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10 Sheets—Sheet 1.

J. SPEICHER.

ELECTRIC FIRE ALARM SYSTEM.

No. 420,173. Patented Jan. 28, 1890.

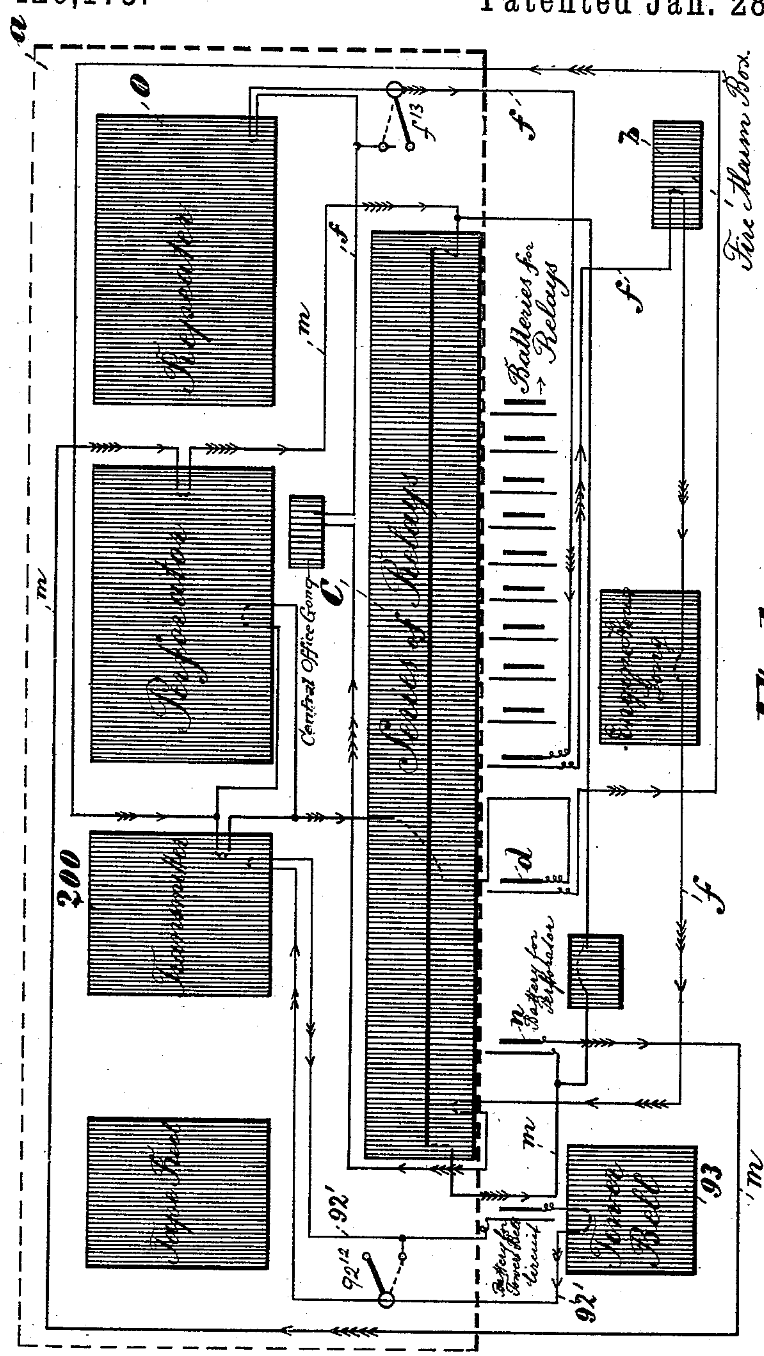

Fig. 1.

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(No Model.) 10 Sheets—Sheet 2.

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ELECTRIC FIRE ALARM SYSTEM.

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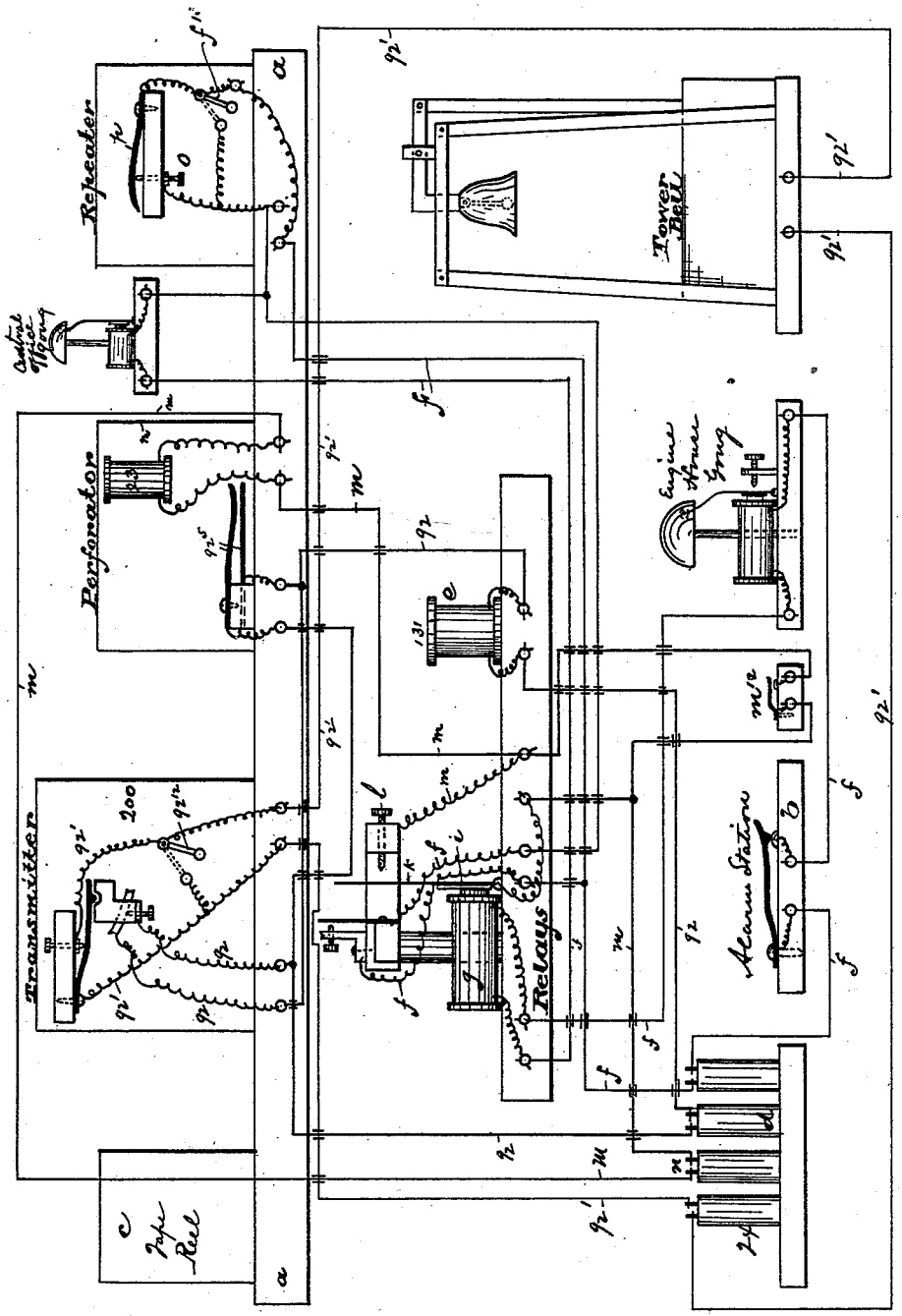

Fig. 2.

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ELECTRIC FIRE ALARM SYSTEM.

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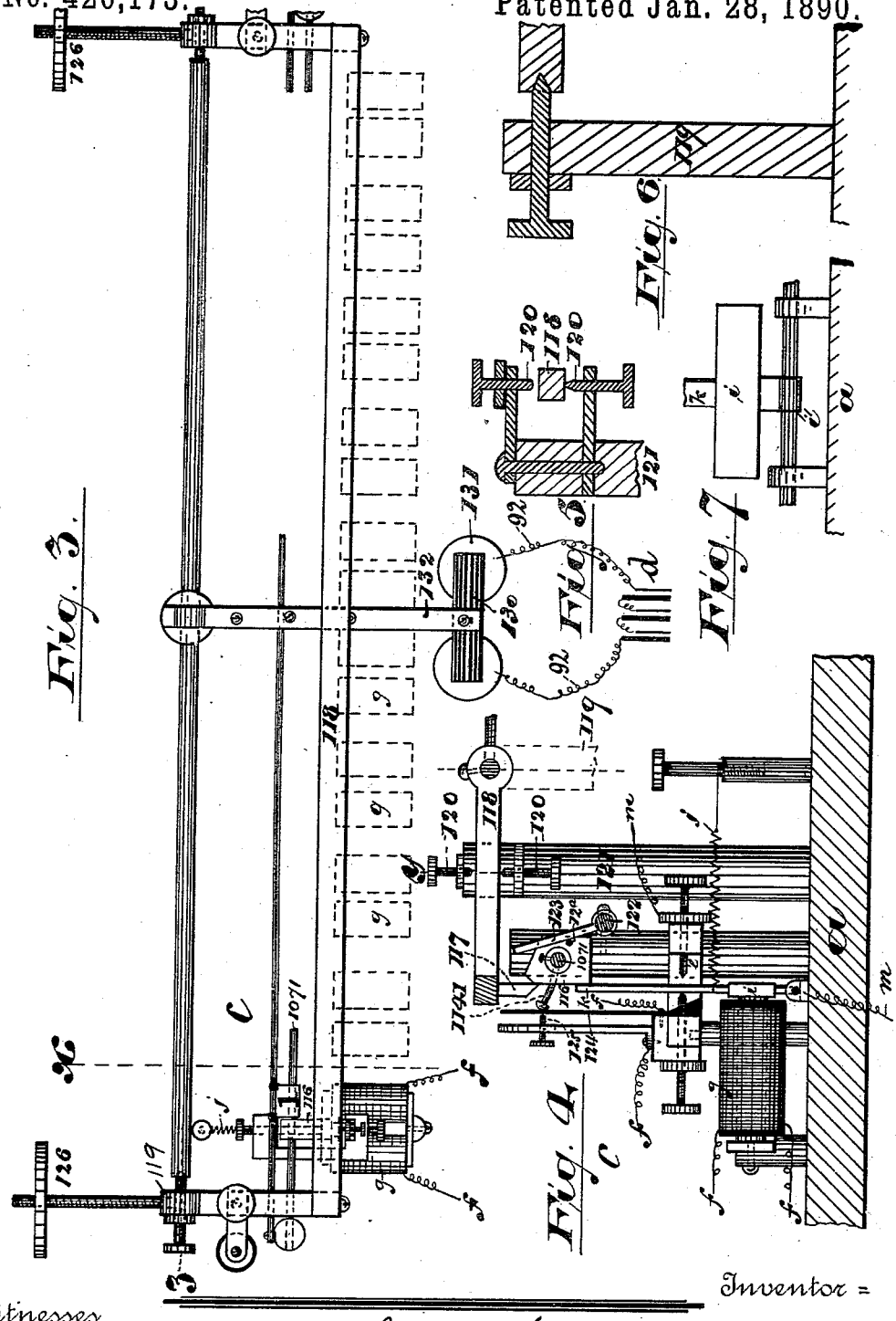

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ELECTRIC FIRE ALARM SYSTEM.

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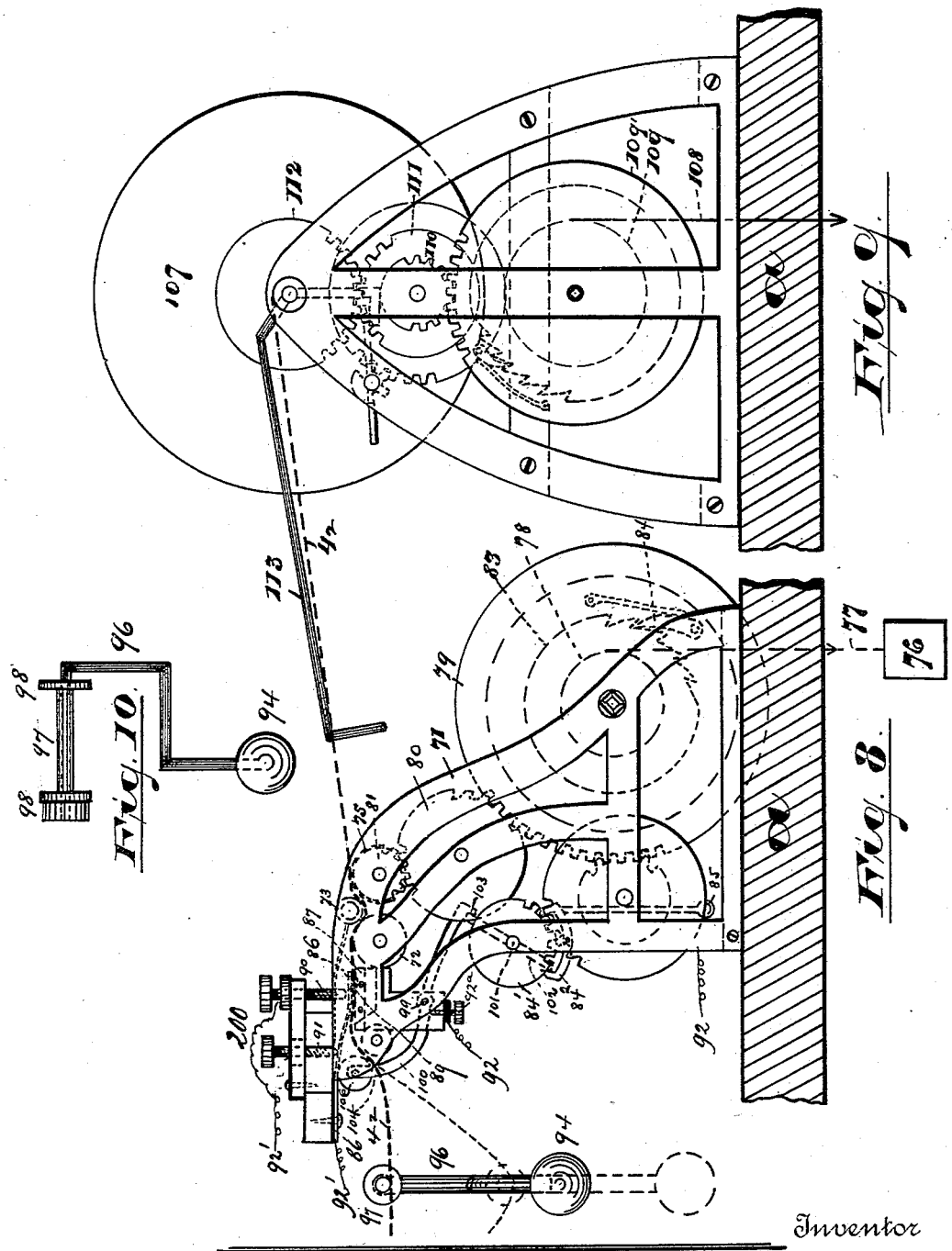

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ELECTRIC FIRE ALARM SYSTEM.

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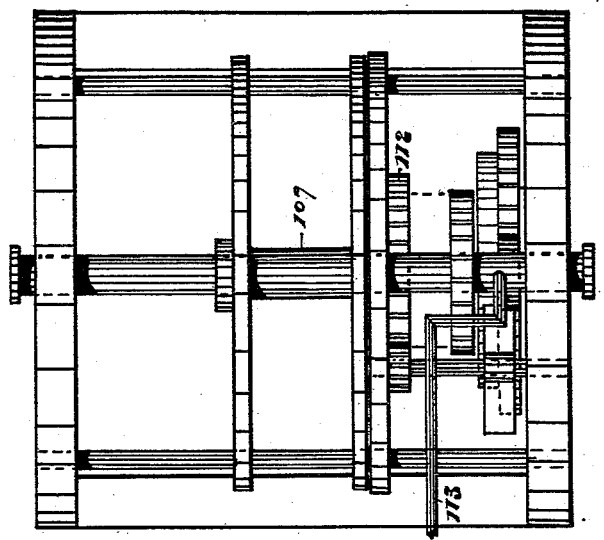

Fig. 12.

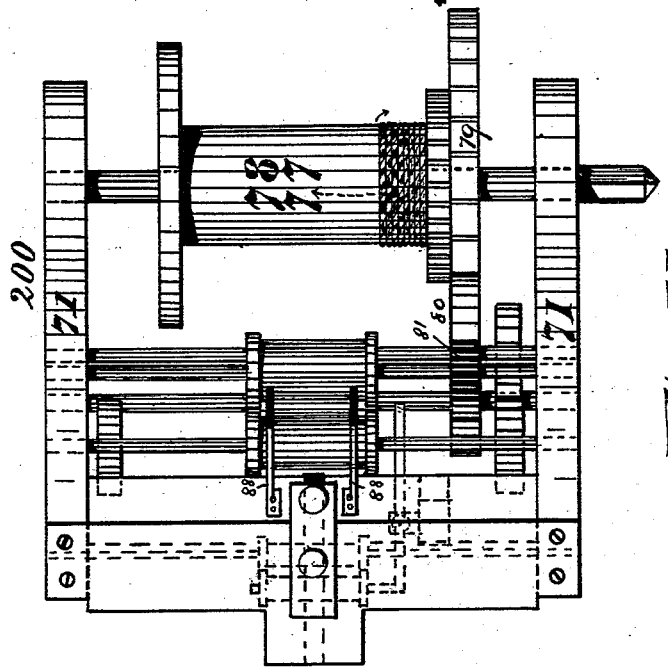

Fig. 11.

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ELECTRIC FIRE ALARM SYSTEM.

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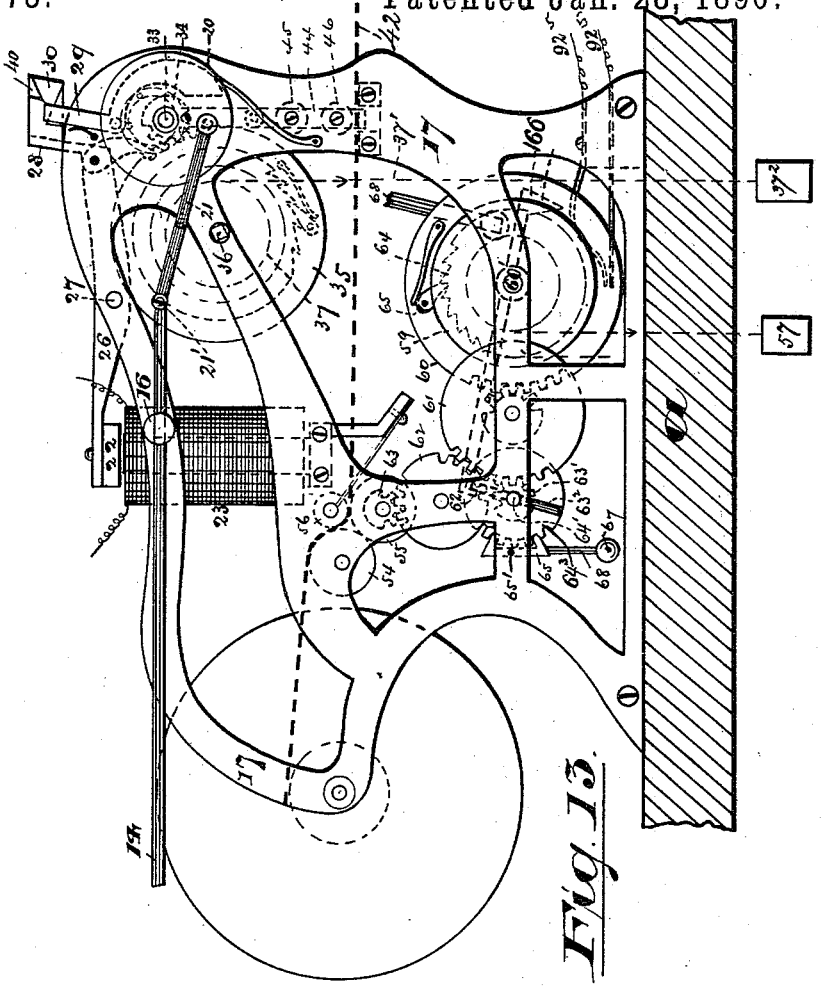

Fig. 13.

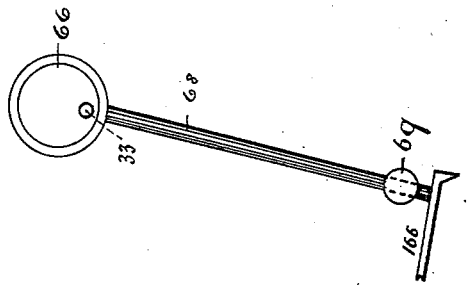

Fig. 14.

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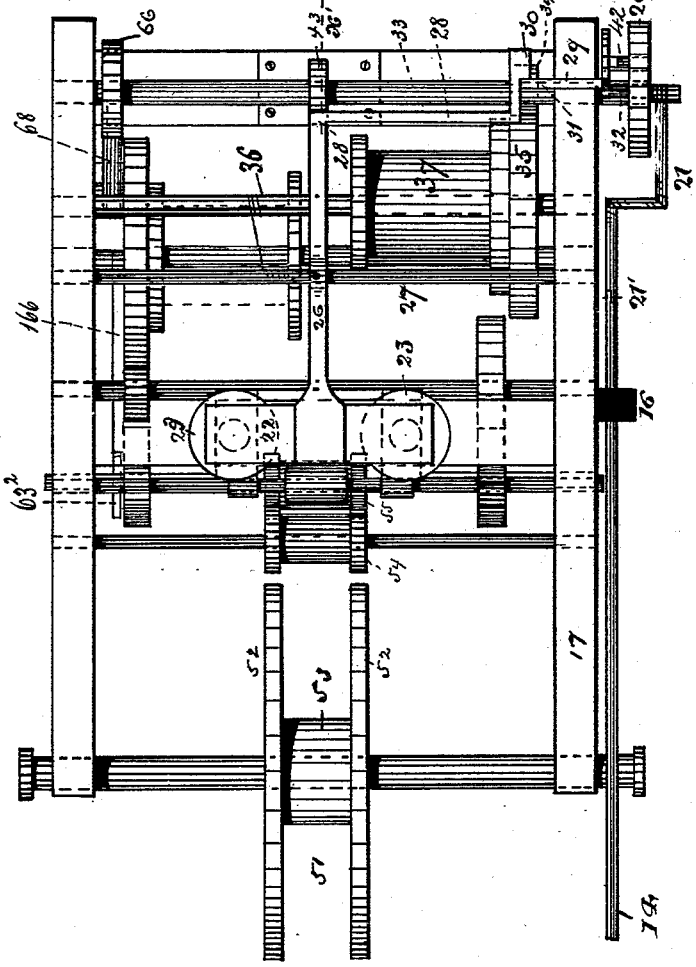

Fig. 15.

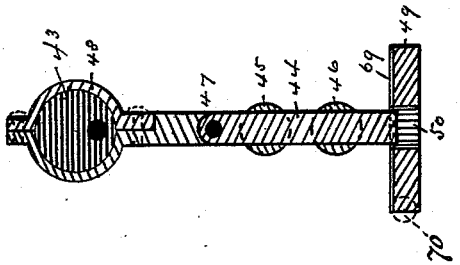

Fig. 16.

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ELECTRIC FIRE ALARM SYSTEM.

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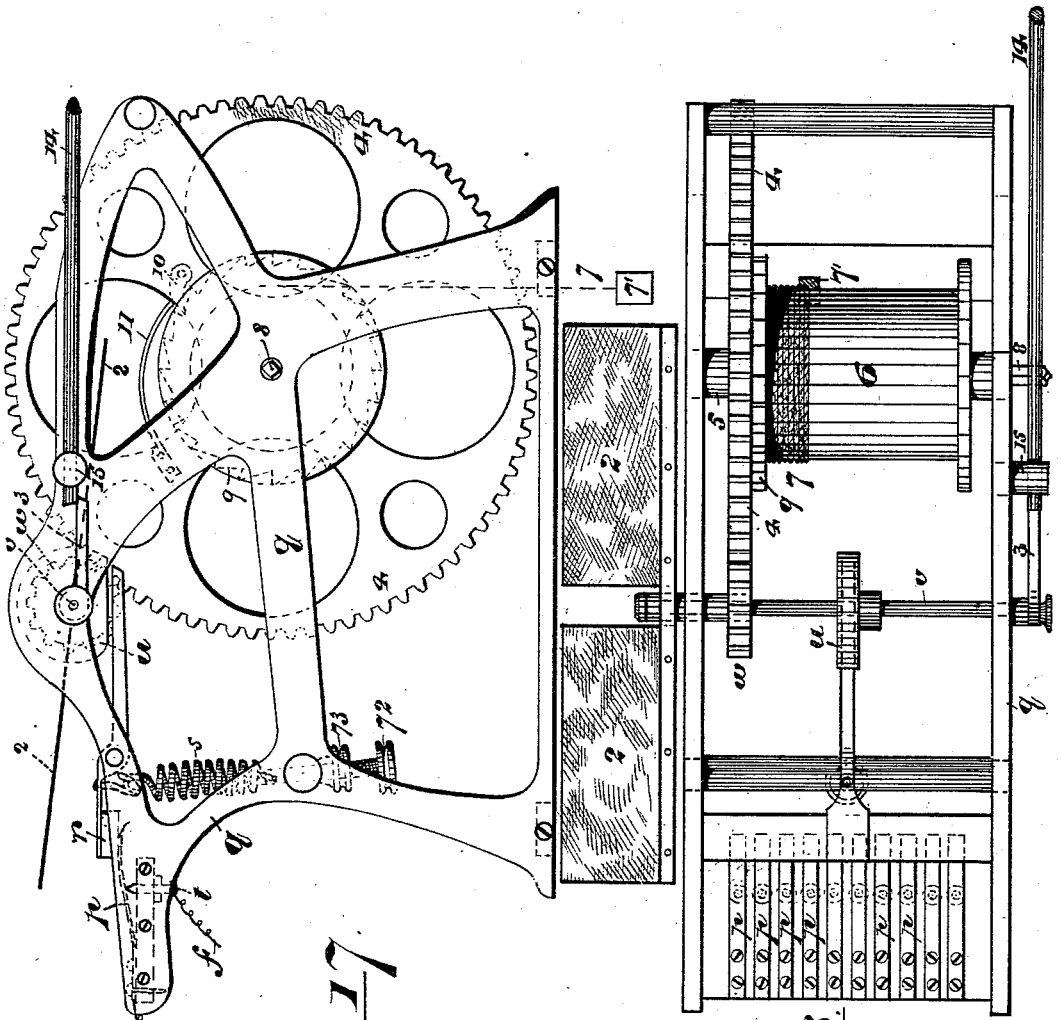

Fig. 1.

Fig. 1B.

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ELECTRIC FIRE ALARM SYSTEM.

No. 420,173. Patented Jan. 28, 1890.

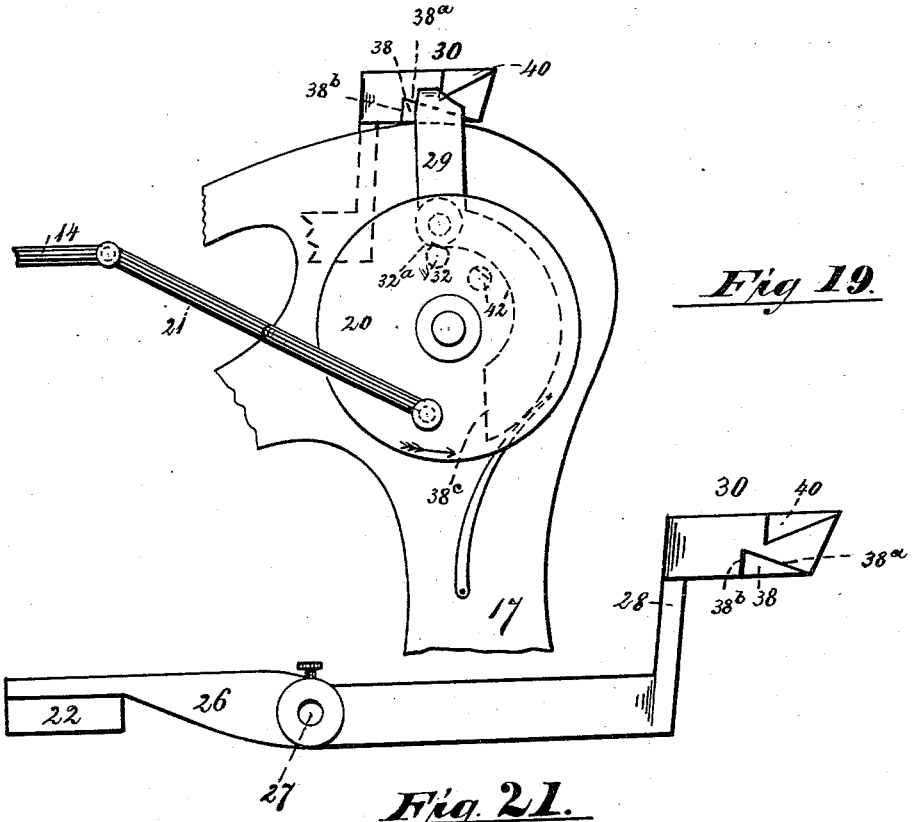

Fig 19.

Fig. 21.

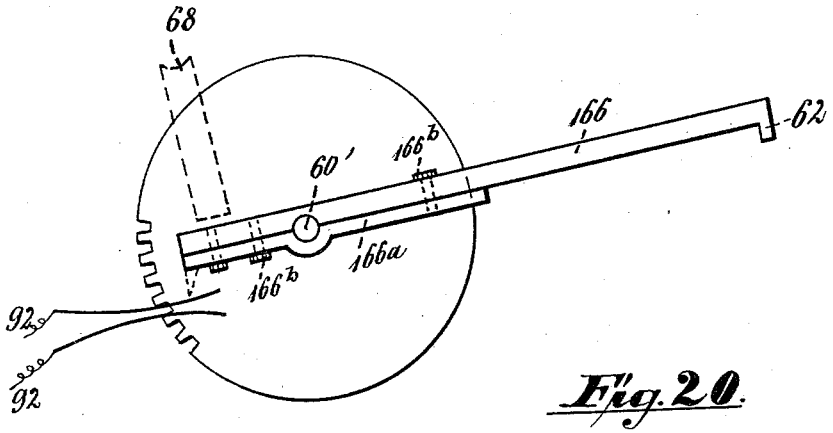

Fig. 20.

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(No Model.) 10 Sheets—Sheet 10.

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ELECTRIC FIRE ALARM SYSTEM.

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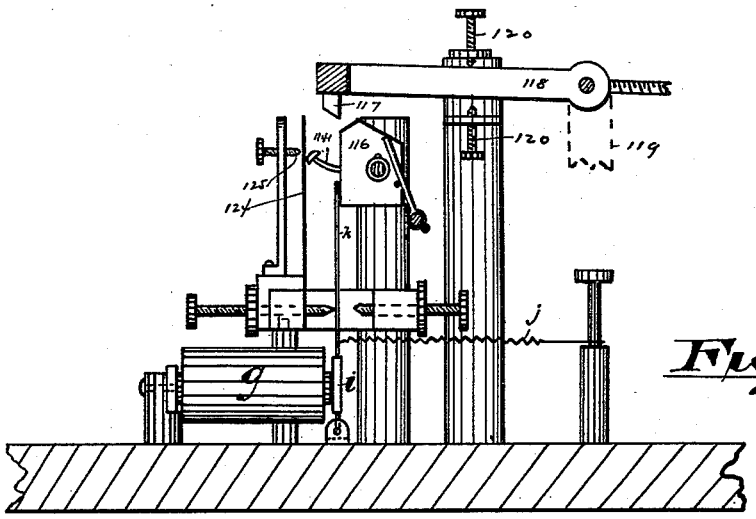

Fig. 22.

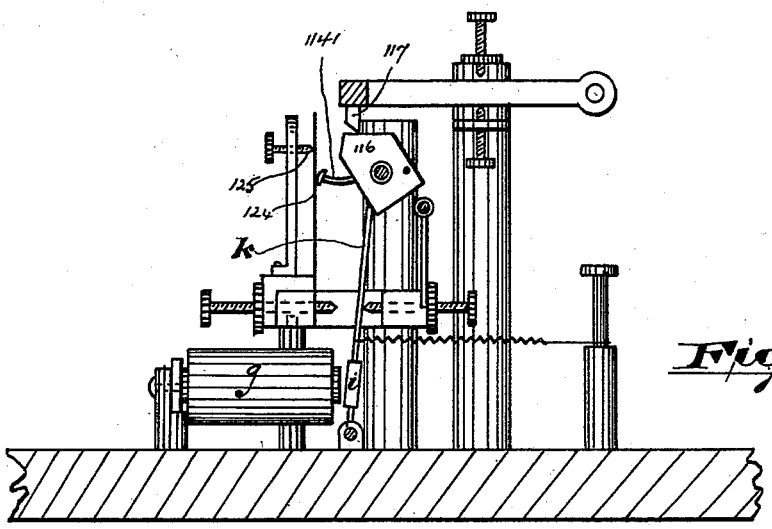

Fig. 23.

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UNITED STATES PATENT OFFICE.

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ELECTRIC FIRE-ALARM SYSTEM.

SPECIFICATION forming part of Letters Patent No. 420,173, dated January 28, 1890.

Application filed June 21, 1888. Serial No. 277,807. (No model.)

To all whom it may concern:

Be it known that I, JOHN SPEICHER, a citizen of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Electric Fire-Alarm Systems; and I do hereby declare the followlowing to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

One object of this invention is to prevent in fire-alarm telegraphy the interference of one alarm with another on a different circuit—that is to say, while a first alarm is being transmitted of a second alarm from a station on a different circuit from the first station being thus transmitted, and thus producing a confused ringing which would prevent the firemen from knowing the location of either of the alarm stations or boxes.

A further object is to allow a signal to be struck at a station and be received at the central station at a rapid rate, so that the firemen may quickly know the location of the fire, and to repeat the alarm on the large central alarm-bell or tower-bell and outlying tower-bells more slowly, so that the heavy levers and bell-hammers may have time to act.

Further objects are to prevent mixed alarms or alarms received simultaneously from different stations on a given circuit from being repeated on the alarm-bells, to reduce the uncertainty of action caused by dust interfering with the operation of the contact-points or terminals, to prevent interference caused when the mechanism is acting quickly, to reduce the cost of construction, and generally to secure a more certain, quick, and effective operation of parts, and a system that will be more perfectly automatic and certain of proper results and of greater durability than those now employed.

Referring to the accompanying drawings, in which like letters of reference indicate corresponding parts in each of the several figures, Figure 1, Sheet 1, is a plan illustrating the general relations of the several mechanisms to one another, and the wires connecting the same. Fig. 2 illustrates the same, the electrical parts of the mechanism being somewhat more in detail. Fig. 3 indicates in plan a series of relays and co-operating mechanism. Fig. 4 is a sectional view of the same, taken on line x, Fig. 3. Fig. 5 is a section taken on line y, Fig. 4; and Fig. 6 is a section taken on line z, Fig. 3. Fig. 7 is a detail view of a portion of an armature of one of the series of relay-magnets. Fig. 8 is a side elevation of a transmitter. Fig. 9 illustrates the construction of a reel for winding the tape or ribbon after it has passed through said transmitter. Fig. 10 is a face view of the weight, shown edgewise in Fig. 8. Fig. 11 is a plan of said transmitter, and Fig. 12 is a plan of said reel. Fig. 13 is a side elevation of a mechanism which I have herein termed a "perforator." Fig. 14 is a detail of a certain plunger operated by an eccentric found in said perforator. Fig. 15 is a plan of said perforator. Fig. 16 is a sectional view taken on line x' of Fig. 15 of a punch or die for perforating the tape or non-conducting ribbon prior to its passage through the transmitter. Fig. 17 is a side elevation of a repeater, by means of which the alarm is transmitted to the various engine-houses or stations. Fig. 18 is a plan of the said repeater. Fig. 19 is an enlarged view showing in detail certain devices arranged in the perforator for operating a reciprocating rod or bar extending to and working in connection with the repeater. Fig. 20 is an enlarged detail, illustrating a stop-lever and its connection with a certain shaft in the perforator. Fig. 21 is a detail view of a certain armature-lever employed in that part of the device termed herein the "perforator." Figs. 22 and 23 are views of the mechanical parts disclosed in Fig. 4, showing the said parts in different relations to one another, Fig. 22 showing a certain frame (118) raised from the position shown in Fig. 4 by an electro-magnet to release a certain pivotal block, and Fig. 23 showing the said block turned under the influence of an arm k.

In said drawings, a indicates a table or bed-

plate, to which the several mechanisms are attached, although said mechanisms may be upon independent plates and be only connected by the conducting-wires, tapes, &c.

The description of the several co-operating mechanisms will be taken up in the order of action upon the striking of an alarm at a signal-box, (which is indicated at *b* in Figs. 1 and 2,) and the transmission of the alarm to the bells at the tower and engine-houses. The ordinary lever of the station-box *b* being pulled or operated, and the circuit-wheel set in motion and a circuit thus completed or broken, the signal is transmitted by means of electrical connections and currents to the central station in the usual manner. The circuit-wires *f*, upon which the said station is situated, connect with the automatic mechanisms at the central station, where the signal is automatically repeated and transmitted to the bells and to the engine-houses, the strokes of the signal at the outlying alarm station or box being transmitted to the gongs of the engine-house at the rate of, say, one blow to the second, or at such a rate as to enable the firemen to clearly distinguish and count the strokes, and yet the rate is not so slow as to compel the firemen to wait the slow repetition of the strokes necessary in operating the tower or large alarm-bell. The said automatic mechanism at the central station also transmits the signal to the tower or large alarm-bell at a slow rate of, say, a stroke to every two seconds, which is ample time to allow the heavy bell-hammer and the mechanism controlling the same to act effectively.

The ordinary wires which connect the outlying stations or signal-boxes with the central station are in several main circuits. These are all brought into connection with a device (located at *c* and shown in detail in Figs. 3, 4, 5, and 6) which is operated in part by local batteries and magnets, (shown, Fig. 2, at *n* and 23, respectively, on the circuit *m*, and *d* and 131 on the circuit 92,) and serve to prevent interference of alarms cotemporaneously passed thereto over two separate circuits in case of two fires in different parts of the city at the one time, locking out one of said alarms until the first has completed its striking, so that there will be no confusion of strokes at the tower-bell, and also preventing the operation of any of the other circuits.

Referring now more particularly to Figs. 3 and 4, *f f* indicate wires connecting the central station with one or more of the fire boxes or stations and one or more engine-houses, the said wires and the said stations, houses, &c., forming one of the series of main circuits. The said wires connect with one of a series of relay-magnets *g g*, and from the latter the current is conducted to a repeater *o*. (Shown in detail in Fig. 17, hereinafter particularly described.) The repeater may be cut out by a short-circuiting key f^{13}, Figs. 1 and 2, to allow of the instrument being tested at the central office without repeating the test-strokes over all the circuits. When the current through the said wires *f* is broken by a person operating the lever of the alarm box or station in the ordinary way to make an alarm, an armature *i*, pivoted as at *i'*, Fig. 7, is drawn back and released from the magnet *g* of the relay by a spring *j*, Fig. 4, and an arm *k*, connecting with said armature, is brought into contact with a point *l*, Fig. 4, connected with the circuit-wire *m*, which latter wire connects with a local battery *n* and magnet 23, stationed in the punching-machine. When the contact is thus made, a local circuit is completed, by means of which a perforator or punch, hereinafter referred to, and the repeating mechanism in the repeater are operated simultaneously, or nearly so. After the punching-stroke of the punch or perforator is completed, whereby the tape is perforated or indented and certain contact-points in the transmitter held apart by the unindented or imperforate part of the tape are allowed to come together to complete a circuit, the large bell is sounded and the circuit is again closed. When the operations are conducted on a reversed plan and the imperforate parts of the tape hold the contact-points together, the perforations allow the points to be separated and the circuit broken to produce the alarm, as will be understood. The main-circuit wires *f* connect with the repeater, (above referred to,) located, as at *o*, on the general plan and detail shown in Figs. 17 and 18. The said main-circuit wire of each of the series connects with one of a series of springs or terminals *p*, arranged at one end of the frame-work *q* of the said repeater *o*. Said series of springs *p* (one for each circuit in the system) all bear against an insulated lever *r*, which latter is, where it engages the said springs *p*, held thereon by a heavier spring *s*. Beneath said springs *p* are contact-points or terminals *t*, connecting with other wires *f* of the main circuit, against which points *t* the said springs *p* are held by said lever *r* and springs *s*; but the normal tendency of said springs *p* is to rise from said points *t* and open or break the circuit. The lever *r* is operated by the cam *u*, arranged on a shaft *v*, in connection with a pinion *w*, an arm 3, and a fan 2, loosely secured on its shaft or bearings, so that it may be allowed to make several revolutions before it is stopped by friction, by means of which said fan the movement of parts is regulated. The pinion *w* meshes with a larger cog-wheel 4, journaled on a shaft 5 in said frame *q* and connected with a drum 6, upon which a weighted cord or rope 7 is wound. 7' indicates the weight on said cord. The cord may be wound upon said drum by means of an angular key-spindle 8, forming a part of the shaft 5, and be held against back motion by means of a ratchet-wheel 9, pawl 10, and spring 11, Fig. 17, as will be understood.

When the arm 3, in connection with the shaft *v*, cam *u*, and pinion is released, as

hereinafter described, the weight is allowed to drop, and to thus turn the drum, and with it the cog-wheel 4, pinion *w*, and cam *u*, which latter depresses one end of the lever *r* and raises the insulated end, which allows the series of springs to rise from their respective contact-points and break or open all the fire-alarm circuits, and thus ring all the gongs or bells on the said circuits.

The mechanism which controls or holds the arm 3 is so constructed as that the said arm is allowed to make ordinarily but one revolution at a time and be stopped by a return of the said controlling mechanism to the path of the said arm immediately after releasing the same.

The tension of the spring *s* is regulated by means of an adjusting-screw 72 and locknut 73. The mechanism above referred to for releasing the arm 3 and allowing the lever *r* and spring *p* to rise and break the circuit of the wires *f*, so that the alarm is repeated on all the several circuits, consists in the construction illustrated of a reciprocating rod 14, Figs. 13, 15, 17, and 18, which slides longitudinally in bearings 15 and 16, the first of which is on the frame *q* of the repeater and the second on the frame 17 of what I have, for purposes of identification in description, termed the "perforating mechanism" or "perforator." The said rod 14 is given a reciprocating motion by means of crank-wheel 20 and pitman-rod 21, pivotally connected to said rod 14 at 21′, which pitman-rod connects the sliding rod 14 with said crank-wheel 20. A revolution of the said crank-wheel will cause the sliding rod to be first withdrawn from the path of the arm 3 and immediately returned thereto again, as will be apparent, so that the said arm 3 can make but one revolution before it is stopped. When the fire-box-signal lever is drawn and the current through the main fire-alarm circuit *f* is broken and the parts *k* and *l*, Fig. 4, are brought into contact, as before described, a local circuit with which all of the arms *k* of the several fire-alarm circuits have a connection is closed, and an armature 22, Figs. 13 and 15, working in connection with magnets 23, Fig. 15, and battery *n*, Fig. 2, of said local circuit, the wires of which are marked *m*, is depressed or brought into contact with said magnets. The said armature is connected with or forms a part of a lever 26, fulcrumed on a shaft 27. Said lever is at the end thereof opposite the armature brought to a position adjacent to the crank-wheel 20, before referred to, by being bent, as at 28, or otherwise formed to secure that result. At its extremity the said lever is provided with a catch 30 of suitable construction, adapted to engage with a trip-lever 29 and hold the same. When the armature 22 is brought into contact with magnet 23, the lever 26 is raised from holding engagement with the trip-lever 29, a stop or projection 31, the upper end of which is in engagement with the catch 30, as shown in Fig. 15, and the lower end of the said trip-lever engages a pin or teat 32 on the inner face of the crank-wheel, as shown in Fig. 19. Said disengagement releases the crank-wheel from fixed engagement with the trip-lever, and said crank-wheel is thus allowed to revolve to give an impulse to the reciprocating shaft or rod 14, whereby said shaft or rod is withdrawn from holding engagement with the arm 3 and returned again to a position to engage said arm. On the shaft 33, which carries the crank-wheel, is also arranged a pinion 34, which meshes with a large cog-wheel 35, arranged on a suitable shaft 36, having an angular head, Fig. 13, adapted to receive a key. On the same said shaft 36 is arranged or formed a drum 37, upon which a weighted cord 37′ may be wound. When the crank-wheel is released, the weight 37^2 is immediately allowed to act to turn the said drum 37, cog-wheels 34 and 35, and crank-wheel, and to give impulse to the reciprocating rod 14, the said rod being thus impelled by the weight 37^2. When the catch 30 of the lever 26 is raised from its holding position on the sounding of an alarm, the trip-lever 29 is disengaged from the lug 40 of the catch 30, and is forced forward by the pressure of the pin 32 on the wheel 20, which bears on the projection 32^a of the trip-lever. The said trip-lever, after being disengaged from the teat or pin 32, and after allowing the revolution of the crank-wheel under the influence of the weight 37^2, next engages in a return movement an inclined face 38^a of the lug 38, formed on the catch 30, over which it rides into engagement with the stop surface 38^b of said lug. The said return movement of the trip-lever is occasioned by the lug, pin, or projection 42′ on the wheel 20 engaging the extremity 38^c of said lever. The said trip-lever remains in such engagement with the stop surface 38^b until the armature rises and depresses the catch 30 when it passes into engagement with the stop surface of the lug 40. The pin or projection 32 is made short enough to pass the stop surface 38^c and allow the engagement of the pin 42′ with said stop surface, as above described. The crank-wheel may engage the armature-lever directly; but I prefer to employ the intermediate parts, as by that construction the impact force is distributed over several parts, and the machine is thus relieved and rendered more durable. It will now be evident that when the lever at the fire-box station is pulled the alarm will be automatically transmitted to all the circuits represented by or connected with the springs *p*.

The devices last described are, in the construction illustrated, arranged on and form a part of the devices for operating a punch; but said devices may be arranged on an independent frame-work without departing from the invention, as will be evident.

To repeat the signals at a slower rate than would be produced by the mechanism of the

fire-alarm box, as before referred to, I have provided a transmitter 200, which employs in its operation a perforated tape of paper or insulating substance, which is perforated at every opening of the main current, thus allowing a contact to be made through each perforation, or allowing a spring-contact point to drop into said perforation and break a circuit to cause an alarm to be sounded on the tower-bell, or when a "tapper" or small gong is used at the engine-house to cause the alarm to be transmitted to the larger gong therein at a slower rate than the rate of the tapper. To perforate or indent the said tape (indicated at 42) at every opening of the fire-alarm circuits, and to do so prior to the passage of the tape through the transmitter, is one of the special functions of the mechanism I have termed the "perforator."

In connection with the shaft 33, upon which the crank-wheel revolves, is arranged an excentric 43. (Indicated in Figs. 13 and 15, but more clearly shown in detail in Fig. 16.) Arranged upon said eccentric is a reciprocating punch 44, which slides vertically in bearings 45 and 46, and is jointed, as at 47, to allow a vertical and straight movement of the punching end thereof. Said punch is secured to the eccentric 43 by a strap 48, or in any other suitable manner. By revolving the eccentric under the influence of the mechanism already described the punch is caused to perforate or indent the tape in connection with a die 49, perforated at 50 to receive said punch, over which the said tape is caused to travel when set in motion at the striking of an alarm by the tape-drawing mechanism in connection with the perforator, which will now be described.

On the frame 17, at a suitable position therein or independent of said frame, is arranged a reel 51, having a hub 53, on which the tape is wound, and flanges 52, which are separable to allow the insertion of the tape in the form of a roll. Forward of said reel 51 is arranged a series or group of friction-wheels 54 55 56, between which the tape passes. Said wheels are given a movement, when released or allowed to travel, by a weight 57, connected with the drum 59. The said drum is connected with the friction-wheels by a train of gearing 60, 61, 62, and 63, by which the motion of the drum is transmitted to the friction-wheels. The back movement of the drum is regulated by means of an ordinary ratchet-and-pawl attachment 64 65.

To release the friction-wheels, so that they will move to draw the tape toward the punch when an alarm is struck, I have devised the following arrangement of parts: Upon the shaft 33, which carries the crank-wheel and eccentric above described, is arranged another eccentric 66, Figs. 14, 15, and 20, to which is connected a plunger 68, which slides in bearings 69, (preferably a perforated stud,) arranged on the inside of the frame-work 17, near the journal of the drum 59. Said plunger engages the end of a stop-lever 166, which latter is fulcrumed, as at 60′, Fig. 13, on the journal of the said drum, being held in frictional contact with the said drum or the gear-wheel connected therewith, or, and preferably, in frictional contact with shaft 60′, as indicated in Fig. 20, so as to move therewith after having been struck by the plunger to make a return movement. The said stop arm or lever is provided with an adjustable strap 166^a to take up wear by means of screws 166^b, Fig. 20. When the plunger 68 is thrown down by the rapid movement of the eccentric 66 under the influence of the weight 37^2, the stop-lever 166, which is provided with a hook or detent 62, is raised from holding engagement with the train of mechanism already referred to, thus releasing the friction-rolls for carrying the tape forward to the punch. The operation of said rolls continues under the influence of the weight 57 until the stop-lever 166 again returns the detent 62 into holding engagement with the pin 63^2. The preferred construction for thus bringing the said detent into engagement with the said train of mechanism is shown more clearly in Fig. 13, in which one of the shafts connected with the train of gearing, or, and preferably, the shaft 64′, carrying the cog-wheel 63′, is provided with an arm or arms 63^2, which extend from and revolve with the said shaft 64′. After the plunger has, as described, thrown the stop-lever 166 by depressing one end thereof, said lever, because of its frictional relation to the drum 59 or the shaft 60 therewith connected, immediately begins to descend in a return movement at its detent end, moving with said drum or shaft. It continues its descent until the said detent arrives at the path of the revolving arm 63^2 of the train of gearing when the movements of both of said parts are stopped, and the movements of the friction-wheels 54, 55, and 56 and progress of the tape thus terminated.

The speed of the tape is regulated by a governor, which in the present case consists of a ratchet-wheel 64^3, arranged on the shaft provided with the arm 63^2, and in connection with said ratchet-wheel 64^3 is arranged a double pawl 65, arranged on a pin or stud 65′, and provided with a weight 67, which may be adjusted on its carrying-arm 68 to increase or diminish the speed of the ratchet-wheel.

The die-plate of the punch is provided with a holder or stripper 69, Fig. 16, which prevents the tape from being drawn up from said plate by the punch and with a roller 70, over which tape may be drawn to prevent friction.

After leaving the mechanism I have herein termed a "perforator" the tape passes to the transmitter 200, by means of which the impulses received from any of the fire-alarm circuits is transmitted at a slow rate of speed over the circuit 92′ to the tower or larger bell,

or under certain circumstances or conditions to the gongs of the engine-houses. Should I not wish to have the alarm transmitted to the bell, the transmitter 200 may be cut out by means of a short-circuit key 92^{12}. Said transmitter 200, as herein described, is shown more clearly in Figs. 8 and 11, in which 71 is a frame of the transmitter. 72, 73, and 75 are friction-rolls arranged to carry or draw the tape forward at a slow rate under the influence of a weight 76, a cord or rope 77, a drum 78, and a train of gearing 79 80 81, which connects said drum with one of the friction-wheels and gives movement to the same. The movement of the said wheels is also regulated and controlled by a suitable device for preventing back motion and a governor similar to the one before referred to, which may consist of a ratchet 83 and pawl 84, governing-wheel 84′, and double pawl 84^2, provided with an adjustable weight 85. To make or break the main or bell circuit over which the alarm is to be sent to the tower-bell by means of the transmitter, in connection with the perforated tape I have provided a spring 86, which lies upon the paper or tape 42 as it is drawn over the tablet or plate 87 and between the guides 88, Fig. 11, of the transmitter. When a perforation arrives in the progress of the tape at the said spring 86, or at the teat or point 89 thereof, the said spring drops either to make or break a contact. In the case illustrated the spring drops because of its resilience and breaks the communication between the parts 90 and 86 of the circuit 92′, connected with the tower-bell or station 93. The spring may be raised by indentations on the tape to make or break the circuit. Said spring 86 may be adjusted in its relations to the co-operating parts by an adjusting-screw 91, arranged in insulated bearings. Inasmuch as the speed of the friction rolls or wheels of the perforator varies from the speed of those of the transmitter, a fullness or slack is formed in the tape between the two mechanisms, as indicated in Fig. 8. This fullness or slack is taken up by means of a weight 94, provided with a bent arm 96 and a roller 97, having flanges 98, Fig. 10. As the fullness is formed, the weight draws the tape downward and keeps the same taut, so that it cannot become disarranged in the machine. I take advantage of this fullness and the process of taking it up in cutting or stopping off the friction-wheels 72, 73, and 75, which draw the perforated tape beneath the circuit breaking or closing spring. Upon the shaft 101, connected with the gearing of the transmitter, is arranged an arm or arms 102, similar in construction to the one or those described in connection with the perforator. Said arm 102 revolves with said shaft 101 until it is stopped by a detent 103 after all the perforations of a series representing the number of alarm signal stations or boxes have passed under the spring 86 of the circuit breaker or closer of the transmitter. The mode of operating the said detent 103 is substantially the same as indicated in Fig. 8, in which 100 indicates a lever fulcrumed on a shaft or stud 99 and carrying at one end the said detent 103. At the other end the said lever carries on a bent arm 104 thereof a roller 106, which may be flanged like the roller 97 of the weighted arm. Said roller lies over and upon the perforated tape. When the tape is slack and the weight 94 suspended therefrom is allowed to drop to the lower position, (indicated in outline in Fig. 8,) the roller 104, carried by the lever 100, is allowed to drop by its own weight sufficiently to detach the detent from the revolving arm 102, thus enabling the weight 76 to revolve the drum 78, gear-wheels, and the friction-wheels for drawing the tape forward from the punch to the transmitter. After the friction-wheels 54 55 56 of the perforator have stopped paying out the tape, and the punch has finished making the perforations indicating the number of the alarm-station, the tape, which will then be very full, because of having been paid out to the punch more quickly than the transmitter friction-rolls could move the same along, will continue to be drawn through the transmitter, the friction-wheels therein taking up the slack and raising the weight 94, which keeps the said tape taut in its fullness. When the fullness is nearly or completely taken up or brought to a straight horizontal line, the said tape engages the roller 106 of the lever 100, and raises the said roller and at the same time lowers the detent 103, which is thus brought into stopping relation to the revolving arm. The progress of the tape through the transmitter is thus ended, and said tape is thus left at a position ready to move forward on the sounding or striking of another alarm. The tape, after passing through the transmitter, is taken up on a reel 107, Figs. 9 and 12, with separable flanges to allow the roll of the tape to be removed when the reel is full. Said reel is operated by a weighted cord 108, a drum 109, and a train of gear-wheels 109′, 110, 111, and 112, connected with said reel. To prevent undue tension being brought on the tape as it is being wound on the reel, so as to tear the tape, I have provided an ordinary guarding-lever 113 and mechanism for operating the same.

The lock-out mechanism, by means of which a second alarm attempted to be transmitted over another circuit from that over which the first alarm is being transmitted is locked out, is illustrated more clearly on Sheet 3, in which 119 are posts, upon which a vibrating frame 118 is pivoted or fulcrumed, said frame consisting, preferably, of two long bars or rods extending the length of the series of relays and end rods connecting the same. At about the center of the frame, and forming a part of the same, is a bar 132, which is rigidly connected with an armature 130. Said armature connects with suitable magnets 131

on the local circuit 92, connected with the battery *d*. When the perforator and transmitter are operated by the transmission of an alarm, the circuit 92 is closed, and the frame-work at the side thereof toward the relay-magnets is lowered. On the under side of the frame 118 at the edge toward said relay-magnets are arranged a series of stops or lugs 117, Fig. 4, which correspond with the arms *k*, one for every circuit. Beneath said frame on a pivoted bar 107′, extending parallel with the lower bars or rods of the frame, are arranged a series of lock-blocks 116. These may be provided each with pin or support 12^a, Fig. 4, against which an indicating plate or drop 123 may rest, which latter, when the lock-block is turned, as hereinafter described, will be thrown forward and downward by said block to indicate to the attendant the circuit over which the alarm has been transmitted. The drops are or may be pivoted on a bar 122, supported by suitable posts, preferably the ones carrying the pivoted bar 107′. The movement of the frame 118 may be controlled or steadied by limiting or adjusting screws 120 120, carried by suitable ears, arms, or bearings of the posts 121, as indicated in Figs. 4 and 5. Counterbalance-weights 126 are provided, as shown in Fig. 3, to raise the armature and its attachments after the circuit is broken.

When the first alarm has been transmitted over the circuit *f*, as described, and the local circuit *m* closed by the action of the spring *j*, and the arm *k*, connected with the armature *i*, moved as heretofore described, the said arm *k*, which engages the lower part of the pivotal block 116, turns the latter pivotally, so that its opposite side is caused to push the drop 123, so that it falls and indicates the circuit over which the alarm is being transmitted. The upper side of the block thus moved, of course, moves in the opposite direction, so that the lug 117, corresponding with the block thus turned, passes (when the frame drops) forward of an upward extension of said block. The circuit *m* for operating the punch and transmitter having been closed, as described, the mechanisms of said punch and transmitter operate to close the local circuit 92, and to cause the frame 118, with its lugs 117, to drop, and the latter, with the one exception above noted, to pass to the position shown in Fig. 4 into locking engagement with the block 116, so that the latter is prevented from turning, and thus the armature *i* and arms *k* of all the circuits, with the exception of the first one, are prevented from operating, so that the revolution of the ordinary circuit-wheel at the fire-alarm station will have no effect until after the transmission of the first alarm is completed, when the parts regain their normal positions. When the pivotal block 116 is turned by the movement of the armature-arm *k*, a limb 114′ of said block presses against a spring 124 and brings it in contact with the point or terminal 125 of the divided circuit *f*. To secure a certain closing of the circuit 92, which operates the locking mechanism, so as to prevent the relays *g* from being locked in an open position, so that the interference of alarms will not be prevented, I have provided terminals 92^5 92^5 on a divided circuit with the lever and insulated terminal of the transmitter to assist the same and secure an instantaneous closing. This is obtained by means of the plunger 68, which depresses the lever 166 and forces the said terminals 92^5 into contact.

In operating the device to secure an alarm which indicates the locality of a fire on the several bells, gongs, &c., of the engine-houses, central office, and towers of the system, a lever or other handled mechanism is pulled or operated at the district or local alarm box *b*, to release and secure an operation of the circuit-wheel or other changer therein. In the case under consideration the normally-closed circuit *f* is broken by the operation of the circuit-changer. The circuit being thus broken and the flow or action of the electrical influence from the battery interrupted, the effect of breaking is first transmitted over the wire *f* to the engine-house gong or tapper, if such there be on the circuit, effecting an alarm thereon. The current or effect of breaking is continued over the line *f* to the central office, and first passes to the particular relay or electro-magnet corresponding with the circuit thus broken, demagnetizing said magnet so that it releases the co-operating armature-arm *k*. The said arm, being thus free, is acted on by the spring *j*, and is drawn into contact with the local circuit *m*, closing said circuit, magnetizing its electro-magnet 23, and occasioning the several results which will subsequently be described. The movement of the arm *k*, owing to the demagnetizing of the electro-magnet *g*, turns the locking and shunt-closing block 116, Fig. 4, on its pivotal rod 107′, so that the pin or projection 114′ thereof engages the spring terminal 124, and forces it against its co-operating terminal 125. The contact of said terminals closes the shunt of the circuit *f*, so that subsequent flows of the current pass thereover and the repeater-terminals of the particular circuit are cut out. Thus the repeater cannot repeat the strokes which have already been sounded on the engine-house gong of said particular circuit and thus produce a false alarm or confused ringing. This shunt is more particularly desirable where tappers are employed, and the circuit-wheels of the alarm-boxes are consequently made to move at a rapid rate of speed. The metallic circuit also passes through the repeater; but the breaking of the particular circuit at the alarm-box is ineffective in producing any direct operation thereat. The central-office bell is sounded, however, to notify the attendant, who will in consequence be on the alert to notice any failures to operate or defects

in operation. At the closing of the circuit *m*, owing to the attraction of the armature *i*, and contact of terminals *k l* the current starts from the battery *n* and magnetizes the magnet 23, which attracts the armature 22, and through the medium of the mechanisms described allows of the operation of the punching or indenting mechanism under the exerted power of the motor 37^2 and co-operating parts. Through the intervention of the reciprocating rod 14 and its co-operating parts the repeater mechanism is released, so that its motor is effective in causing the repetition of the alarm-impulse over all of the circuits of the city, excepting the one on which the alarm was first sent in.

The circuit *m* is provided at the central office with the key m^{12}, by which the alarm may be transmitted therefrom by hand.

The closing of the local circuit *m*, in addition to liberating the punching mechanisms for indenting or perforating the transmitter-tape and releasing the repeating mechanisms, also closes another circuit 92 for operating in connection with the magnet 131 a locking mechanism by which the several circuits, other than the one over which the alarm has been first transmitted, are prevented from effecting the local circuit *m* and producing an interference. To secure a certain and quick closing of said circuit 92, and a continuous holding of the same during the several repetitions of the alarm, the closing is effected at two places in the system—first at the perforator, in which case the plunger 68, under the influence of the motor 37^2, engages the lever 166 and positively and instantaneously drives the terminals 92^5 together. This circuit is also closed at the transmitter, the closing depending on the less instantaneous dropping or changing of the position of the tape released by action of the magnet 23 and unwinding of the reel in the perforator. The dropping of the tape allows of a corresponding movement of the lever 100, which is in metallic circuit with the frame 71 and wire 92. When said lever drops, it engages a contact-point 92^a and closes the circuit 92, where it remains until the tape 42 rises at the end of the alarm and breaks the connection, as will be understood upon reference to Fig. 8. The closing of the circuit 92 magnetizes the electro-magnet 131, attracts the armature 132, and locks all the circuits, except the one over which the alarm was first sent to prevent an interference. The passage of the indented or perforated tape either opens or closes the tower-bell or slow-stroke-bell circuit 92′ to effect an alarm in the manner already described with sufficient fullness. By thus making or breaking the main circuit *f* the local circuit *m* is either made or broken (in the present case the open circuit is closed) to operate the punch or perforator and set the tape in motion. The tape immediately begins to make a fullness between the perforator and the transmitter, because of the differences in the speed of the different parts as it passes through said perforator and transmitter. The current or the effect of interrupting the current also passes to the repeater over the main circuit *f*, from which the alarm is transmitted to all the several engine-houses connected therewith. While the alarm of the first circuit is thus being transmitted and repeated, the other circuits are locked out, so that no alarms can be transmitted or repeated which would tend to a confusion of strokes on the bells, gongs, &c. After the circuit-wheel of the first box has finished its revolutions and the alarm from said first circuit has been sounded any locked-out alarm from either of the other circuits will then be transmitted to and sounded over the bells and gongs, provided the circuit-wheel of the second station is still in operation at the close of the operation of the first-circuit mechanisms; but in practice I prefer to employ at the central station in connection with each of the circuits a tapper or small gong which will not be cut out while an alarm is being transmitted over another circuit. This tapper will indicate to the attendant by the confused ringing of the two alarms at the central station the fact of two fires or a second alarm, and then by cutting out the repeater-spring *p* of the circuit of the second alarm he will secure a unitary alarm on the tapper, indicating the location of the second box. After the ringing of the first alarm is finished the attendant may then sound the second alarm by means of an ordinary key m^{12}, arranged in connection with the circuit-wires *m*, so as to close the circuit and thus operate the perforator.

When it is desired to employ a tapper in the engine-house in addition to the gongs, so that the circuit-wheels of the fire-boxes may be made to work at a more rapid rate of speed to produce, say, two strokes to the second, so that the alarm may be first quickly sounded on the said tappers to awake the firemen or to call their attention to the alarm before it is repeated on the gongs, which ordinarily work at the rate of, say, one stroke to the second, all that will be necessary will be to duplicate the repeater with its weight 94 for controlling the fullness of the tape and the speed of the transmitter friction-rolls being regulated accordingly. The tapper would in this case be on the main circuit with the fire-boxes and the gongs on an independent circuit.

By means of the perforated tape a record may be kept of the date, &c., of the fire, by a simple writing on the said tape adjacent to each series of perforations. Thus additional records are rendered unnecessary.

It is evident that a very large number of modifications and mechanical changes may be made in the device without departing from the spirit or scope of the invention, and although I have described many constructions positively I do not wish to be understood as limiting myself thereto.

In regard to the perforator, it is evident that instead of perforating the tape I may simply indent the same, the indentation or the corresponding projection on the face of the paper serving as a means of breaking or completing the circuit.

While the several parts or mechanism of the system are especially adapted in connection with a fire-alarm, yet the individual parts or mechanisms may be employed in other connections. It is also apparent that the several devices may be made to operate on either an open or closed circuit without any material change in the invention, and in lieu of weights springs may be employed.

Having thus described the invention, what I clam as new is—

1. In a fire-alarm system, the combination, with circuits *f*, having alarm-boxes, repeater-terminals, engine-house and central-office gongs, and electro-magnets *g* thereon, of a local circuit *m*, controlled by said electro-magnets and having the electro-magnet 23 thereon, which controls the repeater-terminals of the circuit *f* and operates perforating or indenting mechanisms and changer-terminals 92^5, a circuit 92, having said terminals, an electro-magnet 131, and a lock controlled by said magnet, a transmitter for effecting an alarm on the tower-bell, said tower-bell, and a circuit 92′, connecting therewith, a tape extending from the perforator to the transmitter, means for moving the same forward at varying rates of speed, whereby a fullness is formed between said perforator and transmitter, and a circuit-changer 100 of said circuit 92, controlled by said tape, and all said parts being arranged and adapted to operate substantially as and for the purposes set forth.

2. In a fire-alarm system, the combination, with fire-alarm-box circuits having electro-magnets *g*, armatures for closing a local circuit *m*, and an electro-magnet arranged on said local circuit and controlling a locking-circuit having magnet 131, of a lock consisting of a frame connected with the armature of magnet 131, and blocks 116, adapted to be held by said frame and to engage arms of the armatures of the magnets *g*, substantially as and for the purposes set forth.

3. In a fire-alarm system, the combination, with the shunted fire-alarm-box circuit *f* and its magnets *g*, of a local circuit and its magnet, a repeater and mechanisms for operating the same, circuit 92 and its magnet, an armature for changing said local circuit, a spring *j*, blocks 116, having pins or projections 114′ for affecting the terminals 124 125 of the shunt, and a locking-frame, all said parts being arranged and adapted to operate substantially as and for the purposes set forth.

4. In a fire-alarm system, the combination, with a series of fire-alarm-box circuits, each having a magnet *g*, and armature *i*, of an arm arranged to form a part of a local circuit *m*, a series of blocks 116, pivoted as at 107′, and a series of plates or drops 123, adapted to indicate the circuit over which the alarm has been transmitted, substantially as and for the purposes set forth.

5. In a fire-alarm system, a repeater, combining therein a frame *q*, contact-points *t*, spring *p*, wires *f*, lever *r*, spring *s*, cam *w*, revolving on a shaft with an arm 3, and a reciprocating shaft 14, all said parts being arranged and combined substantially as and for the purposes set forth.

6. In a fire-alarm system, fire-alarm-box circuits having terminals in the repeater and relay magnets *g*, a local circuit *m*, having armatures controlled by said magnets *g*, and having thereon a magnet 23, armature-arms *k*, adapted to be locked to prevent operation by an attempted alarm from a second box, a locking-circuit 92, having terminals in both the perforator and transmitter controlled by said magnet 23 and having magnet 131, and an armature having locking mechanisms therewith connected for locking said arms *k*, a perforator for perforating or indenting the tape controlled by said magnet 23 and actuated when released from such control by a motor, a plunger 68, also actuated by said motor for releasing the tape-reel and operating the terminals 92^5, a reciprocating rod 14 for engaging the repeater, also actuated by said motor and adapted to allow of the release of the repeater-motor, said repeater and its motor, a transmitter having therein terminals of a tower-bell circuit, said circuit friction-wheels for forwarding the tape, a motor for operating the same, a weight for holding the tape taut between the perforator and transmitter, and said tape adapted to affect the terminals of the locking-circuit in said transmitter, substantially as set forth.

7. In an electric fire-alarm system, the combination, with magnets *g*, batteries, a repeater, fire boxes or stations, and engine-houses, gongs or bells, all arranged on a circuit with suitable connecting-wires, of a local battery opened or closed by mechanism operated by the main circuit and having thereon a punching apparatus, a transmitter, a tower-bell circuit, and a weight 94, arranged between the transmitter and punching apparatus, keeping the tape taut, said parts being arranged and combined substantially as and for the purposes set forth.

8. In an electric fire-alarm system, the combination of a perforator or punch adapted to perforate or indent the paper, a transmitter adapted to be affected by the perforations or indentations in said paper in transmitting an electric current, the said transmitter being adapted to forward the paper at a slower rate of speed from that of the punch, and thus form a fullness in the forwardly-moving paper, and a weight resting on said paper for holding said paper taut, and stopping mechanism arranged in connection with said transmitter and adapted to stop off the movement,

said stopping mechanism being operated by the tightening paper, substantially as and for the purposes set forth.

9. In an electric fire-alarm system, the combination, with a suitable frame, of tape rolls and gearing for operating the same, a lever 100, adapted to engage the tape at one end and to enter into holding engagement with the gearing at the other end to stop the same, substantially as and for the purposes set forth.

10. In a fire-alarm system, the combination of a punching apparatus adapted to indent or perforate the paper tape and to cause the same to travel forward at a given rate of speed, and a transmitter adapted to be affected by the punched tape to transmit the alarm and having means, as described, for carrying the paper forward at a less rapid rate, a weight 94, arm 96, and roller 97, all arranged and adapted to operate substantially as and for the purposes set forth.

11. In a fire-alarm system, the transmitter combining therein frames 71, terminals adapted to be connected to transmit the current, rolls for carrying the tape forward, gearing for operating the rolls, and arms 102, operating, in connection with said gearing, a lever having a roll 106 to engage the tape at one end and a hook or projection 103 at the other end, adapted to engage said arm, substantially as and for the purposes set forth.

12. In a fire-alarm system, in combination, the frame 17, crank-wheel 20 and train of gear-wheels, and a weight or its equivalent for revolving the same when released by the catch, a magnet 23, armature 22, and a lever 26, provided with a catch, a reciprocating shaft 14, connected to said crank, an arm 3, shaft *v*, gear-wheels and weight 7′, or its equivalent, a cam, a lever, and a series of terminals, all arranged and adapted to operate substantially as set forth.

13. In a fire-alarm system, the combination, with a series of magnets and armatures and arms *k*, connected therewith, of an armature lever 132, a frame 118, having teeth or locking devices 117, and a series of pivoted pieces or blocks 116, adapted to engage said arms *k* to hold the same and be held by said locks 117, substantially as and for the purposes set forth.

14. In a fire-alarm system, the combination, with the relay *g*, armature *i*, arms *k*, and conducting-wires *f f*, a frame 118, pivoted on suitable studs or standards and provided with locking-teeth 117, an armature, magnet, and conducting-wires for controlling said frame, a series of pivotal blocks 116, arranged on a shaft 107′, to be engaged by the said arms *k* and teeth 117, and drop-plate 123, adapted to indicate the circuit over which the alarm has been transmitted, substantially as and for the purposes set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 1st day of June, 1888.

JOHN SPEICHER.

Witnesses:
CHARLES H. PELL,
C. H. BALDWIN.