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## THERMIONIC AMPLIFIER

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This invention relates to thermionic ampli-  
fiers and more particularly to arrangements  
wherein a common stage of amplification is as-  
sociated with a preceding plurality of amplifiers,  
the total output from said preceding amplifiers  
being required to be amplified by the common  
stage.

It is often required to couple two or more  
stages of amplification to a succeeding common  
stage; for example, this requirement frequent-  
ly arises in microphone pick-up systems where-  
in each microphone has its individual amplifier,  
the outputs from the individual amplifiers being  
required to be fed to a common amplifier. An-  
other example arises in television systems where-  
in each of a plurality of photo-electric cell sys-  
tems has its individual photo-cell amplifier  
whose outputs are required to be fed to a main  
line amplifier. Arrangements of this kind pre-  
sent considerable practical difficulties for, if the  
outputs from the various amplifiers are simply  
coupled in parallel to the input of the succeed-  
ing common amplifier (as is usual at the present  
time) trouble will be experienced unless careful  
matching of the phase of the outputs from the  
various individual amplifiers (which are coupled  
to the common amplifier) is resorted to. Fur-  
thermore, since the various individual amplifiers  
are coupled to the common amplifier input cir-  
cuit in parallel the over-all "gain" is not very  
great.

The present invention has for its object to  
avoid these difficulties and according to the said  
invention the various individual amplifiers whose  
total output is required to be amplified in a com-  
mon succeeding stage are connected in series  
with one another across an input circuit in or  
coupled to said common stage.

One form of construction in accordance with  
the invention and wherein the said invention is  
applied to a system comprising two amplifiers  
whose total output is required to be fed to a  
common stage will now be described.

The invention is illustrated in the accompany-  
ing drawing which shows diagrammatically one  
form of construction in accordance therewith.

Referring to the drawing two signal inputs  
derived, for example, from two microphones are  
applied to two separate and distinct amplifiers  
which may be of any known type and which are  
represented in the accompanying drawing as  
within the rectangle  $A_1$  and  $A_2$  respectively, the  
inputs to these amplifiers being applied as indi-  
cated by the arrows marked 1 and 2 respectively.  
The output from the amplifiers  $A_1$  and  $A_2$  are

applied to the input circuits of two triodes  $V_1$   
and  $V_2$  respectively, these triodes being illustrat-  
ed as of the indirectly heated cathode type. The  
triodes  $V_1$  and  $V_2$  are the amplifiers whose total  
output is required to be amplified in a common  
succeeding stage and as will be seen the two  
valves  $V_1$  and  $V_2$  are in series with a source  
of plate potential (not shown). The positive  
terminal +HT of the source (not shown) of  
plate potential is connected through an anode  
resistance AR to the anode of one valve  $V_1$  the  
cathode of which is directly connected to the  
anode of the other valve  $V_2$  the cathode of the  
last mentioned valve being connected to earth.  
As will be seen, separate inputs are applied across  
the grid circuits of these two valves as in the  
usual way, and grid resistances  $GR_1$  or  $GR_2$  are  
connected as shown between each grid and a suit-  
able source of bias potentials  $B_1$  or  $B_2$ . The  
junction point of the anode resistance and the  
anode to which said resistance is directly con-  
nected, is connected through a coupling con-  
denser as shown to the first grid of a common  
amplifier indicated within the rectangle  $C_1$ .

The invention is of course not limited to ar-  
rangements wherein inter-stage coupling is ef-  
fected as illustrated by resistance and capacity  
but other forms of coupling may be employed.

Having now particularly described and as-  
certained the nature of my said invention and  
in what manner the same is to be performed, I  
declare that what I claim is:

1. An amplifying system comprising a source  
of potentials to be amplified, a first amplifier  
therefor, means including a condenser for capac-  
itively coupling said source to the input side  
of said amplifier, a second source of potentials to  
be amplified, a second amplifier, means includ-  
ing a condenser for capacitively coupling said  
second source to the input side of said second  
amplifier, a tube having an input grid, a cathode  
and a plate, means including a condenser for  
capacitively coupling the output of the first am-  
plifier to the input grid and cathode of said tube,  
another tube having an input grid, a cathode and  
a plate, means including a condenser for capaci-  
tively coupling the output of said second ampli-  
fier to the input grid and cathode of said other  
tube, means for directly connecting the cathode  
of one of said tubes in series with the plate of  
the other of said tubes, a connection supply-  
ing plate potential to said tube whose cathode  
is connected serially with the plate of the other  
tube, whereby plate potential for said other tube  
is supplied through said serial connection, a com-

mon amplifier for said tubes, means connecting the input terminals of said common amplifier across the plate of one of said tubes and the cathode of the other of said tubes, and an output circuit connected to the output terminals of said common amplifier.

2. In an amplifier circuit system wherein the total output of a plurality of amplifiers receiving separate inputs is required to be amplified in a common succeeding amplifier, said circuit system comprising, a plurality of separate input sources, a separate amplifier having a plurality of thermionic tubes connected to each separate input source, means for combining the output of said separate amplifiers comprising a first and second thermionic amplifier device having at least an anode, grid and cathode, each one of said thermionic amplifier devices being coupled to said separate input sources by separate capacitive means connected from the output of each of said separate amplifiers to the grid of the respective thermionic amplifier device, said thermionic amplifier devices being connected in series by a connection from the cathode of said first thermionic device to the anode of said second thermionic device, the output of said first and second thermionic devices being connected across the input circuit of the common succeeding amplifier.

3. In an amplifier circuit system wherein the total output of a plurality of amplifiers receiving separate inputs is required to be amplified in a common succeeding amplifier, said circuit system comprising, a plurality of separate input sources, a separate amplifier having a plurality of thermionic tubes connected to each separate input source, means for combining the output of said separate amplifiers comprising a first and a second thermionic amplifier device each having at least an anode, grid and cathode electrode, capacitive coupling means connecting the output of said separate amplifiers to the grids of said first and second thermionic amplifier devices, an anode resistance connected from the anode of said first thermionic amplifier device to the positive side of a high potential source, the cathode of said first thermionic amplifier device being connected to the anode of said second thermionic amplifier device, the cathode of said second thermionic device being connected to the negative side of said high potential device, and a coupling condenser connected to the junction point of said anode resistance and said anode for coupling said first and second thermionic devices to the input grid circuit of said common succeeding amplifier, the cathode of said common succeeding amplifier being connected to the negative side of said high potential source.

4. An amplifying system comprising a source of potentials to be amplified, a first amplifier therefor, means including a condenser coupling said source to the input side of said amplifier, a second source of potentials to be amplified, a second amplifier, means including a condenser for capacitively coupling said second source to the input side of said second amplifier, a vacuum tube having an input grid, a cathode, a separate heater for indirectly heating said cathode, and a plate, means including a condenser for capacitively coupling the output of the first amplifier to the input grid and cathode of said tube, another vacuum tube having an input grid, a cathode, a separate heater for indirectly heating said cathode, and a plate, means including a condenser for capacitively coupling the out-

put of said second amplifier to the input grid and cathode of said other tube, means for directly connecting the cathode of one of said tubes in series with the plate of the other of said tubes, a connection supplying plate potential to said tube whose cathode is connected serially with the plate of the other tube, whereby plate potential for said other tube is supplied through said serial connection, a common amplifier for said tubes, means connecting the input terminals of said common amplifier across the plate of one of said tubes and the cathode of the other of said tubes, and an output circuit connected to the output terminals of said common amplifier.

5. An amplifying system comprising a source of potentials to be amplified, a first amplifier therefor, capacitive means for coupling said source to the input side of said amplifier, a second source of potentials to be amplified, a second amplifier, capacitive means for coupling said second source to the input side of said second amplifier, a vacuum tube having an input grid, a cathode, a separate heater for indirectly heating said cathode, and a plate, capacitive means for coupling the output of the first amplifier to the input grid and cathode of said tube, another vacuum tube having an input grid, a cathode, a separate heater for indirectly heating said cathode, and a plate, the heaters of said first and second mentioned indirectly heated tubes being connected together in parallel from a source of electrical potential, capacitive means for coupling the output of said second amplifier to the input grid and cathode of said other tube, means for directly connecting the cathode of one of said tubes in series with the plate of the other of said tubes, a connection supplying plate potential to said tube whose cathode is connected serially with the plate of the other tube, whereby plate potential for said other tube is supplied through said serial connection, a common amplifier for said tubes, means connecting the input terminals of said common amplifier across the plate of one of said tubes and the cathode of the other of said tubes, and an output circuit connected to the output terminals of said common amplifier.

6. In an amplifier circuit system wherein the total output of a plurality of amplifiers receiving separate inputs is required to be amplified in a common succeeding amplifier, said circuit system comprising a plurality of separate input sources, a separate amplifier having a plurality of thermionic tubes connected to each separate input source, means for combining the output of said separate amplifiers comprising a first and second thermionic amplifier device having at least an anode, grid and cathode, each one of said thermionic amplifier devices being coupled to said separate input sources by separate capacitive means connected from the output of each of said separate amplifiers to the grid of the respective thermionic amplifier device, a separate bias resistance and a source of bias potential connected in series between each grid and cathode of said first and second thermionic amplifier devices, said thermionic amplifier devices being connected in series by a connection from the cathode of said first thermionic device to the anode of said second thermionic device, the output of said first and second thermionic devices being connected across the input circuit of the common succeeding amplifier.

7. In an amplifier circuit system wherein the

total output of a plurality of amplifiers receiving separate inputs is required to be amplified in a common succeeding amplifier, said circuit system comprising a plurality of separate input sources, a separate amplifier having a plurality of thermionic tubes connected to each separate input source, means for combining the output of said separate amplifiers comprising a first and a second thermionic amplifier device each having at least an anode, grid and cathode electrode, capacitive coupling means connecting the output of said separate amplifiers to the grids of said first and second thermionic amplifier devices, a separate bias resistance and a source of bias potential connected in series between each grid and cathode of said first and second thermionic amplifier device, an anode resistance con-

nected from the anode of said first thermionic amplifier device to the positive side of a high potential source, the cathode of said first thermionic amplifier device being connected to the anode of said second thermionic amplifier device, the cathode of said second thermionic device being connected to the negative side of said high potential device, and a coupling condenser connected to the junction point of said anode resistance and said anode for coupling said first and second thermionic devices to the input grid circuit of said common succeeding amplifier, the cathode of said common succeeding amplifier being connected to the negative side of said high potential source.

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