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MULTIPLE-POLE TWO-POSITION DUAL-WAFER ULTRA-HIGH-FREQUENCY TRANSMIT-RECEIVE SWITCH CONTROL

Filed May 23, 1960

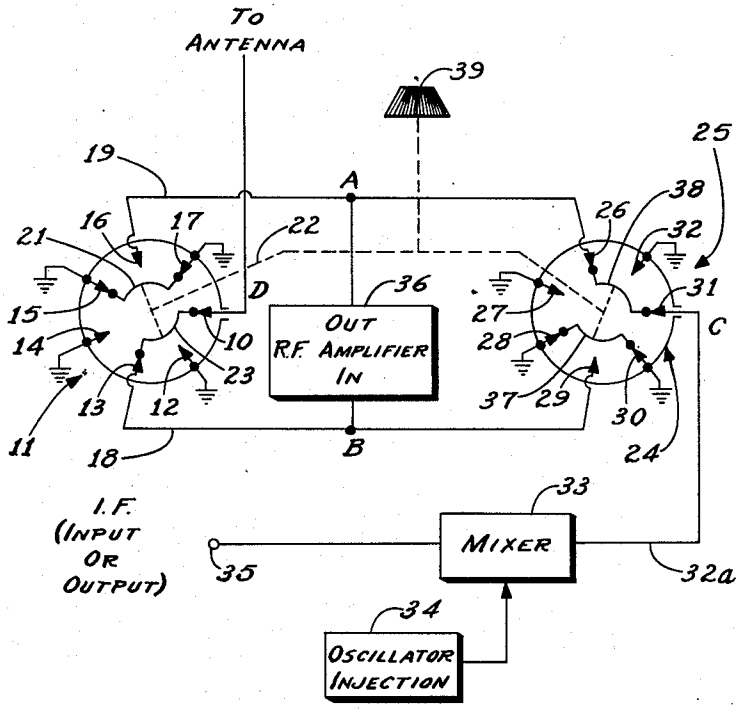


FIG 1

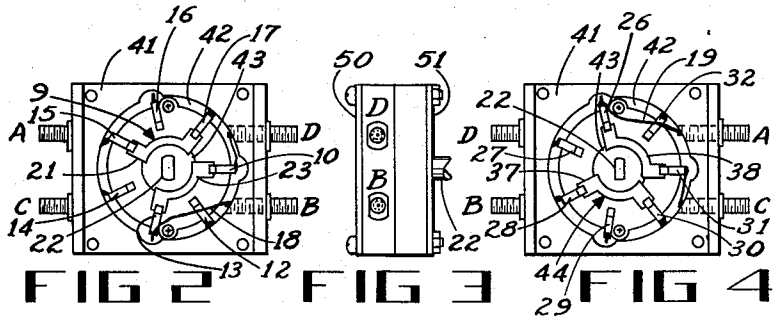


FIG 2 FIG 3 FIG 4

INVENTOR.

SAMUEL L. BROADHEAD JR.

BY

ATTORNEY

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MULTIPLE-POLE TWO-POSITION DUAL-WAFER ULTRA-HIGH-FREQUENCY TRANSMIT-RECEIVE SWITCH CONTROL

Samuel L. Broadhead, Jr., Cedar Rapids, Iowa, assignor to Collins Radio Company, Cedar Rapids, Iowa, a corporation of Iowa

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This invention relates in general to switches and in particular to a transmit and receive switch wherein the unused contacts are grounded when in the inoperative position.

The switch of this invention is designed so that when radio frequency energy, as for example in the vicinity of 400 megacycles, is switched, the disconnected circuitry is grounded so as to prevent radio frequency pickup. This switch is also designed so that a single mixer may be used for both transmission and reception in a radio system.

Another object of this invention is to provide a radio frequency transmit-receive switch which has a continuous surge impedance throughout the switch and obtains a very low standing wave ratio in the frequency range of the design.

Another feature of the switch is that very high attenuation is obtained between the input and output of the radio frequency, which prevents oscillations.

Further features, objects and advantages of the invention will become apparent from the following description and claims when read in view of the accompanying drawings, in which:

FIGURE 1 is a schematic illustration of the switch according to this invention;

FIGURE 2 illustrates one side of the switch with the top cover removed;

FIGURE 3 shows the side of the switch; and

FIGURE 4 illustrates the second side of the switch with the cover removed.

FIGURE 1 illustrates the first side of a switch **11**. Terminals **10**, **12**, **13**, **14**, **15**, **16**, and **17** are mounted about the periphery of the switch **11**. Contacts **12**, **14**, **15**, and **17** are connected to a common ground plane, as for example the frame of the switch. Contact **10** might be connected to an antenna, not shown. Contact **13** is connected to a lead **18**. Contact **16** is connected to a lead **19**.

A first shorting bar **21** is rotatably supported at the center of the switch and extends from contacts **17** and **15** in one position, and when rotated to a second position by control shaft **22** extends from contact **16** to contact **10**. A second shorting bar **23** extends from the contact **10** to contact **13** in the first position and from contact **12** to contact **14** in the second position. Shaft **22** is also connected to the shorting bar **23** and rotates it with bar **21**.

The opposite side **25** of the switch **11** has a wafer **24** which has contacts **26**, **27**, **28**, **29**, **30**, **31**, and **32** spaced about its periphery. Contacts **27**, **28**, **30**, and **32** are connected to ground, which might be the case of the switch. Contact **26** is connected to lead **19** which extends to contact **16** of the other side of the switch. Contact **29** is connected to lead **18** which is connected to connected to contact **13** on the other side of the switch. contact **31** is connected to lead **32***a* which leads to a mixer **33**. Mixer **33** receives an input from an oscillator **34**. The mixer **33** is a bilateral and is connected to a terminal **35**.

A radio frequency amplifier **36** is connected between leads **18** and **19** and has an input at lead **18** and an output at lead **19**.

A third shorting bar **38** is rotatably supported by the wafer **24** and in a first position extends from contact **31** to contact **26** and in a second position extends from contact **27** to contact **32**. A fourth shorting bar **37** in a first position extends from the contact **28** to contact **30** and in the second position from the contact **29** to the contact **31**. Shaft **22** is connected to shorting bars **37** and **38** and a knob **39** is connected to shaft **22** to rotate it and the four shorting bars from the first to the second positions.

In operation the knob **39** is moved to the "receive" position, which places the shorting bar **23** in engagement with contacts **10** and **13** and shorting bar **38** in engagement with contacts **26** and **31** such as shown in FIGURE 1. The shorting bar **21** would engage grounded contacts **15** and **17** and the shorting bar **37** would engage the grounded contacts **28** and **30**. An incoming signal from the antenna, not shown, would pass from contact **10** through shorting bar **23** to contact **13** to lead **18**. Since contact **29** is unengaged, a signal cannot pass to shorting bar **38**; therefore, it will pass through the radio frequency amplifier **36** from point B to point A and to contact **26** through the shorting bar **38** to contact **31** and consequently to the mixer **33** through the lead **32***a* and will provide an input to a conventional receiver I.F. that may be connected to terminal **35**.

It is to be noted that during reception the shorting bars **37** and **21** are grounded at both ends to eliminate radio frequency pickup. In transmission the knob **39** would be rotated to the "transmit" position and the shorting bar **21** would be moved to engage contacts **16** and **10** and the shorting bar **37** would be moved to engage contacts **29** and **31**. The shorting bar **38** would engage contacts **27** and **32** and shorting bar **23** would engage contacts **12** and **14**. An output signal to be transmitted would be supplied to the mixer **33**, mixed with an output of the injection oscillator **34** and passed to contact **31**. The shorting bar **37** would connect it to the contact **29** and it would pass through the lead **18** to the R.F. amplifier **36**. From point A it would pass from lead **19** to contact **16** through the shorting bar **21** to the antenna through contact **10**.

It is seen in transmission and reception that the unused shorting bars are grounded at both ends to eliminate radio frequency pickup.

FIGURE 2 illustrates a first side of the actual switch of this invention and comprises a body portion **41** which is formed with a central opening **42**. A first disc **43** is rotatably mounted on one side of the switch. Contacts **10** and **12–17** are mounted about the periphery of the switch. The shorting bars **21** and **23** are rotatably supported by disc **9** and shaft **22** and are insulated therefrom by the plastic disc **43**. Terminal A corresponds to point A in FIGURE 1. Contact D is connected to the antenna. Terminal B corresponds to point B in FIGURE 1.

FIGURE 3 illustrates the side of the switch. Cover plates **50** and **51** are connected to the switch to enclose it.

FIGURE 4 illustrates the opposite side of the switch and shows shorting bars **37** and **38**. The shaft **22** is connected to shorting bars **37** and **38** through insulating disc **44**. Contacts **26**, **27**, **28**, **29**, **30**, **31**, and **32** surround the switch. Terminal C corresponds to point C in FIGURE 1.

It is seen that this invention provides an improved radio frequency switch wherein the unused terminals are grounded. A constant surge impedance is obtained. Very large attenuation between the input and outputs exists due to the actual shorting of the unused shorting bars. Another advantage is that the switch eliminates one mixer when used as a transmit-and-receive unit.

Although it has been described with respect to preferred embodiments, it is not to be so limited, as changes and modifications may be made which are within the full intended scope of the invention as defined by the appended claims.

I claim:

1. In a control system for alternately switching a first lead and a second lead oppositely to the output and input terminals of an RF amplifier; dual switching wafers each having at least two switch positions; switch positioning means for simultaneously switching said dual switching wafer between switch positions; each of said dual switch wafer being provided with a pair of shorting bars connected for movement with said switch positioning means; each of said dual wafers having a plurality of fixed contacts; one of the fixed contacts of one of the dual switching wafers being connected to said first lead, and one of the fixed contacts of the other dual wafer being connected to said second lead; a second fixed contact of each of said switching wafers being connected in common to one of the terminals of said R.F. amplifier; a third fixed contact of each of said switching wafers being connected in common to the other terminal of said R.F. amplifier; a plurality of additional fixed contacts of each of said dual switching wafers being connected to ground; with said fixed contacts being positioned for a first one of the shorting bars of each respective switching wafer to provide a connection between the contact connected to the lead associated with that wafer and a contact connected to a terminal of said amplifier, and with the other shorting bar of each pair of shorting bars being in contact with grounded contacts at each end; and alternately when the switching means switches the dual switching wafers to the other switch position the other shorting bar of each pair of shorting bars being connected between the lead contact associated with that wafer and the contact connected to the opposite terminal of said amplifier, and the first one of the shorting bars of each of the pair of shorting bars being, for this other switch position, in contact with grounded contacts at each end.

2. The control system for alternately switching a first lead and a second lead oppositely to the output and input terminals of an R.F. amplifier of claim 1, wherein said first lead is a radio frequency antenna lead, and said second lead is a radio frequency signal lead; with connection of said antenna lead to the output terminal of said R.F. amplifier in a transmit switch position mode of operation with the R.F. signal lead connected to the input terminal; and in the alternate switch position, the antenna lead being connected to the R.F. amplifier input terminal; and the R.F. output terminal being connected to the R.F. signal lead for the radio frequency receive mode of operation.

3. The control system for alternately switching a first lead and a second lead oppositely to the output and input terminals of an R.F. amplifier of claim 2, wherein said R.F. signal lead is connected to a mixer fed an injection frequency from a frequency source to provide an I.F. output when the control system is switched to the receive mode of operation; and alternately, for said mixer to provide an R.F. input to the R.F. amplifier resulting from an I.F. input and the injection frequency applied to said mixer from said frequency source for the transmit mode of operation.

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CERTIFICATE OF CORRECTION

Patent No. 3,146,397 August 25, 1964

Samuel L. Broadhead, Jr.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 49, for "and", second occurrence, read -- to --; line 63, after "is", second occurrence, strike out "connected to"; line 65, for "contact" read -- Contact --; column 2, line 68, for "input" read -- inputs --; column 3, line 12 and 13, for "wafer", each occurrence, read -- wafers --; column 4, line 34, for "2,769,127" read -- 2,760,127 --.

Signed and sealed this 29th day of December 1964.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents

UNITED STATES PATENT OFFICE

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