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COMMUNICATION IN PIPE LINES

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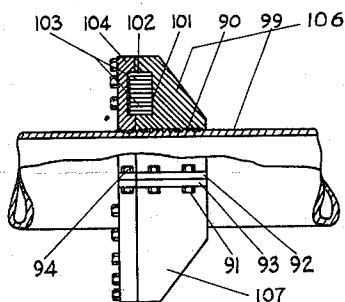


Fig. 1

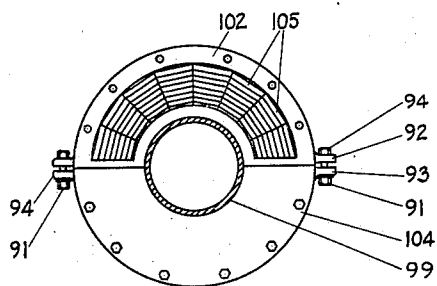


Fig. 2

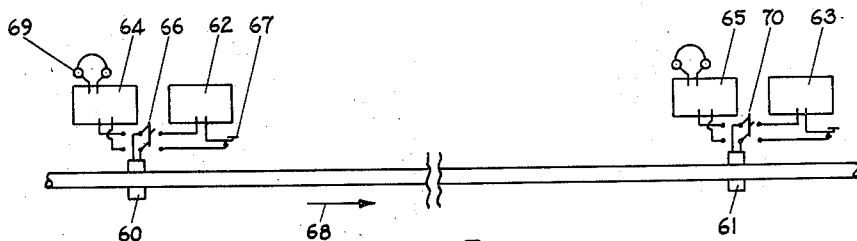


Fig. 3

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COMMUNICATION IN PIPE LINES

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10 Claims. (Cl. 179-1)

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The present invention is a division of my co-
pending application Serial No. 706,159 filed Jan-
uary 10, 1934.

The present invention relates to communica-
tion along pipe lines or other mechanical con-
ductors by means of sound or compressional wave
vibration.

At the present time pipe lines have been exten-
sively used for the transportation of both oil and
gas. These pipe lines extend frequently for a
great distance, sometimes over 100 miles and usu-
ally are built in such a way that a continuous
mechanical connection is made for the whole dis-
tance. Such lines are usually called all-welded
lines when the joints between sections of the
pipes are welded together.

Other connecting means, however, may be
used, but in practically all cases a close metallic
connection is made between sections of the line
at all points.

In pipe lines for the use of oil and gas, it is
customary to place pumping stations at distances
between 25 and 50 miles in order to boost the
pressure for the transmission of the oil or gas
along the line. In order to operate these pump-
ing stations satisfactorily, it is necessary to pro-
vide communicating means between the various
stations and this has been heretofore accom-
plished by the use of telegraph, telephone or
wireless communication.

Means of communication along the lines has
been found to be quite essential and while some
delay in the means of communication may be
tolerated, still it is essential to be able to transmit
messages relative to the transmission of the oil
or gas and the operation of the prior station on
the line in order to operate the whole system
satisfactorily.

The systems employed at the present time for
communication using methods mentioned above
are both expensive to install and to maintain
with the possible exception of some forms of
wireless communication against which there are,
however, certain definite objections. Not only
has wireless communication between stations
proved to be expensive, but it is also apt to inter-
fere with local broadcasting and communication
and not always to be dependable under certain
difficult transmission conditions.

In the present invention, communication is
accomplished by means of the line itself which
is made to act as a transmission line not for
electromagnetic energy, but for the energy for
compressional wave vibration. While the sys-
tem is primarily to be used in connection with

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transmission of messages and signals along a
pipe line, it may also be applied to other methods
of communication along a continuous metallic
conductor as, for instance, a railroad rail.

In the present invention a two-way communi-
cation may be established over the same line and
it is also possible to signal in one direction only
and to receive compressional wave vibrations
from that direction. The communication may
be by telegraph or code signals or speech may be
impressed over the line for telephonic communi-
cation. It will be appreciated, of course, that due
to the fact that sound or compressional wave
vibrations are transmitted at a much lower ve-
locity than that of electromagnetic waves, that
a two-way communication will not be spontane-
ous, but that considerable time may elapse be-
tween the transmission of speech or a message
one way and the other way. For instance, if
two stations are situated 25 miles apart upon
the line, it will take approximately 8 seconds for
the sound to travel the distance of 25 miles,
which means that the sender at one end must
wait approximately 16 seconds until he receives
the message transmitted from the other end.
This, however, is not objectionable under the
special circumstances, as it undoubtedly would
be in commercial telephonic communication.
The operators at the various stations appreciate
that such a delay is necessary and their opera-
tion of the transmitting stations at either end
will be governed accordingly.

The present invention will best be understood
from the following description with reference to
the accompanying drawings in which Fig. 1
shows the invention as applied to a pipe line;
Fig. 2 shows a side view looking from the left
of Fig. 1 with the top cover removed; while Fig.
3 is a diagrammatic illustration of the applica-
tion of the invention to the pipe line showing
complete sending and receiving stations and indi-
cating the manner in which they are connected
to the line.

In the modification shown in Figs. 1 and 2 the
pipe is shown as 99. Pipes for the transmission
of oil may be 8 inches in diameter and one-quar-
ter inch thick and are frequently made of fusion
welded pipes with joints butted and welded to-
gether throughout their entire length. In places
there may be certain valves used and, if such is
the case, an all metallic welded connection may
be made around the valves to allow efficient
sound transmission. As pipes for this purpose
are usually of the dimensions described above,
it has proved to be highly essential to employ

compressional wave frequencies which will not require apparatus of excessive size to be used. This is particularly true since the wave length of compressional waves in steel is much higher than that in other media and for this reason the compressional wave frequencies used for this purpose are confined to the upper range of audibility and the supersonic range. It is possible, however, to bring the frequencies down to values of 10,000 cycles but frequencies much below this will demand apparatus of considerable size which will be difficult to mount and operate successfully in the positions required.

Referring now to Figs. 1 and 2 the pipe 99 is provided with a split collar 100 formed in two parts 106 and 107, as shown in Fig. 2. Each of these, as shown by the sectioned portion of Fig. 1, comprises a heavy mass having a surface substantially normal to the pipe, the opposite side of the collar being tapered from its outer periphery toward the pipe. The general external shape of the collar is therefore substantially that of a truncated cone. The inner surface of the collar is ribbed as indicated at 90 to make a good contact with the pipe surface. The two halves of the collar are clamped together by means of the bolts 91 passing through radially extending ribs 92 and 93 in the upper and lower halves of the collar respectively. Each half of the collar is provided with an annular recessed portion 101 in which piezo-electric crystals 102, preferably of the Rochelle salt type, are placed endwise therein. Electrodes 103 are provided at opposite faces of the crystal and electrical energy is impressed between these faces to produce a longitudinal vibration of the crystal, which vibration is transmitted to the pipe. The recessed portion in which the crystals are placed may be covered by a cover 104 and the crystals may be entirely sealed in a liquid such as oil or in any other suitable means whereby the vibrations of the crystals may be conveniently transmitted to the system. These crystals, being aperiodic in character, may be excited at a high frequency, for instance, 15,000 or 20,000 cycles per second, which frequency may be modulated by speech waves producing so-called carrier bands a number of thousand cycles on either side of the carrier wave. At the receiving end the carrier wave may be eliminated and the speech reproduced in the usual manner.

In Fig. 2 there is shown a side view looking into the recessed portion 102 of one half of the collar. It will be noted that the crystals are preferably arranged in rows 105, 105, etc., and it may be also mentioned that these crystals may be connected in series or in parallel series combination, whichever is desired to match the impedance of the circuit with which the device operates.

In Fig. 3 there is diagrammatically illustrated the layout of the entire system, 60 and 61 illustrating the sender and receiver or transceiver, as it may be called at different stations. The power amplifiers are indicated at 62 and 63, respectively, and the receiver amplifiers at 64 and 65, respectively. When the system is used for sending at the left, the switch 66 is thrown to the right and in this condition the key 67 is operated to transmit compressional wave impulses over the line in the direction of the arrow 68. When the switch 66 is thrown to the left, the station may be used for receiving and the operator listening with the phones 69 will pick up the translated sound vibrations transmitted over the line. The

system connected with the transceiver 61 operates in a similar manner, the switch 70 being thrown to the right for sending and to the left for receiving.

Having now described my invention, I claim:

1. A means for transmitting vibrations along a metallic pipe comprising a collar formed on the pipe and a Rochelle salts oscillator formed in part with said collar for transmitting and receiving compressional wave vibrations.

2. A means for transmitting vibrations along a metallic pipe comprising a pipe section provided with an external projecting flange having a surface substantially perpendicular to the pipe, a plurality of piezo-electric elements mounted in said flat surface, means for exciting the same and means for covering the surface to completely enclose the said elements.

3. A means for transmitting vibrations along a metallic pipe comprising a pipe section provided with an externally projecting flange tapered at one end substantially to the external pipe size and being provided with a flat surface substantially perpendicular to the pipe; a plurality of piezo-electric elements mounted in said flat surface and means for exciting said elements.

4. A means for transmitting vibrations along a metallic pipe comprising a pipe section having rigidly fixed thereto an external mass and piezo-electric means mounted in said mass for vibrating the same.

5. A means for transmitting vibrations along a metallic pipe comprising a collar formed in at least two parts, means clamping the collar to the pipe, a plurality of piezo-electric crystals mounted in said collar and means for exciting the same.

6. Means for transmitting vibrations along a pipe line comprising means forming a mass about said pipe and having a surface projecting normally from the axis of the pipe, a plurality of piezo-electric crystals mounted in radial rows in said surface and means adapted to set the crystals into vibration.

7. Means for transmitting vibrations along a pipe line comprising means forming a mass and a surface projecting normally from the axis of the pipe and an annular recess in said surface, a plurality of Rochelle salt crystals mounted in said recess and means for applying electric energy to said crystals for vibrating the same.

8. Means for transmitting vibrations along a pipe line comprising a collar surrounding said pipe, a plurality of piezo-electric crystals mounted on one side of said collar and adapted to be vibrated in a direction longitudinal with said pipe and means forming a casing with said collar for enclosing said crystals.

9. Means for transmitting vibrations along a pipe line comprising a hollow annular mass surrounding and fixed to said pipe, Rochelle salt crystal means mounted within said mass adapted to be vibrated in a direction parallel to the axis of said pipe and a sound-conducting liquid filling residual space in said hollow mass not occupied by said crystal means.

10. Means for transmitting speech along a pipe line comprising a heavy collar surrounding said pipe, a plurality of Rochelle salt crystals mounted in said collar, said crystals being adapted to vibrate in a direction parallel to the axis of the pipe and means for vibrating said crystals at a high frequency modulated by speech waves.

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