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SHORTING PLUNGER

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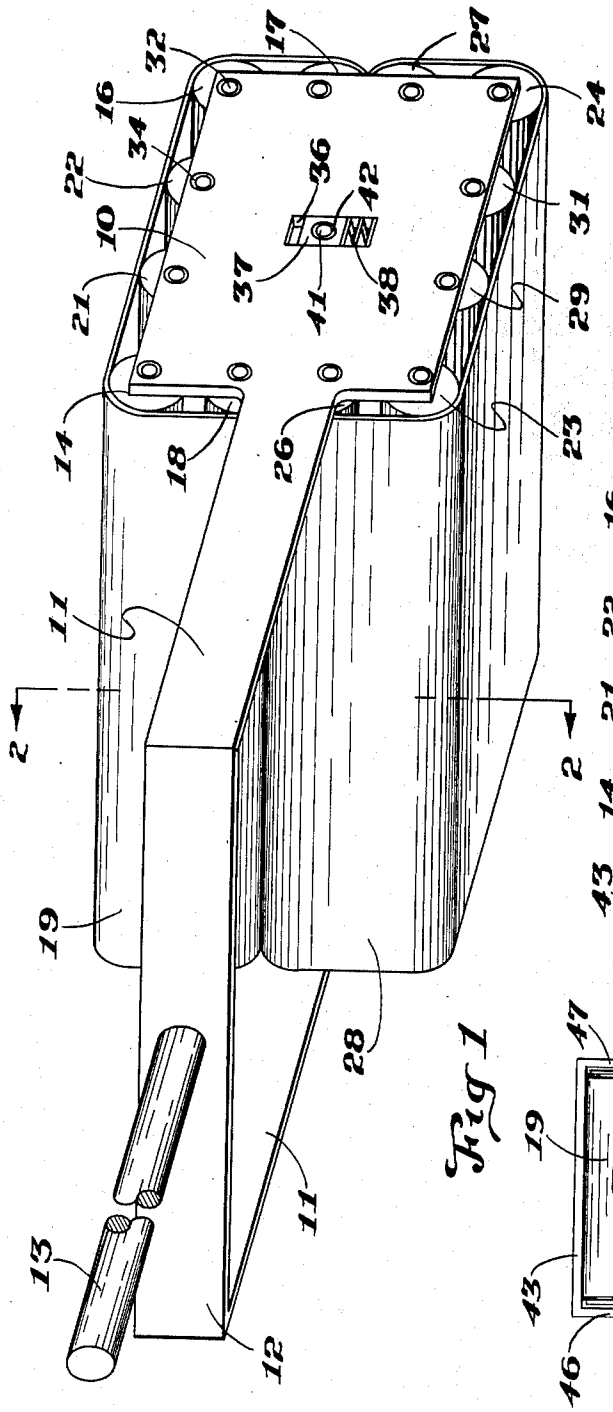


Fig 1

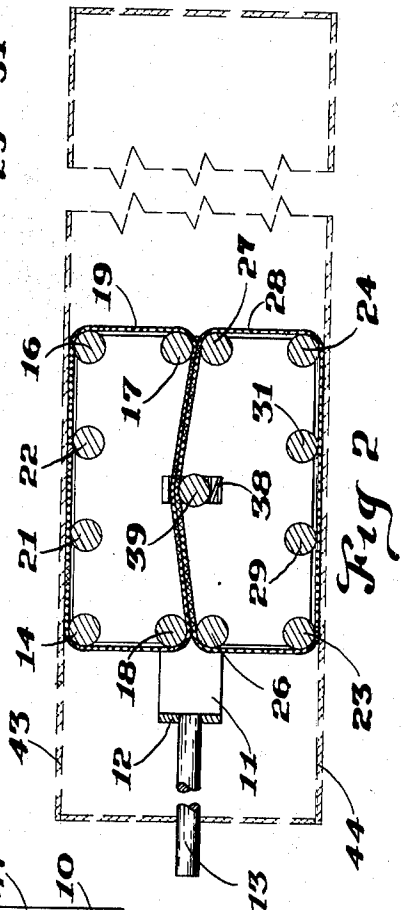


Fig 2

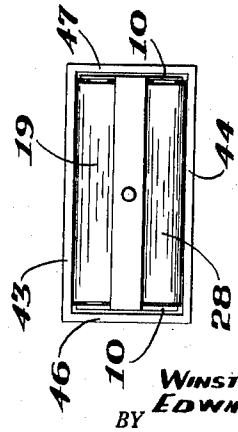


Fig 3

INVENTORS
WINSTON F. WILLIAMS
EDWIN M. PHILLIPS
BY Marvin Moody
ATTORNEY

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SHORTING PLUNGER

Winston F. Williams and Edwin N. Phillips, Cedar Rapids, Iowa, assignors to Collins Radio Company, Cedar Rapids, Iowa, a corporation of Iowa

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2 Claims. (Cl. 333—98)

1

This invention relates in general to means for shorting energy travelling in a wave guide and in particular to a shorting plunger. It is oftentimes desirable to vary the length of a wave guide as, for example, with a shorting plunger and in order to short out the voltage vectors within the guide it is necessary to have a conducting member which forms a low resistance path between the top and the bottom of the wave guide. It is imperative that the plunger make good contact with the wave guide at either side so its resistance will be maintained low. Prior to this invention fingers under spring tension have been used as shorting plungers but have the disadvantage that the fingers scratch and scar the inner surface of the wave guide, or alternately become deflected so as not to engage opposite sides of the wave guide.

It is an object of this invention, therefore, to provide a shorting plunger which may be easily moved longitudinally of the wave guide while maintaining good contact with the upper and lower surfaces of the guide and which does not mar or scratch the surfaces.

Another object of this invention is to provide a shorting plunger for a wave guide which does not depend upon spring-loaded fingers to make contact with the side walls of the wave guide.

Still another object of this invention is to provide an improved and easily manufactured shorting plunger for a wave guide.

A feature of this invention is found in the provision for a pair of endless belts mounted on rollers adjacent each other so that they have a common side in contact and the opposite sides in contact with opposite sides of a wave guide.

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

Figure 1 illustrates a shorting plunger of this invention;

Figure 2 is a sectional view taken on line 2—2 illustrating the shorting plunger in its operating position in a wave guide section; and

Figure 3 is an end view illustrating the shorting plunger of this invention in the wave guide.

Figure 1 illustrates the shorting plunger of this invention which comprises a pair of end plates 10 which have rotatably supported therebetween a plurality of rollers for carrying a pair of endless belts. Push bars 11 extend from one side of the plates 10 and are fastened to a cross bar 12. A rod 13 is connected to the center of cross bar 12 and extends outwardly therefrom.

The end plates 10 have rollers for the upper

2

belt 19 mounted therein with rollers 14 and 16 rotatable supported at the upper corners of the plates 10, and rollers 17 and 18 rotatably mounted at opposite edges of the plates 10 just above their centers.

The endless belt 19 which might be made of copper foil or of some metal of high conductivity is mounted on the rollers 14, 16, 17 and 18 between the end plates 10. The belt 19 may also be made of webbing from conducting material. The belt 19 is narrower than the distance between the plates 10. Between rollers 14 and 16 in plates 10 are mounted a pair of supporting rollers 21 and 22 which engage the center portion of the belt 19 to maintain it in contact with the upper surface of the wave guide.

A pair of rollers 23 and 24 are rotatably supported in the end plates 10 at the lower corners thereof and rollers 26 and 27 are rotatably supported at the opposite edges of the plates 10 slightly below the center of plate 10. A second flexible belt 28 of conducting material is mounted on rollers 23, 24, 26 and 27. A pair of supporting rollers 29 and 31 are rotatably supported along the bottom edges of the plates 10 between rollers 23 and 24. The rollers mounted in the end plates 10 are formed with small projections 32 at either end thereof and these projections are received within bearings 34 mounted in the end plates so that the rollers may rotate freely relative to the plates.

A slot 36 is formed in the center of either end plate 10 and a block 37 is slidably received therein. A spring 38 is mounted between the lower end of the slot 36 and the lower edge of the block 37 to normally urge the block upwardly. A roller 39, best shown in Figure 2, is formed with projections 41 at either end thereof which are received in bearings 42 in the blocks 37. As shown in Figure 2, the roller 39 is mounted below the belts 19 and 28 and serves as an idler roller to maintain the belts taut and in electrical contact. Since the block 37 is free to move up and down in the slot 36, the tension will be maintained at all times.

With reference to Figure 3, the shorting plunger of this invention is shown within a rectangular wave guide having an upper wall 43, a lower wall 44, and end walls 46 and 47, respectively. It is to be noted that the distance between plates 10 is less than the distance between end walls 46 and 47 so that the plunger may be received therein. The belts 19 and 28 maintain electrical contact with the upper wall 43 and the lower wall 44 of the wave guide and thus short-out the energy

travelling down the wave guide. The side view of Figure 2 illustrates how the belts **19** and **28** contact the upper and lower walls **43** and **44**.

In operation, the edge of the plunger farthest from the handle **13** is inserted into the wave guide and the handle pushed to move the plunger within the wave guide. The rollers **14, 16, 17, 18, 21,** and **22** rotate counterclockwise and rollers **23, 24, 26, 27, 29, 31** and **39** rotate clockwise. The portions of the belts in contact passing over the roller **39** between rollers **18** and **7** move with the same speed and in the same direction. The rollers minimize friction and the plunger may be easily moved in and out of the wave guide.

When the plunger is pulled out of the wave guide, the direction of rotation of the rollers will reverse.

It is seen that this invention provides an improved shorting plunger which always maintains good contact with the upper and lower walls of a wave guide without scarring them. Friction is also minimized so that the plunger may be freely moved in and out of the wave guide.

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

We claim:

1. A shorting plunger for a rectangular wave guide comprising, a pair of generally rectangular end plates received within said wave guide with the plane of said end plates being normal to the long sectional axis of said wave guide, a first roller rotatably supported between said end plates adjacent their upper edges so that a portion of the roller's periphery extends above the end plates, a second roller rotatably supported between the end plates longitudinally displaced from the first roller and a portion of the second roller extending above the edge of the end plates, third and fourth rollers rotatably supported between the end plates adjacent the longitudinal center line of the end plates, fifth and sixth rollers supported between the end plates below the third and fourth rollers, seventh and eighth rollers rotatably supported between the end plates near the lower corners thereof with a portion of their peripheries extending down below the end plates, said third and fifth rollers mounted directly below the first roller on a line transverse to the axis of the wave-guide, a first flexible conducting belt rotatably supported by said first, second, third and fourth rollers, a second flexible conducting belt rotatably supported by the fifth, sixth, seventh and eighth rollers, said first and second belts in contact between the third and fifth and fourth and sixth rollers, and means for moving said plunger connected to said end plates and extending longitudinally of the wave guide.

2. An apparatus according to claim 1 wherein an idler roller is mounted in said end plates by means including, a flexible block received in a transverse slot formed in each of said end plates, an idler roller rotatably supported between said blocks, tensioning means urging said blocks toward one end of said slot and said first and second belts passing over said idler roller on the side toward which said flexible means biases the roller.

WINSTON F. WILLIAMS.
EDWIN N. PHILLIPS.

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