

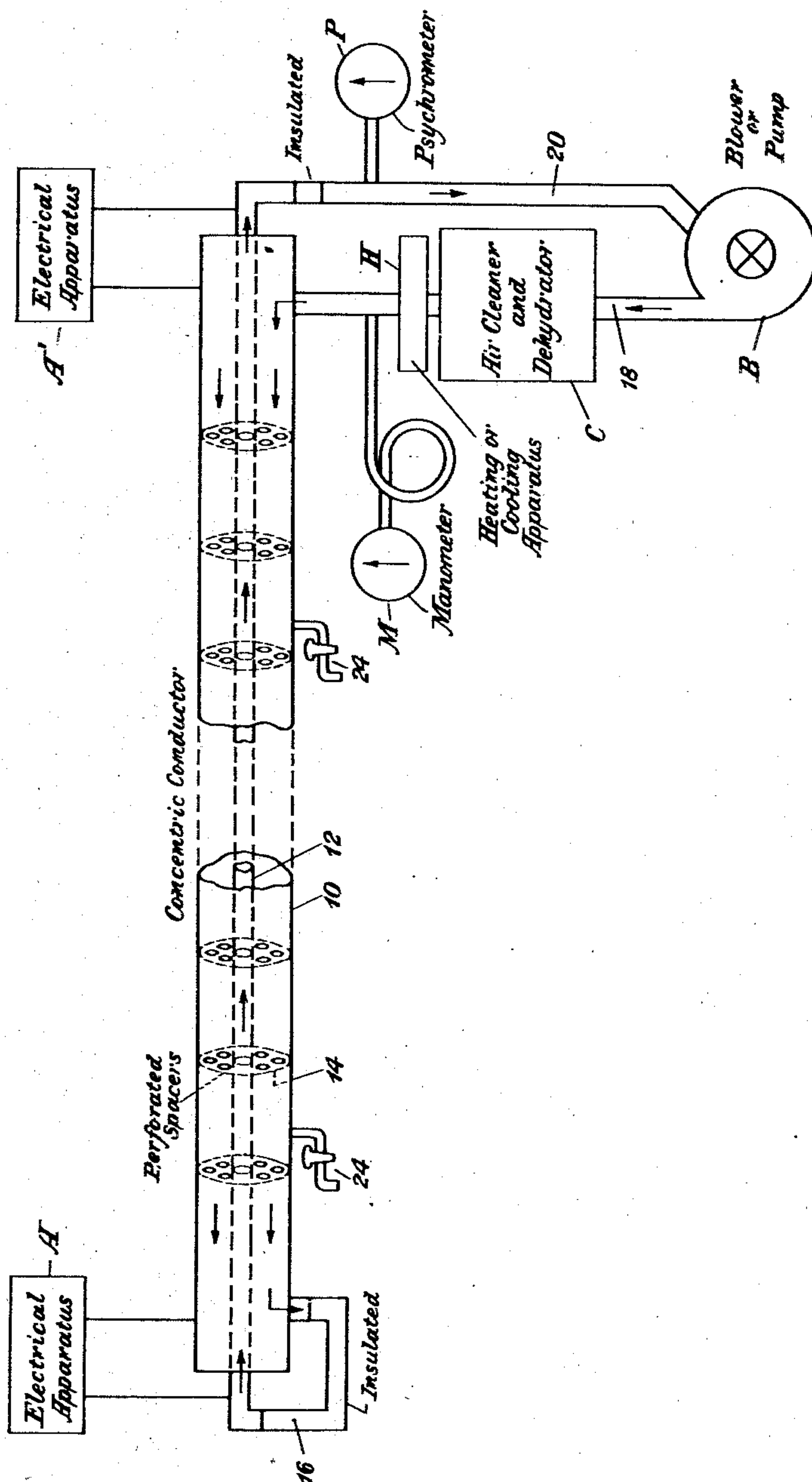
July 12, 1932.

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1,866,611

CONCENTRIC CONDUCTING SYSTEM

Filed May 23, 1929



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CONCENTRIC CONDUCTING SYSTEM

Application filed May 23, 1929. Serial No. 365,525.

This invention relates to a novel form of conductor structure employing concentric cylindrical conductors for the transmission of a wide band of frequencies with relatively low attenuation, and has more particularly to do with the maintenance of such a system in proper operating condition.

If a hollow cylindrical conductor is provided with a return conductor comprising a second hollow cylindrical conductor concentrically arranged with respect to the first conductor, and the two conductors are separated by a dielectric consisting largely of air or other gaseous medium, the transmission line thus formed will have a number of desirable characteristics. Its attenuation at all frequencies will be quite low as compared with the corresponding attenuation of open wire lines and cable circuits such as are now commonly used for telephone transmission. Such a transmission circuit may, therefore, be employed for the transmission of a much wider band of frequencies than has been possible with types of transmission circuits heretofore used. It also has the advantage that it is substantially free from interference from neighboring conductor systems and in itself tends to produce but little interference into adjacent transmission circuits.

In such a system the two conductors are usually maintained in proper concentric relation to each other by dielectric spacers or washers interposed between the two conductors. It is highly essential for the proper operation of the system that these spacing washers be maintained dry and clean. If the outer conductor be a copper pipe or even be made up of stranded wire braided or woven in the form of a hollow cylinder and covered with waterproofing material, the conducting system will be maintained dry and increased leakage losses due to the improper functioning of the dielectric spacers will be avoided. If, however, the outer conductor should be punctured, either due to an accident or to deterioration, moisture would be enabled to enter the space between the two concentric conductors and might result in putting the system out of commission. In order to avoid this effect it is proposed, in accordance with the

present invention, to maintain a circulation of air under pressure through the conductors. Preferably, the circulating system will be so arranged that the air or other gas will be transmitted in one direction to or from a blower or pump through the interior of the inner conductor, and will be transmitted in the opposite direction through the space between the two conductors. By maintaining such a circulation of air or gas under pressure, any opening in the outer conductor which might enable moisture to enter would be indicated by a drop in pressure, so that the trouble could be at once located and corrected. If any considerable amount of water should enter the system, the water may be drained off by means of drain cocks or by means of suitable pumps, and the remaining moisture in the air may be removed by passing the air which circulates in the system through a suitable air cleaning and drying apparatus.

The invention will now be more fully understood from the following description when read in connection with the accompanying drawing, the figure of which shows a preferred arrangement of the invention.

Referring to the drawing, a concentric conductor transmission system is schematically indicated as comprising an outer tubular conductor 10, with an inner tubular conductor 12 arranged on the interior thereof and concentrically therewith. The two conductors are maintained in proper spaced relation by means of washers such as 14 spaced at suitable intervals, and preferably these washers have transverse openings through them to permit of the circulation of air in the space between the two conductors. For transmission purposes, electrical apparatus schematically indicated at A and A' will have its terminals connected to the terminals of the two tubular conductors 10 and 12 at each end thereof, so that the transmission of signaling currents, power currents and other types of electrical transmission may take place.

In the operation of such a system, particularly where high frequencies are to be transmitted, it is essential, in order to keep leakage losses at a minimum, that the spacing washers such as 14 be maintained in a dry

and clean condition, as any dirt or moisture permits the transmission between the two concentric conductors of leakage currents. So long as the outer conductor 10 is maintained waterproof, this condition will obtain, but if the outer cylindrical conductor be punctured, either by accident or due to deterioration by exposure to the elements, moisture will be enabled to enter the space between the two conductors.

In order to overcome this difficulty, the inner cylinder or pipe 12 is connected at one end through a section of pipe 16 to the outer pipe or tube 10. In order to prevent short-circuiting the terminal electrical apparatus at A, the pipe 16 should include an insulating section or be otherwise constructed so that conduction cannot take place between the two conductors 10 and 12 through the pipe 16. A suitable blower or pump B is provided at the other end of the system, and the output of the blower is connected by means of a pipe 18 through an air cleaner and dehydrater schematically indicated at C to the interior of the outer pipe or conducting tube 10. The inner conducting tube or pipe 12 is connected through a pipe 20 to the input side of the blower or fan B. It is, of course, necessary that an insulating section be included in the pipes 18 or 20, or both, to prevent short-circuiting of the electrical apparatus at A'. A manometer M for indicating pressure may be associated with the pipe 18, and a psychrometer P of known type for indicating the humidity or amount of moisture in the circulating air may be associated with the return pipe 20. If desired, heating or cooling apparatus H may also be included in the pipe 20 where it is desired to maintain the circulating air at a predetermined temperature. The blower B, cleaner and dehydrater C, heating or cooling apparatus H, manometer M and psychrometer P may all be of any known type and are merely indicated schematically in the drawing.

When the blower B is operated the air will be forced under pressure through the space between the outer conductor 10 and the inner conductor 12, and will be returned through the pipe 16 to the inner conductor 12 and thence through the pipe 20 to the blower. The manometer M will indicate the pressure of the circulating air and if a leak should occur in the outer conductor 10 this fact will be indicated by a decrease of the pressure indication upon the part of the manometer M. If, during the normal operation, any moisture should enter the space between the two conductors, this fact will be indicated by the psychrometer P. The air cleaner and dehydrater C will, of course, function to remove the moisture from the circulating air and the interior of the conductor 10 will, therefore, be maintained in a dry condition so that

leakage across the insulating spacers 14 will be maintained at a minimum.

If the outer conductor 10 should be punctured so that any considerable amount of water should enter the system and put it out of commission, the outer conductor may be drained by means of suitable drain cocks 24, and by increasing the amount of air circulated through the system by speeding up the blower B, the transmission circuit may be maintained sufficiently dry for transmission purposes pending the location and repair of the leak. Even where the system has been put entirely out of commission, until the leak has been located and repaired the drain cocks 24 are useful in draining off the water, and the air circulating system is then put into operation to dry out the system so that it can be again used.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a concentric conductor system comprising concentrically arranged tubular conductors for electricity, a gas conduit connecting one end of the inner tubular conductor to the space between the conductors for the flow of gas between said inner conductor and said space, and gas pumping means having an input connection and an output connection, one of said connections being associated with the other end of said inner tubular conductor and the other connection being connected to the space between said conductors, whereby a continuous flow of gas is maintained through the space between said conductors and through the inside of the inner conductor in tandem.

2. In a concentric conductor system comprising concentrically arranged tubular conductors for electricity, a gas conduit connecting one end of the inner tubular conductor to the space between the conductors for the flow of gas between said inner conductor and said space, gas pumping means having an input connection and an output connection, one of said connections being associated with the other end of said inner tubular conductor and the other connection being connected to the space between said conductors, whereby a continuous flow of gas is maintained through the space between said conductors and through the inside of the inner conductor in tandem, and means to indicate the pressure in the system.

3. In a concentric conductor system comprising concentrically arranged tubular conductors for electricity, a gas conduit connecting one end of the inner tubular conductor to the space between the conductors for the flow of gas between said inner conductor and

said space, gas pumping means having an input connection and an output connection, one of said connections being associated with the other end of said inner tubular conductor and the other connection being connected to the space between said conductors, whereby a continuous flow of gas is maintained through the space between said conductors and through the inside of the inner conductor in tandem, and means to indicate the moisture in the gas returning to the pumping means after circulation.

4. In a concentric conductor system comprising concentrically arranged tubular conductors for electricity, a gas conduit connecting one end of the inner tubular conductor to the space between the conductors for the flow of gas between said inner conductor and said space, gas pumping means having an input connection and an output connection, one of said connections being associated with the other end of said inner tubular conductor and the other connection being connected to the space between said conductors, whereby a continuous flow of gas is maintained through the space between said conductors and through the inside of the inner conductor in tandem, and means to remove the moisture from the gas returning to said pumping means after circulation.

In testimony whereof, I have signed my name to this specification this 20th day of May, 1929.

HERMAN A. AFFEL.