April 12, 1938. A. W. DRING 2,114,017

CABLE TERMINAL

Filed May 25, 1937 3 Sheets-Sheet 1

FIG. 2

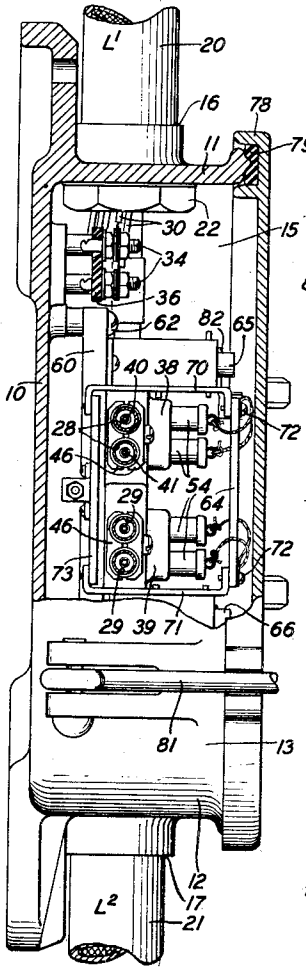
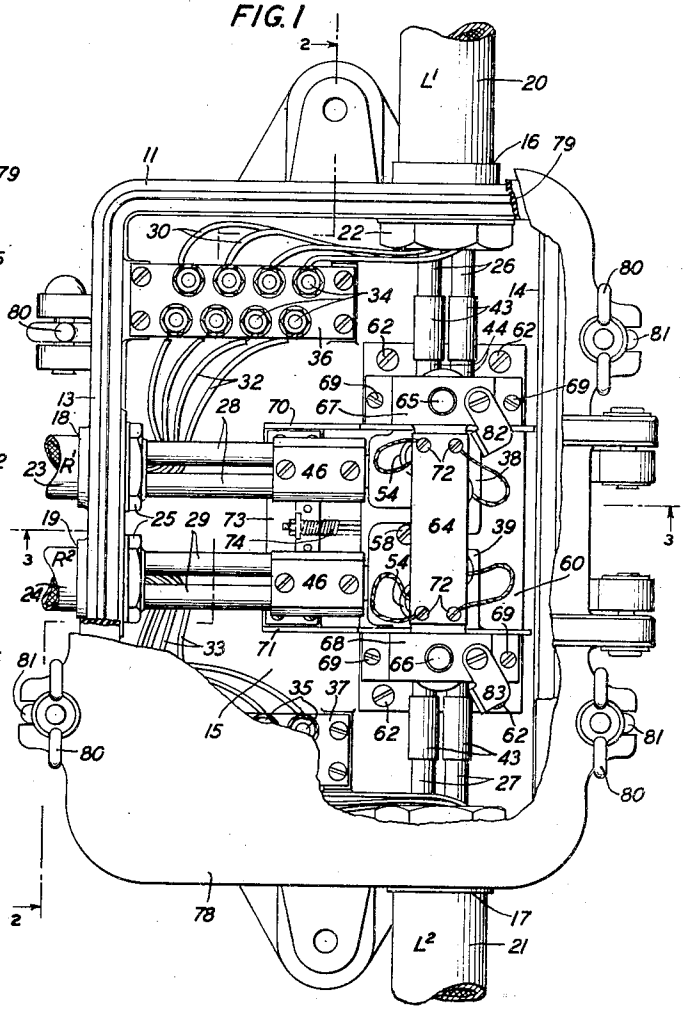


FIG. 1



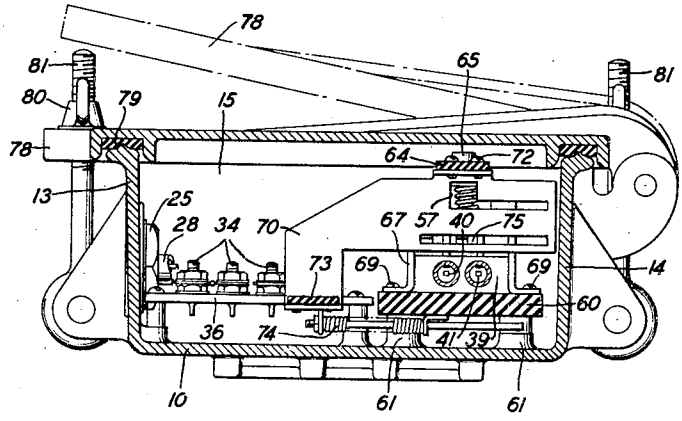


FIG. 3

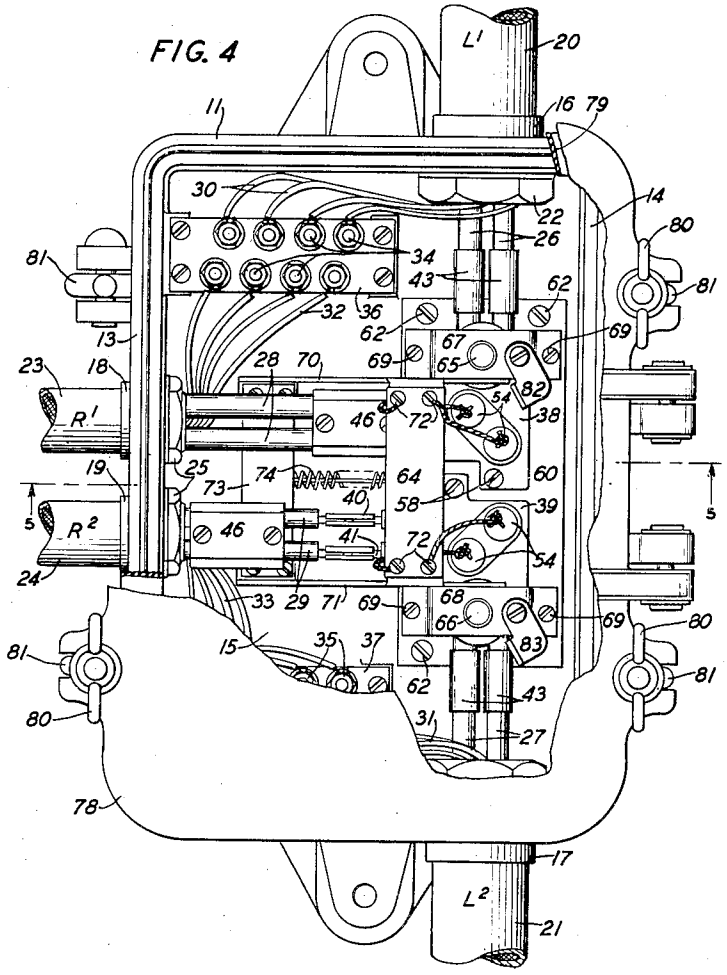
INVENTOR
A. W. DRING
BY J. MacDonald
ATTORNEY

April 12, 1938. A. W. DRING 2,114,017

CABLE TERMINAL

Filed May 25, 1937 3 Sheets-Sheet 2

FIG. 4



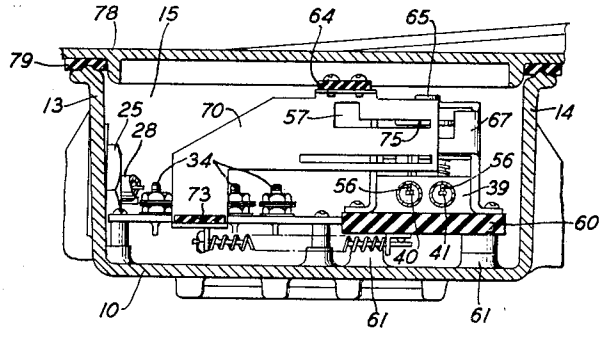


FIG. 5

INVENTOR
A. W. DRING
BY J. MacDonald
ATTORNEY

April 12, 1938. A. W. DRING 2,114,017

CABLE TERMINAL

Filed May 25, 1937 3 Sheets-Sheet 3

FIG. 6

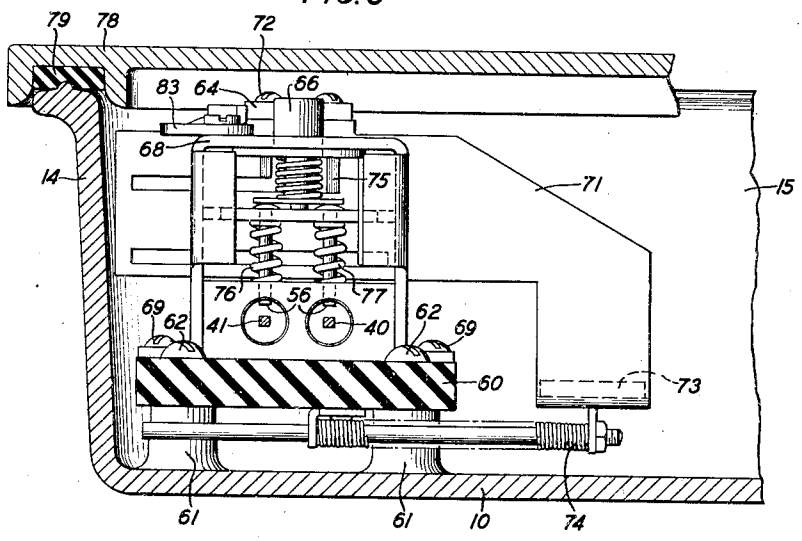


FIG. 9

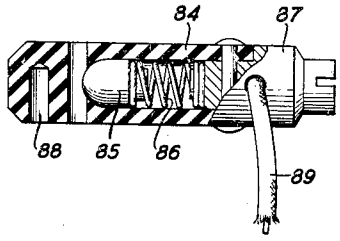


FIG. 7

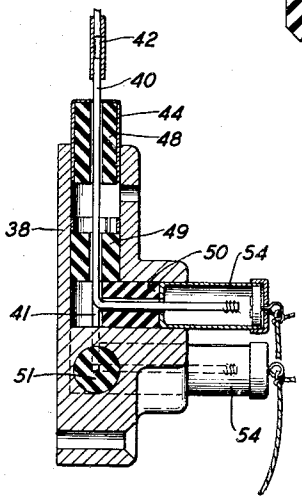
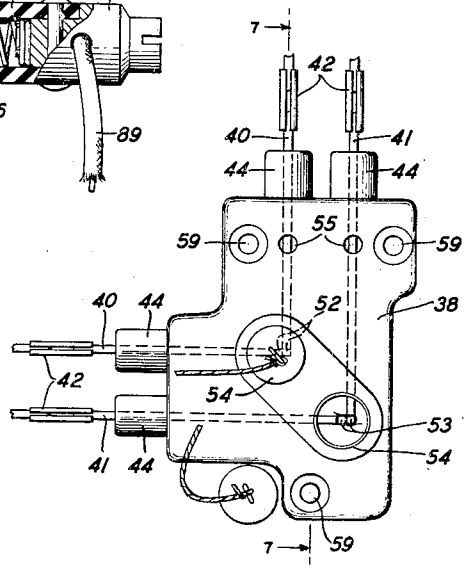


FIG. 8



INVENTOR
A. W. DRING
BY J. MacDonald
ATTORNEY

Patented Apr. 12, 1938 2,114,017

UNITED STATES PATENT OFFICE

2,114,017

CABLE TERMINAL

Arthur W. Dring, Summit, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application May 25, 1937, Serial No. 144,633

5 Claims. (Cl. 247—14)

This invention relates to cable terminals and more particularly to terminals designed for use with repeater equipment on coaxial telephone and telegraph circuits.

The object of the present invention is to provide terminal facilities for the coaxial conductors and the two quads of ordinary conductors, that form a part of each coaxial cable.

Another object of the invention is the provision of a terminal having means incorporated therein for making electrical tests on the coaxial cable conductors without exposing the person making such tests to the hazard of electrical shock.

A still further object of the invention is the provision of means whereby the live conductors are short-circuited before access to them can be had.

In coaxial telephone and telegraph circuits, it is necessary to place repeater stations at certain intervals, for example, about every ten miles, along the transmission line and inasmuch as the wave bands carried by these cables are numerous and the frequency range is from 50 to 200,000 kilocycles, it is essential that there be no leakage which would result in cross-talk and consequently impair the transmission. Furthermore, due to the large number of frequencies transmitted, the possibility of leakage and cross-talk is much greater than if only a small number of frequencies were used. It is, therefore, necessary that any apparatus designed for use in such systems incorporate in them structural means which will prevent such leakage and will provide, as near as possible, a structure equal, theoretically, of course, to an unbroken transmission line.

Applicant has provided a cable terminal for repeater stations which reduces to a minimum the possibility of cross-talk and has also provided means for gaining access to the coaxial conductors without impairing the shielding characteristics of the cable. He has also provided a cable terminal which embodies certain safety features which prevent a person from receiving an electrical shock when making tests on the cable, by making it necessary to perform certain acts, which in turn, short-circuit the transmission line and cut off the power, before he can obtain access to the live portions of the cable.

Other novel features of the terminal will be readily apparent from the following detailed description taken in connection with the accompanying drawings in which

Fig. 1 is a front view of applicant's terminal with the cover portion broken away;

Fig. 2 is a vertical cross-sectional view taken on line 2—2 of Fig. 1 with a portion of the casing broken away;

Fig. 3 is a horizontal cross-sectional view taken on line 3—3 of Fig. 1;

Fig. 4 is a view similar to Fig. 1 except that the protecting or guard plate has been moved away to allow access to the test connections;

Fig. 5 is a horizontal cross-sectional view taken on line 5—5 of Fig. 4;

Fig. 6 is an enlarged fragmentary view of the locking mechanism;

Fig. 7 is a vertical cross-sectional view of the coupling device;

Fig. 8 is a top plan view of the coupling device with the center conductors joined to the conductors of the coaxial cable by means of sleeves; and

Fig. 9 is a view partly in section of a testing plug suitable for use with the terminal of this invention.

In the preferred form of this invention, the terminal comprises a casing having a rear wall or base 10, and end and side walls 11, 12, 13 and 14 integral therewith which form the compartment or housing 15. Located in the side wall 13 and in the end walls 11 and 12 are suitable openings 16, 17, 18 and 19 through which the ends of the coaxial cable are arranged to be inserted. The ends of the cable L1 and L2 which comprise the line or main portion of the cable, terminate in a fixture which is known as a cable plug, 20 and 21 (not shown in detail) and which forms the subject-matter of a pending application in the name of J. J. Harley, Serial No. 113,133, filed November 28, 1936. These plugs 20 and 21 are secured in the openings 16 and 17 on the top and bottom of the casing by means of the nuts 22 and permit the conductors of the cable to pass therethrough without the admittance of air or moisture. The repeater cable stubs R1 and R2 also terminate in the same type of plugs and are indicated at 23 and 24. The conductors are brought out in the same manner as described with reference to the main line cable L1 and L2 and the plugs 23 and 24 are secured in the openings 18 and 19 in the side wall 13 of the casing 10 by means of the nuts 25.

Projecting from the ends of the plugs 20, 21, 23 and 24 and extending into the interior of the housing 15, are the shielded coaxial cable conductors 26, 27, 28 and 29 and the quadded conductors 30, 31, 32 and 33.

The ends of the shielded conductors 26, 27, 28 and 29 are joined together by suitable means

which provide easy access to the central conductor and at the same time prevent injury to the person testing the line by grounding or short-circuiting the conductors, which in turn causes devices at the source of power supply (not shown) to cut off the power. The structure of the connections and protecting means will be described more fully further on in the description.

The quadded conductors **30**, **31**, **32** and **33** are terminated on the binding posts **34** and **35** which are located on the insulated panels **36** and **37** and are used for talking and for pressure alarm circuits.

Located in the interior of the housing are the two couplers **38** and **39** which are shown in detail in Figs. 7 and 8. These couplers, as shown in Figs. 7 and 8, contain two insulated conductors **40** and **41**, which correspond to the inner conductors of the coaxial cable and are joined thereto by means of the sleeves **42**. The bodies of the couplers **38** and **39** are of metal and provide the circuit connections for the outer or shielded portions of the cable. The coupler is connected electrically to the outer shield of the individual coaxial conductors by means of the metallic sleeves **43** which fit snugly on the outer shield of the cable and the projecting portions **44** and **45** of the couplers **38** and **39**. This provides a circuit from the main cable L1 through the plug **20**, over the individual conductors **28** through the outer sleeves **43**, the projecting portions **44** on the coupler **38** through the sliding sleeve **46**, over the conductor **28** into the plug **23** of the repeater cable stub R1. The circuit continues through the repeater equipment (not shown) and returns to the main cable L2 through the stub of the repeater cable R2, the plug **24**, over the conductor **29**, the sliding sleeve **47**, through the projection **45** on the coupler 39, over the sleeves **43**, the conductors **27** in the plug of the cable L2, and back to the main line, thereby providing a loop circuit which includes the repeater equipment. The circuit just traced is for the outer portion or shield of the coaxial cable.

The circuit for the inner or central conductor of the coaxial cable may be similarly traced. Starting at the plug **20** of the L1 main cable, the circuit is over the central conductors **40** and **41** of the coupler **38** to which they are joined by means of the sleeves **42**, see Figs. 7 and 8; from the coupler **38** we pass to the center conductors of the R1 cable stub ends **28** which are part of the plug **23**, the circuit then may be traced through the repeater (not shown) back through the stub of the R2 cable, the center conductors of the cable ends **29**, over the center conductors of the couplers **39** in a manner similar to that described with respect to the coupler **38**, and back to the main cable L2 through the plug **21**, thereby completing the loop circuit for the inner conductor.

By referring to Figs. 7 and 8, it will be observed that the conductors **40** and **41** which are positioned in the coupler **38** by means of the insulating bushings **48**, **49**, **50** and **51**, are bent upwards at right angles to each other and extend some distance above the face of the coupler and in parallel relation to each other. The free or extending ends **52** and **53** are soldered together to form one continuous conductor and are confined in the metallic housings or caps **54** which are readily removable to permit access to these conductors for testing purposes.

The detail of the coupler **38**, shown in Figs. 7 and 8, is substantially the same as the lower coupler **39**, and the description with respect to coupler **38** applies with equal force to coupler **39**.

Holes **55** are provided in the top of the couplers to permit the plungers **56** of the switching devices **67** and **68** to make contact with the inner conductors **40** and **41** for the purpose of short-circuiting these conductors; this causes the current in the conductors to be cut off by the operation of devices (not shown) which are located at the source of power. The operation of the short-circuiting mechanism will be explained in detail further on in the description. The couplers **38** and **39** heretofore referred to are secured in position in the compartment or housing **15** by means of suitable bolts **58** which pass through the holes **59** in the couplers and into the insulating plate **60** which, in turn, is bolted to the upstanding bosses **61** on the base **10** of the housing **15** by means of the bolts **62**.

As pointed out earlier in the specification, this terminal is equipped with safety means which must be operated before access to the live conductors can be made. This device removes the power from the conductors before they can be tested.

The points of access to the inner conductors **40** and **41**, for the purpose of making tests, are located under the sliding sleeves **46** and under the caps or housings **54** of the couplers **38** and **39**. The sliding sleeves **46** may be moved only a very short distance when the screws **63** are loosened due to a portion of the guard assembly preventing any appreciable movement. However, with the locking device **57** in position as shown in Fig. 1, the sleeves **46** may be moved just enough to break the circuit of the outer conductor. This break in the outer conductor removes the ground from the outer circuit and allows for such tests as can be made without first removing the power from the inner circuit, but is not sufficient to permit the accidental contacting with the inner conductor by the fingers of the man making the tests. The movement of the sleeves **46** also removes the ground from the coupler assemblies which are ordinarily grounded through the outer conductor of the coaxial cable and through the sleeves **46**. When the locking device is operated and the current is cut off the guard plate moves out of the way and the sleeves **46** may be slid all the way back, as shown in Fig. 4.

As shown in Fig. 1, a guard plate **64** is positioned over the caps or housings **54** of the couplers **38** and **39**, thereby preventing access thereto. It is, therefore, apparent from the foregoing that in order to get to the inner conductors **40** and **41**, the sleeves **46** must be slid all the way back and the caps or housings **54** must be removed, and as long as the guard is in the position as shown in Fig. 1, this cannot be accomplished. In order to gain access to the inner conductors, the guard plate **64** must assume the position as shown in Fig. 4.

In order to move the guard plate so that it assumes the position as shown in Fig. 4, the buttons **65** and **66** of the two switches **67** and **68** must be depressed simultaneously. The switch assemblies are secured to the insulating plate **60** by means of the bolts **69** and the guard plate **64** is secured to the two side plates **70** and **71** of the locking device **57** by means of the screws **72**. The bottom portion of the plates **70** and **71** are jointed together by means of the insulating plate **73** to which is secured the spring **74** for moving the guard plate **64** into the position as shown in Fig. 4 upon the depression of the buttons **65** and **66**.

When the ons 65 and 66 of the switches 67 and 68 are ssed simultaneously, the plungers 56 enter thpertures 55 in the couplers and make contacth the inner conductors 40 and 41, thereby shcircuiting these conductors and cutting off power. At the same time, it releases the h mechanism 75 which holds the plungers 5own in contact with the conductors 40 and 41ainst the tension of the springs 76 and 77, a also permits the guard plate assembly to ve out of the way due to the spring 74, as sh in Figs. 4 and 5, thereby exposing the hous or caps 54 which may now be removed, a own in Fig. 8, and the sleeves 46 may be slid a he way back, as shown in Fig. 4.

Locate inder the screws 69, toward the hinged side of t terminal, are rotatable buttons 82 and 83 whic may be moved to a position over the buttons and 66 to maintain them in their depressed osition. This is for the purpose of maintaing either one or the other of the buttons in its depressed position when it is desired to hol he short on either the "in" or "out" side of the ne.

The urpose of the test plug 84 as shown in Fig. 9s to provide means for making electrical tests a the extending portions 52 and 53 of the coaxi conductors 40 and 41 without exposing the wrkmen to the hazard of electrical shock. The esign of the plug is such that it can be plac on the test positions of the terminal, only whe the terminal guard plate 64 is in the open posiion as shown in Fig. 1.

The test plug 84 consists of a shell of insulating matrial in which is assembled a ball point 85 attached to a spring 86 which in turn is attached to the terminal 87 at the end of the plug 84. The spring 86 in addition to giving the required pressure to the ball point 85 acts as a conductor through which the current passes to the terminal 87 and thence to the flexible conductor 89.

In order to make a test the soldered joints at the points 52 and 53 are unsoldered and one of the upstanding wires enters the slot 88 in the insulated portion of the plug 84 while the other wire makes electrical contact with the ball point 85. This arrangement makes it impossible to make contact with more than one wire at a time.

After the tests have been made, the guard plate 64 is returned to its normal position, as shown in Fig. 1, by moving it back against the tension of the spring 74.

The terminal housing is provided with a door or cover 78 hingedly secured to the side wall 14 in such a manner that it may be drawn down tightly against the gasket 79 by means of wing nuts 80 and the hinged bolts 81, in order to provide a water-tight joint.

What is claimed is:

1. A cable terminal for coaxial cables comprising a housing, openings in the side walls of said housing for the admittance of cable stubs which comprise coaxial conductors and insulated conductors, a cover on said housing, means on said housing, cooperating with said cover, for securing it in place, binding post panels mounted on the interior of said housing, coupling devices mounted in said housing and having central conductors mounted therein, said conductors insulated from the body of the couplers and having portions thereof extending above the surface of said couplers and removable caps positioned over the extending portions of said central conductors.

2. A cable terminal for coaxial cables comprising a housing, openings in the side walls of said housing for the admittance of cable stubs which comprise coaxial conductors and insulated conductors, a cover on said housing, means on said housing cooperating with said cover for securing it in place, binding post panels mounted on the interior of said housing, coupling devices mounted in said housing and having central conductors mounted therein, said conductors insulated from the body of the couplers and having portions thereof extending above the surface of said couplers, removable caps positioned over the extending portions of said central conductors, and a guard plate normally positioned over said caps.

3. A cable terminal for coaxial cables comprising a housing, openings in the side walls of said housing for the admittance of cable stubs which comprise coaxial conductors and insulated conductors, a cover on said housing, means on said housing cooperating with said cover for securing it in place, binding post panels mounted on the interior of said housing, coupling devices mounted in said housing and having central conductors mounted therein, said conductors insulated from the body of the couplers and having portions thereof extending above the surface of said couplers, removable caps positioned over the extending portions of said central conductors, a guard plate normally positioned over said caps, and means comprising push buttons adjacent said caps and said guard plate for short-circuiting said inner conductors and moving the guard plate out of the way so that the caps may be readily removed.

4. A cable terminal for coaxial cables comprising a housing, openings in the side walls of said housing for the admittance of cable stubs which comprise coaxial conductors and insulated conductors, a cover on said housing, means on said housing cooperating with said cover for securing it in place, binding post panels mounted on the interior of said housing, coupling devices mounted in said housing and having central conductors mounted therein, said conductors insulated from the body of the couplers and having portions thereof extending above the surface of said couplers, removable caps positioned over the extending portions of said central conductors, a guard plate normally positioned over said caps, means comprising push buttons adjacent said caps and guard plate for short-circuiting said inner conductors and moving the guard plate out of the way so that the caps may be readily removed, and locking means associated with said push buttons for maintaining said buttons in a depressed position.

5. A cable terminal for coaxial cables comprising a housing having openings therein for the admittance of cable stubs, a cover on said housing for providing access to the interior thereof, said cover provided with a plurality of locking devices for maintaining said housing in a water-tight condition, binding post panels mounted on the interior of said housing, means for connecting together the ends of the cables terminated in said housing, locking means for protecting said cable ends positioned over said connecting means, and a pair of push buttons for releasing said locking means in order to provide access to the live portions of the cable.

ARTHUR W. DRING.