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 Continuation-in-part of application Ser. No. 549,758, Apr. 21, 1966, now Patent No. 3,401,469, which is a continuation-in-part of application Ser. No. 493,345, Oct. 6, 1965, now abandoned

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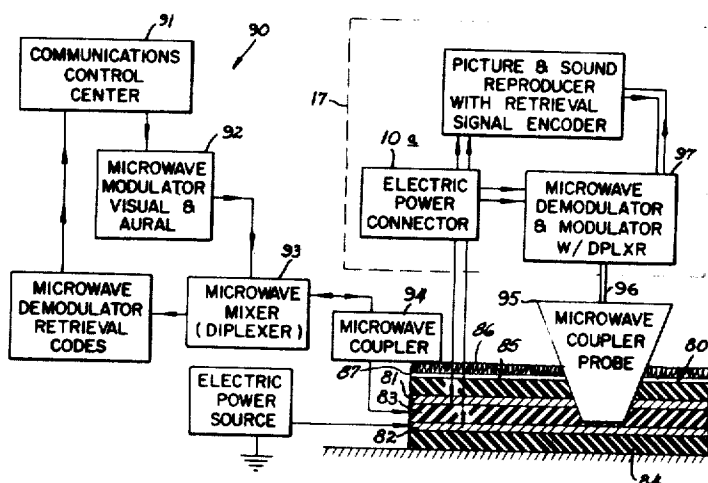
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[54] COUPLING DEVICE FOR TRANSMITTING ELECTROMAGNETIC ENERGY FROM FLOOR COVERING

9 Claims, 9 Drawing Figs.

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 [51] Int. Cl. H04b 9/100
 [50] Field of Search 333/98 P,
 21; 339/95, 9, 96, 97 P, 98, 99, 22; 325/308, 31,
 28; 179/82, 1 P, 1 C; 178/DIG. 2; 350/96; 250/199

ABSTRACT: A coupling device for penetrating a laminated floor covering, carrying electromagnetic energy and thereby transmitting power or signal or both from the floor covering to a receiving unit located on the covering. The coupling device has an enlarged upper body with a probe portion extending downwardly therefrom having a tapered conductive tip and an upper conductive member above the tip and separated therefrom by an insulating member. When the coupling is properly inserted in the floor covering, the tip and the upper conductive member on the probe due to their predetermined spacing automatically contact conductive layers of the floor covering. In a composite version of the coupling, a microwave signal receiving rod embedded within the probe portion between its tip and its upper conductive member becomes automatically located within a microwave signal propagation layer of the floor covering that is provided between conductive layers. A coupling device with a plurality of probe legs for providing multiple signal and power pickups is also provided.



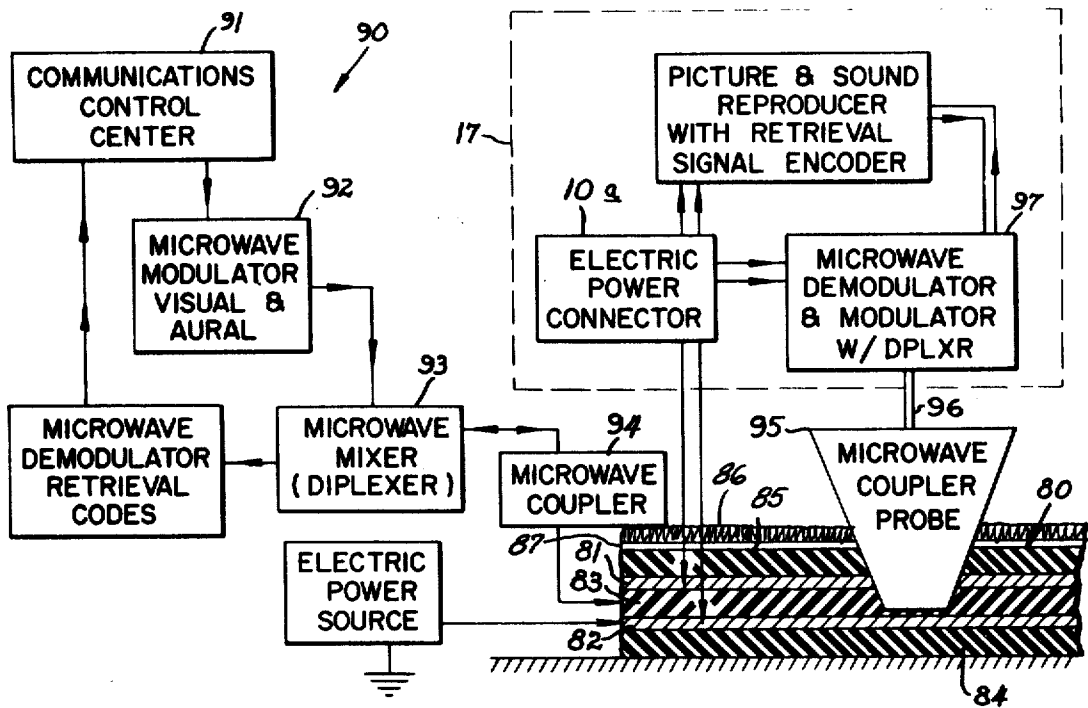


FIG_2

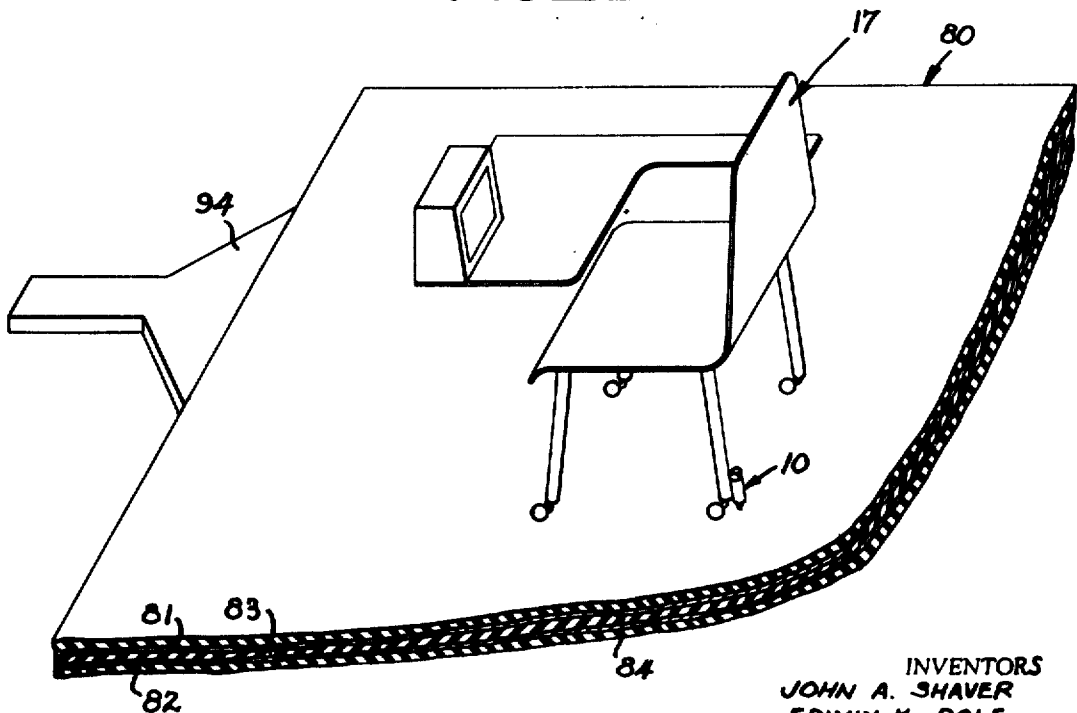


FIG_1

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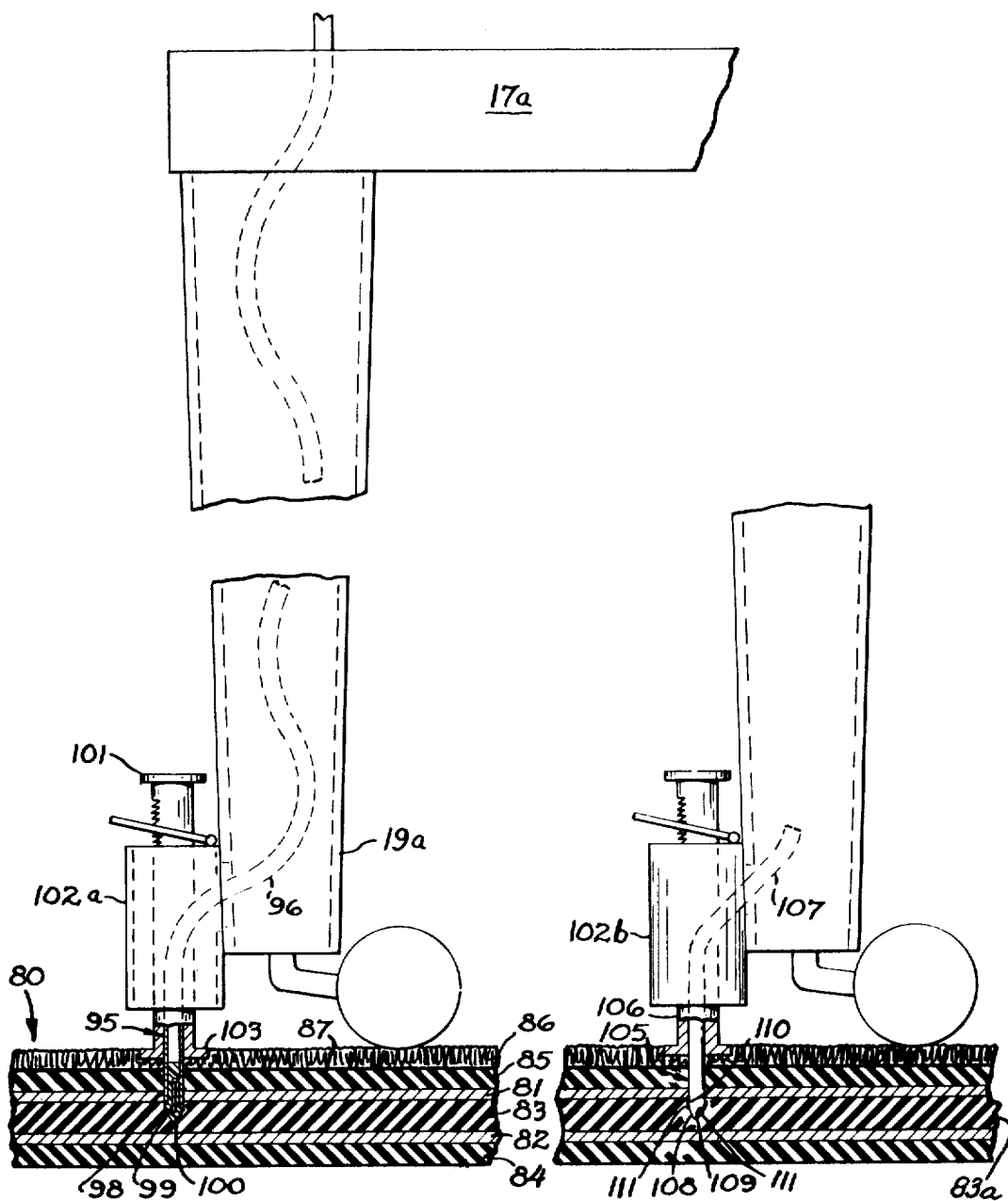


FIG_3

FIG_4

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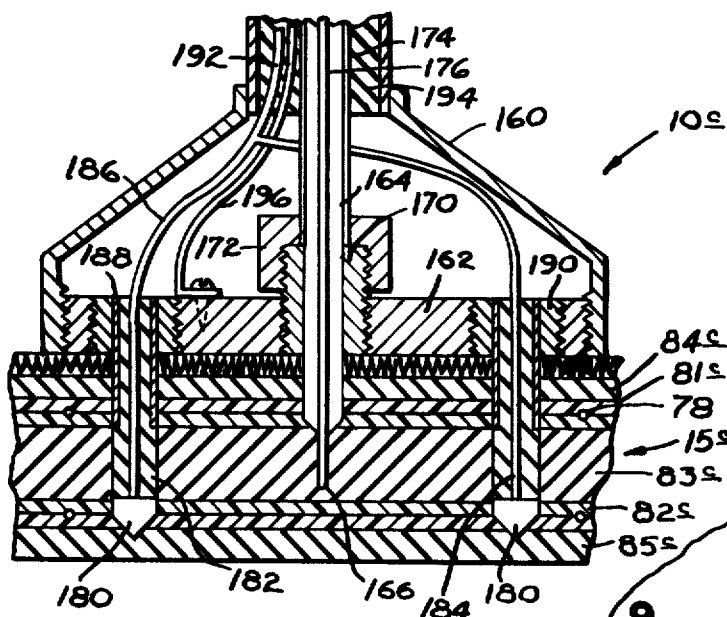


FIG_9

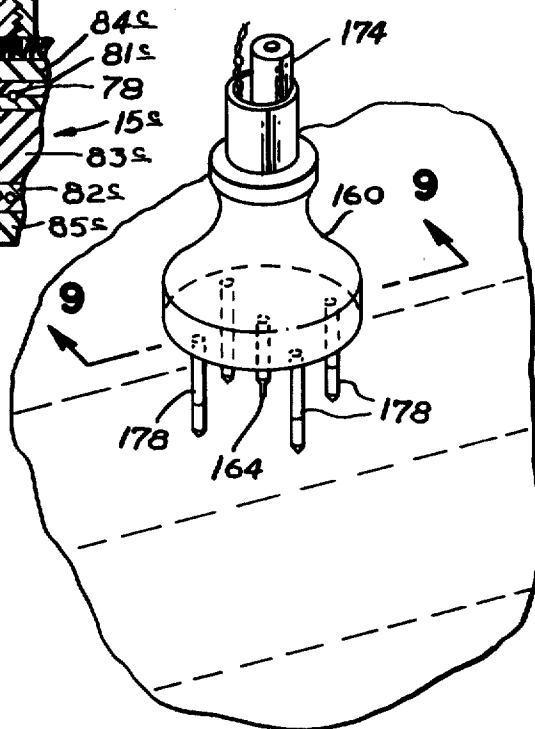


FIG_8

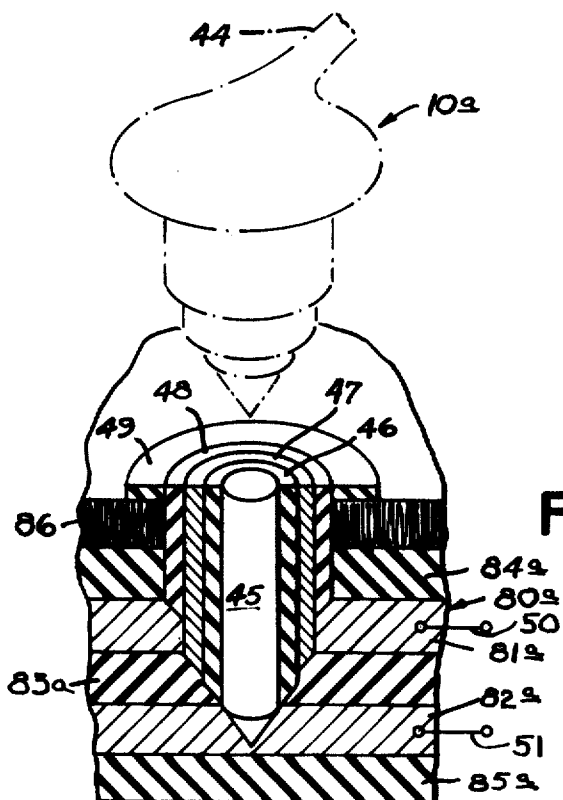


FIG_5

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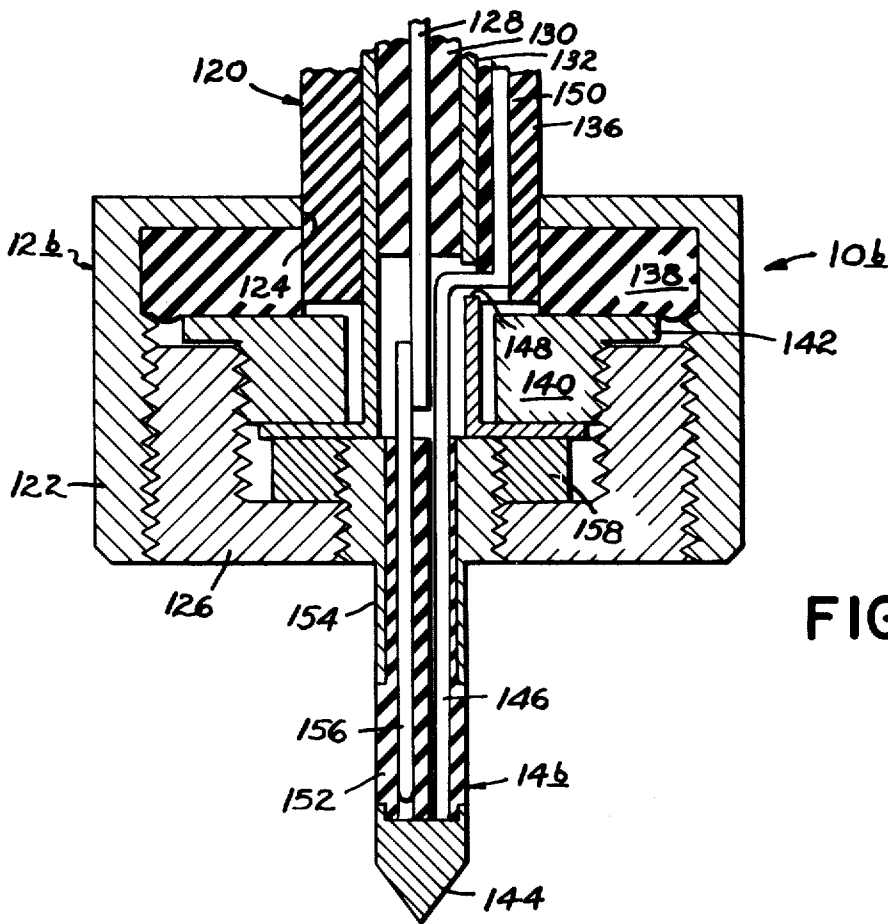


FIG_7

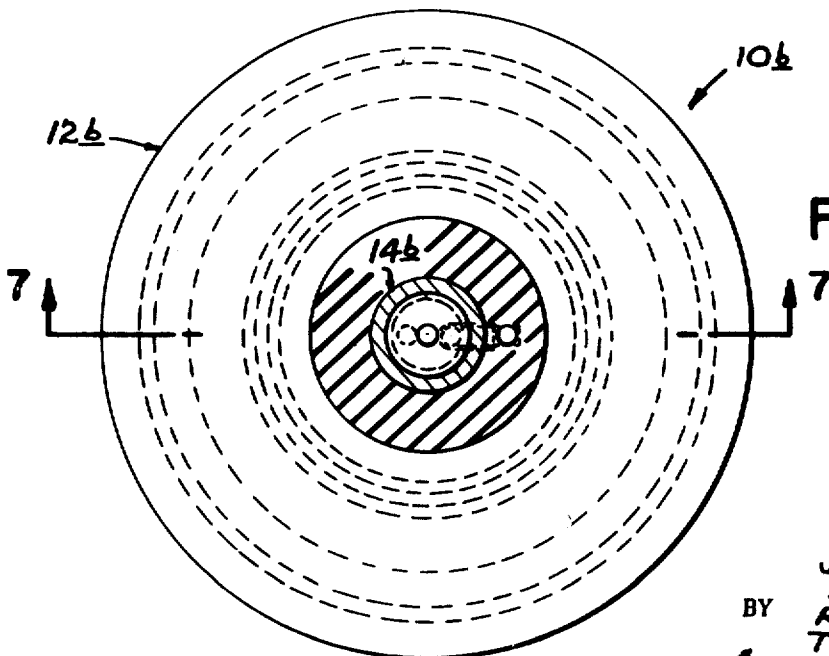


FIG_6

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COUPLING DEVICE FOR TRANSMITTING ELECTROMAGNETIC ENERGY FROM FLOOR COVERING

This application is a continuation-in-part of copending application Ser. No. 549,758 now U.S. Pat. No. 3,401,469 filed on Apr. 21, 1966, which was a continuation-in-part of a copending application, Ser. No. 493,345, filed on Oct. 6, 1965, now abandoned.

This invention relates generally to electrical coupling devices, and more particularly to coupling devices for making a connection between a floor covering capable of carrying electromagnetic energy in the form of power or signals, and a receiving unit located on the floor covering adapted to use the power or signals.

In our parent application a unique system is disclosed for disseminating information from a central distribution and control station to a floor covering which may be installed in any suitable location such as a school classroom. The floor covering receives an input of one or more channels of information signals in the form of electromagnetic energy and/or power and carries it throughout the area of the room. The system includes receiving units or learning stations which are movable to any location on the floor covering and are equipped with various audio, video or other electronic devices which may utilize the power or signal energy carried by the floor covering. The general object of the present invention is to solve the problem of providing a coupling device for extracting either power or information signals or both from the floor covering and transmitting it to the receiving unit.

Another object of the present invention is to provide a coupler unit that will penetrate the signal or power carrying floor covering and automatically control its depth of penetration in order to make the proper contact connections when it is inserted to a limit position.

Another object of our invention is to provide a coupling device that is reliable, durable, safe to operate and which is particularly well adapted for ease and economy of manufacture.

Another more specific object of our invention is to provide a coupling device which can be inserted normally into a laminated floor covering of the appropriate design and when inserted to a predetermined limit will provide both a connection for simultaneously transmitting electrical power as well as microwave signal energy which is propagated through the floor covering.

Yet another object of our invention is to provide a multiprobe coupling device which will provide a low-resistance energy path with spaced-apart conductors in the floor covering at any location where it is inserted therein.

Another object of the present invention is to provide a coupling unit particularly adapted for extracting signal energy from laser transmissions throughout the floor covering in which the coupling unit is inserted.

The aforesaid and other objects of our inventions are accomplished by a coupling unit generally comprising an enlarged upper portion and a lower probe portion with a sharp tip which extends downwardly therefrom. The upper portion thus provides a natural stop so that the probe portion will penetrate the floor covering to a predetermined depth and bring the tip and an upper conductive probe portion into contact with conductive layers as the floor covering. On some versions of our coupling unit a signal pickup member such as a microwave probe is supported within insulation material forming part of the penetrating probe portion and is positioned to be in contact with a signal propagating layer of the floor covering. Various forms of our coupling devices may be made within the scope of the invention to accommodate either a power or signal transmission or both for different types of receiving units.

Other objects, advantages and features of the present invention will become apparent from the following detailed description taken in conjunction with the drawings, in which:

FIG. 1 is a fragmentary view in perspective showing a coupling device embodying the principles of the invention as it appears when attached to a receiving unit for use in combination with a power or signal carrying floor covering material;

FIG. 2 is a block diagram of an information dissemination system utilizing a coupling device according to our invention;

FIG. 3 is a fragmentary view in cross section showing a microwave coupling device according to the present invention when inserted within a laminated floor covering;

FIG. 4 is a fragmentary view in cross section showing another form of penetrating coupling device for use in transmitting signals from floor covering when laser waves are the transmission medium;

FIG. 5 is an exploded view in perspective and in section showing a penetration type of coupling device for extracting electrical power from a floor covering for transmission to a receiving unit;

FIG. 6 is a plan view of a coupling device for transmitting both power and microwave signal energy from a floor covering to a receiving unit;

FIG. 7 is a view in section taken along the line 7-7 of FIG. 6;

FIG. 8 is a view in perspective showing a multiprobe-coupling device embodying the principles of the present invention;

FIG. 9 is an enlarged view in section taken along 9-9 of the coupling device of FIG. 8.

Referring to the drawing, FIG. 1 shows a coupling device 10 embodying the principles of one invention as it appears when normally installed on a typical receiving unit to which it transmits electrical power and/or signal energy from a floor covering 80 beneath the receiving unit that carries electromagnetic power or signal energy or both. Such covering generally comprises a laminated construction preferably having an upper layer 86 of some fabric or carpetlike material. Beneath its upper layer are a pair of spaced-apart layers 81 and 82 of electrically conductive material through which electrical energy supplied from an external source can be transmitted throughout the entire area of the floor covering. Between the two conductive layers is a layer 83 of dielectric material which in some instances may be adapted to propagate signal energy throughout the floor covering. Below and above the conductive layers are a pair of insulating layers 84 and 85, respectively. The floor covering generally is a flexible material of a uniform thickness that may be penetrated by a sharp pointed coupling device at any point on its surface. Thus, in all of its forms the coupling device 10 of our invention has an enlarged upper portion 12 and a tapered lower probe portion 14 which is sufficiently pointed at its tip to enable it to penetrate to the lowermost conductive layer of such a laminated floor covering by the application of a relatively small force.

To facilitate the insertion of the coupling device it may be attached in some suitable manner to a receiving unit 17 to which it transfers the energy derived from the floor covering. In some instances the coupling device may be attached to or housed within a leg of a receiving unit or merely connected to it by a suitable conductor or cable.

One form of a coupler for transferring power only from a floor covering to a receiving unit is shown in FIG. 5. Here the floor covering 80a as previously described, has two conductive layers 81a and 82a separated by an insulating layer 83a and a pair of top and bottom layers 84 and 85 of insulating material adjacent to the upper and lower conductive layers, respectively. To the upper insulating layer may be bonded a layer 86 of carpet or some other eye appealing and penetrable composition surface material. The coupling device 10a which may be attached to receiving unit by an umbilical cable 44 or enclosed within one of its supporting legs is comprised of concentric cylindrical shells of conductive and insulating material whose ends are exposed along the lower probe end portion 14. A central cylindrical portion 45 is preferably of a relatively hard conductive material and has a sharp lower end that will enable it to penetrate the floor covering easily. Surrounding

the center portion is a shorter insulating layer 46 and then an even shorter conductor 47 and finally a still shorter outer insulating layer 48. The latter is integral with a circular top 49 that extends outwardly from the outer layer and forms the upper coupler portion 12. A pair of input leads 50 and 51 for the conductive layers 81a and 82a carry the electrical energy from an external source to the edge of the carpet. Output leads forming the cable 44 extend from contacts at the upper end of the coupler through its top portion 49. When this coupling device 10a is installed it is merely pressed into the floor covering 15 until its enlarged upper portion 49 is flush with the carpet surface. At this position, the normally exposed end of the conductor 45 will be buried within and contact a lower conductive layer 82a of the floor covering and the exposed end of the conductor 47 will be buried within the intermediate conductive layer 81a. Thus, since an electrical potential exists between the conductive layers, a current will flow through the coupling unit to any receiving unit to which it is connected. The conductive layers of the multilayer floor covering 15 may be made from a variety of conductive materials such as metallic foil or a woven mesh or screen of fine metallic wires or conductors. For some coverings we may use conductive layers formed by current carrying granular material such as graphite and metallic powders held together by a binder. The insulating layers 83a, 84 and 85 may be of any suitable nonconductive material such as a flexible sheet of plastic or an insulating fabric of natural or synthetic fiber or yarn.

The laminated floor covering or carpet material shown in FIGS. 1 to 3 is capable of transmitting laser waves, or it can serve as a microwave transmission medium. In addition, it may also provide for the transmission of electrical power for use in operating various receiving units in a manner similar to that just described above with respect to FIG. 5. In this floor covering the spaced-apart conductive layers 81 and 82 are made of a suitable electrically conductive material such as metal foil or woven metal strands. However, we have found that particulate metal or conductive materials bonded together by or suspended in a plastic material provide a flexible conductive sheet that is particularly well adapted for our floor covering. The upper conductive layer 81 is used to establish an electric ground plane. These layers 81 and 82 may vary in thickness depending on the conductive material used and the particular application of the floor covering 80. Between the layers 81 and 82 we provide the layer 83 of dielectric or insulating material that spaces the conductive layers apart by some predetermined specific dimensional relationship, so that either laser waves or electromagnetic energy at microwave frequencies can be transmitted through the layer 83. This signal carrying layer 83 is preferably made of a light, flexible plastic such as any of the well-known foamed or clear plastic materials having low signal attenuation properties. Where laser wave energy is used the signal carrying layer (shown as 83a in FIG. 4) must be the clear-type plastic material. Bonded to the lower conductive layer 82 is an insulating layer 84 that is preferably made of some flexible, nonflammable plastic material. A layer 85 of similar material is bonded to the upper conductive layer 81 and provides a support structure to which a woven or tufted exterior fabric or carpet material 86 may be attached, either by bonding or other means. Between the exterior layer or carpet material 86 and the layer 85 a fluid sealing layer 87 is preferably provided. This latter layer may be a flowable or gummy-type substance such as a relatively thin layer of partially cured rubber, as used in puncture proof tires, which will flow together to close holes that are made by penetrating signal sensing couplers during the use of the floor covering.

The floor covering material 80 may be particularly useful in an information dissemination system wherein the signal transmission medium is electromagnetic energy at microwave frequencies. Use of this medium makes it possible to transmit a large number of information channels from a transmission control center through a signal feed point at the periphery of a carpet or floor covering section.

A block diagram illustrating such a microwave information dissemination system 90 is shown in FIG. 2. From a central communications control center 91 the preselected visual and/or aural information is sent to a microwave modulator 92 where it is put in the form of multichannel microwave signals. This electromagnetic signal information is fed to microwave mixer or diplexer 93 and thence through a coupler device 94 that feeds the electromagnetic microwave signals into the floor covering 80. FIG. 1 shows how such a feed coupler may be attached to the edge of the floor covering. In the floor covering the conductive layers 81 and 82 function as wave guides which allow the microwave signals to be propagated throughout the floor covering. On the surface of the floor covering, receiving devices such as the study stations 17 heretofore described in our parent application are movable to any convenient location. Essentially, each is equipped with a microwave coupler probe 95 connected by a suitable waveguide transmission means 96 to a combined microwave demodulator and modulator 97 having a diplexer for handling both the received signals for use by the study station and also signals transmitted from the study station back to the control station 91. A suitable power connector such as the penetrating-type connector 10a shown in FIG. 5, may be used to penetrate the floor covering 80 and provide power for operating the receiving unit components including video and audio receivers, other teaching machines and a retrieval signal encoder for return transmissions. The various microwave components of the aforesaid system 90 may be of conventional construction according to known state of the art principles and for that reason and to conserve space are not described herein in detail.

The coupler probe 95, however, is shown in some detail in FIG. 3 since it provides a unique solution to the problem of transmitting the microwave signals from the floor covering to the study station while allowing the latter to be freely moved to any position on the floor covering. In the form shown, the probe comprises essentially a piece of metallic pipe 98 forming a hollow waveguide having the proper cross-sectional shape and size to be compatible with the wavelength, frequency and mode of the electromagnetic microwave energy being transmitted through the floor covering. Near its lower end a metal rod or probe tip 99 projects into the center of but is insulated from the waveguide 98 or resonant cavity. The probe tip 99 is used to provide the necessary coupling to the external circuitry of the study station for the injection into or extraction of energy from the dielectric layer 83 between the conductive layers 81 and 82 of the floor covering 80. The lower end of the probe tip 99 extends below the waveguide section of the coupler and is encased in a relatively hard dielectric plastic material 100 that protects the probe tip and keeps it centered while enabling the entire coupler probe 95 to be forced into the floor covering each time the study station is moved to a new location on it. At its upper end the waveguide is attached in some suitable manner to the study station 17 and is connected to the waveguide plumbing which leads to the demodulator and modulator unit. Various arrangements may be made for this plunger, and the one shown in FIG. 3 is merely illustrative. Here, the waveguide pipe 98 is fixed within a foot-operated plunger 101 that is movable mounted within a plunger body 102a attached to the leg 19a of a study station 17a. A suitable stop means such as a flange 103 on the waveguide pipe automatically positions the probe tip within the dielectric layer 83 when the flange 103 bears against the floor covering surface. The upper end of the waveguide pipe is attached to a flexible signal conductor or waveguide transmission means 96, such as the metallic bellows type. Preferably this extends upwardly through a cavity in the leg 19 to the modulator and demodulator unit 97.

A plunger-type coupler 105 for a laser transmission system may be utilized with the floor covering 80 and also with a laser modulator-demodulator unit connected to audio and video receivers in a receiving unit. The laser plunger coupler 105 comprises a solid rigid rod made of relatively hard clear plastic

or glasslike material similar to material sold under the trademark Lucite. As shown in FIG. 4, the rod may be fixed in a movable plunger 106 which is mounted within a plunger body 102a. At its upper end the rod is connected to a flexible light wave conductor 107 of plastic or glass fiber material that preferably extends within the leg of a study station to the laser modulator-demodulator (not shown in FIG. 4). At its lower end, which is adapted to penetrate the floor covering 80, the plunger coupler 105 has a front surface 108 facing the source of laser energy entering the floor covering that is beveled at an angle to the longitudinal axis of the rod. From the lower tip of the rod 105 which is the lower edge of the beveled surface a curved rear surface 109 extends upwardly. A frontal surface 110 above the front beveled surface 108 and the curved surface 109 are both coated with a layer 111 metal material that serves as a focusing reflector. A suitable stop such as the flange 103 also serves here to position the beveled surface of the rod 105 within the dielectric layer 83. Thus, the laser energy striking the beveled 108 end of the rod 105 in the dielectric layer 83 of the floor covering 80 enters the probe only at this beveled surface. It impinges on the curved surface 109 whose curvature is such to reflect the energy directly upward through the plunger and thence through the conductor 107 to the demodulator of the particular study station.

It is apparent that for the best reception the beveled surface 109 should be directed towards the input source of light energy entering the floor covering. To provide the adjustment to take care of this directional factor the rod 105 may be rotatable once it is inserted into the floor covering and thus the maximum signal can be received despite the position of the study station.

Other forms of penetrating couplers may be used for the foregoing embodiments of FIGS. 1-4 and the plunger-type arrangement shown is merely one illustration of a workable structure.

For example, in another form of our invention, shown in FIGS. 6 and 7, a composite coupler 10b is provided which is capable of transmitting both electrical power and microwave signal energy from a section of penetrable, laminated floor covering 80 to a receiving unit 17. In general, this coupler comprises an upper housing 12b which retains the end of a composite cable 120 for carrying both power and microwave signal energy and a lower probe portion 14b that extends downwardly. In the embodiment shown, the housing is comprised of a circular lock nut 122 having a central opening 124 in a transverse upper end portion and internal threads on cylindrical sleeve portion. A base member 126 is threaded into the lower end of the locking nut and retains the probe portion of the coupler.

The coaxial cable 120 comprises a central core conductor 128 of material that is capable of conducting microwave energy. Surrounding the central core is a uniform layer of insulating material 130 and around the latter is a layer of a suitable shielding material 132 as normally used in coaxial cable. The latter shielding extends below the insulating material and forms a flared radially end portion 134 extending outwardly within the coupler housing. On the outside of the shielding is a relatively thick layer of insulating material 136 which also extends through the opening 124 into the coupler housing. Within the housing is an elastomeric packing ring 138 that fits flush up against the transverse end portion of the housing and around the end of the outer insulating material 136. Around the shielding layer 132 just below the outside insulation layer and flush against the packing ring 138 is a shield locker 140. This locker ring has a radially extending flange 142 on its upper end and external threads on a lower body portion below the flange that engage with internal threads on the inside of the base member.

The probe portion 14b of the coupler 10b comprises a tapered tip portion 144 at its lower end made from a hard electrically conductive material, and connected to this tip portion is a conducting rod 146 that extends upwardly above the locker ring 140 and through a side opening 148 in the shield-

ing to connect with a conductor 150 embedded in the thick outside insulating layer 136 of the composite cable. As shown, the connection of the conductor rod 146 and the cable conductor is preferably located within the coupler housing. Surrounding the conductor rod along its length is a layer of insulating material 152 such as hard rubber or plastic. This insulating material extends above the probe tip 144 in a cylindrical section of the same diameter and through the center of an upper probe portion 154 that is threaded to the probe base. Thus, the insulating layer provides a nonconductive separation between the probe tip 144 and the conductive upper probe portion. Embedded within the insulating body 152 and parallel to, but spaced from the conductor rod 146, is a microwave pickup rod 156. This rod, which may be of any highly conductive material such as copper, extends downwardly to a point just above the tip portion while its upper end extends through the upper probe portion and is connected to the central core conductor 128 of the coaxial cable 120.

When the coupler is assembled, the upper probe portion 154 is attached to a locking ring 158 and is threaded through the base member to press the flared end portion 134 of the cable shield against the shield locker 140, thereby holding the shield firmly in place. The probe base member 126 is also threaded into the locking nut and forces the flange of the shield locker against the packing 138. This pressure on the lower face of the packing causes it to grip the end of the cable 120 and hold it firmly within the coupler housing.

The spacing of the coupler tip 144 and the exposed upper conductive portion 154 are designed so that when the coupler is pushed normally into the signal and power carrying laminated floor covering 80 until the probe portion 14b is fully inserted, the lower tip 144 will contact a lower conductive layer 81 of the covering and the exposed upper portion 12 will contact an upper conductive layer 82. The exposed upper coupler acts as a ground since it provides a current path directly to the coupler housing. Current through the probe tip 144, which is thus the "hot" side can flow through the conductor rod 146 to the conductor of the coaxial cable. Between the probe tip and upper portion the pickup rod 156 embedded in the insulating body is positioned within a layer 83 of microwave propagation material between the conductive layers. Thus, microwave signal energy is received by this rod and is transmitted directly to the shielded coaxial cable.

In FIGS. 8 and 9, another coupling device 10c is shown which is particularly adaptable for use with a form of laminated floor covering 15c having spaced-apart wire conductors 78 embedded in the penetrable layers 81c and 82c of conductive material. In this coupler embodiment the coupling device comprises generally an enlarged upper portion or housing 160 and a base member 162 that fits within the housing supported in the base member is a central probe member 164 comprised of a microwave pickup rod 166 that extends into the signal propagation layer 83c of the floor covering when the coupling device is installed. As previously described with respect to the composite coupler 10b, the rod 166 is supported within a hard, nonconductive material forming a protective layer 168 that surrounds the rod above its tip. Bonded to the latter layer around its upper end is a threaded member 170 that fits within the base member 162 and also within a nut 172 above the base member attached to the end of a coaxial cable 174 extending into the coupling device 10c. The latter has a central core conductor 176 which is aligned with and connected to the pickup rod 166 when threaded member is properly inserted in the nut. Spaced radially from the central pickup probe are a plurality (e.g., 4) of somewhat longer probes 178 for deriving power from the floor covering in which the coupler is placed. As in previous embodiments, each of these power probes has a conductive tip portion 180 of a hard material tapered to a point. Attached to the tip and extending upwardly through a cylindrical insulation body 182 is a conductor rod 184 that is connected to a wire conductor 186 within the coupler housing spaced above the conductive

tip 180 is an upper conductive portion 188 which is attached to a threaded member 190 of conductive material at its upper end. The conductor rods of all the power probe members are connected together to form a common power lead 192 that extends upwardly and is embedded within an outer insulation layer 194 surrounding the coaxial cable. A ground wire 196 which is connected to the base member 162 also extends upwardly adjacent to but insulated from the common power lead. As with our previous coupling devices the conductive tip and upper portion on each of the power probes 178 are spaced so that they will contact the conductive layers of the floor covering when the device is pushed normally into it. Also, the central signal probe 164 is automatically positioned within the signal propagation layer of the floor covering.

The plurality of power probes 178 makes this coupling device 10c particularly useful with the floor covering 15c which utilizes the parallel conductive wires 78 within the conductive layers. As shown in FIG. 8, the spacing of the power probes may be such that no matter where it is randomly inserted within the floor covering at least one of the power probes will be close enough to a wire conductor 78 so that a low-resistance current path will be provided to the coupling device. In the meantime the signal probe is always in the proper position to derive signal information within the propagation layer.

In all of the aforesaid embodiments of our invention, a unique coupling device is provided which can be inserted directly into laminated signal and power carrying floor covering by mere manual pressure. When the device is fully inserted until stopped by its enlarged upper portion the appropriate power or signal receiving contacts of its probe portions are engaged with the appropriate signal or power carrying members of the floor covering to provide for the efficient, safe flow of electromagnetic energy. The coupling device can be attached in various ways to any receiving unit which requires electrical power or which utilizes the channels of audio or visual information signals carried by the floor covering.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

We claim:

1. For use in combination with an information dissemination system including a laminated floor covering having spaced-apart electrically conductive layers above and below a nonconductive layer through which electromagnetic wave energy is transmitted, a coupling device adapted for connection to a receiving unit and adapted to penetrate said floor covering to receive or transmit modulated wave signals through the nonconductive layer, said device comprising:

a rigid probe member having an end portion including a signal sensing means;

stop means for controlling the amount of penetration so that said end portion is located within said nonconductive layer of the floor covering when the coupler probe is forced generally vertically into it;

and means connected to the upper end of said rigid probe member for transmitting signal energy to or from audio or video components of said receiving unit.

2. The coupler probe as described in claim 1 wherein said rigid member includes a wave guide pipe; a probe tip providing said signal sensing means attached to the side of said guide pipe and insulated from it;

and a solid plastic material surrounding said probe tip and forming said tapered end.

3. The coupler probe as described in claim 1 where said rigid member is formed as a rod of relatively hard, clear, glass-like material having a beveled surface at its lower end comprising said sensing means;

a coating a light reflective material on said rod above said beveled surface;

a curved outer surface of a predetermined curvature extending rearwardly from said beveled surface; and light reflective material on said curved surface; whereby coherent light waves impinging on said beveled surface and against said curved reflective convex surface are directed upwardly through said rod and to said receiving unit.

4. A coupling device connected to a receiving unit and adapted to penetrate a floor covering having a layer of dielectric material between layers of conductive material for transmitting electromagnetic energy from the covering to the receiving unit, said device comprising:

an enlarged upper portion with a lower transverse surface forming a stop;

probe means extending downwardly from said upper portion and tapered to a point at its lower end, a lower conductive member and an upper conductive member on said probe portion;

insulation means separating said upper and lower conductive members;

separate lead means extending within said upper portion and connected to said upper and lower conductive members;

and microwave pickup means spaced downwardly from said upper portion between said upper and lower conductive members.

5. The device as described in claim 4 wherein said lower conductive member of said probe means comprises a central core of conductive material and said upper conductive member comprises a conductive sleeve separated from said core by an insulating sleeve and terminating above the tapered end of said core.

6. The device as described in claim 4 wherein said lower conductive member of said probe means is a tapered tip member, said upper conductive member is a sleeve of conductive material spaced above said tip member and an insulating member between said tip member and said sleeve member.

7. The coupling device of claim 6 wherein said microwave pickup means is secured within said insulating member and extending upwardly through said upper conductive sleeve member.

8. The coupling device of claim 7 including a coaxial cable extending into its said enlarged upper portion having a central conductor connected to the upper end of said microwave pickup means, shield means around said central conductor, and means for clamping said shield means and securing said coaxial cable within the enlarged upper portion of the device.

9. A coupling device adapted to penetrate a laminated floor covering having a pair of conductive layers separated by a dielectric material for simultaneously transmitting electrical power and signal energy from the floor covering to a receiving unit thereon attached to the coupling device, comprising:

an enlarged upper portion;

a rigid signal probe member attached to and extending downwardly from said upper portion and including a signal sensing means at its lower end;

said upper portion including stop means for controlling the amount of penetration so that said end portion is located at a predetermined location within the floor covering when said signal probe member is forced generally vertically into it;

means connected to the upper end of said rigid probe member for transmitting signal energy to or from audio or video components of said receiving unit;

and power probe means attached to and extending downwardly from said upper portion of said coupling device and spaced from said signal probe member, said probe means including a plurality of elongated, spaced-apart conductive members having conductive portions located above and below said end portion of said signal probe member so as to penetrate and contact the conductive layers of the floor covering.