order to obtain the desired transparency to light is very low, but by providing wires or rods in electrical contact with my thin metal film at frequent intervals over its whole surface, the distance from any point on the film to any of the rods or wires may be made extremely small, and accordingly the electrical conductivity of my electrode when considered as a whole is extremely high, my electrode combining to a very high degree the desirable characteristics of good transparency to light and low electrical resistance.

It will be recognized that many equivalents may be employed without departing from the essence of my invention as herein disclosed, and accordingly no limitations are to be imposed except as indicated in the appended claims.

I claim:

1. An electrode comprising a film of light-transparent metal superimposed upon an electrically conducting wire gauze.
2. An electrode comprising a light-transparent film of metal in association with an electrically conducting support contacting with one surface of the light-transparent film at a plurality of points.

3. An electrode for the detection of ionic effects comprising a metallic film transparent to light in association with a metallic grid of higher electrical conductivity than
5 the light-transparent film.
4. An electrode comprising a series of electrically conducting members and a light-transparent metallic film connecting these members.
- 10 5. An electrode comprising an electrically conducting wire gauze and a light-transparent metallic film closing the openings of such gauze.
6. An electrode comprising a grid of electrically conducting material and a light-transparent metallic film connecting the individual members of such grid. 15

In testimony whereof, I have hereunto subscribed my name this 27th day of April 1922.

WALTER O. SNELLING.