

May 17, 1932.

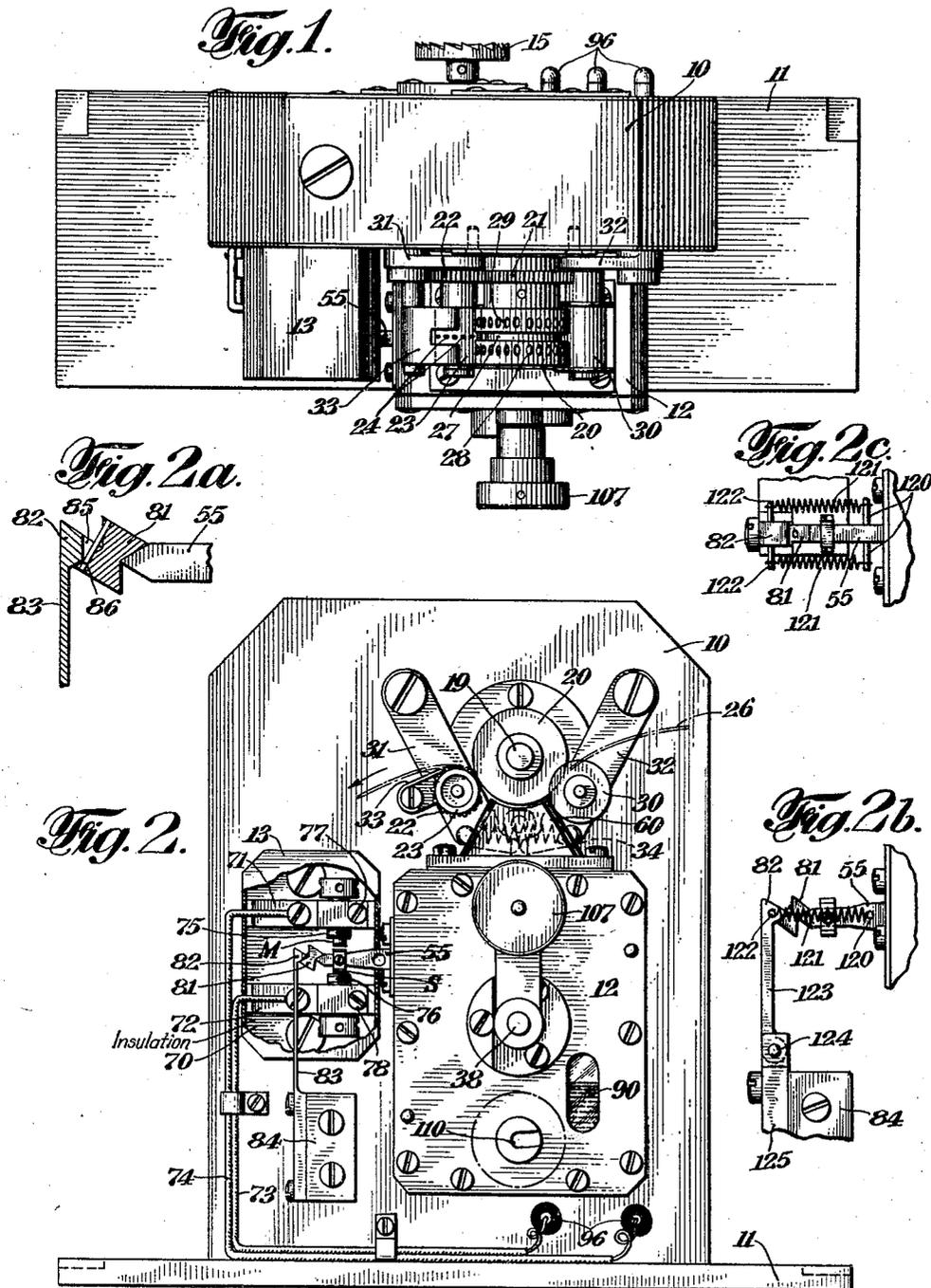
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1,858,511

AUTOMATIC TELEGRAPH KEYING HEAD

Filed May 22, 1931

6 Sheets-Sheet 1



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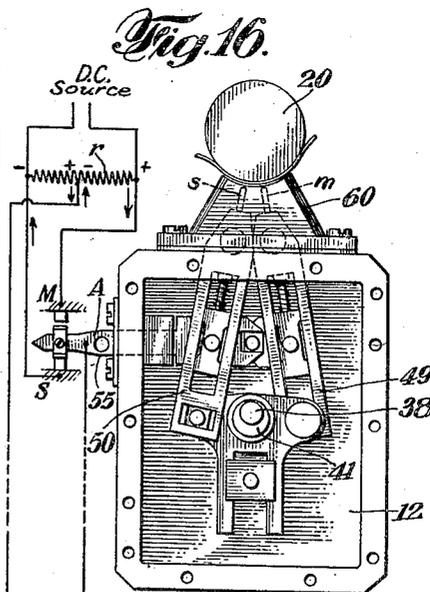
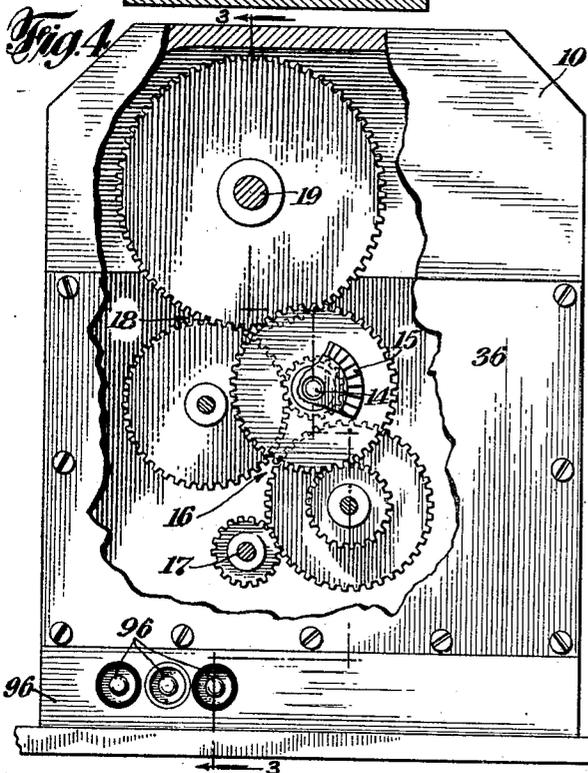
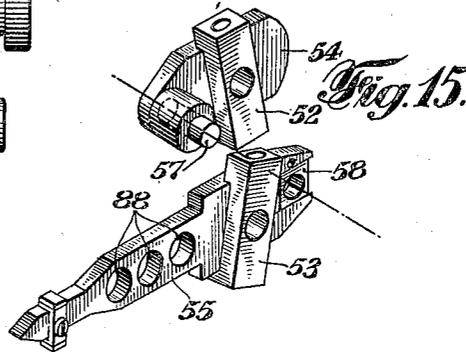
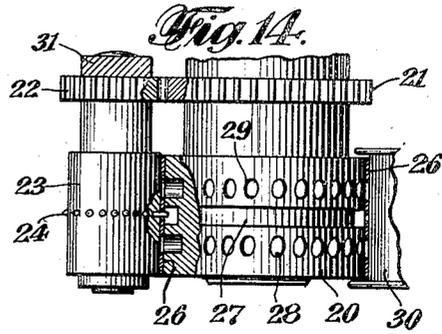
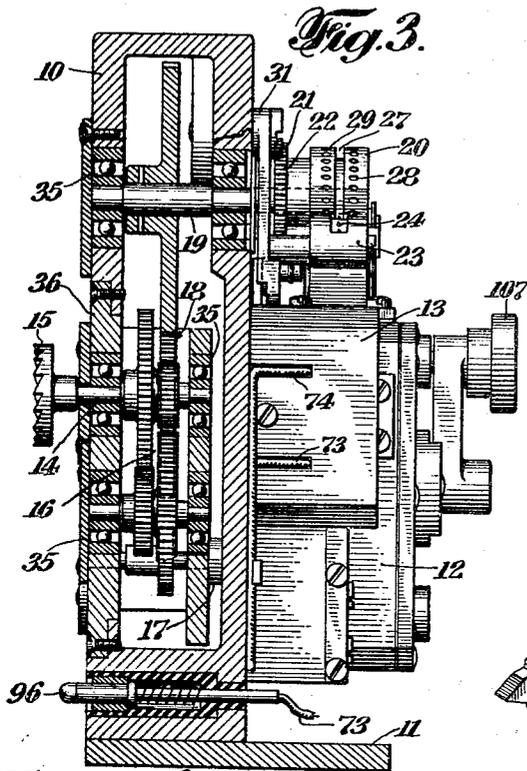
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AUTOMATIC TELEGRAPH KEYING HEAD

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6 Sheets-Sheet 2



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AUTOMATIC TELEGRAPH KEYING HEAD

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6 Sheets-Sheet 3

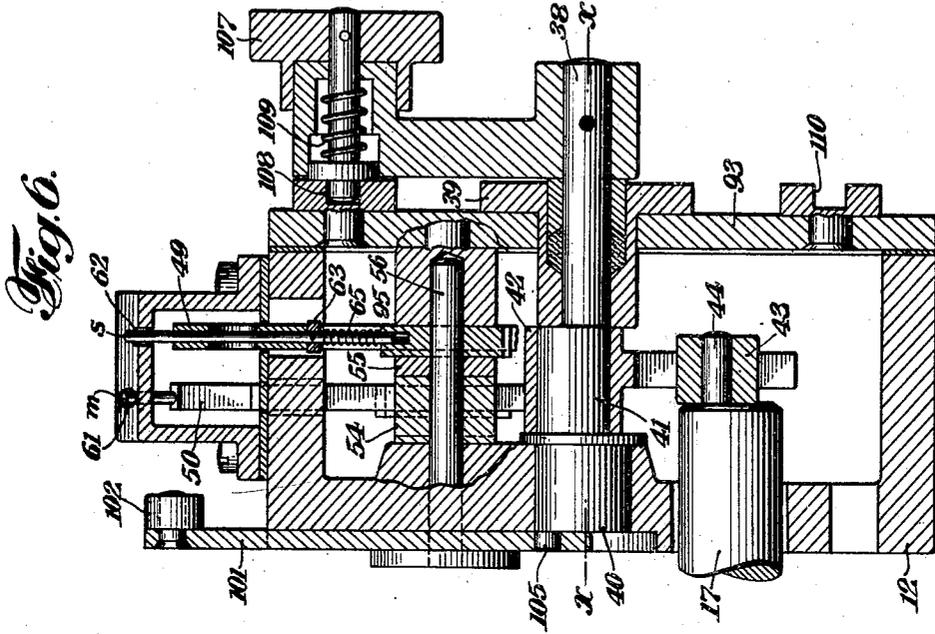


Fig. 6.

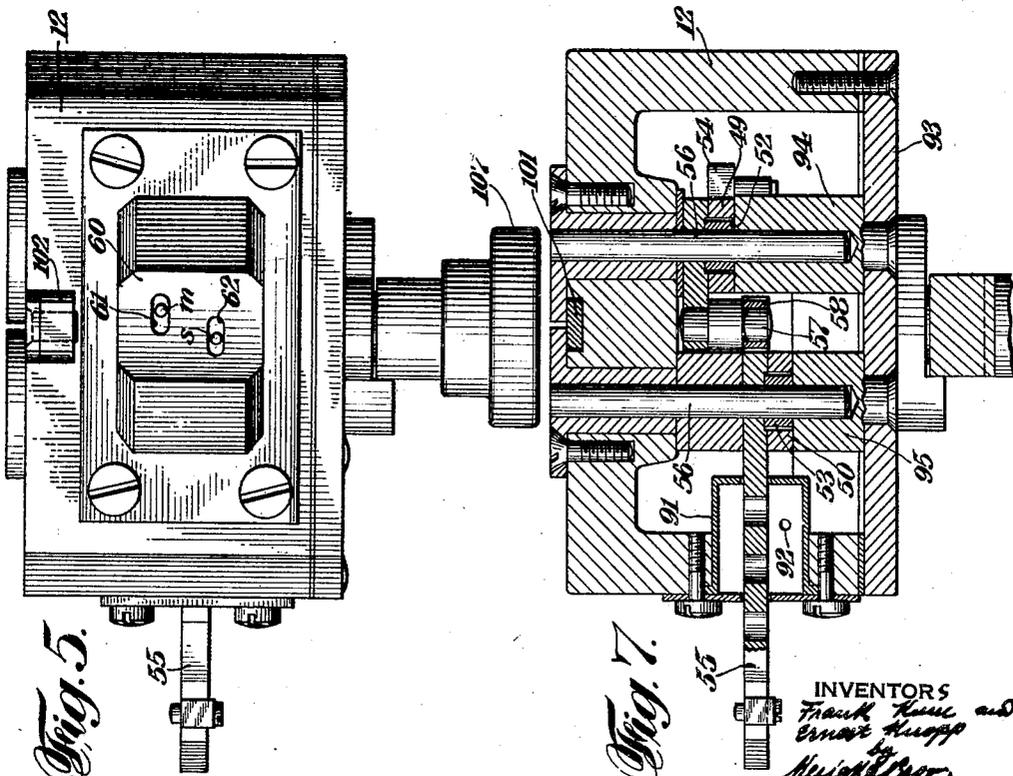


Fig. 5.

Fig. 7.

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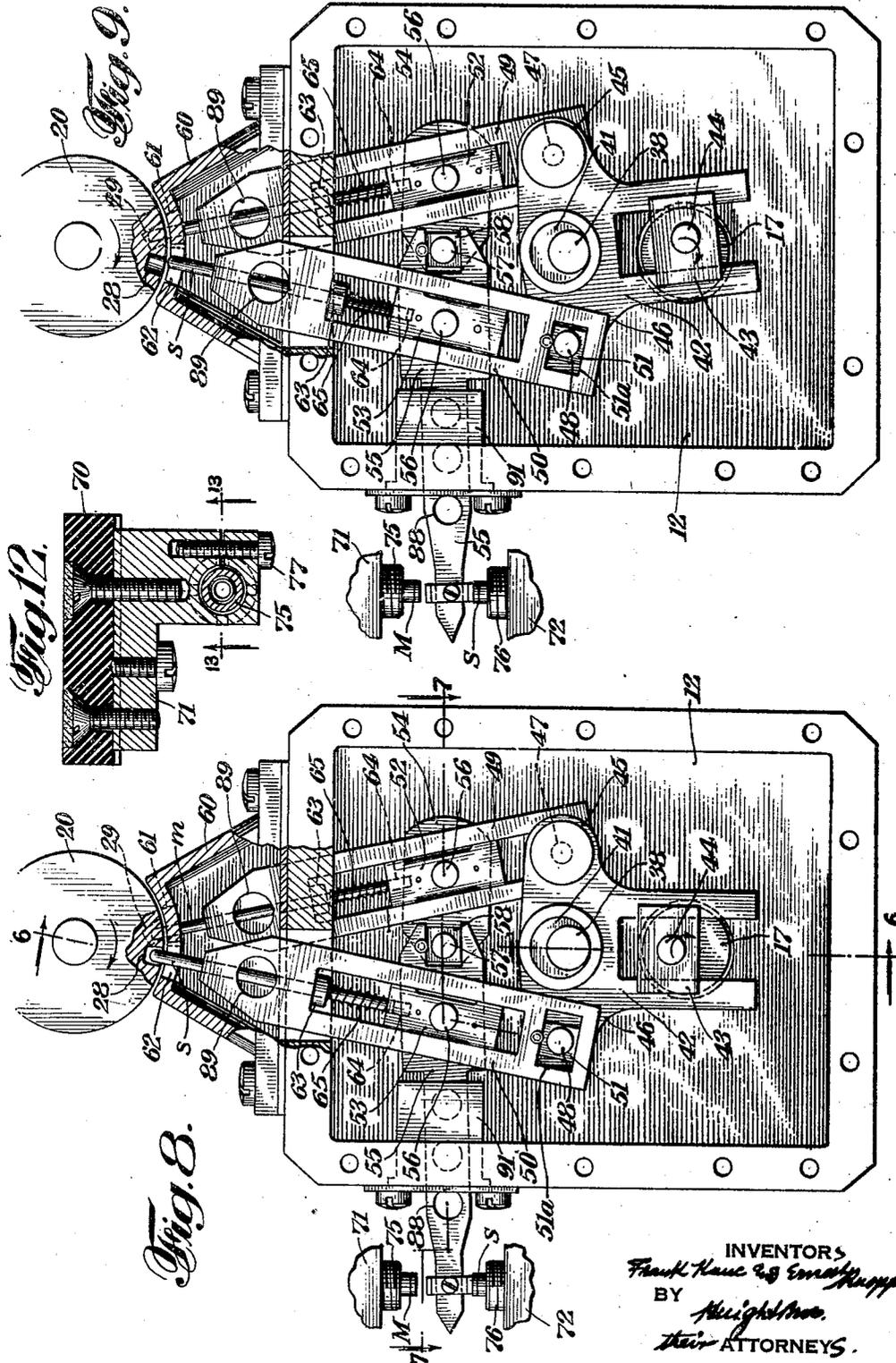
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AUTOMATIC TELEGRAPH KEYING HEAD

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6 Sheets-Sheet 4



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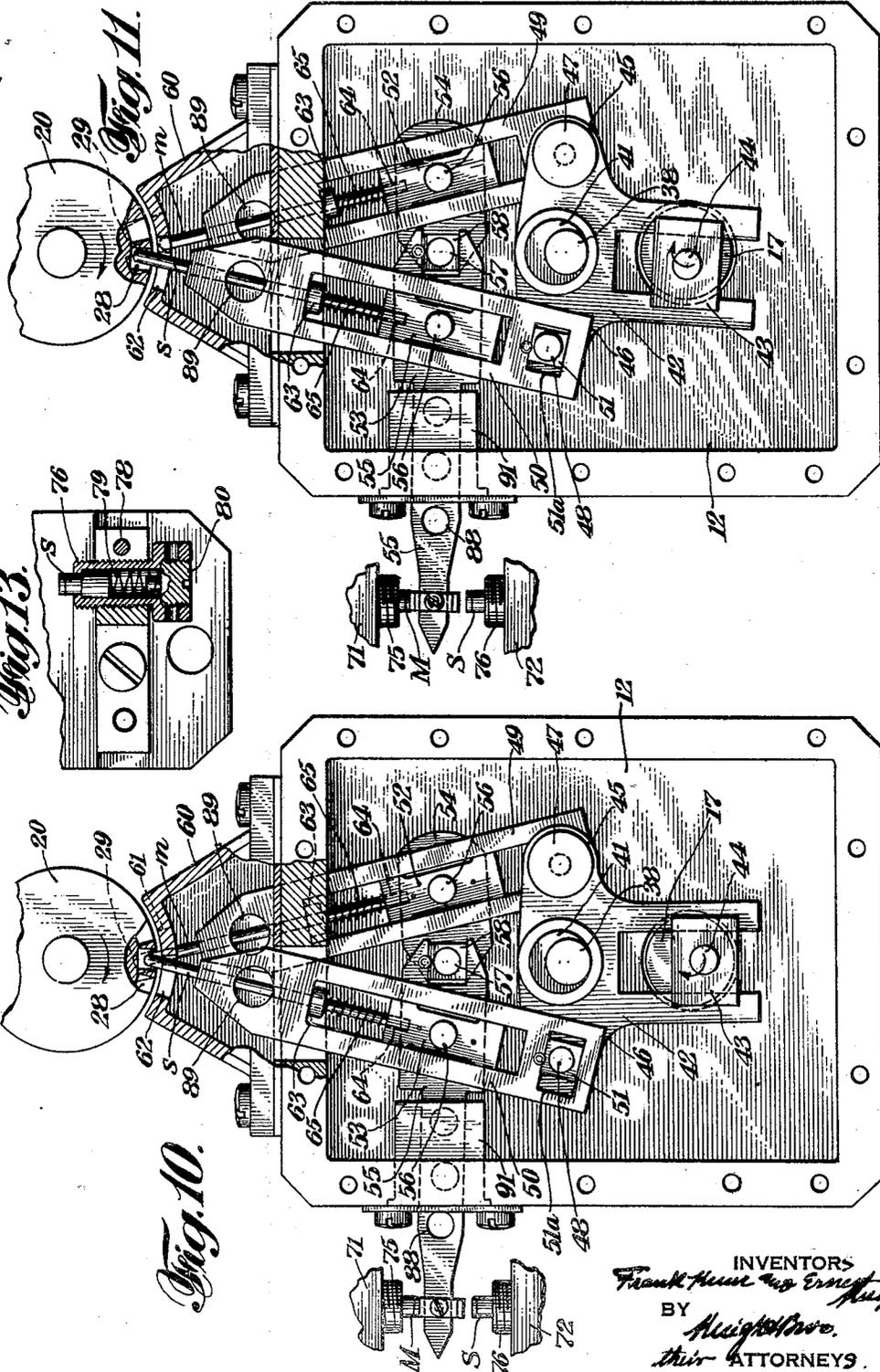
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AUTOMATIC TELEGRAPH KEYING HEAD

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6 Sheets-Sheet 5



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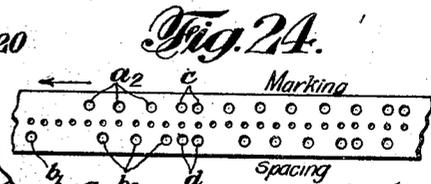
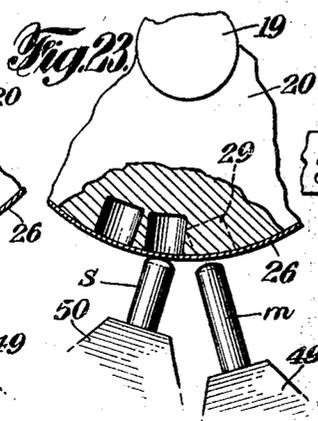
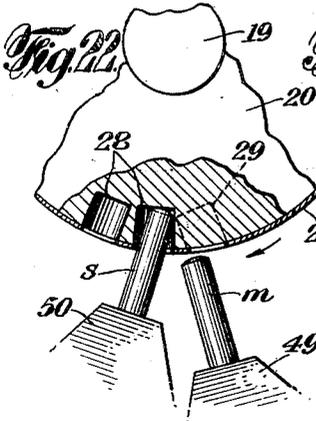
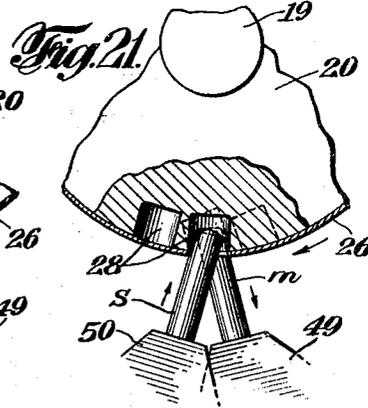
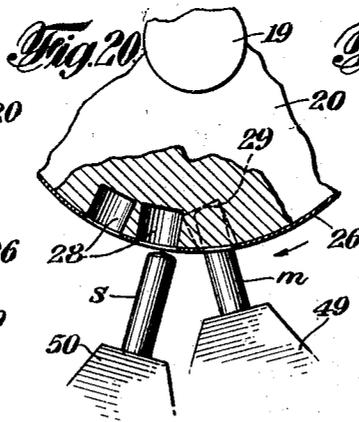
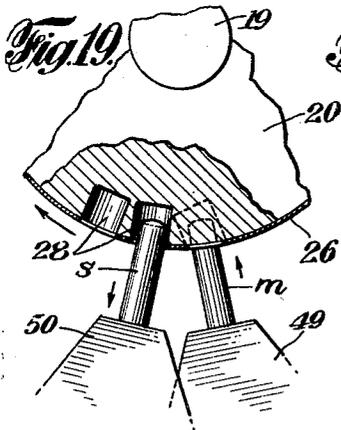
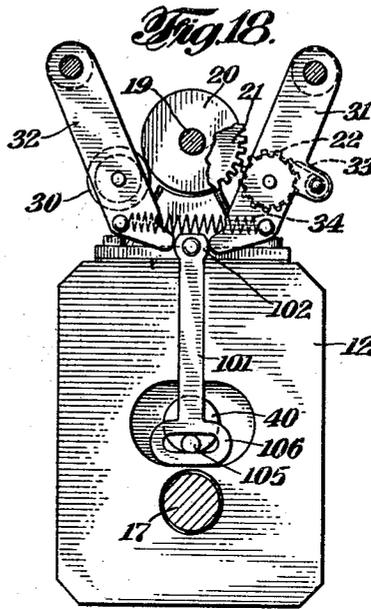
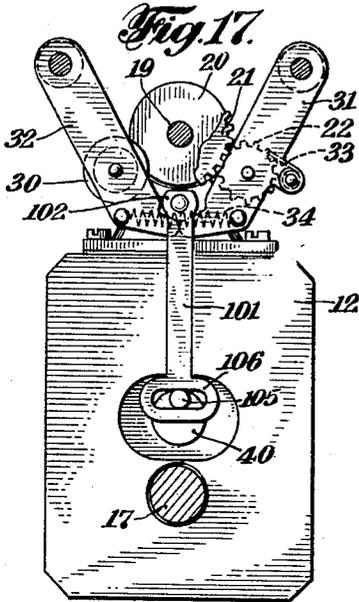
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AUTOMATIC TELEGRAPH KEYING HEAD

Filed May 22, 1931

6 Sheets-Sheet 6



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AUTOMATIC TELEGRAPH KEYING HEAD

Application filed May 22, 1931. Serial No. 539,334.

Our invention relates to automatic keying heads for transmitting telegraphic code signals, for instance in Morse code, automatically by operating this key through perforations in a tape, previously made in the latter in suitable combination to represent the different signal symbols.

Automatic keying heads of this type are well known in the art and our improvements relate in particular to the mechanical construction of such keys by which we are enabled to operate the key at a much higher speed than is possible, so far as we are aware, with the keys at present in use.

The present day automatic keys either "make" or "break" the contact, or do both, by spring power, and only the mechanism which controls the springs is positively operated. As soon as a certain operating speed is attained by such a key, natural oscillations are set up in the contact mechanism, due to the elasticity of the springs and the masses which they control, which oscillations seriously interfere with the proper timing of the contacts, with respect to their "make" and "break", so that for instance Morse dots and dashes become very irregular and indistinguishable from one another.

In our improved automatic keying mechanism these difficulties are overcome by positively gearing and operating at all times all elements of the mechanism which are directly concerned in the movement of the contact arm, so that this arm is at all times only positively moved, whereby the operating speed of the key can be increased to several times the speed of the keys at present in practical use for line or radio transmission.

Our invention is illustrated in the accompanying drawings in which—

Fig. 1 represents a top plan view of the keying head;

Fig. 2 represents a front view of the keying head with parts broken away to show the contact mechanism;

Fig. 2^a represents a detail in greatly enlarged, partly vertical sectional view, of the toggle joint in Fig. 2, for holding the contact arm in contact position;

Fig. 2^b represents in similar scale a modification of the toggle joint shown in Fig. 2^a;

Fig. 2^c represents a plan view of Fig. 2^b;

Fig. 3 represents a left hand end view of Fig. 2 partly in section on line 3—3 in Fig. 4 showing the details of the gear drive.

Fig. 4 represents a rear view of the keying head, with parts broken away to show the gear drive;

Fig. 5 represents a plan view of the selector lever gear housing in larger scale;

Fig. 6 represents a vertical section of the same housing on the same scale taken on the line 6—6 of Fig. 8;

Fig. 7 represents a horizontal section of the lever housing through the lever pivots on line 7—7 of Fig. 8;

Fig. 8 represents a front view of the lever housing in the same scale with front cover removed, showing the selector pin levers in a position in which both selector pins are drawn furthest apart, pin *s* receding from, pin *m* advancing into a hole in drum 20, contact arm on lower (spacing) contact;

Fig. 9 represents the same view as Fig. 8, with the driving crank pin for the selector levers advanced over Fig. 8 one-quarter turn to position II, showing the marking selector pin *m* advanced completely into a hole of the selector drum, contact arms still down, spacing selector pin withdrawn from selector drum hole, contact arm about to be lifted from spacing contact S;

Fig. 10 represents the same view as Fig. 8 with crank pin advanced another one-quarter turn to position III, both selector pins in transverse alignment, contact arm has been moved up to marking contact M, pin *m* about to withdraw from, pin *s* advancing into drum hole;

Fig. 11 represents the same view as Fig. 8 with crank pin advanced another one-quarter turn to position IV, spacing selector pin *s* advanced completely into selector drum hole, pin *m* completely withdrawn, contact arm still up, ready to return to spacing contact S as in Fig. 8;

Fig. 12 represents a greatly enlarged horizontal section through the lower contact block 72 of Fig. 2;

Fig. 13 represents a greatly enlarged frag-

mentary vertical section through the contact block tip on the line 13—13 Fig. 12;

Fig. 14 represents a greatly enlarged fragmentary detail of the tape drive seen in plan in Fig. 1;

Fig. 15 represents an exploded perspective view of the contact lever and its interlinking lever shown in Figs. 8 to 11;

Fig. 16 represents a front view of the selector lever housing in reduced scale, showing the eccentric mechanism for throwing the selector lever gear down to keep both selector pins out of engagement with the tape and the tape drum to allow insertion of the

Fig. 17 represents a rear view of Fig. 16, showing the tape feeding rollers in gear with the selector or tape drum;

Fig. 18 represents the same rear view showing the feeding rollers thrown out of gear with the selector drum, to allow the insertion of the tape;

Figs. 19 to 23 show in greatly enlarged scale different operating positions of the selector pins with relation to each other and with the selector drum,

Fig. 19 showing the spacing pin *s* retracting from, and the marking pin *m* advancing through a hole in the tape, into a selector drum hole (corresponding to position Fig. 8),

Fig. 20 showing the marking pin *m* entirely advanced, spacing pin *s* entirely withdrawn, rotation of selector drum about to carry pin *m* to left to throw contact lever up, (corresponding to position Fig. 9),

Fig. 21 showing the spacing pin *s* advancing, marking pin *m* retracting. (corresponding to Fig. 10),

Fig. 22 showing the spacing pin *s* entirely advanced, marking pin *m* entirely withdrawn, rotation of selector drum about to carry pin *s* to left, to throw contact lever down (corresponding to Fig. 11),

Fig. 23 showing the relative position of selector pins as in Fig. 22, but prevented from entering drum holes when tape has no perforations;

Fig. 24 represents a fragment of a perforated transmitting tape, to show spacing of telegraph code symbols, and

Fig. 25 represents a similar fragment of a receiving tape on which the transmitted symbols are recorded in dots and dashes of the telegraph code.

Discussing first the underlying principle of the conventional perforated tape control for automatic keying, reference is made to Figs. 24 and 25 and to the circuit diagram shown in Fig. 16. In this latter figure for example a direct current source *D. C.* is employed at the transmitter end of the system, shown in that figure, across which source a resistance *r* is connected which is tapped in the center. One end of this resistance is connected to the

"spacing" contact *S* of the transmitter key, and the other end of the resistance is connected to the "marking" contact *M* of the key. The center of the resistance is connected to one terminal of the receiving coil at the distant receiver, the other end of this coil being connected to the contact *A* of the contact arm which operates between the two contacts by the function of the key mechanism which will be described later. If for instance the arm contact *A* is thrown onto the spacing contact *S*, a current flows from the center of the resistance, through the line, in the direction of the right hand arrow through the receiver coil and through the other side of the line over contacts *A*, *S* to the minus side of the source. If the arm contact *A* stands on the "marking" contact *M*, the current flows in the direction of the left hand arrow through the distant receiver coil. Thus, according to the position of the key contact arm, the distant receiving coil, by means well known in the art and not shown here, causes the throw of an inked pen *p* to one or the other side of a moving receiving tape, of the character shown in Fig. 25. The time for which the pen remains on one or the other side of the tape depends upon the duration of the contacts between contact *A* and *S* or *M*. When contact is made for a certain length of time at *M*, for instance one of the markings *a*₂ heavy lined in Fig. 25 is produced on the receiving tape which represents a code dash. When contact is made at *S*, the pen swings to the other side of the tape and now the first of the spacing symbols *b*₂ is produced which spaces the first code dash *a*₂ from the second following dash *a*₂. When "marking" contacts of shorter duration are made, code dots such as *c* in Fig. 25, followed by spaces, the same as *b*₂, will be produced. If the contact arm remains a comparatively long time on the spacing contact, long spaces, such as between words, shown at *b*₁ in Fig. 25 are produced.

The correspondingly perforated tape shown in Fig. 24 when fed through the transmitter keying head according to the present invention, permits two suitably disposed selector pins, one for each longitudinal row of holes, to enter the perforations and a pin conveying drum in a manner to be described presently, and while a pin remains in the perforation and in the drum, and the latter with tape continues to travel, the pin is taken along laterally a certain distance and by its tilting causes the contact *A* of the key to move on one or the other contact and to produce the signals referred to hereinabove. For instance, a selector pin entering the first marking hole *a*₂ in Fig. 24 would be taken to the left with the travelling tape and by the mechanism to be described would close immediately the marking contact which remains closed (thereby producing the first dash *a*₂ in Fig. 25) until the other selector

pin encounters the next spacing hole b_2 in Fig. 24, when the contact arm is thrown at once onto the spacing contact to produce the first space b_2 in Fig. 25, which ends when the marking pin encounters the second marking hole a_2 which throws the contact arm back onto the marking contact of the key, and so forth. The two tape fragments in Figs. 24 and 25 are shown vertically above one another and the tracing produced by the receiver pen p according to each particular transmitter tape perforation shown in Fig. 24, is shown immediately below in Fig. 25.

With this preliminary explanation in mind, the mechanical construction and function of the keying head will now be described.

The keying head consists of four principal mechanisms: the selector pin operating lever mechanism shown in detail in Figs. 6 to 11; the driving gear trains for the lever mechanism, shown in detail in Figs. 3 and 4; the contact lever mechanism, shown in Fig. 2; and the tape release mechanism shown in Figs. 2, 6, 16, 17 and 18.

Referring first to the driving gear trains and to Figs. 1, 2, 3 and 4, the keying head comprises a main box 10 which contains the driving gear and which is mounted on a base plate 11, as shown more particularly in Fig. 2. On the front of the main box 10 is mounted the selector lever box 12 and adjacent to the latter the contact box 13.

The driving gear in main box 10 comprises a driving shaft 14 which protrudes at the rear of the box as shown in Fig. 3 carrying at its outer end a saw tooth coupling 15 by which it is coupled to the conventional driving mechanism used in this type of key (not shown). Through a train of step up gears 16 shaft 14 drives the main operating shaft 17 which extends into the selector lever box 12, and which will be referred to later. Through another train of step down gears 18 shaft 14 drives the selector drum or tape drum shaft 19 on which is mounted at the front of box 10 the selector or tape drum 20 right above the selector lever box 12. This selector drum, shown more detailed in Fig. 14, is provided with a gear 21 at the outside of box 10 which meshes with a gear 22 integral with the star wheel roller 23, the pin teeth 24 of which engage the central row of perforations of the tape 26 shown in Fig. 24, when the tape is laid around the lower portion of the tape drum periphery as shown in Fig. 2. The pin teeth 24 run freely in a groove 27 provided in the tape drum 20. By this last described gearing the tape is positively driven with respect to the drum 20, so that the perforations in the two outer rows of the tape when present, will always precisely register with the two rows of selector pin holes 28 and 29 provided in drum 20. An idling roller 30 is provided on the other side of drum 20 by which

the tape 26 is guided onto and held on drum 20. The star wheel roller 23 and idling roller 30 are respectively mounted on arms 31, 32, the upper ends of which are pivotally attached to the front of main casing 10. They are held in the position shown in Fig. 2 by means of a tension spring 34 shown in Fig. 2 in dotted lines, thereby pressing the star wheel roller and the idling roller against the tape and selector drum 20. The release of this mechanism for insertion or removal of tape 26 will be described later. Arm 31 is provided with a stripper 33, the end of which extends close to the periphery of star wheel roller 23, straddling the teeth of this roller as shown in Fig. 1, for the purpose of promptly freeing the tape from the star wheel teeth and to facilitate the smooth running off of the tape in the direction of the arrow shown in Fig. 2. From this gear drive, so far described, it will be observed that the selector lever operating shaft 17 (Fig. 3) and the tape or selector drum 20 and the tape feeding star wheel are always operated in exactly timed relation to one another. The shafts of all gear wheels run in ball bearings such as shown at 35, and in order to facilitate the mounting of the gears, the two gear trains 16 and 18 together with the main drive shaft 14 are mounted in a frame 36 which is inserted into the rear wall of gear box 10 as shown in Figs. 3 and 4.

Referring now to the selector pin operating mechanism, contained in lever box 12 this mechanism is constructed as follows. Referring to Figs. 6 to 11, and in particular to Fig. 8, 17 is the drive shaft for this mechanism, previously described as extending from main box 10 into selector lever box 12 as shown in Fig. 6. In the lever box 12 and mounted above shaft 17 is a transverse pivotal shaft which has a thin portion 38 extending through a guide bushing 39 beyond the front of box 12, and which is also provided with a thick portion 40 journalled in the rear wall of box 12. The central portion 41 of this shaft is eccentric for reasons to be described later on. The eccentric portion 41 and the thin end 38 of the shaft are shown in Figs. 8 to 11 in end view. The eccentric portion 41 serves as a pivot for a rocking frame 42 which has a forked lower end in which a guide block 43 is slidingly disposed which block engages a pintle 44 eccentrically disposed at the end of gear driving shaft 17 (see also Fig. 6). Thus when shaft 17 revolves, rocking frame 42 is rocked on eccentric 41 from one side to the other, assuming successively the central position shown in Fig. 8, then after one-quarter turn the inclined position shown in Fig. 9, after another one-quarter turn again a central position shown in Fig. 10, and after another one-quarter turn an inclined position shown in Fig. 11.

Rocking frame 42 has near its pivot point two lateral extensions 45 and 46 which carry respectively the two transverse pivot pins 47 and 48. By these pivot pins the selector pin levers 49 and 50 respectively are attached to the rocking frame 42, for instance as shown at the left hand side of Fig. 8, by means of a transverse sliding block 51, which can slide in the transverse slot 51^a provided in each frame. These levers which have the shape of frames, are guided respectively by guide blocks 52, 53. Guide block 52 is fixed to an interlinking lever 54, and guide block 53 to contact lever 55, which latter protrudes through the wall of box 12, its outer end cooperating with contacts M and S. The shape of these two last mentioned levers is shown more clearly in an exploded perspective view in Fig. 15. These two guide blocks and levers are pivoted each on a separate axle 56, the axles extending from the rear wall through box 12 (see also Fig. 6) on which axles the levers can freely rock. The two levers are besides interlinked by means of a pin 57 which is located in a sliding block 58 slidingly mounted in the rear end of lever 55. These elements are very clearly shown in Fig. 15. From this interlinking it becomes obvious that when one lever is rocked clockwise the other will be rocked counter clockwise, and vice versa. The guide blocks 52, 53 of these two levers, which, as was stated before, serve as longitudinal guides for the respective selector pin frames 49 and 50, are set with respect to the longitudinal axis of their pertaining levers at an angle, as appears for instance from Figs. 8 and 15, so that the two selector pin frames stand inclined towards one another. Assuming for the moment that interlinking lever 54 and contact lever 55 are held stationary and rocking frame 42 is rocked from one side to the other by main drive shaft 17, the two selector pin frames 49 and 50 alternately merely move up and down longitudinally, so that their respective selector pins *m* and *s* which protrude from their upper free ends move alternately into and out of the hollow tape bridge 60 which is mounted on top of gear box 12. For this purpose the top of the bridge, which closely follows the contour of the tape or selector drum 20, is provided with slots 61 and 62 respectively (see also Fig. 5).

As shown for instance in Fig. 8, each of the selector pins *m* and *s* is longitudinally guided in its pertaining frame and is provided with a collar 63 which is located inside of the frame. The inner end of each pin is guided in a hole 64 provided in the pertaining frame guide block. Between the guide block and the collar is arranged a spring 65 which tends to keep the collar in contact with the inner upper end of the frame, and thereby tends to maintain the pin pushed out of the frame as far as possible. Thus, when

such a selector frame is retracted by the rocking motion of rocking frame 42 its selector pin is retracted with it against the tension of its spring. The description of this frame construction has been made only with respect to frame 50, it is the same with respect to the other frame 49.

As will also be noted from Figs. 8 to 11 and also from Fig. 6, the two selector frames 49 and 50 are pivotally attached to rocking frame 42 at opposite sides, frame 49 being attached to the rear of frame 42 in Fig. 8, and frame 50 to the front. The transverse spacing between these two selector frames, which can be very clearly seen from Fig. 6 is chosen so that the distance between the two selector pins *m* and *s* described hereinbefore is equal to the distance between the longitudinal rows of large perforations on the transmitter tape shown in Fig. 24. In Figs. 6 and 8 to 11 the marking pin *m* is located to the rear, and the spacing pin *s* at the front (see also Fig. 5).

The selector drum 20, around the lower portion of which the tape runs, and with the holes 28 and 29 of which the perforations in the tape—if present—register, as has been described hereinbefore, is positively geared and timed with relation to the rocking motion of frame 42, so that for instance when the spacing pin *m* in Fig. 8 commences to protrude through its slot in the tape bridge 60, a hole 29, shown in dotted lines in Fig. 8, has arrived in line to permit the marking pin *m* to enter. The row of marking holes 29 are drilled into drum 20 at an angle to the drum radius so that when the marking pin *m* has arrived near, or at the bottom of a hole, as shown in Figs. 9 and 20, it will come in contact with the wall of the hole at the right hand side, so that when drum 20 continues revolving in the direction indicated by the arrow in Figs. 8 to 11 and Fig. 20, marking pin *m* will be taken along to the left into the position shown in Fig. 10. In other words, guide frame 49 of marking pin *m*, aside from performing a longitudinal motion due to the operation of rocking frame 42, will also swing to the left on its pivot stud 56 from the position in which it is shown in Fig. 8 to the position in which it is shown in Fig. 10. Since the guide block 52 of frame 49 is rigidly attached to interlinking lever 54, this lever is rocked counter clockwise from the position shown in Fig. 8 into the position shown in Fig. 10 which, due to the interlinking of levers 54 and 55, will cause contact lever 55 to rock clockwise to the same angular extent from the position shown in Fig. 8 to the position shown in Fig. 10. In other words, whereas in Fig. 8 the outer end of contact lever 55 which protrudes to the left beyond casing 12 is in contact with the spacing contact S, it has been thrown by the aforementioned rocking motion upward into the position shown in Fig. 10 where it makes contact

with the marking contact of the key. The detailed construction of these contacts will be referred to shortly hereinafter. While the marking pin *m*, as has just been described, enters one of the marking holes 29 of drum 20, frame 50 of spacing pin *s* moves longitudinally downwardly into the position shown in Fig. 9, whereby it has retracted its pin *s* from the spacing hole 28 of drum 20 in which it is shown in Fig. 8, so that the tip of the pin is below the surface of tape bridge 60. This permits the aforescribed rocking of frame 49 by drum 20 to the left. When contact arm 55 swings upwardly from the position in Fig. 8 to the position in Fig. 10, frame 50 of the spacing pin *s* rocks with arm 55 clockwise into the position shown in Fig. 10 in which the tips of the two pins *m* and *s* are shown in transverse alignment, which is the closest approach of the pin tips to one another, whereas in Fig. 8 they are shown furthest apart. In Fig. 8 with the contact arm on the spacing contact S, and the selector pins *m* and *s* are always drawn furthest apart, and are in "spacing position", whereas in Fig. 10, with contact arm 55 on the marking contact, the two selector pins *m* and *s* are in "marking position". In Fig. 9 the pins, so far as the tilting of the two frames 49 and 50 is concerned, remain still in spacing position in which they are shown in Fig. 8, and their pertaining selector frame only performs a longitudinal motion to either withdraw its pertaining pin from a hole in drum 20, or to advance its pin into it, as the case may be. Similarly in Fig. 11 the two pins *m* and *s*, together with their pertaining frames remain in the same marking position shown in Fig. 10, and in the position Fig. 11, the frames only perform longitudinal motion to withdraw a pin from, respectively advance it into one of the holes.

While marking pin *m* has been tilted by drum 20 from the position shown in Fig. 9 into the position shown in Fig. 10 to cause arm 55 to make a marking contact, rocking frame 42 has gradually arrived in the position shown in Fig. 10, in which the marking pin *m* is still in its marking hole, but in which the spacing pin *s* has been in the meantime part-way advanced into a spacing hole which is transversely in alignment with the marking hole in which the pin *m* is located at the time. This has been made possible by the tilting of pin *s* from the position shown in Fig. 9 into position shown in Fig. 10, in which it "meets" the hole as it were. It will be noted from Figs. 8 to 11 as well as from Figs. 19 to 23 that the holes in drum 20 are substantially larger than the diameter of the pins, so that these pins can start entering the holes which they encounter quite early, without striking the edges. Furthermore, it should be noted that the marking holes 29 are inclined at an angle to the drum radius, while the spacing

holes 28 extend substantially in radial direction. This is necessary, because the marking pin *m* is inclined in the direction of the drum rotation, while spacing pin *s* is inclined more or less against the drum rotation. In order that each pin should encounter the hole wall first near the hole bottom, so as to stay in contact with the wall as long as possible in order to tilt frames 49 and 50 at the largest possible angle, the holes 29 must be inclined as described. This will be obvious especially clearly from Figs. 19 to 22. When the rocking of frame 42 in Fig. 10 continues clockwise, spacing pin *s* is pushed gradually to the bottom of the spacing hole 28 which it has entered in Fig. 10, and when this happens (as shown in Fig. 11) pin *s* is taken along by drum 20 in the direction of the arrow and tilted to the left back into the position shown in Fig. 8. By this tilting frame 50 of pin *s*, together with contact lever 55 is rocked counter clockwise so that the contact lever is thrown from the marking contact M back to the spacing contact S as shown in Fig. 8. Through the interlinking between levers 55 and 54, the latter lever is rocked clockwise, and thereby rocks the guide frame 49 of marking pin *m* (which latter in the meantime has been withdrawn from its hole) to the right into the "spacing" position shown in Fig. 8, in which it is ready to meet the next marking hole 29 as shown in Fig. 8. From the position of the pin slots 61, 62 in the tape bridge 60 shown in plan in Fig. 5, it will be observed that the tilting range of spacing pin *s* is set slightly beyond the tilting range for the marking pin *m* in the direction of the selector drum rotation. This is arranged so that when a marking contact is made as in Fig. 10, for instance due to the first marking perforation *c* in Fig. 24, and immediately thereafter a spacing contact should occur, in order to produce a short code dot, as shown by the first hole *d* in Fig. 24, the spacing pin *s* is in a position to enter this first perforation *d*, and the corresponding hole 28 in drum 20 as shown in Fig. 10, so as to promptly throw the contact lever onto the spacing contact.

From these movements so far described it will, therefore, be clearly seen that the function of rocking frame 42 is to advance the pins *m* and *s* into, respectively out of engagement with selector drum 20 without any effect upon the contact position of arm 55, whereas the function of drum 20 is to positively tilt the frames 49 and 50 toward or away from one another, and to thereby directly affect the position of contact arm 55 with respect to contacts M and S.

Since the engagement of drum 20 by the pins depends upon the presence of a perforation in the tape, it follows that the position of contact arm 55 with respect to the marking and spacing contacts M and S is directly controlled by the presence or absence of per-

forations in the tape in Fig. 24. For instance, in Fig. 22 in which the spacing pin s is shown in a marking hole 28 of drum 20 (see also Fig. 11) ready to be carried by drum 20 to the left in order to throw contact lever 55 from the marking contact M in Fig. 11 onto the spacing contact in Fig. 8, this throwing of the contact arm cannot occur in the case, with a similar position of frames 49 and 50, and a similar tilting of pins s and m , shown in Fig. 23, where the tape has no perforation, so that the spacing hole 28 in the figure, which is in the same position of spacing hole 28 of Fig. 22, is covered by the tape. In that case, instead of advancing into hole 28 when its frame 50 advances, pin s is pushed back into the frame, as shown in that figure, against the tension of its spring 65. Drum 20 now continuing to rotate in the direction of the arrow, hole 28 passes by the tip of pin s without having tilted frame 50 and, therefore, without having thrown contact arm 55 from the marking to the spacing contact. This "missing" of holes continues until a spacing perforation arrives through which pin s can enter into a spacing hole 28 such as is shown in Fig. 22. This condition vice versa prevails when the contact arm happens to stand on a spacing contact brought about by a spacing perforation in the tape, for instance the hole b_1 in Fig. 24. As soon as the contact arm has thereby been thrown into spacing position as shown in Fig. 8, and spacing pin s has been withdrawn from the spacing hole 28 as shown in Fig. 9, and if no further spacing and marking perforations should happen to occur for some distance on the tape in Fig. 24 as it travels in the direction of the arrow shown in that figure, neither the spacing or marking pin can enter into the next hole 28, respectively 29, of drum 20, and the contact arm remains in spacing position as shown in Figs. 8 and 9. Thus, in Fig. 24 the tape space between b_1 and a_2 passes over drum 20. This produces in the receiver a direction of current flow in accordance with which the recorder pen p in Fig. 25 remains in its lowermost position, and thereby produces the line b_1 on this tape which is a spacing line between signals. As soon as the first marking hole a_2 in Fig. 24 arrives within the range of the marking pin m , this pin will enter the hole as in Figs. 8 and 9, and will be taken along by the drum to the left and throw contact arm 55 from the spacing contact onto the marking contact. Since in Fig. 24 no spacing perforation occurs directly underneath the first marking hole a_2 , the corresponding spacing hole 28 in drum 20 remains covered, and thus the contact arm remains on the marking contact and produces the first line a_2 on the receiving tape Fig. 25. Upon arrival of the first spacing hole b_2 in Fig. 24 the device throws the contact arm onto the spacing contact and pro-

duces the first spacing line b_2 in Fig. 25, and so on. For instance at c in Fig. 24 a spacing hole d is right in line with a marking hole c and, therefore, the contact arm 55 will be thrown immediately, after having arrived on the marking contact, back to the spacing contact and back to the marking and back to the spacing contact, thereby producing two short dashes c with the short intervening space d in Fig. 25.

It should be particularly noted with respect to the function of the contact arm that this arm is not only positively moved between the marking and spacing contacts in accordance with the dictation of the perforation in the tape, due to the positive action of drum 20 on the marking and spacing pins, by which alone the tilting of the two sliding frames 49 and 50 can occur, but the movement of this contact arm, when it does occur, always occurs in absolutely timed relation with the rotation of drum 20. Since this drum is positively geared to the star wheel roller which positively feeds the tape as previously described, and since it is likewise positively geared to the longitudinal motions of the two sliding frames 49 and 50, the making and the breaking of the contact at M and S is positively and with great exactness timed within the occurrence of the tape perforations, so that even at high speeds, no interference with the precise timing of the making and breaking of the contacts by natural vibrations or lags of operating elements, such as springs which are used in the prior art type keying heads, can occur.

The contact mechanism for the marking and spacing contacts M and S of which in Figs. 8 to 11 only fragments are shown, is constructed as follows. Referring to Fig. 2 the contact arm 55 which protrudes beyond the left side of the lever box 12, is surrounded at its outer end by the contact box 13, the cover of which is partly broken away in Fig. 2. This box consists of a base plate 70 of insulating material on which are mounted two metal contact blocks 71 and 72 to which the leads 73 and 74 respectively are connected. These leads are connected to contact pins at the rear of the keying head casing 10 (see Figs. 3 and 4) at which point the leads are connected into the transmitter wiring system such as is shown diagrammatically in Fig. 16. Contact blocks 71 and 72 each carry an adjustable contact screw 75, 76 respectively, which is provided with a contact point M and S, respectively, representing the marking and spacing contacts. After the proper spacing adjustment of screws 75 and 76 with relation to the contact arm has been made, these contact screws are set by means of the clamping screws 77, 78. One of the contact blocks is shown in considerably enlarged horizontal section in Fig. 12. Since as previously described the contact arm 55

is positively driven in both directions, and therefore positively encounters the two contacts, a certain amount of cushioning or damping should be provided in order to avoid undue rebounds at high speeds. For this purpose the contact screws are constructed as shown in Fig. 13 with respect to the spacing contact *s*. The screw 76 is hollow and contains the contact point *S* proper which is held in the position shown by means of a comparatively strong spring 79 which is positioned in the hollow screw by means of a plug 80 threaded into the outer end of screw 76.

In order to retain the contact arm on the contact on which it has been thrown by the mechanism, and until it is positively removed by the mechanism from this contact, a toggle joint is provided which engages the outer end of contact arm 55 as shown in Figs. 2 and 2^a. This toggle joint consists of an X-shaped toggle block 81 which engages the edged end of the contact arm at the bottom of one of its grooves as shown in detail in Fig. 2^a, the bottom of the opposite groove of this toggle block being engaged by the edged pawl 82 forming the head of a flat spring 83 mounted on the main casing 10 at 84. The edge of pawl 82 is placed exactly in horizontal alignment with the edged end of arm 55 when it stands in the middle position between the two contacts, so that when the arm is thrown onto one or the other contact, toggle block will snap over the edged end of arm 55 to one or the other side, the pressure of spring 83 exerted through pawl 82 holding it there with a certain amount of force, until it is positively removed by the operating mechanism. In order to prevent the toggle block 81 from jumping out of position at high speed operation, pawl 82 is provided with a central vertical slot 85 shown in Fig. 2^a through which passes a small pin 86 driven into the toggle block 81. This prevents lateral movement of this block.

In order to avoid an undue exertion of pressure by spring 83 against arm 55 and thus against the pivotal bearing of arm 55, this toggle joint may be arranged as shown in Figs. 2^b and 2^c. In this case leaf spring 83 is replaced by a lever 123 pivotally attached at its lower end to a foot 125 mounted on block 84 mentioned before. Pawl 82 is provided at the other, free end of this lever and engages one side of toggle block 81, whose other side engages arm 55, the same as in Fig. 2^a. In Figs. 2^b, 2^c, however, the spring pressure is exerted differently. Arm 55 is provided with a transverse pin 12 and pawl 82 with a transverse pin 122. Between the ends of these pins, on each side of the toggle block, is provided a tension spring 121, which spring pulls pawl 82 toward the end of arm 55 with the toggle block between. The effect is similar to that described with reference

to Fig. 2^a, provided the edge of pawl 82 is properly placed with respect to the edge of the arm end when the arm is in middle position. In this case, however, the spring pressure affects only the pawl and the arm end and the toggle block without pressure being exerted against the pivotal bearing of arm 55.

In order to reduce as much as possible the mass of all elements moving at high speed they are perforated wherever feasible. For instance, contact arm 55 as shown in Fig. 15 is provided with a number of transverse perforations 88, and the two pin guide frames 49 and 50 are provided near the upper end with transverse perforations 89.

The entire lever gearing contained in box 12 is constantly splashed with oil, and for this purpose the casing is partly filled with oil as shown at 90 in Fig. 2. In order that the oil may not creep out through the side of box 12 through which the contact arm 55 protrudes, this arm runs through a splash box 91 which is inserted in the side wall of box 12 and which extends partly into the box as shown for instance in Figs. 7 and 8. In case oil should splash onto arm 55 inside of the box and tend to run along the arm toward the outside, it must first run into splash box 91 in which the small drops of oil are readily shaken off by the rapid oscillations of arm 55, and they collect at the bottom of the box, whence the oil is drained through hole 92 shown in Fig. 7 back into box 12.

The cover 93 of the lever box 12 serves at the same time as a support for the pivot pins and shafts extending transversely through this box as shown in detail in Figs. 7 and 8. For instance, main pivotal shaft 40, 41, 38 in Fig. 6 has its outer supporting bushing 39 mounted in the box cover 93, this bushing extending sufficiently far into the box to hold rocking frame 42 laterally in place on its pivot. Further, spacing elements 94 and 95 are fastened on cover 93 which serve for supporting the free ends of pivot studs 56 which carry the contact arm 55 and the interlinking lever 54. These spacing elements 94, 95 are each of sufficient length to extend respectively to the contact arm and to the interlinking lever to hold these elements laterally in place on their pivotal axes.

It has been stated at the beginning with reference to the description of the tape drive mechanism shown in Figs. 2, 3, 14, 17 and 18 that the star wheel roller 23 and the tape guide roller 30 are respectively mounted on pivotal arms 31 and 32 mounted on casing 10 and which are held together at their outer ends by means of a spring 34 shown in Figs. 2, 17 and 18, so as to hold the tape drive gearing in mesh. In order to draw these two arms 31 and 32 apart to remove the star wheel roller 23 sufficiently from drum 20 to insert the perforated tape 26, and to properly bring

its central perforations in engagement with the pin teeth of the star wheel, the tape release bar 101 is provided. This vertical bar is slidingly inserted into and flush with the rear wall of box 12 and is provided at its upper end with a roller 102 (shown in large scale in Fig. 6) which stands in alignment with the ends of arms 31 and 32 which ends, when the tape drive gear is in mesh, surround roller 102 at the bottom. When bar 101 is pulled down the lower ends of arms 31 and 32 are spread apart as shown in Fig. 18 by which the star wheel gear 22 is thrown out of engagement with the driving gear 21 of drum 20, and the star wheel 23 and tape guide roller 30 (Fig. 14) are sufficiently far removed from drum 20 to permit the insertion of the tape from the front of the keying device in Fig. 2. The number of pin teeth on star wheel roller 23 (Fig. 14) is equal to the number of gear teeth of the roller gear 22, and both are axially in alignment. Likewise, the number of marking and spacing holes on drum 20 is equal to the number of gear teeth of gear 21, and the holes and the teeth are in axial alignment. Thus, when the perforated tape is inserted so that the teeth 24 of the star wheel properly enter the central perforations *f* of the tape (Fig. 24), the outer rows of perforations of the tape for marking and spacing will always exactly register with the respective marking and spacing holes on drum 20, as soon as the gears are put back into mesh.

From the previous description of the mechanism, by which the marking and spacing pins are caused to penetrate through the perforations in the tape, it will be noted that at all operating positions of the pin mechanism at least one of the pins is penetrating a perforation, or if the tape has no perforation there is at least one pin sufficiently tensioned by its spring so that it would penetrate through the tape if a hole were present. It would, therefore, be impossible, notwithstanding the releasing mechanism for the tape drive previously described, to insert a tape into the mechanism or withdraw it therefrom. In order to clear the drum and the tape entirely of the marking and spacing pins, when the tape is to be withdrawn or inserted the following mechanism is provided.

It had been mentioned at the beginning with reference to the description of the pivotal shaft 38, which carries the eccentric 41 (Fig. 6) on which the rocking frame 42 rocks, that this shaft is mounted at 40 in the rear wall of the casing, its thinner end 38 protruding through the front of the casing. So long as the eccentric 41 stands in the position shown for instance in Fig. 8, the vertical operating range of sliding frames 49 and 50, extends far enough upwardly, so as to allow the marking and spacing pins to penetrate

into the respective holes of drum 20, and to function in the manner described hereinbefore. If, however, as shown in Fig. 16 shaft 38 is revolved 180°, the eccentric is thrown into its lowermost position, and the vertical operating range of the two guide frames 49 and 50 is lowered sufficiently, so that even in the furthest upward position pins *s* and *m* remain below the surface of tape bridge 60. Thus, the path for inserting or removing the tape is entirely cleared. In order to throw the tape drive gear into and out of mesh, together with the lowering of the operating range of the spacing and marking pins below the surface of the tape bridge 60 as just described, a pintle 105 is attached to the rear end of pivotal shaft 40 which engages a slot 106 provided in the enlarged lower end of sliding bar 101 previously described with reference to Figs. 6, 17 and 18. When pintle 105 is elevated, shaft 40 stands in the position with eccentric 41 raised, and the tape drive gears are in mesh, and the entire keying operating mechanism is in operating position as shown in Figs. 8 to 11. As soon as pins *s* and *m* are drawn below the surface of tape bridge 60 by throwing eccentric 41 180° down, pintle 105 throws bar 101 into the position shown in Fig. 18 in which the tape drive gears are released. For operating pivotal shaft 40, 41, 38 in this manner an operating handle 107 (Figs. 2 and 6) is attached to the protruding end of shaft 38, which handle is locked by means of a spring controlled pin 108 in its uppermost position shown in these figures, which is the operating position of the device with all gears in mesh. When handle 106 is withdrawn against the pressure of spring 109, pin 107 is drawn out of its socket and the handle can be swung 180° and the lever be locked in the lower socket 110 in which position the mechanism is cleared for insertion of the tape.

We claim:

1. In an automatic keying head in combination a movable contact arm, a positively driven arm operating element, a coupling device adapted to positively couple said arm with said operating element, and a tape perforated to represent the signals to be keyed, and being interposed between said operating element and said coupling device for preventing the arm coupling by said device, except through a perforation in said tape.

2. In an automatic keying head in combination a movable contact arm, a constantly, positively driven arm operating element, a coupling device adapted to positively couple said arm with said operating element, and a tape perforated to represent the signals to be keyed, and being interposed between said operating element and said coupling device for preventing the arm coupling by said device, except through a perforation in said tape.

3. In an automatic keying head in combination a movable contact arm, a constantly, positively driven arm operating element, a coupling device adapted to intermittently positively couple said arm with said operating element, and a tape perforated to represent the signals to be keyed, and being interposed between said operating element and said coupling device for preventing the arm coupling by said device, except through a perforation in said tape.

4. In an automatic keying head in combination a movable contact arm, a constantly, positively driven arm operating element, an oscillating coupling device, disposed to intermittently positively couple said arm with said operating element, and a tape perforated to represent the signals to be keyed, and being interposed between said operating element and said coupling device for preventing the arm coupling by said device, except through a perforation in said tape.

5. In an automatic keying head in combination a movable contact arm, a constantly, positively driven arm operating element, an oscillating coupling device, positively driven in timed relation to said operating element, and disposed to intermittently positively couple said arm with said operating element, and a tape perforated to represent the signals to be keyed, and being interposed between said operating element and said coupling device for preventing the arm coupling by said device, except through a perforation in said tape.

6. In an automatic keying head in combination, a movable contact arm operably disposed between two abutment contacts, a positively driven arm operating device having means geared to it for positively conveying with said device a tape, perforated to represent the signals to be keyed, and coupling means, positively geared with said arm and adapted to engage said arm operating device, for positively moving said arm in either direction between said contacts, said tape being interposed between said operating device and said coupling means to prevent the engagement of said coupling means, except through a perforation in said tape.

7. In an automatic keying head in combination, a movable contact arm operably disposed between two abutment contacts, a positively driven arm operating device having means geared to it for positively conveying with said device a tape, perforated to represent the signals to be keyed, and coupling means, positively geared with said arm and disposed and operated in timed relation to the motion of said operating device, to engage said arm operating device at uniform intervals to cause the positive movement of said arm alternately from one contact to the other, said tape being interposed between said operating device and said coupling

means to prevent the engagement by said coupling means, except through a perforation in said tape.

8. In an automatic keying head in combination, a movable contact arm operably disposed between two abutment contacts, a positively driven arm operating device having means geared to it for positively conveying with said device a tape perforated to represent the signals to be keyed, and coupling means, positively geared to said arm and including two coupling elements disposed and operable in timed relation to the motion of said operating device to alternately engage said arm operating device at uniform intervals to cause the positive movement of said arm alternately from one contact to the other, said tape being interposed between said operating device and said coupling means to prevent said elements from engaging said device, except through a perforation in said tape.

9. In an automatic keying head in combination a pivoted contact arm disposed between two abutment contacts, a selector drum positively driven at uniform speed, and means geared to said drum for positively conveying in timed relation to the drum motion a tape perforated to represent the signals to be keyed, a coupling device positively connected to said contact arm and including two reciprocating coupling pins, operable in timed relation to the drum motion, and disposed to alternately move toward and away from said drum, said pins being spaced apart in the direction of the drum axis, said drum having two peripheral rows of suitably spaced holes, one row for each pin, whereby said pins are permitted to alternately enter a hole of each row to couple the arm with said drum to cause the positive movement of the arm by the drum movement from one contact to the other during such coupling engagement, said tape being interposed between said drum and said pins to prevent said pins from entering said drum holes, except when cleared by a perforation in the tape.

10. In an automatic keying head in combination a pivotal contact arm disposed between two abutment contacts, a selector drum positively driven at uniform speed, and means geared to said drum for positively conveying in timed relation to the drum motion a tape perforated to represent the signals to be keyed, a coupling device comprising an interlinking pivoted arm coupled at one end with the rear end of said contact arm, two sliding frames, one disposed on each of said arms and spaced apart from the other in the direction of the selector drum axis, a reciprocating device geared in timed relation to the drum motion and connected to said frames to alternately move said frames toward and away from said drum, a coupling pin at the end of each frame, said drum hav-

ing two peripheral rows of suitably spaced holes, one row for each pin, whereby said pins during the frame reciprocation can alternately enter a hole of each row to positively intermittenly couple said contact arm with said drum to cause the positive movement of said arm by the drum motion alternately from one contact to the other during such coupling engagement, said tape being interposed between said drum and said pins to prevent said pins from entering said drum holes, except when cleared by a perforation in the tape.

11. In an automatic keying head in combination a pivoted contact arm disposed between two abutment contacts, a selector drum positively driven at uniform speed, and means geared to said drum for positively conveying in timed relation to the drum motion a tape perforated to represent the signals to be keyed, a coupling device comprising an interlinking pivoted arm coupled at one end with the rear end of said contact arm, two sliding frames one disposed on each of said arms and spaced apart one from the other in the direction of the selector drum axis, a reciprocating device geared in timed relation to the drum motion and connected to said frames to alternately move said frames toward and away from said drum, a coupling pin yieldingly disposed at the end of each frame, said drum having two peripheral rows of suitably spaced holes, one row for each pin, whereby said pins during the frame reciprocation can alternately enter a hole of each row to positively intermittenly couple said contact arm with said drum to cause the positive movement of said arm by the drum motion alternately from one contact to the other during such coupling engagement, said tape being interposed between said drum and said pins, to prevent said pins from entering said drum holes, except when cleared by a perforation in the tape, said pins yieldingly receding into their respective frame when prevented by the tape from entering a drum hole.

12. In an automatic keying head in combination a pivoted contact arm disposed between two abutment contacts, a selector drum positively driven at uniform speed, and means geared to said drum for positively conveying in timed relation to the drum motion a tape perforated to represent the signals to be keyed, a coupling device comprising an interlinking pivoted arm coupled at one end with the rear end of said contact arm, so that both arms rock in opposite directions, a sliding block fixed on each arm and a sliding frame on each block disposed to slide toward and away from said drum, a reciprocating device geared in timed relation to the drum motion and connected to said frames to alternately move the frames toward and away from the drum, a coupling element at

the end of each frame adapted to engage said drum during the frame reciprocation to couple said contact arm with said drum during such engagement for positively moving said arm by the drum motion alternately from one contact to the other, said tape being interposed between said coupling elements and said drum to prevent said elements from engaging said drum, except through a perforation in said tape.

13. In an automatic keying head in combination a pivoted contact arm disposed between two abutment contacts, a selector drum positively driven at uniform speed, and means geared to said drum for positively conveying in timed relation to the drum motion a tape perforated to represent the signals to be keyed, a coupling device comprising an interlinking pivoted arm coupled at one end with the rear end of said contact arm, so that both arms rock in opposite directions, a sliding block fixed on each arm and a sliding frame on each block disposed to slide toward and away from said drum, a reciprocating device geared in timed relation to the drum motion and connected to said frames to alternately move the frames toward and away from the drum, said frames being spaced apart in the direction of the drum axis, a yieldingly disposed coupling pin arranged in the end of each frame, said drum having a peripheral row of holes for each pin, spaced apart in each row the shortest distance between adjacent holes occurring in the tape, whereby said pins can alternately enter a hole of each row during the frame reciprocation to intermittenly positively couple said contact arm with said drum to cause the positive rocking of said arm through the pins by the drum motion alternately from one contact to the other during such coupling engagement, said tape being interposed between said drum and said pins to prevent said pins from entering said drum holes, except when cleared by a perforation in the tape.

14. In an automatic keying head in combination a pivoted contact arm disposed between two abutment contacts, a selector drum positively driven at uniform speed, and means geared to said drum for positively conveying in timed relation to the drum motion a tape perforated to represent the signals to be keyed, a coupling device comprising an interlinking pivoted arm coupled at one end with the rear end of said contact arm, so that both arms rock in opposite directions, a sliding block fixed on each arm and a sliding frame on each block disposed to slide toward and away from said drum, a reciprocating device geared in timed relation to the drum motion and connected to said frames to alternately move the frames toward and away from the drum, said frames being spaced apart in the direction of the drum axis, a yieldingly disposed coupling pin arranged in the end of

each frame, said drum having a peripheral row of holes for each pin, spaced apart in each row the shortest distance between adjacent holes occurring in the tape, said frames and pins being inclined towards one another at their ends, the drum holes for the pin, which is inclined towards the direction of drum rotation, being inclined toward that direction, the holes for the pin, which is inclined against the drum rotation extending substantially in radial direction, whereby each of said pins can alternately with the other freely pass into an encountered hole of its row to the hole bottom during the frame reciprocation, to be taken along by the hole wall, and to thereby positively rock said contact arm through the drum motion from one contact to the other, said tape being interposed between said drum and said pins to prevent said pins from entering said drum holes, except when cleared by a perforation in the tape.

15. In a lever system; pivotally mounted to oscillate between two abutments, a toggle element supported at one of its points at a point of said system which partakes in the oscillation, and a yielding element disposed to support said toggle element at another point and to exert a pressure against said element toward its other supporting point in the direction of a line extending between said supporting points when the system is positioned intermediate its abutments, whereby said toggle element is held between its supports in an unstable equilibrium, tending to throw and hold said system either against one or the other of said abutments.

16. In a lever system a lever arm, pivotally mounted to oscillate between two abutments, a toggle element supported at one of its points at the end of said arm, and a spring pressed pawl having its end disposed to support said toggle element at another point and to exert a pressure against said element toward its other supporting point in the direction of a line extending between said supporting points when the arm is positioned intermediate its abutments, whereby said toggle element is held between its supports in an unstable equilibrium, tending to throw and hold said arm either against one or the other of said abutments.

17. A keying head having oppositely disposed abutment contacts, a contact arm, and means for moving said arm alternately on to said contacts at suitable intervals, and means for holding said arm on either contact during said intervals, comprising a pawl provided with an edged head and having the edge disposed opposite to and in line with the similarly edged end of the arm, when the arm is in a position intermediate said contacts, a toggle block grooved on opposite sides and interposed at its grooved portions between said two edges, a spring disposed to

press said pawl and toggle block toward the arm end, whereby said block is held in an unstable equilibrium between the two edges and, through the spring pressure, tends to hold the arm on the contact, against which it has been thrown by said moving means.

18. A keying head having oppositely disposed abutment contacts, a contact arm, and means for moving said arm alternately on to said contacts at suitable intervals, and means for holding said arm on either contact during said intervals, comprising a pawl provided with an edged head and having the edge disposed opposite to and in line with the similarly edged end of the arm, when the arm is in a position intermediate said contacts, a toggle block grooved on opposite sides and interposed at its grooved portions between said two edges, a spring disposed to press said pawl and toggle block toward the arm end, whereby said block is held in an unstable equilibrium between the two edges and, through the spring pressure, tends to hold the arm on the contact, against which it has been thrown by said moving means, and means for holding said block in position longitudinally of said edges.

19. In an automatic keying head in combination, a movable contact arm operably disposed between two abutment contacts, a positively driven arm operating device having means geared to it for positively conveying with said device a tape, perforated to represent the signals to be keyed, and coupling means, positively geared with said arm and adapted to engage said arm operating device, for positively moving said arm in either direction between said contacts, said tape being interposed between said operating device and said coupling means to prevent the engagement of said coupling means, except through a perforation in said tape, each of said abutment contacts having a cushioned contact point to prevent the rebound of said contact arm.

20. In an automatic keying head in combination two abutment contacts and a pivoted contact arm disposed and movable therebetween, a selector drum having a plurality of recesses on its periphery and being positively driven at uniform speed, a tape feed positively geared to said drum and adapted to convey over said drum a tape perforated to represent the signals to be keyed, a reciprocating coupling device connected with said arm and having coupling pins adapted to alternately engage the drum recesses through the tape perforations for coupling the arm intermittently with said drum to move the arm from one contact to the other in accordance with the occurrence of the tape perforations, and a rotatable pivotal shaft having an eccentric serving as a pivot for said reciprocating coupling, whereby through the rotation of the eccentric said reciprocating

coupling may be raised and lowered to move said pins into and out of operating range with said drum recesses, means for hand operating said pivotal shaft, and means operatively connected with said pivotal shaft for simultaneously removing said tape feed from said drum to clear said drum for insertion and removal of the perforated tape.

21. In a keying head of the character described, in combination a contacting mechanism, a rotating selector drum, a coupling mechanism between said drum and said contacting mechanism for putting the contacting mechanism under the control of said drum, and a tape drive for feeding a perforated tape over the periphery of said drum to control said coupling through the tape perforations, said tape drive comprising two pivoted arms, disposed with their ends adjacent to said drum and on opposite sides of the drum axis, one arm carrying near its end a tape drive roller and its driving pinion, the other arm carrying near its end a tape guide roller, a gear wheel on said drum engageable with said roller drive pinion to feed said tape positively and in timed relation with the drum speed over said drum, means for normally forcing the free arm ends towards one another to hold said tape feed roller and said guide roller in engagement with said drum, and hand controlled means for spreading said arms apart to clear said drum from the tape feed and from the guide roller to permit the insertion and the removal of the tape.

22. In a keying head of the character described, in combination a contacting mechanism, a rotating selector drum, a coupling mechanism between said drum and said contacting mechanism for putting the contacting mechanism under the control of said drum, and a tape drive for feeding a perforated tape over the periphery of said drum to control said coupling through the tape perforations, said tape drive comprising two pivoted arms, disposed with their ends adjacent to said drum and on opposite sides of the drum axis, one arm carrying near its end a tape drive roller and its driving pinion, the other arm carrying near its end a tape guide roller, a gear wheel on said drum engageable with said roller drive pinion to feed said tape positively and in timed relation with the drum speed over said drum, a tension spring for normally forcing the free arm ends towards one another to hold said tape feed roller and said guide roller in engagement with said drum, and a cam roller disposed midway above said arm ends, and hand controlled means for moving said cam roller against said cam ends to spread the arms apart to clear said drum from the tape feed and from the guide roller to permit the insertion and removal of the tape.

23. In a keying head of the character described, in combination a contacting mecha-

nism, a rotating selector drum, a coupling mechanism between said drum and said contacting mechanism for putting the contacting mechanism under the control of said drum, and a tape drive for feeding a perforated tape over the periphery of said drum to control said coupling through the tape perforations, said tape drive comprising two pivoted arms, disposed with their ends adjacent to said drum and on opposite sides of the drum axis, one arm carrying near its end a tape drive roller and its driving pinion, the other arm carrying near its end a tape guide roller, a gear wheel on said drum engageable with said roller drive pinion to feed said tape positively and in timed relation with the drum speed over said drum, means for normally forcing the free arm ends towards one another to hold said tape feed roller and said guide roller in engagement with said drum, and hand controlled means for spreading said arms apart to clear said drum from the tape feed and from the guide roller to permit the insertion and the removal of the tape, and means operated by the same hand controlled means for simultaneously removing said coupling mechanism out of coupling range with said drum to clear the drum also from said coupling mechanism for the insertion and removal of the tape.

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ERNEST KNOPP.

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