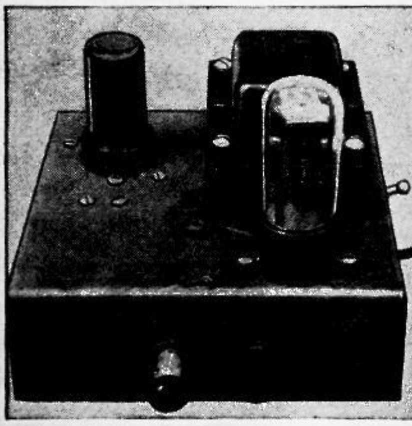
By ROBERT B. ESSEX

BRIDGED-T CIRCUIT

Pointing Out Possibilities of This Useful Circuit and Describing a Self-Powered Two-Tube Unit

THE Bridged-T circuit has been placed upon a shelf and almost entirely cast aside by the home experimenter, Ham, serviceman and design engineer, because of its seeming complexity. In reality, this circuit is very easy to handle, and may be applied with little difficulty by anyone with a little radio knowledge.

The Bridged-T is actually an R-C filter network, and when employed as shown in Fig. 1, will attenuate or suppress only one frequency. In other words, if we knew that several widely separated frequencies were present in the plate circuit V_1 Fig. 1, we could by choosing the proper values of the Bridged-T following V_1, suppress any one of those frequencies. All other frequencies would appear at the output of the Bridged-T (grid circuit of V_2 Fig. 1). The circuit as shown in Fig. 1 is applicable as a scratch filter in high- or low-fidelity phonographs, and as a "whistle eliminator" in high-fidelity, wide-band broadcast receivers. The whistle or heterodyne phenomenon is caused by two stations in adjacent channels beating with each other and giving rise to a high frequency audio note. The scratch noises and whistles are subdued by choosing the components of the Bridged-T to suppress 10,000 cycles. Frequencies much above 10,000 cycles are generally not reproduced by even good phonographs or broadcast receivers, and therefore noise in this portion of the spectrum is not our concern. The values of R and C for some very common frequencies are shown at the end of this article; also the mechanics of computation for a 2,000-cycle filter. For frequencies other than indicated, component values may be chosen and substituted in the formula for computation of the 2,000 cycle filter.



Bridged-T filter with self-contained power supply, as constructed for the author's use.

The great advantage in using an R-C network of this type is that no bulky and expensive iron-core inductances are necessary as in many of the more common frequency-discriminating circuits and filters.

When the Bridged-T is applied as shown in Fig. 2 an interesting phenomenon takes place. The tube V_2 will amplify only one frequency. In other words the circuit becomes a selective amplifier and rejects all but that one frequency. The constants and frequencies shown in the table below may be substituted for R and C in Fig. 2

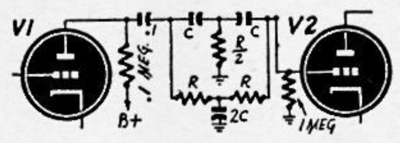


Fig. 1—A standard bridged-T filter circuit.

and the desired amplifier characteristics obtained. Thus, if a selective amplifier is required in a CW receiver for code reception to cut down static, noise and interfering signals, a Bridged-T may be employed. Most CW signals sound best to the ear when heterodyned to give a 1,000-cycle beat-note. A selective amplifier operating at 1,000 cycles will permit only one signal to pass through and suppress any other signal producing heterodyne notes of a higher or lower frequency than 1,000 cycles. Naturally, static and noise are also considerably reduced, as this type of interference is generally high-frequency audio and much above 1,000 cycles.

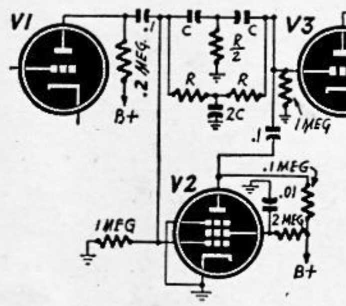


Fig. 2—This circuit passes one frequency.

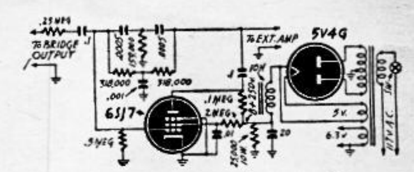
R AND C FOR COMMON FREQUENCIES

Cycles	C—mfd	R—onms	2C—mfd	R/2—ohms
60	.005	530,000	.01	265,000
120	.005	265,000	.01	133,000
400	.001	398,000	.002	199,000
1,000	.0005	318,000	.001	159,000
5,000	.00025	127,000	.0005	635,000
10,000	.0001	159,000	.0002	79,500

All tolerances should be held within 5%.

The basic formula is:
(1) $f = \frac{1}{2\pi} RC$;
or solving for R:
(2) $R = \frac{1}{2\pi} FC$;
F = frequency in cycles
R = resistance in ohms
C = capacity in farads
$2\pi = 6.28$

For audio frequencies other than those shown in the table and falling between 60 and 10,000 cycles, "C" is chosen as the value corresponding to the next highest frequency. This value of "C" is substituted in formula (2) and "R" obtained.



Schematic of equipment shown in photograph.

Let us suppose that it is necessary to have the filter operate at 2000 cycles. The next highest frequency above 2000 is 5000 cycles. The value of "C" corresponding to 5000 cycles is .00025 MFD., and is substituted as shown below:

$$R = \frac{1}{(6.28)\ (2000)\ (.00025\ [10]^{-6})}$$

Therefore

R = 318KΩ approx
C = .00025
R/2 = 159KΩ
2C = .0005 MFD.

The foregoing represent only a few of the many uses of the Bridged-T. The author constructed the Bridged-T selective amplifier shown in the photograph.

Excellent results were obtained when it was used in conjunction with a capacity and inductance bridge, to suppress the harmonics of the internal 1,000 cycle mechanical vibrator.

Other applications would call for changes in the R and C constants of the circuit to meet the special conditions of the given job. Used for phonograph scratch filter, as suggested earlier in the article, these constants might be adjusted to 5000 cycles or slightly higher. At 10,000 cycles, as stated previously, the circuit might be used to cut out 10-Kc. beat notes between adjacent broadcast stations. An item on a bridged-T circuit as a simple 10-Kc. filter appeared in the June, 1945, issue of *Radio-Craft* on page 585. This circuit, a coil-condenser-resistor combination without a tube, is not as adaptable as those described here, as the tube's amplification compensates for the insertion loss otherwise experienced when a filter is placed in any circuit.

The writer has not attempted to work with a bridged-T circuit having a variable resistor, though the idea immediately suggests itself in connection with many kinds of experimental work. A unit could also be constructed which could be switched from a "rejector" to an "acceptor" circuit, thus making it more versatile for use in the home laboratory or shop.

It is hoped that this article will direct the attention of the technician to the many possibilities of the Bridged-T circuit, as well as to the ease of designing and constructing it.