Jan. 14, 1941. H. BRIEBRECHER 2,228,868

POWER SUPPLY SYSTEM

Filed Oct. 21, 1938

Fig 1

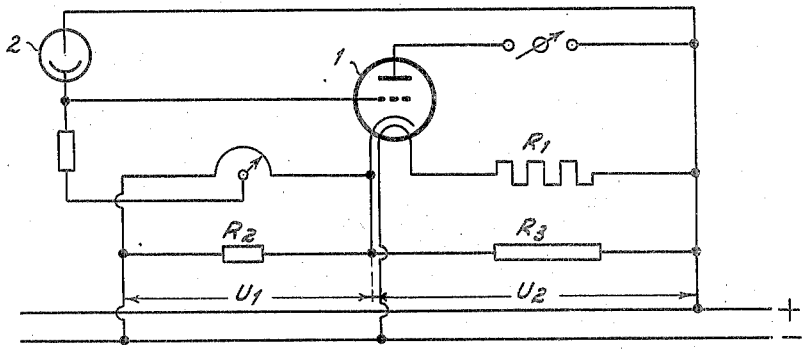



Fig 2

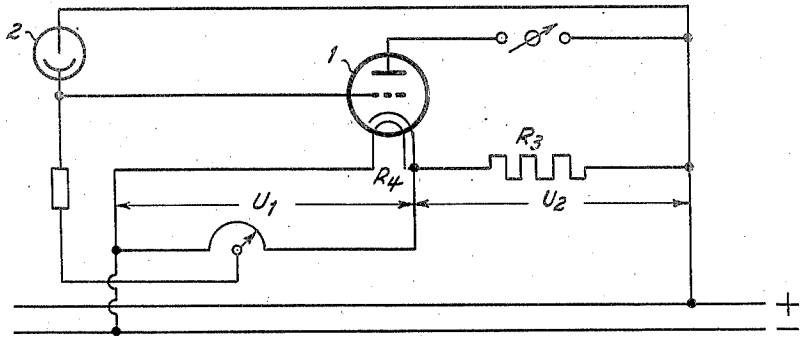
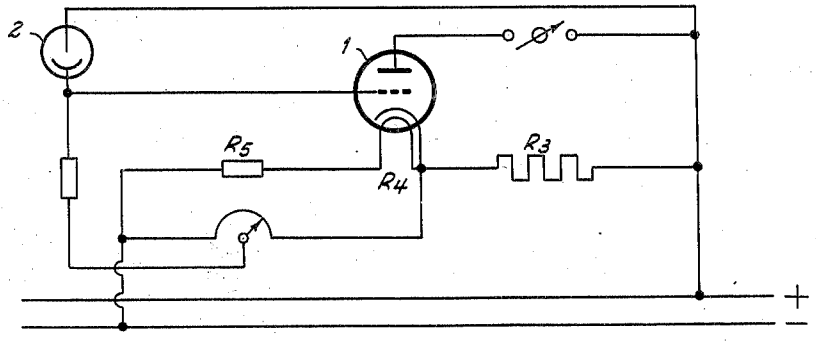



Fig 3




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## POWER SUPPLY SYSTEM

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3 Claims. (Cl. 179—171)

This invention is concerned with a circuit organization adapted to amplify feeble electric potentials, especially the voltage variations caused by photo-electric cells in measuring amplifiers in which the plate current of the amplifier tube is to be kept independent of and unaffected by the fluctuations of the supply-line voltage.

If conventional amplifiers are connected with the supply line, there results a marked dependence of the amplified current upon the fluctuations of the line potential, and this occasions an uncontrollable variation of the plate current. This dependence is particularly pronounced when the amplifier is associated with a D. C. supply line.

An amplifier arrangement of his kind known in the prior art is illustrated in Fig. 1. The heating current of the indirectly heated tube 1 is set to the proper value by the agency of the series resistance $R_1$. The grid and the plate potentials as well as the voltage for the photo-electric cell are derived from the voltage divider comprising the resistances $R_2$ and $R_3$. Thus, if the supply-line potential varies, say +10 percent, then the potential $U_2$ of the plate and the potential $U_1$ of the grid will vary in the same proportion. The fall of voltage at the filament of the tube, however, because of the temperature dependence of the filament resistance, grows roughly in double proportion, that is, by around 20 percent. This growth of the plate potential and the filament potential results in a rise of plate current. The simultaneous rise of the negative grid bias voltage $U_1$, to be sure, partly counteracts such an increment, but it is discovered that in this arrangement, with the majority of types of tube, there results a change in the plate current amounting to twice or even three times the change in the supply line voltage so that this amplifier scheme becomes unserviceable for precise measurements.

Now, by the object of the present invention these drawbacks are obviated by using the fall of voltage occasioned at the filament of the tube to act as the grid biasing voltage with the consequence that the plate current of the amplifier tube becomes perfectly unaffected by fluctuations of line potential.

For a more detailed explanation of the object of this invention reference is made to the appended drawing.

In Fig. 1 is shown a discharge tube 1 together with a photo-electric cell 2 connected in an amplifier circuit organization in which the production of the grid biasing voltage is effected in the usual way by the cathode resistance $R_2$ so that, as before outlined, there occur appreciable changes in the plate current as a result of supply line voltage fluctuations.

Figs. 2 and 3 illustrate two exemplified embodiments of the circuit arrangement as here disclosed.

The fall of potential occasioned at the filament or heater of the tube serves for biasing the grid. Owing to the temperature dependence of the heater, for instance, in the presence of the line potential of +10 percent, there results a change in the negative grid potential being twice as large, say, for instance, 20 percent, whence there is a chance to compensate by the aid of such grid voltage variations the effects of the plate and the heating voltage variations. As a result the plate current becomes largely independent of the fluctuations of the supply line voltage.

By the arrangement here disclosed it becomes readily feasible to make the shape of the grid potential charcateristic as a function of the supply line voltage variations as may be desired in dependence upon the grid transparency, the drive range, etc. The case also may arise where the fluctuations of the supply-line voltage by simultaneous automatic grid voltage variations may thus be over-compensated, in other words, that the plate current, upon an increase in the line potential, will not only rise, but even diminish.

According to a further object of the invention the grid biasing voltage of tube 1 is not taken only from, or across, resistance $R_4$, but rather from a series arrangement comprising the heater resistance $R_4$ and a fixed resistance $R_5$. According to Fig. 3, by suitable choice of the fixed resistance $R_5$ in relation to the resistance $R_4$ of the filament it is possible to secure the desired grid bias voltage for any desired tube. The compensatory effect by grid voltage variation is most marked for $R_5=0$. It becomes so much lower, the less $R_5$ compared to $R_4$.

This arrangement not only offers a chance to stabilize the plate current at a value independent of the fluctuations of the supply line voltage, but it is, for instance, also possible to cause the plate current, with growth of the line voltage, to either raise or decline at a certain rate and proportion.

I claim:

1. In an electrical circuit, an electronic tube having an anode, an indirectly heated cathode, a heater filament for the cathode, and a grid electrode, said heater filament having a resistance

which increases with increasing current through it, a network across which is available a line voltage, the value of the line voltage being subject to variations, means for applying a voltage derived from said line voltage between the anode and cathode of said tube, a circuit for energizing the heater filament comprising a constant resistance and said filament in series connected across said network, said circuit being arranged to cause an increase in the line voltage to produce a proportionately larger increase in the drop across the filament and means for impressing between the grid electrode and the cathode a voltage which is dependent upon the voltage drop across the filament.

2. In an electrical circuit, an electronic tube having an anode, an indirectly heated cathode, a heater filament for the cathode, and a grid electrode, said heater filament being characterized by that its resistance increases with increasing current through it, a network across which is available a voltage the value of which is liable to vary, means for applying a voltage derived from said network between the anode and cathode of the tube, means including a series constant resistance device for connecting the filament across said network, said constant resistance device being arranged to cause the filament voltage to increase in greater proportion than increases occurring in the network voltage, and means for impressing the voltage drop developed across the filament, between the grid electrode and the cathode.

3. In signalling apparatus including at least one electronic tube having an indirectly heated cathode, an anode and a grid electrode, a pair of terminals adapted to be connected to a source of potential, a source of input voltage, a load, a filament for heating the cathode, means including a series impedance for connecting the filament across said two terminals, means including said impedance for connecting the cathode to one of said terminals, a resistor connected across said filament, a tap on said resistor, means connecting the grid electrode to said tap, a connection including said source of input voltage and said impedance in series between the grid electrode and the cathode, and means including said load for connecting the anode to the last named terminal.

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