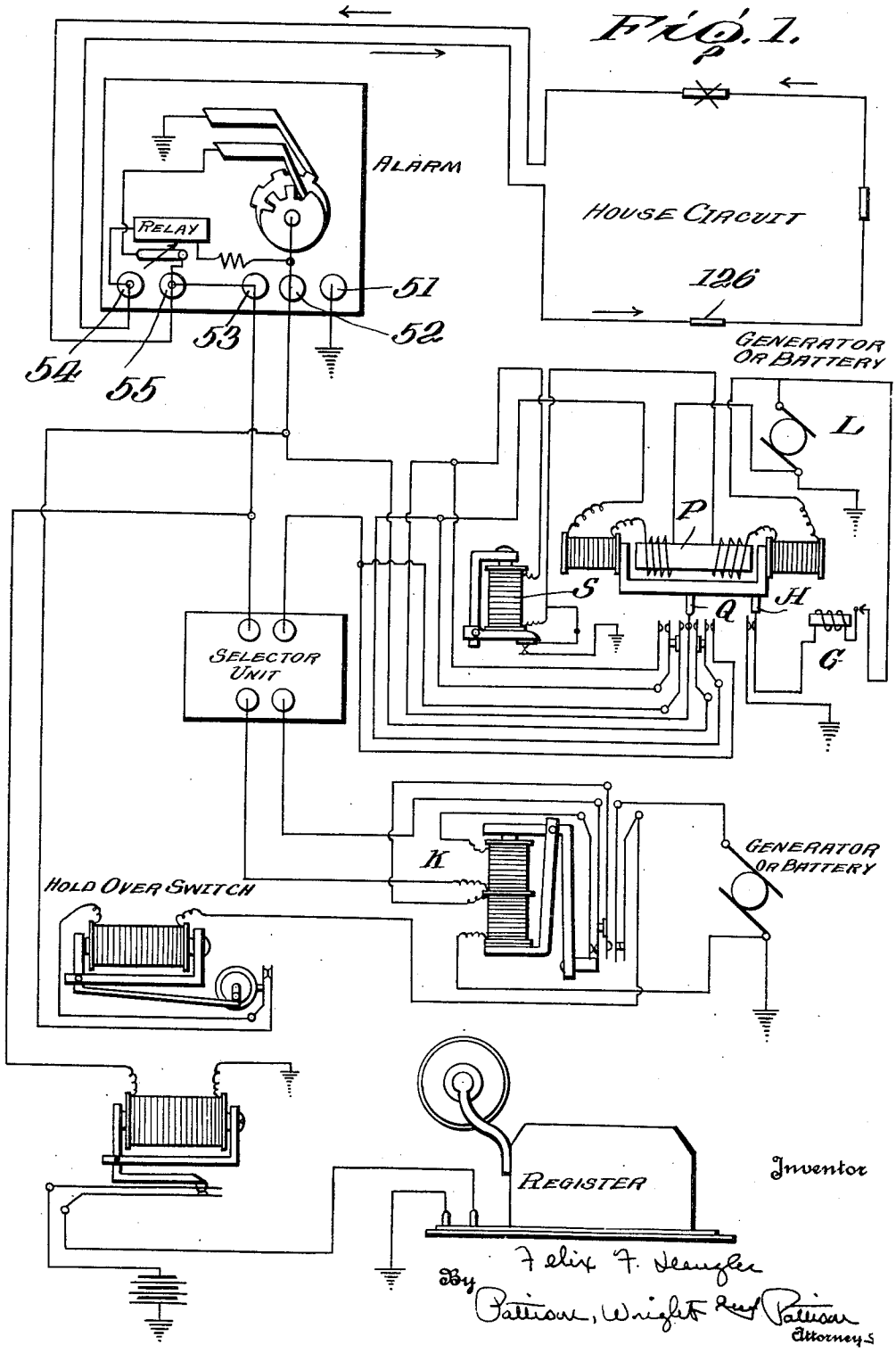
July 12, 1932. F. F. DENZLER 1,867,500

AUTOMATIC FIRE AND BURGLAR ALARM SYSTEM

Filed Jan. 8, 1930 3 Sheets-Sheet 1



Inventor

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July 12, 1932. F. F. DENZLER 1,867,500

AUTOMATIC FIRE AND BURGLAR ALARM SYSTEM

Filed Jan. 8, 1930 3 Sheets-Sheet 2

FIG. 2.

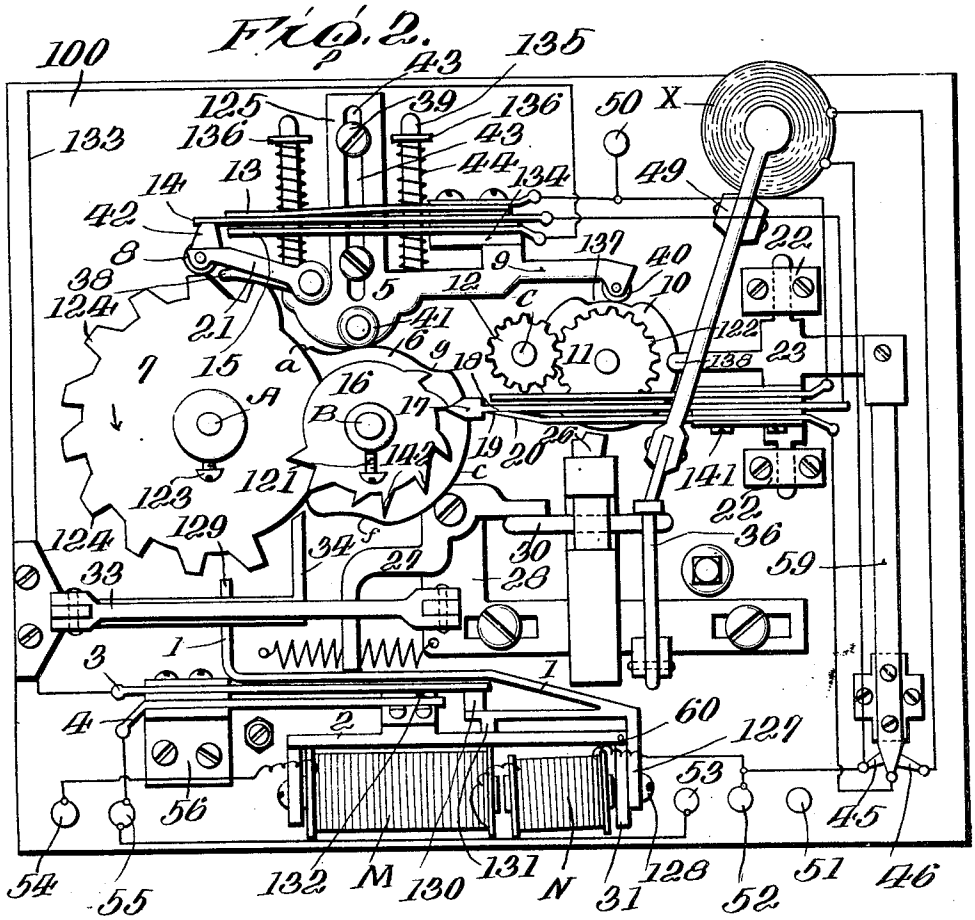
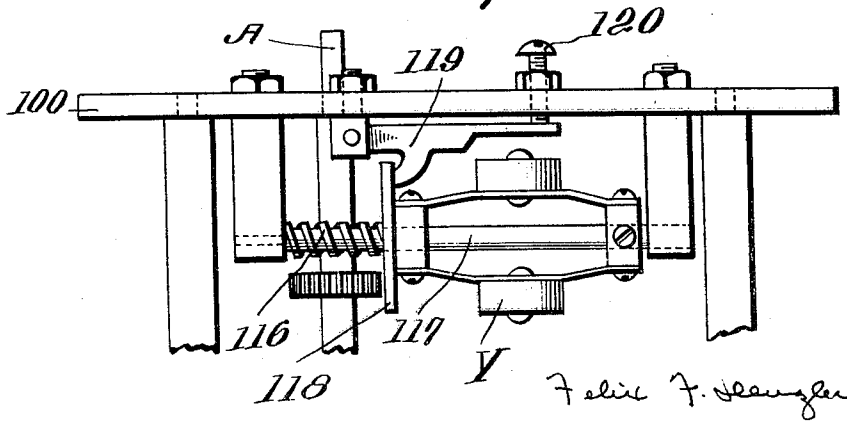


FIG. 4.



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Filed Jan. 8, 1930 3 Sheets-Sheet 3

FIG. 3.

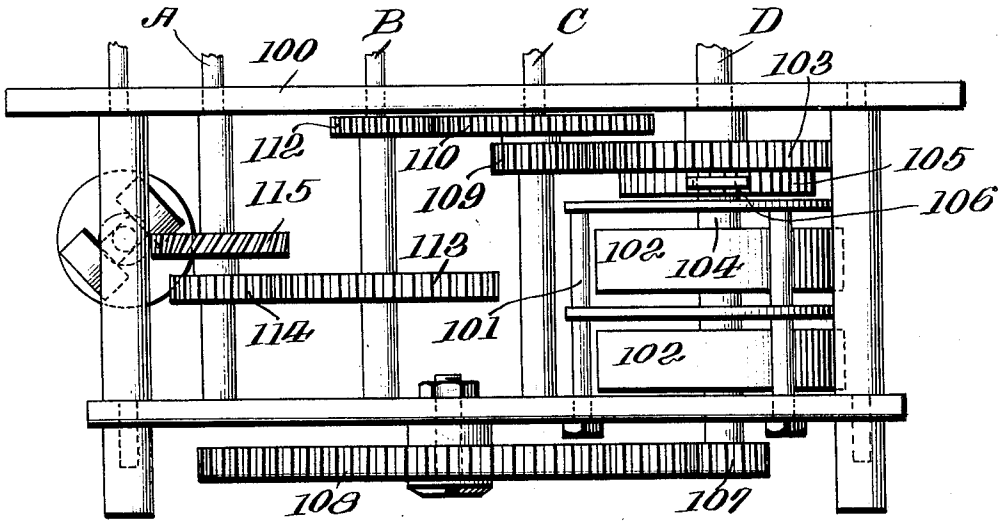


FIG. 5.

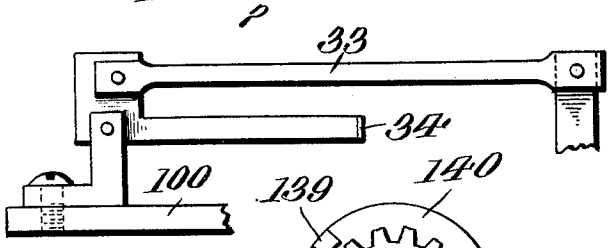


FIG. 6.

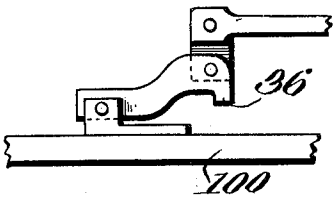


FIG. 7.

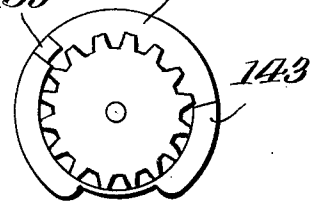


FIG. 9.

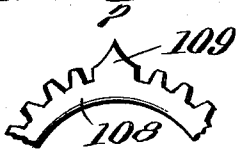
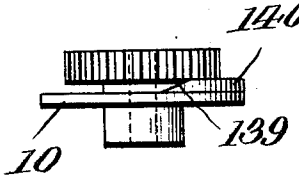


FIG. 8.



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UNITED STATES PATENT OFFICE

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AUTOMATIC FIRE AND BURGLAR ALARM SYSTEM

Application filed January 8, 1930. Serial No. 419,345.

This invention relates to improvements in automatic fire and burglar alarm systems being particularly and specifically directed to such systems which operate in conjunction with and over automatic telephone systems and has means provided for automatically mechanically dialing the desired fire or burglar alarm call over the telephone system.

Accordingly, the primary object of the invention is the provision of a fire or burglar alarm system which operates in conjunction with an automatic telephone system which has means provided for automatically mechanically dialing the desired call over the telephone system.

A further object of the invention is the provision of a new and novel mechanical apparatus for automatically dialing calls on automatic telephone systems.

Another object of the invention is the provision of an automatically operated trouble signal which operates in the event anything happens which would endanger or stop the automatic operation of the rest of the mechanism.

A still further object of the device is the provision of an automatic dialing mechanism for use with automatic telephone systems in which means are provided which cause the apparatus to continue the dialing of the call until actually successful and complete connection of the call has been made and upon the completion of the call discontinues the dialing and stops in a position for another operation of dialing when called upon.

Other objects, novel features of construction and the improved operation of the device will appear more specifically from the following description taken in conjunction with the accompanying drawings.

In the drawings:

Figure 1 is a diagrammatic layout of the complete system.

Fig. 2 is a top plan view of the alarm box.

Fig. 3 is a view in side elevation of the driving motor and gears positioned at one side of the plate 100 in the alarm box.

Fig. 4 is a detailed view in end elevation illustrating the governor and speed control.

Fig. 5 is an enlarged detail view of the latch 33 and its associated parts.

Fig. 6 is an enlarged detail view of the latch 36 and some of its associated parts.

Fig. 7 is a plan view of the cam wheel 10.

Fig. 8 is a view in side elevation of the cam wheel 10.

Fig. 9 is a fragmentary top plan view of the idler gear 108 illustrating the stop carried by the gear.

In carrying out the invention a signal box in which the automatic dialing or impulse sending mechanism is mounted is used in conjunction with a house circuit. This house circuit is a closed circuit over which flows a small portion or small amount of current. This house circuit goes in and about each room or compartment in the building and is in series form.

When the system is installed as a fire alarm system there is installed in the line in each room a fusible link made of some suitable alloy which will melt at a given temperature, preferably that of 155° F. The melting of the fusible link breaks the circuit and causes the mechanism in the signal box to operate without the aid of any manual operation in a manner which will be hereinafter described.

When the system is installed for the purposes of burglar alarm protection the wires in each room of the building stretch across the openings and walls of the building so that the wires will be broken should any one attempt to force entrance and in breaking the wires the electric circuit becomes broken which releases and starts the automatic dialing mechanism in the signal box in the same manner as it was described as starting when speaking of the system as used as a fire alarm protection system.

When the fusible link or the room circuits become broken in any manner whatsoever means which will be hereinafter described automatically connect the automatic dialing or pulsator sending device in the signal box across a pair of telephone wires and the impulses sent out by the dialing mechanism go out over these telephone wires in groups which represent the number which the dialing mechanism is dialing which would be

either a fire alarm station or headquarters or a police station or headquarters.

It will be understood of course that the pulsations sent out by the automatic dialing mechanism are received and handled in the well known manner by a selector circuit at the telephone headquarters with the result that automatic connection is made with the police or fire department, as the case may be.

As soon as the telephone call connection has been made the circuit is changed from the weak or small 24 volt to a 48 volt line in a manner which will be hereinafter described and this same operation causes a jumper to be thrown around the selector circuit thus releasing the selector and making a direct connection with the signal box and the fire station or police headquarters.

In the same operation a hold-over relay is kept in series with the 48 volt line which brings a mechanical device into operation which holds the line from being released or broken until the actual alarm has been sent out and completed, and when it has been completed it at once automatically releases or breaks the line and the line and alarm mechanism returns to its normal position in readiness for another performance or operation.

There is also provided a trouble signal which calls the attention of a proper attendant in the event anything should happen in the line, such as a wire becoming grounded or a wire becoming cut. This trouble signal operates by the presence of a polarized relay which causes the circuit to reverse itself and change its polarity which causes the alarm to continue to come in over the single remaining wire which makes the system positive in operation or as sometimes referred to as "fool proof".

Means are further provided in the signal box to cause the dialing mechanism to continue dialing to make an automatic connection until a connection has been actually successfully made which is necessary by reason of the possibility of the number or station being called being busy. However, the moment the connection is completed the mechanism in the signal box prepares or sets itself to shut down as soon as the complete alarm has been sent out over the telephone wire and in setting itself or stopping its operation to so stop that it is in the correct position for another operation.

Within the signal box there is a suitable plate or bed 100 beneath which in a suitable frame 101 are mounted the springs 102 that constitute the driving or motive power for the mechanism by rotating the main driving gear 103. As is usual there is provided on the drive shaft 104 a ratchet gear 105 and ratchet pawl 106.

The shaft 104 extends upwardly through the plate 100 in the form of a shaft D and also extends downwardly and carries on its lower end a pinion gear 107 which drives the suitably mounted idler gear 108. This idler gear 108 is provided with a stop tooth or extension 109, see Figure 9 of the drawings, which makes it impossible to overwind the springs 102 and also prevents the springs from entirely running down.

A shaft C is rotated by the main drive gear wheel 103 through a suitable meshing gear wheel 109. The shaft C carries a second gear wheel 110 which meshes with the gear wheel 112 carried by the shaft B for the purpose of rotating the shaft B. Intermediate its length the shaft B is provided with a gear wheel 113 meshing with a gear wheel 114 carried by the shaft A and through this connection the shaft A is rotated. By reference to Figures 3 and 4 of the drawings it will be seen that there is provided a governor indicated at Y, which governor is connected with the shaft A through the instrumentality of a spiral gear 115 which meshes with a suitable worm gear 116 formed on the shaft 117 which carries the governor. At one end adjacent the governor there is provided a friction plate 118 against which bears the pivoted friction applying member 119. The amount of friction applied by the member 119 to the disc 118 is adjustable through the set screw 120 which permits an accurate adjustment of the speed of the shaft A which is necessary to the successful operation of the impulse sending or dialing mechanism.

As is clearly apparent from the drawings the gear wheels and the spring driving the motor and governor hereinbefore described are at one side or below the plate 100.

Above the plate 100 upon the extending end of the shaft A is the impulse sending wheel 7; upon the shaft B is the cam wheel 6 and also the alarm impulse sending wheel 16. The position of the wheel 16 on the shaft B is adjustable by reason of the set screw 121. The shaft C carries a gear wheel 12 which engages with the teeth 122 of the gear wheel 11 which carries also the cam wheel 10.

It will be of course understood that the automatic dialing mechanism and the alarm sending mechanism can be constructed to send out any desired number or call. In the drawings the device is arranged so that the telephone number which is automatically dialed is 958.

The impulse sending wheel is adjustable on the shaft A by reason of the set screw 123 and carries on its outer edge 10 cams or cogs 124 which are adapted to be engaged by the roller 8 of the rocker arm 21 which is supported on the slidable member 5. This member 5 is adapted to slide horizontally and to permit this movement the member 5 is provided with an arm 125 having an elongated slot 43. Suitable bolts 39 positioned in the slot 43 hold the member 5 to the plate 100.

The impulse roller 7 revolves once every

two seconds and each time one of the cams strikes the roller 8 an impulse is sent out over the telephone line in a manner which will be hereinafter described. At a speed of one revolution for every two seconds an interval of time of one-tenth of a second is had between each impulse.

The cam wheel 6 revolves once every eight seconds while cam roller 10 is driven through gear wheel 12 which revolves at the rate of one revolution every sixteen seconds. Gear 11 which actually revolves cam 10 is back geared to gear 12 two to one with the result that cam wheel 10 makes one revolution every thirty-two seconds.

Terminal or binding posts are represented at 51, 52, 53, 54 and 55. Terminal post 51 is connected to the ground making the entire unit grounded while 52 and 53 are connected across a pair of telephone wires as is evident in Figure 1 of the drawings.

Coils M and N are so wound that they will flow a very small portion of the current on a closed circuit line which is installed in each room of the building as heretofore described. The take off for the room closed circuit lines is from the terminal posts 54 and 55.

When the device is used for fire protection fusible links 126, see Figure 1, are inserted in the line in each room a certain distance apart, the distance being dependent upon the size and height of the room. It is of course understood that when the system is used for burglar protection these fusible links are not necessary as the circuit is broken by the actual breaking of the line.

When the heat in the room goes beyond 155° F. the fuse melts and the closed circuit is broken, or when the wires are broken the closed circuit is broken with the result that the coils M and N are deenergized which permits 1 which is pivotally mounted at 60 to move downwardly out of the path of travel of the cams 124 of the impulse roller 7.

This unlocks or unlatches the entire mechanism with the result that it proceeds to automatically dial either the fire or police station and then send over the telephone wire a code giving the location of the building in which it is located.

As will be apparent from the following description, the coils M and N act as a relay coil and additionally operate the latch 1, which releases the dialing mechanism and additionally released the latch and permits the sending of the alarm signal.

The coil M is supported on a bracket 2 while the coil N is supported on an extension 31 which is pivotally mounted at 60 on one end of the bracket 2. The portion 127 of the arm 1 is attached to the portion 31 by a suitable screw 128. It will be seen that by reason of the coil N, 31 is in reality an armature swinging on a pivot 60. The latch end 129 of the arm 1 moves a distance approximately one-fourth of an inch when the coils M and N are deenergized and this movement released or unlatches the impulse wheel 7 so that it can be rotated through the spring motor.

Elongated contact members 3 and 4 are clamped in separated relation and insulated from one another within a bracket 56. The contact arm 3 is elongated beyond the arm 4 and carries a fibre block 130 which is adapted to be engaged by the extension 131 of the arm 1 with the result that when the coils M and N are deenergized and the impulse roller wheel 7 is released, as appears in Figure 2 of the drawings, the contact members 3 and 4 meet at 132 thus diverting the current which had energized the coils M and N and which had flowed through the closed circuits in the different rooms of the building.

Now the full force or amount of the current from the terminal 53 travels to the terminal 55, through the contact members 4 and 3 and the wire 133 to a switch member 15 which is carried upon a suitable insulated bracket 134 mounted upon the extending arm portion 9 of the slidable member 5. Also supported and clamped within the bracket 134 are the switch members 13 and 14. The switch members 13, 14 and 15 are all clamped in separated relation in respect to one another and suitable insulated from one another.

As previously mentioned, the slidable member 5 carries a pivotally mounted arm 21 in the end of which is the roller 8 adapted to engage the cam teeth 124 for the impulse sending roller 7. The arm 9 of the member 5 is at the opposite side of the member from the lever 21 and carries a roller 40 adapted to engage the cam roller 10. Intermediate the rollers 8 and 40 the member 5 is provided with a roller 41 adapted to engage the cam wheel 6. The member 5 carries extending studs 135 which are supported and guided in suitable brackets 136 mounted on the plate 100. Coil springs 44 are positioned between the brackets 136 and the member 5 and exert a constant pressure inwardly upon the member 5 to cause the roller 41 to always engage the cam wheel 6 and the roller 40 to engage the cam wheel 10.

It will be seen that the roller 6 has two high spots *a*, and *c* and two low spots *f* and *g*, while the roller 10 has only one low spot 137.

The member 5 is free to slide against tension of the coil springs 44 a distance of approximately one-eighth of an inch and is actuated by the rollers 40 and 41 engaging the high and low spots on the cam wheels 6 and 10 respectively.

As 10 revolves once every thirty-two seconds the roller 40 engages the low spot 137 of the cam wheel 10 once every thirty-two seconds and when the roller 40 is on the low spot of the cam wheel 10 the roller 41 is on one of the low spots of the cam wheel 6. The

low spots on the cam wheel 6 are of different lengths so that when the member 5 assumes its inner position and permits the roller 8 to engage the cams 124 of the impulse wheel 7 the number of cams engaged by the roller would be dependent upon the length of the low spot in the cam wheel 6 that the roller 41 is engaging. The low spots in the cam wheel 6 are so proportioned that the roller 8 will engage alternately 9, 5 and 8 cams of the impulse wheel 7 so as to send out the impulses 9, 5 and 8 over the telephone line.

The sending of these impulses by the roller 8 is caused by the bakelite block 42 of the lever 21 causing the switch member 14 to alternately engage the switch members 13 and 15. Each time the roller 8 rides over a cam 124 switch 14 is separated from switch 15 and connected with switch 13 which last switch is grounded to the terminal 50. This action makes and breaks the circuit at a speed of one-tenth of one second between intervals or impulses. These impulses sent out on the telephone line create an impulse in the selector unit which is a well known device used in connection with automatic telephone and this unit picks up a trunk or a desired line and completes the telephone call as is well understood. The selector unit is designated diagrammatically in Figure 1 of the drawings.

These impulses which are sent out over the telephone wires are identical with those that would be sent by a person in the manual operation of an automatic telephone if they were to dial the number 958. As mentioned, the interval between the impulse is one-tenth of one second and the interval between numbers is approximately one second which is about the same time as that which would be required to rotate the dial in manual operation and represents the time required for the cam wheel 6 to make one-half revolution. The cam wheel 10 has now revolved to a point where the extension 138 of the member 23 which is pivotally supported in the brackets 22 engages the inclined portion 139, see Figures 7 and 8 of the drawings, of this wheel. The extension 138 now rides up on this incline portion 139 and on to the elevated portion 140 thus elevating the switch members 18, 19 and 20 which are suitably fastened and insulated from the member 23 as at 141. This movement of the member 23 and the switch members 18, 19 and 20 carries the bakelite tip 17 on the end of switch member 19 into the path of travel of the teeth 142 on wheel 16 which wheel is of course revolving along with cam wheel 6.

At each contact of the tip 17 with the teeth 142 of wheel 16 the electric circuit is broken between the switch members 19 and 20 and a ground connection made between the switch members 18 and 19. At every contact an impulse is sent over the telephone line which at this time operates a suitable conventional tape register which is diagrammatically illustrated in Figure 1 of the drawings. The wheel 16 is provided with a predetermined number of teeth which determines the number of impulses sent out and thus registers a given call or code upon the tape register and thereby locates the building from which the alarm is being sent.

The wheel 16 revolves three times making three calls and three registers of the call on the tape register before the cam wheel 10 revolves to the point where the extension 138 of the member 23 drops down at point 143 which indicates the end of the elevated portion 140 of this wheel. When 138 drops down at the point 143 the bakelite tip moves out of the path of travel of the wheel 16. During the time the extension 138 of the member 23 was riding on the elevated portion 140 of the cam wheel 10 the switch member 59 was actuated to cause a contact between the members 45 and 46 thus sending the current through the coil X which serves two purposes, one to determine if the line is busy and the other to shut down the apparatus.

In the event the line is busy the apparatus continues to run and repeat the entire performance again but if the line was not busy, the coil becomes energized and the magnetism draws down the member 49 which has a walking beam action and raises the dog 36, see Figure 6 of the drawings, thus clearing or releasing the pin 30 and permitting the member 26 to walk or move into engagement with the cam roller 10 and when 26 drops into the depressed portion or low point 137 of this roller the unit 28 is moved one-sixteenth of an inch and the latch lever 33 with its extension arm 34 moves. By reference to Figure 5 it will be seen that the movement of the latch lever 33 is perpendicular with the result that the extension arm 34 is drawn in a vertical path downwardly to become engaged with the cams 124 of the impulse roller 7 and thus automatically stop the entire apparatus.

The coil X will now operate only as a detector when the proper connection is completed by an automatic unit. The current which flows over the telephone wires is only 20 volts which will not operate the coil X but when the proper connection is completed by the automatic unit the current picked up is 48 volts. This operation is performed by a relay inserted in the line that was found by the automatic unit or in other words the desired telephone connection, as diagrammatically illustrated in Figure 1, and this voltage will cause the operation of coil X to draw down the member 49 and shut down the operation of the apparatus as soon as the alarm has been sent in.

To reset the machine the fuses must be

replaced or the broken wires reattached and then the relay will reenergize the coils M and N with the result that a closed circuit is again established in the several rooms of the building.

When the coils M and N are reenergized the member 27 will be actuated by the upward movement of arm 1 which will pull the pin 30 and the member 26 out of engagement with the cam wheel 10 thus permitting 28 to be pulled back to its original position by the spring 29 and at the same moment latch 33 lifts its extension arm 34 freeing it from engagement with the cams 124 of the impulse wheel 7 and if the line is closed, by setting the relay the extension 129 of arm 1 remains in the path of travel of the cams of impulse roller 7 thus locking the apparatus in a position and condition ready for another cycle of operation in the event of the closed circuits in the rooms of the building becoming broken.

Although Figure 1 is intended to only diagrammatically illustrate the electrical layout, some reference to it and slight description will be given.

The device which delivers the call is designated as the alarm and the closed circuits in the several rooms of the building is designated as the house circuit.

The equipment at the central station is designated as consisting of a selector unit and a 20 volt line or battery, a polarized relay for automatically reversing the polarity in the line, and a second relay in series to circulate the current in event the line should be cut. Still another relay is provided to pick up a 48 volt line and release the 20 volt line.

A hold-over switch and relay are illustrated that will hold the connection over the period of the make and break. All of the equipment mentioned is at the central or so-called telephone station or office.

A tape or punch register is diagrammatically illustrated and is provided with a battery. This device is located either at the fire or police station as the case may be.

The breaking of the closed house circuit by the melting of the fusible links or burglars breaking the actual wires results in the tripping of the mechanism which automatically dials the desired telephone number which is that of the police or fire department as the case may be. The selector unit picks up and automatically makes this connection and in connection with the selector unit there is a double relay indicated at K which switches the current from one battery to another thus giving a more dependable service current. Immediately following this dialing operation the wheel 16 causes the sending out of the code impulse in the form of makes and breaks that register upon the punch tape register the location of the building from which the alarm has been sent.

A battery unit L feeds 20 volts into the polarized relay P which is a 4 winding coil and should anything happen to either wire of the telephone line between the telephon office and the building in which the alarm is situated, a coil P shifts the switch Q which reverses the current and at the same instant H throws a switch which rings buzzer G.

Coil S is relay wired in series and should the out going line be disconnected and ungrounded this coil will ground and complete the circuit and in any event buzzer G will ring until the line is restored to normal but the alarm will still come through on the remaining wire.

The hold over switch is a mechanical device consisting of a geared up fan blade wound each time by the armature of the relay at each make or break, thus holding the jumper around the selector during the make and break period until the complete alarm is over and recorded.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In an alarm signal apparatus for use in conjunction with an automatic telephone system, a power driven apparatus for automatically dialing the desired telephone number, a closed electric circuit, means normally locking said dialing apparatus against operation, means actuated upon the breaking of said closed electric circuit to release the dialing apparatus for automatic operation and the mechanical dialing of the desired telephone number, and means also driven by the motive power which drives said dialing apparatus for automatically and mechanically sending an alarm in the form of electrical impulses over the telephone system after the telephone connection has been made.

2. A fire alarm signal apparatus for use in conjunction with an automatic telephone system, comprising a closed electric circuit having therein fusible connections, a mechanically driven dialing mechanism and a mechanically driven alarm sending mechanism, means normally locking said mechanisms against operation, and means operatable upon the fusing and breaking of said fusible connections for releasing said locking mechanism and permitting the dialing mechanism to dial the desired telephone call number, and means automatically operable after said dialing operation for sending an alarm in the form of electrical impulses over the telephone connection which has been made, for operating a register which automatically records said alarm.

3. In an alarm signal apparatus for use in conjunction with an automatic telephone system, a closed electric circuit, means for sending impulses over the telephone wires for dialing a telephone call, means for driving said dialing mechanism, a lock for holding

said dialing mechanism against operation, said lock being held in locked position in-so-long as said closed circuit remains unbroken, but releasing the dialing mechanism for automatic operation immediately said closed circuit is broken, mechanically driven automatically operatable means for sending the alarm over said telephone system after the telephone connection has been made, a second lock for locking the dialing and alarm sending mechanisms against operation after they have once functioned, and said first named lock moving into locked position and said second named lock moving into an unlocked position when the broken closed circuit has been repaired and closed again.

4. A fire or burglar alarm signal apparatus for use in conjunction with an automatic telephone system, comprising a closed electric circuit positioned on the walls and across the openings of the rooms of a building in which the apparatus is located, a signal box having therein a motor for driving an automatic dialing mechanism for calling the desired telephone number, said motor being provided with a governor, a frictionally operated speed control device, said box further containing a motor driven mechanical electrical impulses alarm sending mechanism, means normally locking both the dialing and alarm sending mechanisms against operation, means operable upon the breaking of either of the closed room circuits for releasing the dialing mechanism for operation, and means forming a part of the dialing mechanism for automaticaly bringing the alarm sending mechanism into operation upon the completion of the operation of the dialing mechanism, whereby the electrical impulse alarm is sent to and received at the station called by the dialing mechanism, and a register for receiving and automatically recording said alarm.

5. An alarm signal apparatus such as described in claim 4 wherein there is provided means to bring about the continuance of the dialing and the sending of the electrical impulse alarm until such time as an actual telephone connection is made with the station or telephone called by the dialing mechanism.

6. An alarm signal apparatus, such as described in claim 4, wherein there is provided a trouble signal which calls the attention of the attendant at the main telephone exchange in the event that anything in the way of trouble happens to the telephone lines between the telephone exchange and the place where the signal box is situated.

7. An alarm signal apparatus for use in conjunction with an automatic telephone system, comprising means to automatically mechanically dial the desired telephone call number, said dialing mechanism comprising a series of motor driven wheels and cams for automatically making and breaking an electric circuit and sending thereover to the telephone wires a series of impulses, said wheels and cams being so shaped as to mechanically and automaticaly alternately send a varied number of impulses representing the number of the station it is desired to call, an alarm sending mechanism for sending over the telephone wires a series of impulses representing a number, the wheels and cams so shaped and driven at such a speed that the alarm sending mechanism operates immediately upon the completion of the operation of the dialing mechanism and sends to the station called by the dialing mechanism a number indicating the place at which the signal box is located, a register for receiving and automatically recording the alarm numbers, and means causing the continuance of the dialing and the alarm sending until an actual connection with the desired dialed telephone is made.

8. In an alarm signal apparatus for use in conjunction with an automatic telephone system, means to automatically mechanically dial the desired telephone call number, a coil acting after telephone number connection has been made to cut in a higher voltage on the line, said coil coupled electrically and mechanically to throw a jumper around a selector which makes the desired call connection, and means to automatically mechanically send an alarm over the telephone wire after the telephone connection has been made, and means operable only by said higher voltage to stop the mechanical dialing and the mechanical sending of the alarm after one cycle of operation, whereby it is assured that the telephone connection is actually completed and the alarm actually transmitted as desired before said dialing and alarm sending is discontinued.

9. An alarm signal apparatus which comprises a complete automatic electric arrangement when set up, including a dial adapted to automatically dial the desired telephone call number and means to automatically and mechanically send the alarm following the said telephone connection, and means causing the continuance of said dialing and signaling until the desired connection is made and the alarm is actually transmitted.

10. An alarm signal system comprising a normally closed electric circuit embodying an automatic dialing system to give the desired telephone number automatically when said electric circuit is broken, said circuit also including means adapted to automatically and mechanically send the alarm following the automatic telephone connection, and means causing the continuance of said dialing and signaling until the desired connection is made and the alarm is actually transmitted, whereby a complete system without any manually operating electrical connection is provided.

11. An alarm signal apparatus for use in conjunction with an automatic telephone system, comprising a closed electrical circuit including an automatic mechanical dialing device and an atuomatic mechanical alarm sending device which are automatically operated upon the opening or breaking of said closed circuit, and means automatically reversing the current and grounding the telephone circuit should one of the telephone wires become disconnected or broken, whereby said telephone connection will be made and said alarm signal delivered in the event of such happening over the single remaining telephone wire.

12. An alarm signal apparatus such as described in claim 11, wherein means are also provided for signaling the fact that the telephone line is not normal when the apparatus is transmitting over a single wire.

In testimony whereof I hereunto affix my signature.

FELIX F. DENZLER.