C. A. HARSCH.

FIRE DETECTING WIRE.

APPLICATION FILED JULY 17, 1915. RENEWED DEC. 27, 1916.

1,235,028.

Patented July 31, 1917.

3 SHEETS—SHEET 1.

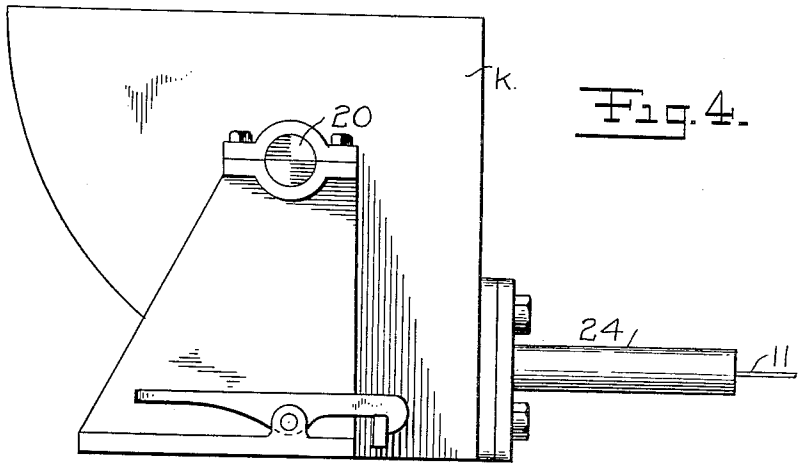


Fig. 4.

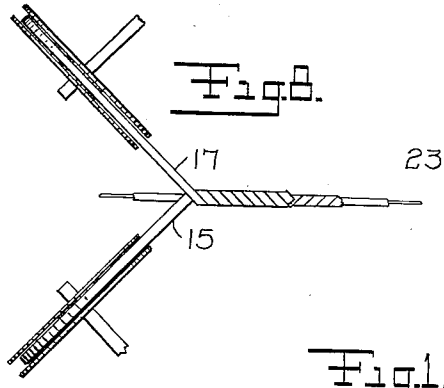


Fig. 8.

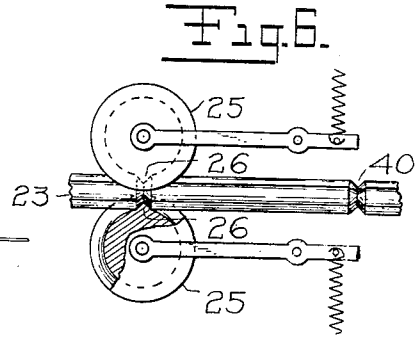


Fig. 6.

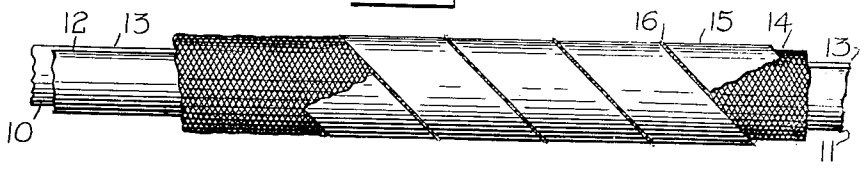


Fig. 1.

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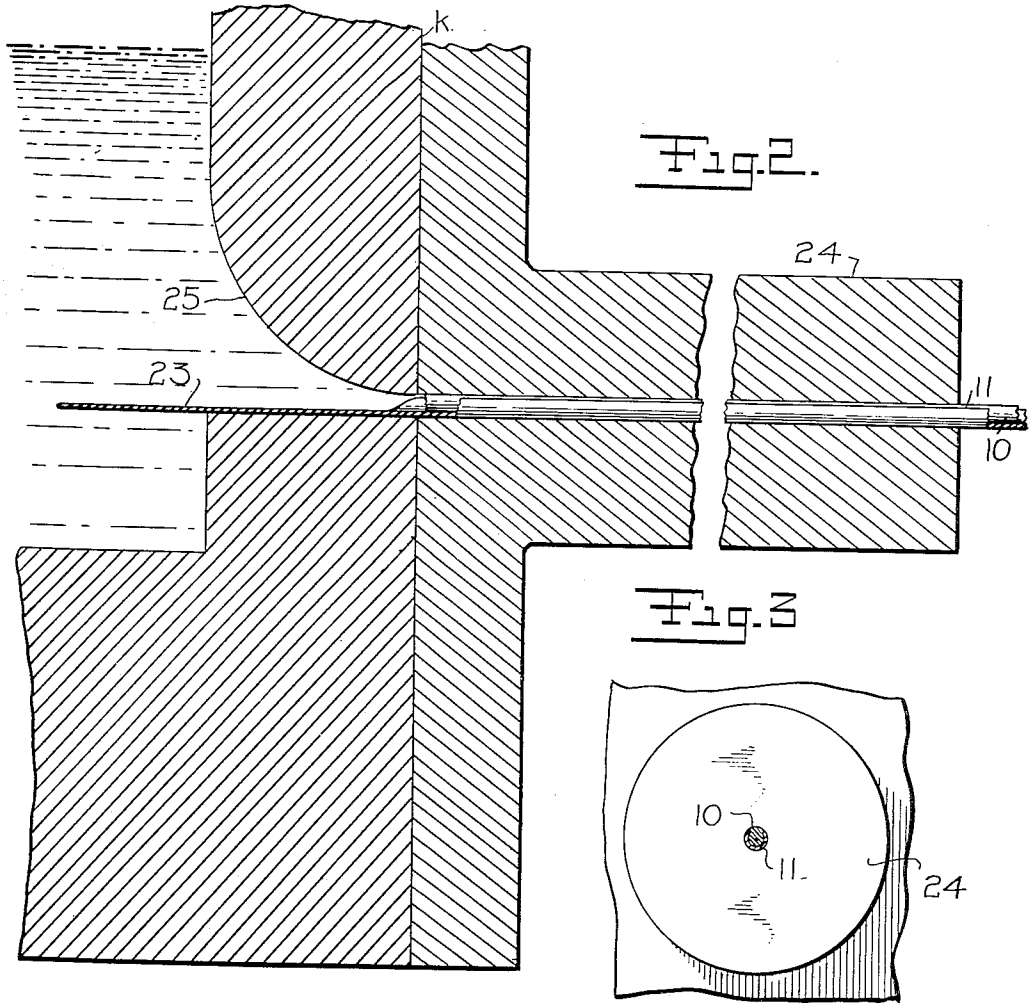
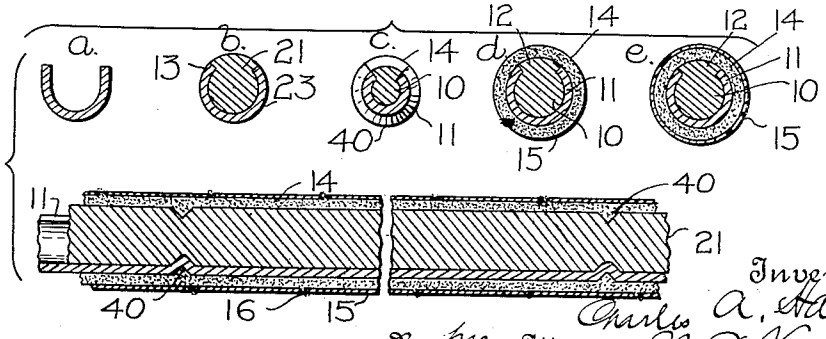


Fig. 2.

Fig. 3

Fig. 9.



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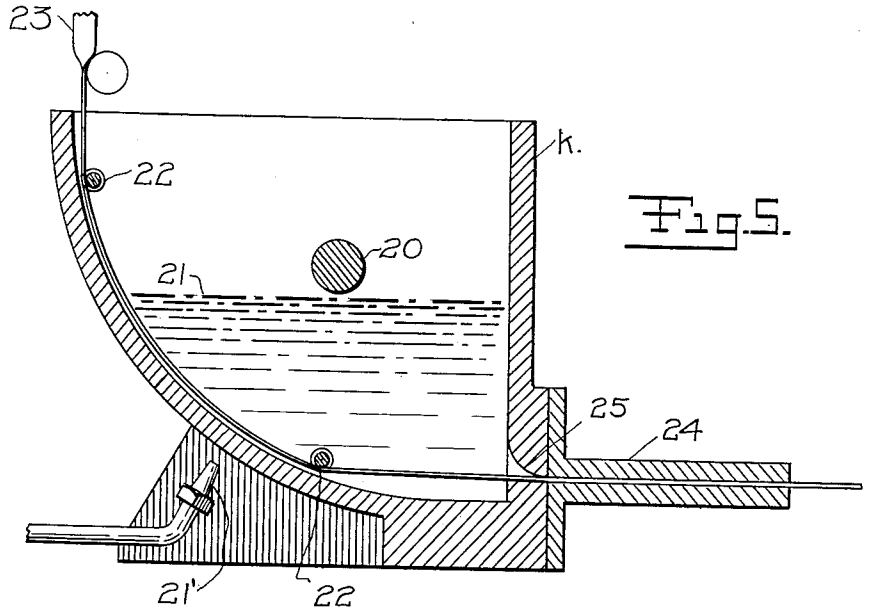


Fig. 5.

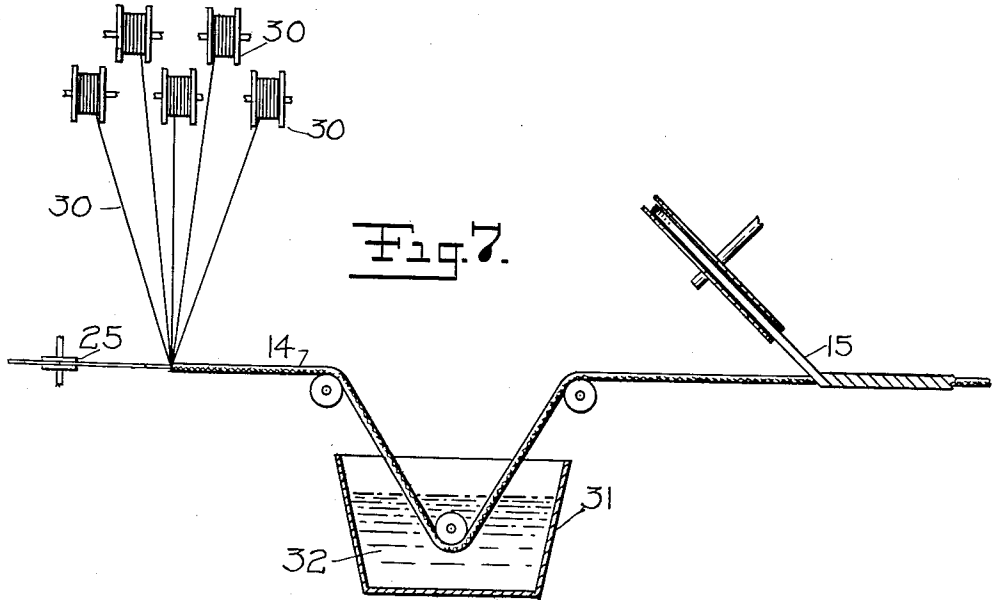


Fig. 7.

Charles A. Harsch Inventor

By his Attorney W B Vanauze

UNITED STATES PATENT OFFICE.

CHARLES A. HARSCH, OF NEW YORK, N. Y., ASSIGNOR TO WILLIAM H. GARRISON, OF BROOKLYN, NEW YORK.

FIRE-DETECTING WIRE.

1,235,028. Specification of Letters Patent. Patented July 31, 1917.

Application filed July 17, 1915, Serial No. 40,527. Renewed December 27, 1916. Serial No. 139,182.

To all whom it may concern:

Be it known that I, CHARLES AUGUST HARSCH, a citizen of the United States, residing in the borough of the Bronx, New York city, New York, have invented certain new and useful Improvements in Fire-Detecting Wires, of which the following is a specification.

This invention relates to automatic fire alarm signaling, and the object is to render the use of fire detecting wire more certain and controllable than has heretofore been possible.

Prior to my invention fire detecting wire consisted of a copper, central conductor, coated with a layer of easily-fusible alloy metal over which was a braiding of insulating material and an armor usually in the form of a lead tube which served as a return conductor. When this wire was subjected to a rise in temperature the fusible conductor was supposed to melt, penetrate the insulation and establish an electrical cross connection between the copper core and the exterior return conductor. It was always difficult to satisfactorily apply the easily fusible metal to the copper core, and it was still more difficult to apply the lead sheathing without melting the fusible conductor.

My invention is founded upon my discovery that if I confine the fusible conductor, that is the easily fusible metal, within the walls of a cell or inclosure, and provide an outlet that when the metal becomes plastic, that is before it becomes fusible, it may be forced outward through a door or perforation in the wall of the cell, and that it will penetrate through the fibrous insulating material and establish the desired electrical connection between the inner and the outer conductors; when the fluid condition succeeding the plastic condition is encountered, due to the continued application of heat, the cross connection becomes more marked and of lower resistance.

The fire detecting wire as made by me consists of an inner core of easily fusible metal, a steel tape preferably electro-galvanized, of suitable breadth to nearly envelop the soft metal core, leaving a longitudinal slot, a braided insulating wrapping impregnated with some insulating material like ozocerite, and an exterior conductor, preferably a steel tape, electro-galvanized, and helically disposed on the exterior. Sometimes I employ two such steel tapes, helically disposed, and reversely wound, but in any case, the impregnated insulating material is caused to occupy the space between the meeting edges of successive convolutions; the tape or tapes thus provide a waterproof armored covering and constitute the return conductor. The accompanying drawings illustrate the invention: Figure 1 shows the complete wire. Fig. 2, shows a vertical cross section of the kettle containing the fusible molten metal to form the core of the wire and the die through which the tape of steel is drawn and formed. Fig. 3 is a cross section of the die. Fig. 4 is a side elevation of the kettle, showing the latch to release the kettle for the purpose of tilting. Fig. 5 is a central vertical cross section of the kettle. Fig. 6 shows the means for crimping the tape to form a series of successive cells. Fig. 7 shows the means for applying the braided insulation and the helically disposed single tape upon the exterior. Fig. 8 shows means for applying two reversely wound helical tapes, and Fig. 9 shows a central longitudinal section of the completed wire and successive steps in the process of manufacture.

In Fig. 1, the fusible conductor is shown at 10; the enveloping steel tape at 11, the projecting fin of fusible metal at 13 which projects through the slot 12 in the tape 11; the fibrous impregnated insulating coating is shown at 14; and the helically disposed tape 15 is of galvanized steel and constitutes the return conductor and an armor. In the process of manufacture there is a kettle, *k*, on trunnion bearings, 20, there is a gas burner, 21, to render the contents of kettle fluid. The easily fusible alloy, 21, is maintained in a molten condition in the kettle *k*. This is composed of lead, bismuth, cadmium and tin, compounded in a manner well known and designed to become plastic at 100° Fahrenheit, and to become fluid and flow at 120° Fahrenheit. On the interior wall of the kettle, *k*, are bails, or guides, 22; a tape, 23, of electro-galvanized steel, .156 inches wide, and .01 inches thick passes under the bails, 22, and a guide, to a circular die, 24, the entrance to which is curved at 25, as shown. This die, 24, doubles the tape as shown in Fig. 9, at *a*, inclosing a wire or conductor, 21, as shown at *b*, in Fig. 9, leaving a fin, 13, to form a complete sym-

metrical figure, composed of the tape, 23, and the fusible metal, 21; that is it is a complete cylinder. The die, 24, is six inches long, the object being to cool the wire as it passes along. For the purpose of forming a series of successive cells, the wire as it emerges from the die, 24, passes between crimping rolls, 25; these rolls are grooved on their periphery, the groove conforming to the outline of the conductor; there is an acute angled projection, 26, on each roll, 25. This projection is semicircular as it conforms to the outline of the groove and crimps the steel tape, 23, onto the fusible conductor, 21; these crimps occurring every two inches, say, and when this limit of two inches is employed, the circumference of the rolls, 25, would be about two inches.

The crimped conductor is drawn along and a fibrous insulating covering is woven upon it as shown in Fig. 7. For this purpose I prefer to employ No. 60 cotton thread, forty eight strands of which and two layers of the same dimensions, each layer having 24 threads are woven on as conventionally represented at 30 in Fig. 7.

The wire, covered with the woven insulating material next passes through a kettle, 31, containing a hydrocarbon molten insulating material, and I prefer to employ for this purpose a residual product of the distillation of petroleum known under the name of ozocerite. This is sold under a trade name of "Ozokerite." For the purpose of a second or return conductor, and as an armor, I apply an electro-galvanized steel tape, 15. This may have the same dimensions as the tape 11, already described. It is helically wound and drawn sufficiently taut to cause the hydrocarbon insulating material to exude and occupy the space between successive convolutions and thus constitute a waterproof insulating armor, and a return electrical conductor. In Fig. 8 I have shown means for applying two of these tapes in respectively reversed helical convolutions. This imparts tensile strength and provides for the drawing in process to which the wire may be subjected in use. In Fig. 9 I have shown at *c* a cross section of the fusible central conductor, 10; in the same figure at *d* the braid 14 is added and one convolution of armor tape, 15, the insulation, 14, projects between successive convolutions; in the same figure at *e* there is shown the fusible metal conductor 10, the tape, 11, the insulation, 14, and the armor, 15.

When heat is applied, as by raising the temperature of the atmosphere in which the fire-detecting wire is supported, the fusible conductor, 10, is first softened or rendered plastic and expands or increases its bulk, and when this stage is reached it can only move in a radial line, through the slot, 12, because the crimp, 40, establishes a limit of movement in a longitudinal direction. Heat may be applied rapidly, or may slowly increase. The result is the same, and in any case, as the heat increases and the plastic condition of the fusible metal, which first occurs is passed, the metal reaches the fluid state and penetrates the insulating material in increased volume. When the fusible metal is forced through the insulating coating, or when it flows through the insulating coating, an electrical connection is established between the central conductor and the outside or return conductor. By my improved construction of this wire I am able to provide a fire detecting wire which operates with certainty at a pre-determined temperature.

In another application, filed July 20, 1915, Serial No. 40,814, I have claimed the improved method of operation, incidentally described herein, this method consisting in confining the fusible metal so that the expansion, preceding the fused condition, exerts an outward, radial thrust, a thrust in radial lines, mechanical in its nature, causing a mechanical penetration of the insulating layer and cross-connecting the two members of the circuit.

What I claim is:

1. In a fire-detecting wire, the combination of a perforate tube of hard metal, a conducting core of easily fusible metal therefor, an insulating coating of permeable material for said tube and an exterior conductor.

2. In a fire detecting wire, the combination of a perforate tube of metal, a conducting core of easily fusible metal, means for preventing longitudinal expansion of said core, a permeable insulating coating for the tube and an exterior conductor.

3. In a fire-detecting wire, the combination of a slotted tube of metal, a conducting core of easily fusible metal, means for preventing longitudinal expansion of said core, a permeable insulating coating, and an exterior conductor.

4. In a fire-detecting wire, the combination of a perforated tube of metal, a conducting core of easily fusible metal, means for preventing longitudinal movement of said core, consisting of a series of successive crimps in said tube, a permeable insulating coating and an exterior conductor.

5. In a fire-detecting wire, the combination of a central conductor having a low fusing point, a perforated, tubular conductor having a higher fusing point surrounding said central conductor and in electrical contact therewith, a permeable, insulating coating and an exterior conductor in close proximity.

6. In a fire-detecting wire, the combination of an easily fusible conductor, means for controlling its movement when heated

consisting of a tubular, perforated conductor of higher fusing point, a permeable insulating coating for said conductor, and a second conductor in contact with the opposite exposed surface of said insulating coating.

7. In a fire-detecting wire, the combination of a conductor adapted to fuse at a low point, an enveloping conductor of hard metal in contact with and partly inclosing the first-named conductor, a layer of permeable insulation and a surrounding layer of conducting material.

8. In a fire-detecting wire, the combination of an easily fusible central conductor, a conducting tape of hard metal, apertured, and adapted to impart tensile strength, mechanical protection and control of movement to the easily fusible conductor when softened under the effect of heat, a permeable insulating coating and an exterior conductor in close proximity.

9. In a fire-detecting conductor, the combination with an easily fusible central wire of a layer of harder metal thereon in electrical surface contact therewith, having in its wall an opening adapted to permit penetration by the fusible conductor when heated, a conductor outside said hard metal layer and a permeable insulating coating between said hard metal and outside conductor.

10. In a fire-detecting conductor, the combination of a perforated, tubular conductor, a core of easily fusible metal therefor, means for dividing said conductor into separate, longitudinal cells, a perforation in the wall of each cell, a superposed outside conductor and a permeable insulating layer between said conductors.

11. In a fire-detecting conductor, the combination of a tubular conductor, a core of easily fusible metal therefor, means for dividing said core into separate longitudinal cells, the wall of each cell being perforated, an associated complementary conductor and a permeable, insulating layer between the two last-named conductors.

12. In a fire-detecting conductor, the combination of a perforated tubular conductor, a core of conducting material subject to expansion on the application of heat, a complementary conductor and a permeable, insulating layer between the two last-named conductors.

13. In a fire-detecting conductor, the combination of a direct and a return conductor, said direct conductor being tubular and perforated, a core therefor of conducting material, expansible by heat; said return conductor surrounding the direct conductor and a layer of permeable insulating material between said conductors.

14. In a fire-detecting conductor, the combination of a perforated, tubular conductor of hard metal, a core of conducting material easily expansible on the application of heat, and an associated complementary conductor, with a layer of permeable material insulating one conductor from the other.

15. In a fire-detecting conductor, the combination of a tubular conductor separated into small cells, in longitudinal succession, each cell having a perforated side wall; a core of conducting material, easily expansible by heat, for each cell, a complementary conductor and a layer of permeable insulating material separating one conductor from the other.

16. In a fire-detecting conductor, the combination of a conductor, a permeable insulating material therefor, a conductor in the form of a perforated tube, and a core of conductor material of low fusing point for said perforated tube.

17. A fire-detecting wire having a core of easily fusible metal, a tape of conducting material folded on said core to leave a narrow space between the opposite edges, a layer of permeable insulating material on the exterior of said tape and a metal tape laid on the surface of said insulating material.

18. A fire-detecting wire having a core of easily fusible metal, a tape of steel folded on said core to leave a narrow space between the opposite edges thereof, a layer of permeable insulating material on said tape and a tape of steel laid on said insulating material.

19. In a fire-detecting wire, a direct and a return conductor, superposed and insulated from each other, a layer of permeable insulating material between said conductors, one of said conductors consisting of a perforated, tubular conductor of hard metal with a core of easily fusible metal.

20. In a fire-detecting wire, a perforated layer of hard metal, a core therefor of easily fusible metal, a permeable insulating coating on said hard metal and a layer of metal outside said coating.

CHARLES A. HARSCH.

Witnesses:
W. H. K. Davey,
Stanley D. Brown.