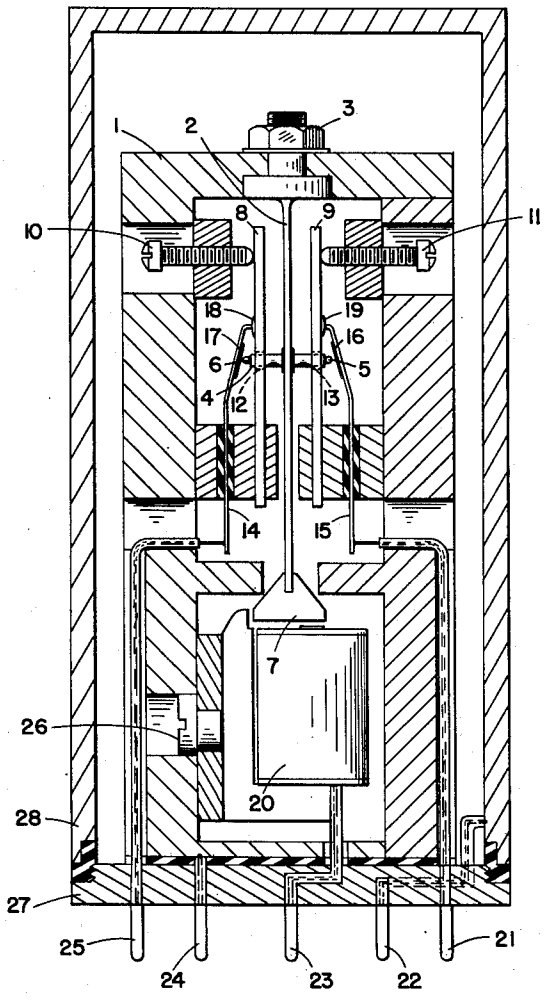
April 27, 1954 L. R. WOODS 2,677,027

CHOPPER

Filed Aug. 4, 1952



INVENTOR.

LEROY R. WOODS

BY William R. Lane

ATTORNEY

Patented Apr. 27, 1954 2,677,027

UNITED STATES PATENT OFFICE

2,677,027

CHOPPER

Leroy R. Woods, Whittier, Calif., assignor to North American Aviation, Inc.

Application August 4, 1952, Serial No. 302,605

8 Claims. (Cl. 200—90)

1

This invention relates to vibratory signal interrupters, and particularly to a chopper type signal interrupter which is characterized by low noise and increased dependability of operation.

Electromagnetic signal interrupters are used to a substantial extent in connection with direct current amplifiers which necessitate the rapid periodic interruption of an input signal, the application of an input signal to a separate circuit such as an A.-C. amplifier, and the subsequent synchronous rectification of the signal. Normally, it is required that an amplifier of this type respond to low level signals of direct current or of very low frequency. It is important in such devices that chopper operation be substantially noise free and free from the effect of temperature change, and that the device be constructed for long and trouble-free operation. Where synchronous rectification is used it is further essential that the capacitance between the input and output chopper contacts, and the capacitance from the contacts to ground be a minimum.

It is therefore an object of this invention to provide an improved electromagnetic chopper.

It is another object of this invention to provide an electromagnetic chopper which is non-temperature sensitive.

It is another object of this invention to provide an electromagnetic chopper which operates at double the driving frequency to thereby eliminate error resulting from pickup by an associated amplifier at the driving frequency.

It is another object of this invention to provide an electromagnetic chopper of minimum capacitance between the signal-carrying elements thereof and ground.

It is another object of this invention to provide an electromagnetic chopper which is readily adjustable by means accessible from the outside thereof.

It is another object of this invention to provide an electromagnetic chopper which is characterized by introducing negligible electrical noise.

It is another object of this invention to provide an electromagnetic chopper the period of electrical contact in which may be readily adjusted.

Other objects of invention will become apparent from the following description taken in connection with the accompanying single figure which is a cutaway view of the invention.

Referring to the single figure, a tubular frame 1 carries at one end a flexible reed 2 cantilevered and attached by a nut 3. Reed 2 carries a crossarm 4 having platinum-iridium alloy tips 5 and 6. This alloy is preferably made of 70 percent platinum and 30 percent iridium. Reed 2 also carries at its end a mass 7 of ferromagnetic material which serves as an actuator for the reed. At the opposite end of frame 1 and interiorly disposed, cantilever members 8 and 9 are anchored securely

2

in frame 1, as shown. The free ends of members 8 and 9 may be adjusted transversely by screws 10 and 11 threaded into a portion of frame 1. Members 8 and 9 are flat, leaflike cantilever beams having holes 12 and 13 arranged to accommodate crossarm 4, as shown. Contact members 14 and 15 are positioned outboard from members 8 and 9, and carry platinum-iridium alloy strips 16 and 17 disposed to be contacted by the ends of crossarm 4. The ends of members 14 and 15 rest upon insulating means such as jewels 18 and 19 which are secured to the outer surfaces of stop members 8 and 9. Reed 2 is caused to oscillate by the influence of electromagnet 20 which is disposed adjacent to mass 7 and off-center from the axis of reed 2. Alternating current is supplied to electromagnet 20 from any source of alternating current through contact members such as prongs 21, 22, 23, 24, and 25, similar to tube base prongs. The vertical position of electromagnet 20 and hence, to some extent, the amplitude of motion of reed 2 may be adjusted by rotation of cam 26 in the lower portion of frame 1. Frame 1 is insulatingly attached to base 27 to which is also attached cover 28 used for shielding purposes. Contact members 14 and 15 are connected to a pair of contact prongs, as is frame 1. Preferably, frame 1, reed 2, and all other nonelectrical parts of the device are constructed of some low temperature coefficient of expansion material such as Invar.

In operation, alternating current is supplied to electromagnet 20, causing transverse oscillation of reed 2 carrying crossarm 4 and platinum-iridium alloy tips 5 and 6. Platinum-iridium alloy tips 5 and 6 periodically make and break contact with platinum-iridium alloy strips 16 and 17 on contact members 14 and 15. Contact members 14 and 15 are insulated from frame 1, as shown, so that a signal supplied to one of the contact members is periodically connected to the frame, and this connection is broken. As reed 2 moves transversely and contact is made between platinum-iridium alloy tips 5 or 6 and platinum-iridium alloy strips 16 or 17, members 14 and 15 yield, with the result that they are removed from contact with jewels 18 and 19 on members 8 and 9. Because of the arcuate motion of strips 16 and 17, the amount of slippage between the contacts on the crossarm and the contact strips is minimized, and a good electrical connection is effected. The length of time that contact is made each cycle is affected by the adjustment of screws 10 and 11 which adjust the transverse positions of members 8 and 9. The amplitude of oscillation of reed 2 may be adjusted somewhat by moving electromagnet 20 longitudinally by rotation of cam 26.

Because frame 1 is insulated from base member 27 and from cover 28, the frame may be held

at a different potential from the cover, and hence from the chassis or other device used to support the chopper. Because of the arrangement of contact members **14** and **15**, the capacitance between these members and the frame is minimized. The use of platinum-iridium alloy contact members reduces noise which would otherwise be introduced into the circuit when the contacts are made and broken. Jewels **18** and **19** minimize wear of members **14** and **15**, resulting in a relatively long life of the device without frequent adjustment. It will be noted, too, that the chopping frequency of the device is double the frequency of the driving signal applied to electromagnet **20**.

Although the invention has been described and illustrated in detail, it is to be clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of this invention being limited only by the terms of the appended claims.

I claim:

1. A vibratory signal circuit interrupter for converting signals of low frequency and low potential in the circuit to relatively high frequency without loading the signal source and without introducing appreciable noise comprising an elastic conducting reed, means for vibrating said reed at constant predetermined frequency, a crossarm on said reed oriented parallel to the direction of vibration thereof and a contact on each end thereof, a generally cylindrical frame for supporting said reed at one end thereof having an integral centrally disposed block with an aperture sufficient to allow motion of said reed, a pair of stop members attached to said block yieldable in a direction parallel to the motion of said reed and having openings for accommodating the ends of said crossarm without touching them and jewels secured at a predetermined position on the outer surface of said stop members, a pair of yieldable contact members attached to said block outboard from said stop members said contact members having platinum-iridium alloy contact strips aligned opposite the ends of said crossarm and tips spaced to be normally in contact with the outer surface of said stop members at the location of said jewels but disconnected from said stop members by motion of said reed, and means for adjusting the spacing between said reed and said stop members whereby if the signal to be converted is supplied to said contact members said signal is converted to a relatively high frequency without introduction of appreciable noise or distortion.

2. A signal interrupter comprising an elongated generally tubular frame having a plurality of side openings, a first pair of similar cantilever beams attached internally to one end of said frame and extending within said frame toward the other end of said frame, a second pair of similar cantilever beams attached internally to the same end of said frame as said first pair of cantilever beams and extending generally parallel to said first pair of cantilever beams but each disposed outboard from one of said first pair of cantilever beams and each bent at the free end thereof to contact with one of said first pair of cantilever beams, a jewel on each of the ends of said second pair of cantilever beams, said first pair of cantilever beams disposed opposite an elastic reed cantilevered from the other end of said frame and having a symmetrically disposed crossarm arranged to contact said second pair of cantilever beams alternately when said reed is oscillated without touching either of said first pair of cantilever beams, platinum-iridium alloy contact strips on said second pair of cantilever beams positioned to be contacted by said crossarm as said reed is oscillated, and electromagnetic means for oscillating said reed whereby signals supplied to said second pair of cantilever beams are periodically interrupted by contact of said crossarm with one of said second pair of cantilever beams.

3. A device as recited in claim 2 and further comprising means for adjusting the spacing of said first and second pairs of cantilever beams.

4. A device as recited in claim 3 in which said electromagnetic means comprises a mass of ferromagnetic material on the end of said reed and an electromagnet positioned adjacent said mass but displaced from the axis of said reed.

5. A device as recited in claim 2 and further comprising platinum iridium alloy tips on the ends of said crossarm to thereby minimize electrical noise in the resultant signal.

6. A device as recited in claim 2 and further comprising a socket connection for receiving connections to said frame and said second pair of cantilever beams, and a shield over said frame whereby said frame may be held at a different potential from said shield and said socket connector.

7. A device as recited in claim 2 in which said beams, said frame, and said reed are constructed of metal having a low coefficient of temperature expansion to thereby substantially eliminate the effect of temperature on the operation thereof.

8. A signal interrupter comprising an elongated generally tubular frame having a plurality of side openings, a first pair of similar cantilever beams attached internally to one end of said frame and extending within said frame toward the other end of said frame, a second pair of similar cantilever beams attached internally to the same end of said frame as said first pair of cantilever beams and extending generally parallel to said first pair of cantilever beams but each disposed outboard of one of said first pair of cantilever beams and each bent at the free end thereof to contact with one of said first pair of cantilever beams, insulating means on each of the ends of said second pair of cantilever beams, said first pair of cantilever beams disposed opposite an elastic reed cantilevered from the other end of said frame and having a symmetrically disposed crossarm arranged to contact said second pair of cantilever beams alternately when said reed is oscillated without touching either of said first pair of cantilever beams, platinum-iridium alloy contact strips on said second pair of cantilever beams positioned to be contacted by said crossarm as said reed is oscillated, and electromagnetic means for oscillating said reed whereby signals applied to said second pair of cantilever beams are periodically interrupted by contact of said crossarm with one of said second pair of cantilever beams.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,515,077	Clark	July 11, 1950
2,614,138	Williams et al.	Oct. 14, 1952