Jan. 20, 1931. H. P. DONLE 1,789,673

AMPLIFIER COUPLING

Filed March 30, 1926

Fig. 1.

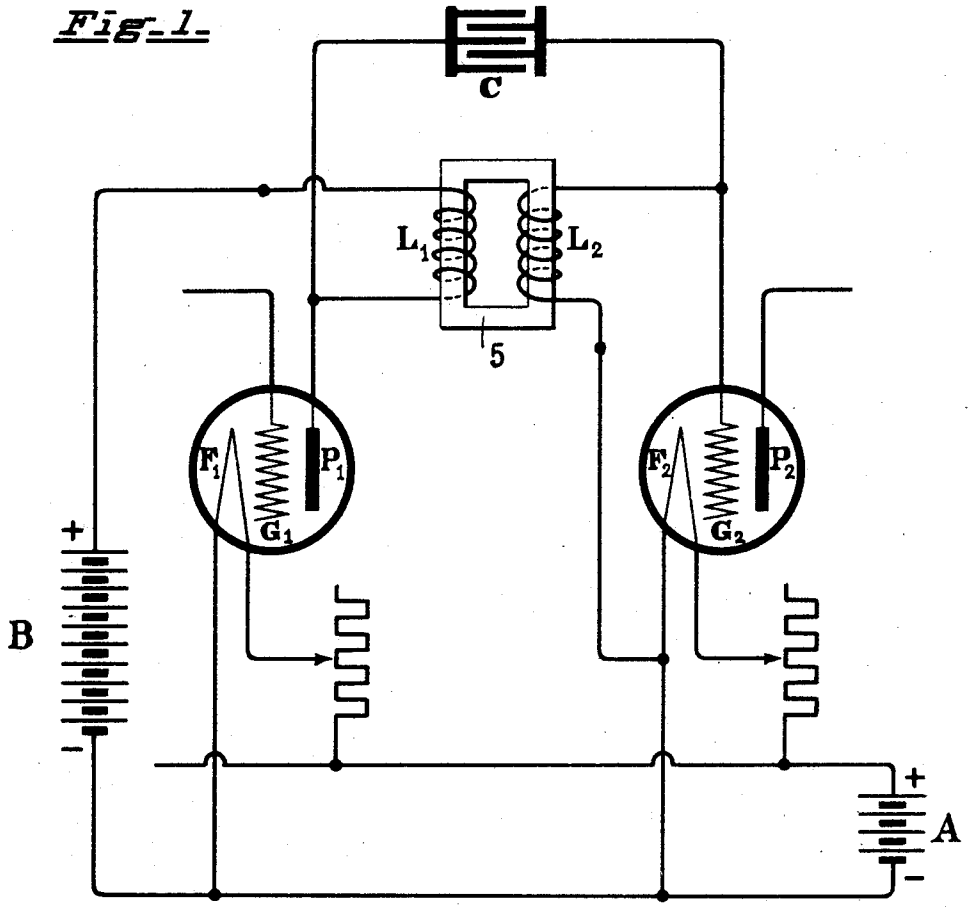


Fig. 2.

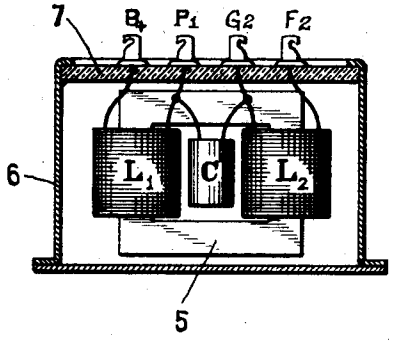
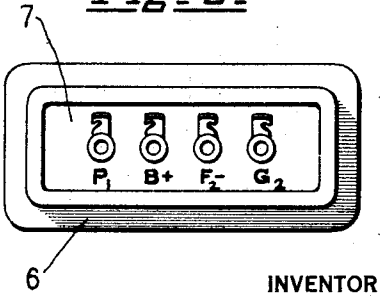


Fig. 3.



INVENTOR

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Patented Jan. 20, 1931

1,789,673

UNITED STATES PATENT OFFICE

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AMPLIFIER COUPLING

Application filed March 30, 1926. Serial No. 98,451.

My invention relates to signal receiving apparatus and apparatus for any systems employing so called vacuum tube amplifiers.

There are three methods of coupling commonly used in the art, viz: transformer, resistance and impedance. Transformer coupling has long been recognized as most efficient from the view of volume amplification, but it frequently gives rise to troublesome distortion and the output varies considerably with the intensity of the applied signal. Resistance coupling is inefficient as to volume and it sometimes gives a choking effect especially on heavy signals.

Impedance coupling is a partially effective attempt to combine the good qualities of the transformer coupling and the resistance coupling. Generally it is more efficient than transformer coupling for high input and more efficient than the resistance type of coupling but it does not give the general volume amplification per tube of the transformer coupling and has some disadvantages in common with resistance coupling.

The object of this invention is to obtain a highly efficient coupling without the disadvantages above pointed out.

Fig. 1 shows diagrammatically parts of a typical system embodying my invention.

Fig. 2 is a side view and section of the preferred form of coupling device.

Fig. 3 is a plan view of the same.

The coupling device is made as a unit for connection in any system or it may be built in to a set. In any event it will consist of two inductance coils L_1 and L_2 on a common core 5 and a condenser C. One coil is connected between the B battery and the plate P_1 of the first tube and the other coil is connected between the filament F_2 and the grid G_2 of the next tube. The condenser is inserted between the plate of the first tube and the grid of the second. The device may have suitable terminals to facilitate the various connections in any suitable manner.

The core may be of any suitable construction and has a closed magnetic circuit without any magnetic shield or leakage tongue between the branches on which the coils are mounted. It has been found most convenient and desirable to mount the coils on opposite branches or legs of the core. This gives the inductances a minimum resistance and when they are of the same size and of the same wire, they will be of equal resistance. The coils are designed to have a low ohmic resistance and an impedance sufficiently high to permit an efficient transfer of energy from one winding to the other at audio frequencies.

The condenser should have a capacity of not less than .001 microfarads and preferably of about .25 microfarads although this is not a critical value. The condenser may be located between the coils.

The absolute values of the inductances depend upon circumstances and the various circuit constants. The coils and condenser are preferably housed in a case 6 which may have an insulating top 7 with terminals P, B, F and G for connection to the corresponding elements.

Such a combination gives excellent results at all usual values of input signals and is particularly desirable on loud signals because it does not load up or choke as do all of the other systems of amplifier coupling. When properly designed the device is comparatively free from feed-back and oscillation and in fact it is possible with this system of coupling to use several stages without difficulty and to give perfect quality of signal reproduction under conditions where choke or resistance coupling would be almost completely inoperative.

The construction is not only more simple and efficient mechanically but also electrically. There is a certain amount of transfer of energy from one coil to the other through the core and the balance through the condenser. The amount of transfer of energy from one coil to the other can be determined by the reluctance of the iron core.

I claim:

1. An audio frequency amplifier having vacuum tubes with a coupling device between them comprising an inductance inserted in the plate-cathode circuit of one tube, an inductance inserted in the grid-cathode circuit of the following tube, a closed magnetic core common to both in-

ductances for producing a substantial mutual inductance between said circuits, and a condenser connected directly between the plate and grid terminals of said inductances, the second mentioned inductance being connected at one end between the condenser and the grid of the second tube and at its other end to the filament of the second tube whereby a substantial capacity coupling is produced, said inductances having low ohmic resistance and impedance sufficiently high to insure an efficient transfer of energy from one inductance to the other at audio frequencies.

2. An audio frequency amplifier having vacuum tubes with a coupling device between them comprising the combination of a transformer having a single closed circuited magnetic core with primary and secondary windings arranged in mutually inductive relation, said windings having low resistance and substantial impedance at audio frequencies, a condenser connected between the high voltage ends of said windings and to the plate and grid of the respective tubes and without substantial inpedance, whereby part of the energy is transferred electro-statically thru the capacity and a part electromagnetically by the windings and the core.

HAROLD P. DONLE.