July 10, 1962 F. G. MASON 3,044,032

CONTACTING TYPE DRUM TUNER FOR HIGH RADIO FREQUENCIES

Filed Sept. 11, 1958

FIG. 1

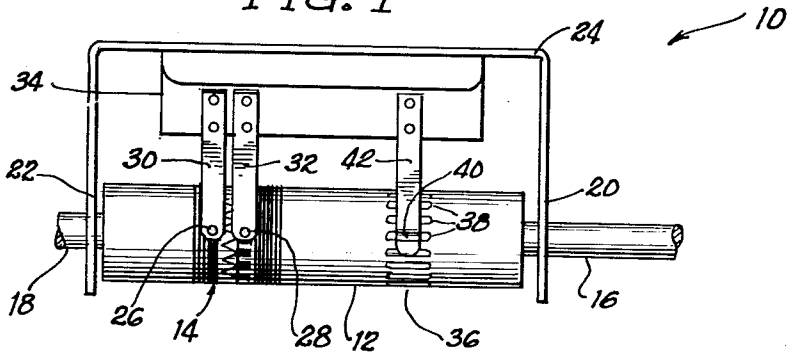


FIG. 2

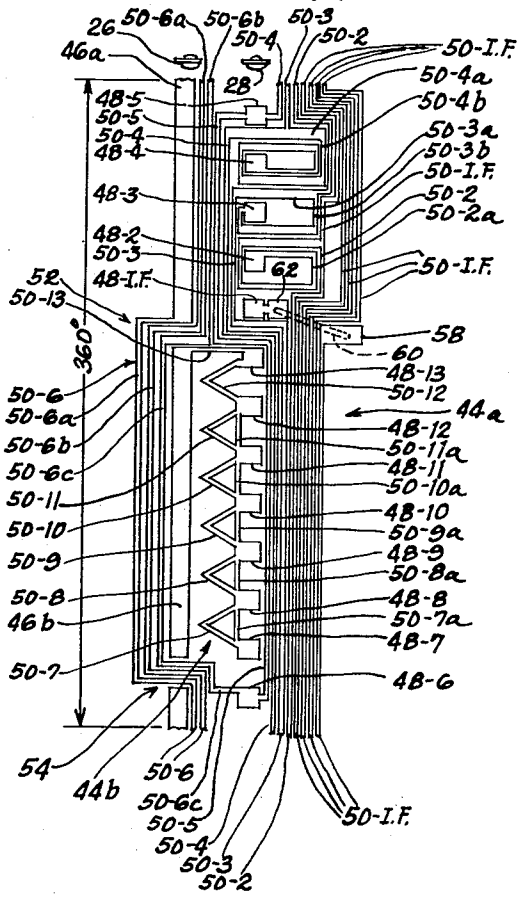
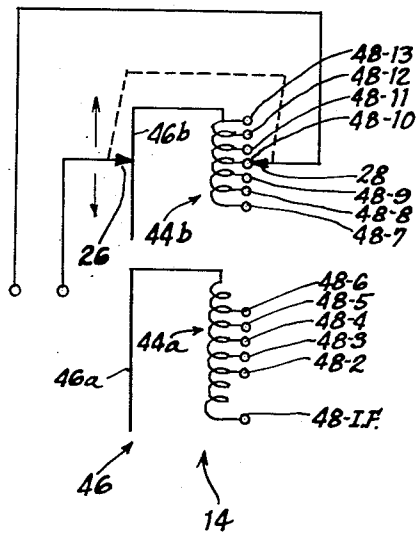


FIG. 3



INVENTOR.
Francis G. Mason

BY
Donnelly MacDougall, Williams & Hersh
Attorneys

United States Patent Office

3,044,032

Patented July 10, 1962

3,044,032
CONTACTING TYPE DRUM TUNER FOR HIGH RADIO FREQUENCIES

Francis G. Mason, Weston, Conn., assignor to Aladdin Industries, Incorporated, Nashville, Tenn., a corporation of Illinois

Filed Sept. 11, 1958, Ser. No. 760,376
8 Claims. (Cl. 336—142)

This invention relates to radio frequency tuners, particularly tuners of the type adapted to be employed in television receivers or other high frequency radio equipment.

One object of the present invention is to provide a new and improved tuner in which the tuning element takes the form of a coil, printed or otherwise mounted on an insulating drum, and formed with integral taps or electrodes adapted to be engaged by a plurality of contacts.

A further object is to provide a new and improved tuner of the foregoing character which is efficient yet extremely compact, whereby several tuners may be ganged together and mounted in a small space.

It is another object of the present invention to provide a new and improved tuner comprising a coil which is printed on the outside of an insulating drum and is formed with integral taps, the coil being ingeniously arranged so as to minimize the need for crossovers or jumpers, whereby the coil may be produced very readily and economically by circuit printing techniques.

Further objects and advantages of the present invention will appear from the following description, taken with the accompanying drawings in which:

FIG. 1 is a plan view of a tuner to be described as an alternating embodiment of the present invention.

FIG. 2 is a developed view of the coil employed in the tuner of FIG. 1.

FIG. 3 is a schematic circuit diagram of the tuner.

It will be observed from FIG. 1 that the illustrated tuner **10** comprises an insulating cylinder or drum **12** with a coil **14** mounted thereon. It is preferred to form the coil on the drum by circuit printing techniques which are well known and need not be described herein. However, any suitable method may be employed in producing the coil **14**.

The drum **12** is provided with end shafts **16** and **18** at the opposite ends thereof. It will be seen that the shafts **16** and **18** are rotatably supported by suitable bearing members **20** and **22** mounted on a frame or chassis **24**.

Circuit connections are made to the coil **14** by means of two contacts or electrodes **26** and **28**, which are in energy exchange relation to the coil. As shown, the contacts are mounted on the outer ends of leaf springs **30** and **32**. It will be apparent that the springs **30** and **32** press the illustrated electrodes **26** and **28** into contacting engagement with portions of the coil **14**, although the electrodes might be capacitively related to the coil. The contact springs **30** and **32** may be mounted on an insulating support **34**, suitably secured to the chassis **24**.

In order that the drum **12**, may be indexed to definite positions or channel settings, the drum is provided with a detent wheel **36**, comprising a series of angularly spaced detent notches **38**. The detent wheel may be integral with the drum or may be a separate piece, secured thereto. A detent member **40** is adapted to engage each of the notches **38** in turn. In this case, the detent member **40** is formed or mounted on the outer end of a leaf spring **42**, which presses the detent member against the detent wheel **36**. It will be understood that any suitable detent arrangement may be employed.

From FIG. 3, it will be apparent that the coil **14** comprises two portions **44***a* and **44***b*. While the tuner may

be arranged to cover any suitable frequency range, the illustrated tuner is especially well adapted to cover the very high frequency (V.H.F.) television band, extending between 54 and 216 megacycles. Those skilled in the art will be familiar with the fact that this commercial band is divided into a lower portion, comprising television channels 2–6, and an upper portion comprising channels 7–13. In this case, the coil portions **44***a* and **44***b* cover the lower and upper portions of the band respectively.

It will be seen that the contact **26** engages a conductive ring **46**, which is divided into two portions or segments **46***a* and **46***b*, corresponding to the coil portions **44***a* and **44***b*. One end of the coil portion **44***a* is connected to the ring segment **46***a*. Similarly, one end of the coil portion **44***b* is connected to the ring segment **46***b*.

The other contact **28** is adapted to engage a series of taps or electrodes **48** connected to the coil **14**. It is preferred to form the taps **48** integrally with the coil. One tap is provided for each of the television channels 2–13. For convenience, these taps are designated 48–2 through 48–13. In addition, the coil portion **44***a* is provided with a tap 48–I.F. whereby the tuner may be tuned to the intermediate frequency of the superheterodyne television receiver with which the tuner is adapted to be employed. With this arrangement, the various stages of the tuner circuit may be converted to extra intermediate frequency amplifiers for amplifying the output of an ultra high frequency converter. Those skilled in the art will be familiar with this scheme. Actually, the tap 48–I.F. is connected to the end of the coil **44***a* remote from the contact ring **46***a*.

The details of the coil **14** are shown to best advantage in FIG. 2, which is a developed view of the coil. It will be seen that the coil **14** is ingeniously arranged to minimize need for cross-overs or jumpers. The coil comprises ribbons or strips of a suitable metal such as copper, for example. The length, width and shape of the ribbons are proportioned to provide suitable inductances for the various television channels and the intermediate frequency. It will be understood that the coil **14** is resonated by its own inherent distributed capacitance, and the capacitance of the circuit connected to the coil.

It will be apparent that the electrode or tap **48–13** is opposite one end of the conductive ring **46***b*. To provide suitable inductance for channel 13, a ribbon conductor **50–13** is simply arranged to extend between the tap **48–13** and the adjacent end of the conductive ring **46***b*.

Additional inductance for channel 12 is provided by a ribbon **50–12** extending between the taps **48–12** and **48–13**. It will be seen that the ribbon **50–12** is roughly L-shaped or in the shape of an open arrowhead.

Additional inductances for channels 11, 10, 9, 8, and 7 are provided by additional L-shaped ribbon conductors **50–11**, **50–10**, **50–9**, **50–8** and **50–7**, extending successively between the taps **48–11**, **48–10**, **48–9**, **48–8** and **48–7**. The incremental inductances between the successive taps **48–7** through **48–12** is reduced by providing additional ribbons **50–7***a* through **50–11***a*, connected in parallel with the ribbons **50–7** through **50–11**, and extending directly between the successive taps **48–7** through **48–12**. It will be understood that the ribbon conductors **50–7** through **50–13** and **50–7***a* through **50–11***a* constitute the coil **44***b*. All of these ribbons, plus the ring portion **46***b* and the taps **48–7** through **48–13**, are preferably formed in one piece by circuit printing techniques. It will be seen that the taps are arranged in a row parallel to the ring portion **46***b*, and that the ribbon conductors are positioned in the space between the ring portion and the taps.

To cover the low portion of the V.H.F. television band,

the coil 44*a*, should have considerable inductance. Thus, the coil 44*a* is more complex than the coil 44*b*.

To provide inductance for channel 6, a coil element 50–6 is arranged to extend between the ring portion 46*a* and the tap or electrode 48–6. Actually, the ribbon conductor 50–6 extends around the drum 12 for two complete turns 50–6*a* and 50–6*b*, plus a third partial turn 50–6*c*.

From FIG. 2, it will be apparent that gaps 52 and 54 are formed between the ends of the ring portions 46*a* and 46*b*. The turns 50–6*b* and 50–6*c* extend along the right hand side of the ring portion 46*a*, and then jog to the left through the gap 52 to extend along the left hand side of the ring portion 46*b*. All three turns 50–6*a*, 50–6*b* and 50–6*c* jag to the right through the gap 54. The tap 48–6 is disposed opposite the end of the ring portion 46*a* adjacent the gap 54. Thus, the turn 50–6*c* runs into the tap 48–6 after jogging through the gap 54. To the right of the ring portion 46*a*, the turn 50–6*b* is immediately adjacent the ring portion while the turn 50–6*c* is spaced farther away from the ring portion. To the left of the ring portion 46–*b*, the turn 50–6*c* is immediately adjacent the ring portion while the turns 50–6*b* and 50–6*a* are disposed successively farther to the left of the ring portion.

At its beginning, the turn 50–6*a* jogs to the left and then continues parallel to the ring portion 46*b*. The jogged or offset arrangement of the turns 59–6*a*, 50–6*b*, and 50–6*c* avoids any interference between any turns and the coil portion 44*b*, which is to the right of the ring portion 46*b*. At the same time, the jogged arrangement avoids any need for a cross over or a jumper along the coil element 50–6.

Additional inductance for channel 5 is provided by a ribbon conductor 50–5, which extends between the electrodes 48–5 and 48–6. This ribbon conductor 50–5 extends for a little less than one turn around the drum 12. It will be observed that the turn 50–5 extends around the drum 12 in a direction opposite to that of the coil turns 50–6. Thus, as viewed from the left in FIG. 1 or 2, the coil turns 50–6 extend clockwise between the ring segment 46*a* and the tap 48–6, while the turn 50–5 extends counterclockwise between the taps 48–6 and 48–5. However, the turn 50–5 is spaced to the right of the turns 50–6 so as to minimize cancellation of inductances.

For compactness and to avoid any need for crossovers, the turn 50–5 extends from the tap 48–6 parallel to the row of taps 48–6 through 48–13, and immediately to the right of the row. The turn 50–5 then jogs to the left through the gap between the taps 48–13, and 48–I.F., and then extends parallel but to the left of the row of taps 48–I.F. through 48–5. At its upper end, as seen in FIG. 2, the turn 50–5 jogs to the right and runs into the tap 48–5.

Another turn 50–4 provides additional inductance for channel 4. This turn extends between the taps 48–5 and 48–4. From the tap 48–5, the turn 50–4 jogs to the right and then extends parallel to the right of the row of taps 48–5 through 48–13. It will be seen that the turn 50–4 is spaced to the right of the turn 50–5. The turn 50–4 also jogs to the left through the gap between the taps 48–13 and 48–I.F., and then extends to the left of the row of taps 48–I.F. through 48–4.

The ribbon 50–4 has a portion 50–4*a* which jogs to the right between the taps 48–4 and 48–5. A spiral coil element 50–4*b* then connects the portion 50–4*a* to the tap 48–4. It will be seen that the spiral coil 50–4*b* extends for about 1½ turns around the tap 48–4.

Additional inductance for channel 3 is provided by another turn 50–3 of the coil 14. In this case, the turn 50–3 is connected to the portion 50–4*a* of the ribbon 50–4. The turn 50–3 extends around the drum 12 parallel and adjacent to the turns 50–4, and then jogs to the left through the gap between the taps 48–13 and 48–I.F. After jogging to the left, the turn 50–3 extends parallel to and along the left hand side of the row of taps 48–I.F. through 48–3. The turn 50–3 then has a portion 50–3*a* which jogs to the right between the taps 48–3 and 48–4. A spiral coil 50–3*b*, extending through approximately one-half turn around the tap 48–3, connects the portion 50–3*a* to the tap 48–3.

Similarly, another turn 50–2 provides additional inductance for channel 2. The turn 50–2 connects with the portion 50–3*a* at the right hand end thereof, and then extends around the drum 12 parallel and adjacent to the turn 50–3. In this case, the turn 50–2 passes to the right of the taps 48–I.F. and 48–2 and is connected to the tap 48–2, by a spiral coil 50–2*a*, which extends around the tap 48–2, for about 1½ turns. A multiple turn coil element 50–I.F. provides additional inductance to tune the tuner to the intermediate frequency. It will be seen that the coil element 50–I.F. connects to the turn 50–2 at the beginning of the spiral coil 50–2*a*. The coil element 50–I.F. comprises three complete turns and a fourth partial turn. All of the turns 50–I.F. extends to the right of the taps 48–2 through 48–I.F. It will be seen that the end of the coil element 50–I.F. is connected to an electrode or terminal 58, which is near the tap 48–I.F., but is to the right thereof, and is separated therefrom by the turn 50–2 and three of the turns 50–I.F. As shown, a jumper 60 is connected between the terminal 58 and a terminal 62 formed integrally with the tap 48–I.F. The jumper 60 may take the form of a short lead soldered or otherwise connected to the terminals 58 and 62. This is the only jumper required by the illustrated arrangement.

When the contact 28 engages the tap 48–I.F., all of the turns 50–I.F., 50–2, 50–3, 50–4, 50–5 and 50–6 are in the circuit between the contacts 26 and 28. When the drum 12 is rotated to bring the tap 48–2 against the contact 28, the coil element 50–I.F. is removed from the circuit. Thus, the inductance of the coil portion 44*a* is reduced so that the tuner will cover channel 2. Similarly, as the drum 12 is rotated to bring the successive taps 48–3 through 48–6 against the contact 28, the successive coil elements 50–2 through 50–5 are removed from the circuit.

Further rotation of the drum 12 will bring the tap 48–7 against the contact 28. The contact 26 will then be engaged by the ring segment 46*b*, rather than the ring segment 46*a*. All of the inductance elements 50–7, through 50–13 will then be in the circuit between contacts 26 and 28. As the drum 12 is rotated to bring the successive taps 48–7 through 48–13 against the contact 28, the successive inductance elements 50–7 through 50–12 will be cut out of the circuit. The cycle of operation may be repeated by continuing to turn the drum 12 in the same direction so as to bring the tap 48–I.F. against the contact 28. There is no need to reverse the direction in which the drum is rotated in order to go from channel 13 to channel 2.

It will be apparent that the coil elements 44*a* and 44*b* may readily be produced by circuit printing techniques. The lead 60 is the only jumper that needs to be installed to complete the coil. By jogging the various ribbons through the gaps between the taps, and the gaps between the ring segments 46*a* and 46*b*, an extremely compact arrangement is produced, requiring only one jumper.

It will be understood that any suitable number of tuners may be operated simultaneously by ganging the tuner shafts together, with gears or other suitable mechanisms. It is also quite feasible to mount two or more of the tuning coils 14 on a single drum. The tuner gives high performance, despite its compactness and low cost.

Various modifications, alternative constructions and equivalents may be employed without departing from the true spirit and scope of the invention as exemplified by the foregoing description and defined in the following claims.

I claim:

1. In a tuner, the combination comprising an electri-

cally insulating cylinder, means rotatably suporting said cylinder, a coil mounted on and extending around said cylinder, a plurality of taps connected to said coil and spaced in a peripheral row around said cylinder, a ring electrode extending around said cylinder parallel to the row of taps, a first contact engageable with said ring electrode, said ring electrode being connected to one end of said coil, and a second contact engageable with said taps in succession, said coil having turn elements extending between the successive taps, some of said turn elements being disposed on said cylinder in the space between said ring electrode and said taps, other of said turn elements extending around said cylinder on the side of said row remote from said ring electrode, certain of said turn elements including spiral coil portions extending around said taps, certain of said turn elements extending in one direction around said cylinder while other of said turn elements extend in the opposite direction therearound.

2. In a tuner, the combination comprising an insulating cylinder, means rotatably supporting said cylinder, coil means mounted on and extending around said cylinder, a plurality of taps connected to said coil means and spaced at intervals in a row around such cylinder, ring electrode means extending around said cylinder parallel to but spaced from said row, said ring electrode means comprising first and second ring segments with gaps therebetween, first and second contacts engageable with said ring segments and the successive taps, respectively, said taps comprising a first group opposite said first ring segment and a second group opposite said second ring segment, said coil comprising a first coil element interconnecting the taps of said first group and having one end connected to first ring segment, said first coil element being disposed on said cylinder in the space between said first ring segment and said first group of taps, a second coil element interconnecting said taps of said second group and connected at one end to said second ring segment, said second coil element having one portion extending around said cylinder between said second ring segment and said second group of taps and then jogging through one of said gaps to extend along said first ring segment on the side thereof remote from said first group of taps, said second coil element having another portion extending between said second ring segment and said second group of taps and then jogging between said first and second groups of taps to extend along said first group of taps on the side thereof opposite from said first ring segment, said second coil element having another portion extending around said cylinder along said first and second groups of taps on the side thereof remote from said first and second ring segments, one portion of said second coil element comprising a spiral coil extending around one of said taps.

3. In a tuner, the combination comprising an electrically insulating cylinder, means rotatably supporting said cylinder, a coil mounted on and extending around said cylinder, a plurality of taps connected to said coil and spaced in a peripheral row around said cylinder, a ring electrode extending around said cylinder parallel to the row of taps, a first contact engageable with said ring electrode, said ring electrode being connected to one end of said coil, and a second contact engageable with said taps in succession, said coil having turn elements extending between the successive taps, certain of said turn elements extending in one direction around said cylinder while other of said turn elements extend in the opposite direction therearound.

4. In a tuner, the combination comprising an insulating cylinder, means rotatably supporting said cylinder, coil means mounted on and extending around said cylinder, a plurality of taps connected to said coil means and spaced at intervals in a row around such cylinder, ring electrode means extending around said cylinder parallel to but spaced from said row, said ring electrode means comprising first and second ring segments with

gaps therebetween, first and second contacts engageable with said ring segments and the successive taps, respectively, said taps comprising a first group opposite said first ring segment and a second group opposite said second ring segment, said coil comprising a first coil element interconnecting the taps of said first group and having one end connected to first ring segment, said first coil element being disposed on said cylinder in the space between said first ring segment and said first group of taps, a second coil element interconnecting said taps of said second group and connected at one end to said second ring segment, said second coil element having one portion extending around said cylinder between said second ring segment and said second group of taps and then jogging through one of said gaps to extend along said first ring segment on the side thereof remote from said first group of taps, said second coil element having another portion extending between said second ring segment and said second group of taps and then jogging between said first and second groups of taps to extend along said first group of taps on the side thereof opposite from said first ring segment, said second coil element having another portion extending around said cylinder along said first and second groups of taps on the side thereof remote from said first and second ring segments.

5. In a tuner, the combination comprising an insulating cylinder, means rotatably supporting said cylinder, coil means mounted on and extending around said cylinder, a plurality of taps connected to said coil means and spaced at intervals in a row around such cylinder, ring electrode means extending around said cylinder parallel to but spaced from said row, said ring electrode means comprising first and second ring segments with gaps therebetween, first and second contacts engageable with said ring segments and the successive taps, respectively, said taps comprising a first group opposite said first ring segment and a second group opposite said second ring segment, said coil comprising a first coil element interconnecting the taps of said first group and having one end connected to first ring segment, said first coil element being disposed on said cylinder in the space between said first ring segment and said first group of taps, a second coil element interconnecting said taps of said second group and connected at one end to said second ring segment, said second coil element having one portion extending around said cylinder between said second ring segment and said second group of taps and then jogging through one of said gaps to extend along said first ring segment on the side thereof remote from said first group of taps.

6. In a tuner, the combination comprising an insulating cylinder, means rotatably supporting said cylinder, coil means mounted on and extending around said cylinder, a plurality of taps connected to said coil means and spaced at intervals in a row around such cylinder, ring electrode means extending around said cylinder parallel to but spaced from said row, said ring electrode means comprising first and second ring segments with gaps therebetween, first and second contacts engageable with said ring segments and the successive taps, respectively, said taps comprising a first group opposite said first ring segment and a second group opposite said second ring segment, said coil comprising a first coil element interconnecting the taps of said first group and having one end connected to first ring segment, said first coil element being disposed on said cylinder in the space between said first ring segment and said first group of taps, a second coil element interconnecting said taps of said second group and connected at one end to said second ring segment, said second coil element having one portion extending around said cylinder between said second ring segment and said second group of taps and then jogging through one of said gaps to extend along said first ring segment on the side thereof remote from said first group of taps, said second coil element having another por-

tion extending between said second ring segment and said second group of taps and then jogging between said first and second groups of taps to extend along said first group of taps on the side thereof opposite from said first ring segment.

7. In a tuner, the combination comprising an insulating cylinder, means rotatably supporting said cylinder, coil means mounted on and extending around said cylinder, a plurality of taps connected to said coil means and spaced at intervals in a row around such cylinder, ring electrode means extending around said cylinder parallel to but spaced from said row, said ring electrode means comprising first and second ring segments with gaps therebetween, first and second contacts engageable with said ring segments and the successive taps, respectively, said taps comprising a first group opposite said first ring segment and a second group opposite said second ring segment, said coil comprising a first coil element interconnecting the taps of said first group and having one end connected to first ring segment, said first coil element being disposed on said cylinder in the space between said first ring segment and said first group of taps, a second coil element interconnecting said taps of said second group and connected at one end to said second ring segment, said second coil element having one portion extending around said cylinder between said second ring segment and said second group of taps and then jogging through one of said gaps to extend along said first ring segment on the side thereof remote from said first group of taps, said one portion of said second coil element extending around said cylinder in a direction opposite to the direction of the other portions of said second coil element.

8. In a tuner, the combination comprising an insulating cylinder, means rotatably supporting said cylinder, coil means mounted on and extending around said cylinder, a plurality of taps connected to said coil means and spaced at intervals in a row around such cylinder, ring electrode means extending around said cylinder parallel to but spaced from said row, said ring electrode means comprising first and second ring segments with gaps therebetween, first and second contacts engageable with said ring segments and the successive taps, respectively, said taps comprising a first group opposite said first ring segment and a second group opposite said second ring segment, said coil comprising a first coil element interconnecting the taps of said first group and having one end connected to first ring segment, said first coil element being disposed on said cylinder in the space between said first ring segment and said first group of taps, a second coil element interconnecting said taps of said second group and connected at one end to said second ring segment, said second coil element having one portion extending around said cylinder between said second ring segment and said second group of taps and then jogging through one of said gaps to extend along said first ring segment on the side thereof remote from said first group of taps, said second coil element having another portion extending between said second ring segment and said second group of taps and then jogging between said first and second groups of taps to extend along said first group of taps on the side thereof opposite from said first ring segment, said one portion of said second coil element extending around said cylinder in a direction opposite to the direction of said other portion.

References Cited in the file of this patent

UNITED STATES PATENTS

1,971,872	O'Brien	Aug. 28, 1934
2,451,643	White	Oct. 19, 1948
2,543,560	Thias	Feb. 27, 1951
2,759,098	White et al.	Aug. 14, 1956