SINGLE-CONTROL VARIABLE PHASE-SHIFT NETWORK

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Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.
The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The invention relates generally to electrical control systems and more particularly to a single-control, variable, phase-shift network. Heretofore, phase-shifting systems have required a large number of component parts and have had limited phase-shift range, and while such prior systems were satisfactory in some situations, they proved to be unsuitable for use in certain situations where a very wide phase-shift range was necessary.

The present invention provides an extremely simple and rapidly adjustable phase-shifting system. In substance, the invention comprises a potentiometer resistor control element connected with a transformer to provide a system whereby two output signals are produced from a single input source which are out of phase with each other by some desired degree by selectively adjusting the potentiometer.

In accordance with the foregoing, an object of the invention is the provision of a single-control, variable, phase-shift network continuously variable over a very wide range.

Another object is to provide a method of producing two signals from a single source which are set out of phase by some desired degree.

A further object is to provide a voltage phase-shift network having a single electrical circuit and having no movable parts other than a phase-shift adjustment knob.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a schematic illustration of the single control variable phase-shift network having an input and two outputs.

Figs. 2, 3 and 4 illustrate curves showing the difference in phase between the signals across the output terminals of the phase-shift network for various control settings.

The network shown in Fig. 1 comprises a transformer T1 having a primary and a secondary winding. The primary winding has terminals 6 and 8; the secondary winding has terminals 10 and 12. Each winding of the transformer has the same number of turns, and the windings are centered at the ends 7 and 11. Terminals 6 and 10 are at the lower ends of the transformer windings and are connected together and to terminal 2 of a pair of input terminals 2 and 4. The center tap terminals 7 and 11 of the transformer windings are connected together by a control element, for instance, a potentiometer resistor, R1 which has a contact arm 5. The phase-shift network has two sets of output terminals; output terminals 8 and 9, and output terminals 12 and 13. The contact arm 5 of the control element R1 and terminals 9 and 13 of the two sets of output terminals are all electrically connected to terminal 4 of the input terminals.

The general operation of the phase-shift network is as follows: A sine wave signal is introduced across input terminals 2 and 4 allowing current/voltage to flow into both halves of the transformer T1. At that point, the signals on both windings are at the same phase angle; that is to say, at the start of the windings the signals on the windings are in phase with each other, while at the ends of the windings the signals are 180 degrees out of phase with each other. However, each winding has a center tap which is brought out and connected together by potentiometer resistor R1 having a contact arm 5, which is electrically connected to output terminals 9 and 13 and to input terminal 2. When contact arm 5 is set at center tap the output signals should be approximately 90 degrees out of phase with each other. This is illustrated in Fig. 2 of the drawing where sine wave A represents the signal at output A across terminals 8 and 9 of Fig. 1, and sine wave B represents the signal at output B across terminals 12 and 13. Moving the contact arm 5 from one side of center will lower the effectiveness of that winding, depending on the side to which it is moved, while at the same time adding to the effectiveness of the other winding. By effectiveness is meant adding to or strengthening the phase angles within the transformer T1 itself. This results in sine waves appearing across output terminals 8 and 9 and output terminals 12 and 13 which are out of phase with each other, the number of degrees by which they are out of phase depending on the setting of the contact arm 5 of potentiometer resistor R1. This may be illustrated in Figs. 3 and 4 of the drawing. Fig. 3 represents the signals across the output terminals when the potentiometer contact arm is moved to the left; sine wave A will then lead sine wave B by some amount depending on the setting of control arm 5. Fig. 4 represents the signals across the output terminals when the potentiometer is moved to the right; sine wave A will then lag sine wave B by an amount depending upon the setting of control arm 5. By using only these two components i.e., a transformer having 1 to 1 ratio and a potentiometer resistor control element, a simple, single-control, variable, phase-shift network can be constructed which has an unusually wide phase-shift range.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A single-control variable phase-shift network comprising a transformer having primary and secondary windings, said windings having an equal number of turns and being center tapped, a pair of input terminals, two pairs of output terminals, one end of said primary winding and one end of said secondary winding being connected to one of said input terminals, the other end of said primary winding being connected to one terminal of one pair of said output terminals, the other end of said secondary winding being connected to one terminal of the other pair of said output terminals, a potentiometer connected between the center taps of said primary and secondary windings, the contact arm of said potentiometer and the center tap of each pair of said output terminals being connected to the other of said input terminals, whereby the phase difference between the voltage appearing across one pair of said output terminals and across the other pair of said output terminals may be varied by the movement of said contact arm of said potentiometer.

2. A voltage phase-shift system comprising a transformer having primary and secondary windings, said windings having an equal number of turns and being center tapped, a pair of input terminals, two pairs of output terminals, one end of said primary winding and one end of said secondary winding being connected to one of said input terminals, the other end of said primary winding being connected to one terminal of one pair of said output terminals, the other end of said secondary winding being connected to one terminal of the other pair of said output terminals, a potentiometer connected between the center taps of said primary and secondary windings, the contact arm of said potentiometer and the center tap of each pair of said output terminals being connected to the other of said input terminals, whereby the phase difference between the voltage appearing across one pair of said output terminals and across the other pair of said output terminals may be varied by the movement of said contact arm of said potentiometer.
tapped, a pair of input terminals, a first and second pair of output terminals, one end of said primary winding and one end of said secondary winding being connected to one of said input terminals, the other end of said primary winding being connected to one terminal of said first pair of output terminals, the other end of said secondary winding being connected to one terminal of said second pair of output terminals, a potentiometer connected across the center taps of said primary and secondary windings, the movable contact arm of said potentiometer and the other terminal of said first and second pairs of output terminals being connected to the other of said input terminals, whereby the phase difference between the voltage appearing across said first pair of output terminals and the voltage across said second pair of output terminals may be varied by the movement of said contact arm of said potentiometer.

3. A phase-shift system as in claim 2 wherein the phase difference may be continuously variable from 20 degrees to 355 degrees.

4. A phase-shift system as in claim 2 wherein the lower ends of said primary and secondary windings are connected together and to one of said input terminals.

5. A variable phase-shift network comprising a transformer having primary and secondary windings, said windings each having the same number of turns and being center tapped, a pair of input terminals, a first pair of output terminals and a second pair of output terminals, the lower end of said primary winding and the lower end of said secondary winding being connected together and to one of said input terminals, the other end of said primary winding being connected to one terminal of said first pair of output terminals, the other end of said secondary winding being connected to one terminal of said second pair of output terminals, a control means connected between the center taps of said primary and said secondary windings, a movable contact means on said control means, said movable contact means and the other terminals of said first and second pairs of output terminals being connected to the other of said input terminals, whereby the phase difference between the signal appearing between said first pair of output terminals and the signal appearing between said second pair of output terminals may be varied by the movement of said contact means of said control means.

6. A network as in claim 5 wherein said control means is a potentiometer resistor having a movable contact arm.

7. A phase-shift system as in claim 5 wherein the phase difference may be varied by said control means from 20 degrees to 355 degrees.

8. A voltage phase-shift system comprising a 1 to 1 ratio transformer having its primary and secondary windings center tapped, a pair of input terminals and two pairs of output terminals, the lower ends of said primary and said secondary windings being connected to one of said pair of input terminals, the other ends of said windings each being connected to one terminal of a pair of said output terminals, a control element connected between the center taps of said windings, a movable contact arm on said control element, said contact arm and the other terminal of each pair of said output terminals being connected to the other of said input terminals, whereby the difference in phase between the signals across the output terminals may be varied by moving said contact arm.

No references cited.