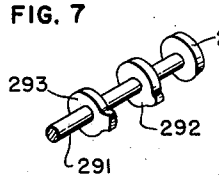
Nov. 28, 1950 L. M. POTTS 2,531,528

MECHANICAL CIPHERING UNIT

Original Filed July 5, 1946 3 Sheets-Sheet 1

FIG. 7



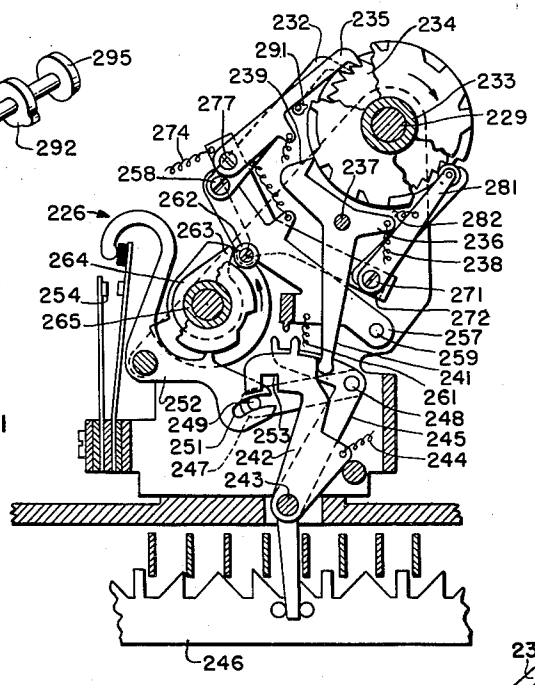


FIG. 1

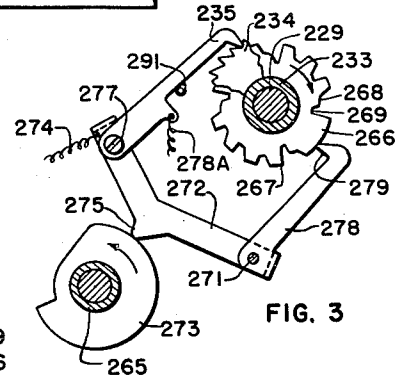
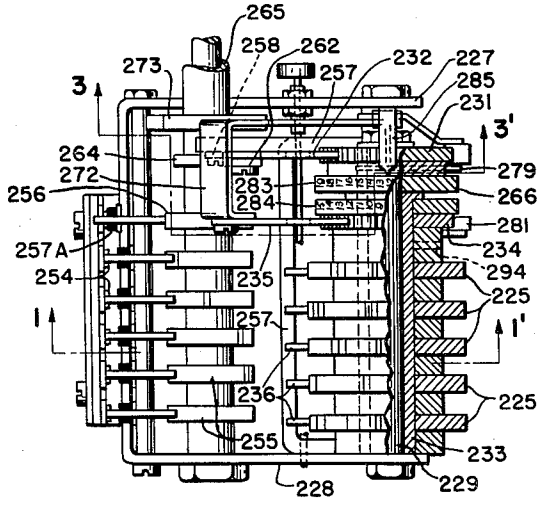


FIG. 3

FIG. 2

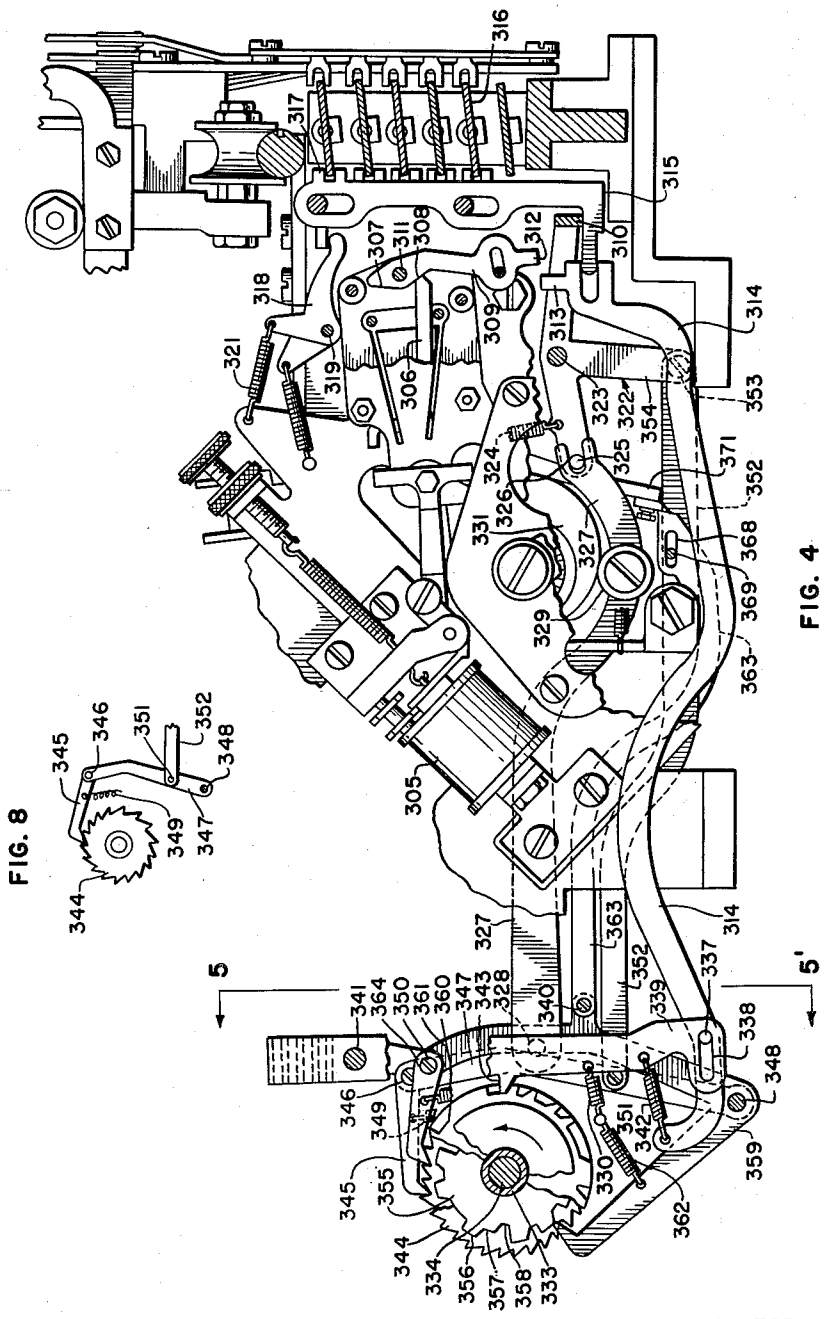


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MECHANICAL CIPHERING UNIT

Original Filed July 5, 1946 3 Sheets-Sheet 3

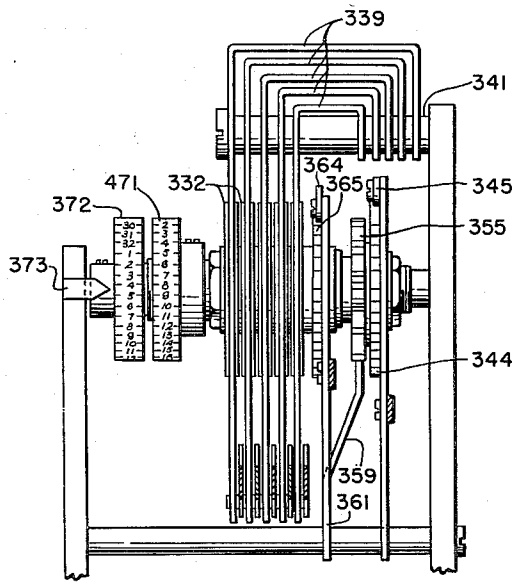


FIG. 5

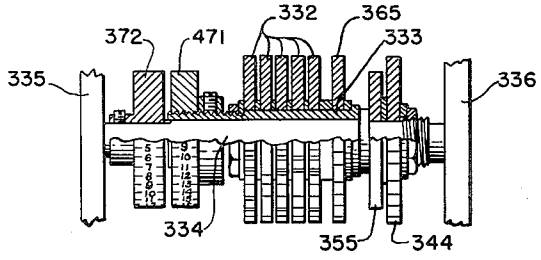


FIG. 6

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2,531,528

MECHANICAL CIPHERING UNIT

Louis M. Potts, deceased, late of Evanston, Ill., by Martha W. C. Potts, executrix, Evanston, Ill., assignor to Teletype Corporation, Chicago, Ill., a corporation of Delaware

Original application July 5, 1946, Serial No. 681,444, now Patent No. 2,504,044, dated April 11, 1950. Divided and this application September 3, 1949, Serial No. 113,918

8 Claims. (Cl. 178—22)

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This invention relates to secret printing telegraph systems and particularly to mechanical ciphering units for accomplishing the enciphering and deciphering of telegraph messages.

This invention is a division of the copending application of L. M. Potts, Serial No. 681,444, filed July 5, 1946, now U. S. Patent No. 2,504,044 of April 11, 1950.

A chief object of the invention is the provision of mechanical ciphering units for secret telegraph message communication.

Another object of the invention is the provision of mechanisms for use with standard printing telegraph apparatus for performing ciphering operations.

An additional object of the invention is the provision of key coding drums which afford a large number of key signal code permutations for ciphering operations without repetition.

Other objects, features and advantages of the invention will appear as the description of the invention progresses.

The present invention utilizes a set of key coding drums having thirty-two positions for providing a large number of key signals for transmitting purposes and a second set of identical key coding drums having a like number of positions for receiving purposes. The mechanical coding elements are under the control of feelers which sense the code drum, allowing mechanical ciphering elements to shift to a spacing or marking position determined by the particular portion of the code drum which presents itself at a particular time, the periphery of the code drum being cut in a promiscuous manner representative of marking and spacing conditions. One stepping device is provided which steps a shaft on which the drums are mounted by means of a sleeve, in each cycle of operation. A second stepping device is provided with a variable feeding arrangement, the amount of feed being determined by the position of a disc rotatable with the first stepping device. This disc is cut to varying depths and determines whether the drums will remain in the same position or whether they will be advanced one or two steps. It is, of course, conceivable that additional depths could be provided in this disc to obtain a greater variety of feeding.

Rotatable with the shaft referred to above is an indicating dial, while a second indicating dial is provided which is rotatable with the code drum sleeve. The dials at a transmitting station could be set at identical positions with dials at a receiving station by a prearrangement before the

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commencement of ciphering operations. The code drum device is further provided with an adjustable cam shaft which may disable the first stepping device if less secretive or simpler ciphering is desirable, permitting the drums to be stepped a uniform number of positions each time. For even less secretive or more simple ciphering, the cam shaft may be moved to a position to disable both stepping devices allowing the code drums to remain stationary during ciphering operation. One set of code drums is employed for controlling the ultimate position of the transmitting levers for transmission while for reception a second set of code drums is provided for determining the ultimate position of the printer vanes.

The invention may be more readily comprehended by reference to the detailed description which follows when read with reference to the drawings in which:

Fig. 1 is a view taken on line 1—1′ of Fig. 2 illustrating a portion of a keyboard transmitter using key coding drums for ciphering purposes;

Fig. 2 is a plan view of the apparatus shown in Fig. 1;

Fig. 3 is a detail view taken on the line 3—3′ of Fig. 2 of a pawl and ratchet stepping mechanism used in the invention;

Fig. 4 is an end view of a portion of the receiver using key coding cams for deciphering;

Fig. 5 is a front elevational detail view taken on the line 5—5′ of Fig. 4 of the printer ciphering mechanism used for deciphering received signals;

Fig. 6 is a detail view, partly in section, illustrating the key code drums shown in Figs. 4 and 5;

Fig. 7 is a detail view of a cam arrangement for disengaging the stepping mechanism disclosed in Fig. 4; and

Fig. 8 is a detail view of a portion of the stepping mechanism for the key code drums.

Referring to the drawings a group of drums 225 which afford a large number of key code combinations are notched promiscuously to represent marking and spacing conditions to provide key ciphering code combinations. It is assumed of course that a transmitting and a receiving station will be equipped with identical key coding drums 225 which will be set to like positions, there being a total of thirty-two positions for each code drum. The first portion of this description relates to the ciphering mechanism to be used with a keyboard transmitter indicated generally as 226.

Journalled on the frame member 227 and 228

(Fig. 2) is a shaft 229 to which is fixedly attached a ratchet 231 which is stepped one position by a pawl 232 in each cycle of operation as will later be described. Freely rotatable about the shaft 229 is also mounted a cam sleeve 233 to which is fixedly secured a ratchet 234 which is variably stepped either one or two positions or not at all in each cycle of the operation by a pawl 235, as will also later be described.

A series of sensing levers 236 are pivoted on rod 237 and urged in a clockwise direction as viewed in Fig. 1, into engagement with the periphery of associated code drums 225 by means of springs 238 which enables pointed arms 239 of sensing levers 236 to feel the periphery of the code drums 225 according to marking or spacing conditions. Depending arms 241 of the sensing levers 236 are in engagement with associated ciphering levers 242 which are pivoted at 243 and normally urged in a clockwise direction by means of springs 244. Thus, depending on whether a high part or spacing condition of coded drum 225 or a notch or marking condition presents itself to arms 239 of the sensing levers at a given time, individual ciphering levers 242 will either be retained in their leftward or marking position or will be allowed to move to their rightward or spacing position.

Selecting fingers 245 are under the control of the permutation bars 246 which are set to marking or spacing positions when the keyboard is operated. Selecting fingers 245 carry links 247 which are pivoted at 248 and have secured thereto pins 249 which are designed to ride in arcuate slots 251 of the transmitting levers 252.

The relative positions of pins 249 with respect to the notches 253 of ciphering levers 242 govern the operation of the transmitting lever 252 to allow transmitting contact pairs 254 to remain open or closed according to enciphered signals. The permissive operation of transmitting contact pairs 254 is accomplished in the usual manner by a series of five transmitting cams 255, Fig. 2. A sixth cam 256 is provided for sending start-stop impulses in the conventional manner by controlling contact pair 257*a*.

The pawl 232 is pivotally connected to locking lever 257 at 258 which is urged in a counterclockwise direction about the pivot 259 by means of spring 261 to place its follower 262 normally in contact with the high part 263 of cam 264 which is mounted on cam sleeve 265. Therefore, from the above description, it is obvious that in each operation of cam sleeve 265, shaft 229 will be stepped one position in a clockwise direction as locking lever 257 moves down and returns to its upward position. Fixed about the shaft 229 for movement therewith is a variable feed disc 266 whose periphery 267 (Fig. 3) is notched at two different levels 268 and 269 for a purpose which will later appear, there being thirty-two positions of the disc 266, equal to the number of teeth in ratchet 231.

Pivotally mounted at 271 (Fig. 3) is a feed control lever 272 which is normally urged in a counterclockwise direction into engagement with the periphery of cam 273 carried by cam sleeve 265 by means of a spring 274, at its follower surface 275. Fixed for pivotal movement with lever 272 is an upstanding sensing arm 278 having a pointed end 279 which feels the periphery 267 of variable feed disc 266. Pivotally attached to the feed control lever 272 at 277 is the stepping pawl 235 which is urged into engagement with the teeth of ratchet 234 by means of a spring 278*a*.

It now can be seen that according to the position of the pointed end 279 of sensing arm 278 upon the periphery 267 of variable feed disc 266 the control lever 272 may be permitted to pivot in a counterclockwise direction by the action of spring 274 either to one position determined by level 268, or another position determined by level 269 or no movement at all will be permitted when the pointed end 279 engages the outer periphery 267 of the variable feed disc 266. This pivoted movement is permitted upon rotation of cam sleeve 265 when a low part is reached on cam 273 by follower 275 of control lever 272. As the follower 275 rides to the high part of cam 273, ratchet 234 is accordingly stepped one or two positions by the pawl 235 or is allowed to remain in its same position. The code drums 225 carried by cam sleeve 233 will thus be set to their various positions. The pawl 232 operates ratchet 231 forward one position for each operating cycle towards the end of rotation of cam sleeve 265 as follower 262 of locking lever 257 rides upon the high part 263 of cam 264 as has been already described. To insure retention of the code drums 225 in their various positions a detent 281 is provided which is pivoted at 271 and normally urged in a counterclockwise direction by means of spring 282 into engagement with the teeth of ratchet 234.

In order to set each of the code drums 225 at a particular position upon the commencement of a ciphering operation, two indicator dials 283 and 284, having thirty-two positions and a fixed pointer 285 are provided. The dial 283 is fixed for rotation with shaft 229 and dial 284 is rotatable with the cam sleeve 233. Thus by a prearrangement the dials 283 and 284 may be set to any one of their thirty-two positions at the transmitting and receiving station so that identical key code signals are afforded for both enciphering and deciphering operations.

For simple ciphering operations there may be provided in connection with the invention a manually rotatable shaft 291 (Fig. 7) suitably positioned below pawls 232 and 235. Shaft 291 carries cam member 292 which operates pawl 232 and a second cam member 293 which operates pawl 235. By this arrangement a set screw not shown could be inserted in cam sleeve 233 at a threaded opening 294 to lock the sleeve to shaft 229. Cam 293 may then be turned by knob 295 to a position to disengage pawl 235 from the ratchet 234. Thus cam sleeve 233 would be stepped one position for each operation of the pawl 232. For even simpler ciphering, knob 295 may be turned to a position to disengage both pawls 232 and 235 from their associated ratchets so that the code drums 225 remain in a fixed position.

The printer receiving unit utilizing a key coding device similar to that already described for the transmitter will now be described, with particular reference to Figs. 4 to 6, inclusive.

Numeral 305 represents the selector magnet which receives incoming signals and accordingly positions the swords 306 to either their marking or spacing positions, to engage either surface 307 or 308 of the lever 309, to pivot the levers about pivot 311, so that the projecting edges 312 thereof, move either to their right or marking positions, or to their left or spacing positions. Projections 312 are designed to cooperate with the projections 313 of the ciphering slides 314 to determine whether vertical slides 315 will be permitted to

move to their upward position, or will remain in their downward position, to operate vanes 316 by means of the bifurcations 317 to marking or spacing positions. Upward movement of slides 315 is accomplished by means of bell cranks 318 which are pivoted at 319 and normally biased in a counterclockwise direction by means of springs 321.

Slides 315 will be enabled to move upwardly when projections 312 and 313 are offset with respect to each other, indicating opposite signal conditions, that is, one being in the marking position and the other in the spacing position. Release of the slides 315 is permitted when the printing vanes 316 are unlocked and bail 310 carried by T-lever 322 is moved upward. T-lever 322 is pivoted at 323 and normally urged in a clockwise direction by means of spring 324. Carried by the T-lever 322 is a pin 325 designed to ride in the bifurcation 326 of the operating lever 327 which is pivoted at 328 and includes a follower 329 for engaging the periphery of printing bail cam 331.

The positioning of the ciphering slides 314 is controlled by means of key code drums 332 which are notched promiscuously to indicate marking or spacing conditions. Code drums 332 are mounted upon and rotatable with cam sleeve 333 about shaft 334 journalled on the frame members 335 and 336. Attached to slides 314 near the rearward extremity thereof are pins 337 designed to ride in the slots 338 of sensing levers 339 which are pivoted about the rod 341 and urged in a clockwise direction by spring 339. Sensing levers 339 are connected to the ciphering slides 314 by means of springs 342 so that as projections 343 of the sensing levers 339 feel the periphery of the code drums 332, ciphering slides 314 tend to follow the movement of sensing levers 339.

For accomplishing the stepping of the code drum 332, a stepping arrangement such as described in connection with the transmitting portion of the invention is employed. Fixed to shaft 334 (Fig. 6) journalled on frame members 335 and 336 is a ratchet 344 which is driven by pawl 345 pivotally connected at 346 to lever 347 which is pivotally mounted on rod 348. A spring 349 (Fig. 8) urges the pawl 345 into engagement with the teeth of ratchet 344. Lever 347 is pivotally connected at 351 to one end of lever 352, which at its other end is pivotally connected at 353 to the depending arm 354 of T-lever 322. Thus, upon each rotation of cam 331 operating lever 327 will pivot T-lever 322 in a counterclockwise direction removing bail 310 from engagement with the base of slides 315 and causing lever 352 to be reciprocated thereby operating lever 347 and pawl 345, to step ratchet 344 and shaft 334 forward one position.

Fixed for rotation with shaft 334 is a variable feed control disc 355 similar to the disc 266 previously described in connection with the transmitter, having an outer periphery 356, a first level notched at 357 and a second level notched at 358, which is sensed by a sensing arm 359 integrally formed as part of lever 361 which pivots about rod 348 and is normally urged in a clockwise direction by means of a spring 362. Pivotally connected at 350 to lever 361 is a stepping pawl 364 which is urged into engagement with ratchet 365 by means of spring 360, which is secured to sleeve 333. Pivotally connected to lever 361 at 340 is a slidable lever 363 which at its other end has a slot 368 for slidable engagement with a suitably mounted fixed pin 369. Slidable lever 363 is normally retained in its leftward position by means of the printer function bail 371 which is operable by a function bail cam, not shown, and in each cycle of operation moves to the right and returns to its leftward position. Thus, according to the operation of sensing arm 359 slidable lever 363 may be allowed to move to the right due to the action of spring 362 to follow function bail 371 and will be pushed to its leftward position as the function bail 371 returns to its normal position. This reciprocable movement of slidable lever 363 is allowed by sensing arm 359 of lever 361 enables pawl 364 to step ratchet 365 either one or two positions. If lever 361 is not permitted to move at all by sensing arm 359 engaging the outer periphery 356 of disc 355, ratchet 365 will remain in its same position. It is understood that suitable detents, not shown, will be provided for ratchets 344 and 365 to retain them in their different positions.

A typical deciphering operation will now be described in order to facilitate a ready understanding of this portion of the invention. As the first enciphered signal is received by the selector magnet 305, swords 306 are positioned according to the signals for operation of levers 309. Ciphering slides 314 will be in the last position according to the code presenting itself to projections 343 of sensing levers 339. As printing bail cam 331 is released for operation near the end of the receipt of the first signal, as explained in an earlier part of the description, follower 329 of lever 327 is engaged causing T-lever 322 to be pivoted in a counterclockwise direction removing bail 310 from engagement with the base of vertical slides 315, allowing selected slides 315 to move upwardly to operate vanes 316. Shortly thereafter, the printing vanes lock and a plain English deciphered signal is printed.

As the T-lever 322 is pivoted as explained above, lever 352 is moved to the right and later returns to the left stepping ratchet 344 forward one position as will be described hereinafter. Before lever 352 returns to the left, however, arm 359 of lever 361 feels for a new level, as function bail 371 moves to the right, upon the variable feed disc 355. If permitted to do so by the variable feed disc 355, lever 361 will pivot in a clockwise direction one or two steps and upon the return movement of function bail 371, will step ratchet 355 and code drums 372 one or two positions. Of course, if no pivotal movement of lever 361 is permitted, no feeding of ratchet 355 will take place.

As cam 331 rotates, the printer vanes 316 are unlocked but prior to this time, bail 310 is ready to move to a position holding vertical slides 315 in their downward position since a low part of cam 331 will now be presented to follower 329 of lever 327 and spring 324 will pivot T-lever 322 in a clockwise direction. Clockwise pivotal movement of T-lever 322 moves lever 352 to the left to thereby enable pawl 345 to step ratchet 344 to its next position. At this time ciphering slides 314 may move to their next ciphering position if they have been previously blocked by interference of their projections 313 with projections 312 of levers 309. Likewise, levers 309 may assume the new setting determined by receipt of the next signal by selector magnet 305 and the position of swords 306. This belated movement of slides 314 may be permitted due to the spring connection existing between slides 314 and sensing lever 339, provided by springs 342.

For setting the code drums 332 to their starting positions by a prearrangement with another

station, indicator dials **371**, **372** and a pointer **373** are provided. Dial **371** is rotatable with sleeve **333** while dial **372** is rotatable with the shaft **334**.

Various changes and modifications may be made in the above described invention without a departure from the spirit and scope thereof.

What is claimed is:

1. In a telegraph ciphering device, a set of code controlled members, a set of key code controlled members, a set of transmitting members controlled jointly by said sets of code controlled members and key code controlled members for transmitting signals determined jointly by said sets of code controlled members and key code controlled members, a set of key code drums for controlling said key controlled members, a stepping device, a variable feed control operated by said stepping device, and a second stepping device for operating said key code drums, said variable feed control being effective to enable a variable stepping of said second stepping device with a consequent variable stepping of said key code drums.

2. In a telegraph ciphering device, a set of members controlled by code signals, a set of key code drums for providing key code signals, advancing means for said code drums, a variable feed means for enabling the variable advancement of said advancing means, said advancing means being effective to cause said key code drums to provide different key code signals, and means controlled by both said code signal controlled members and said key code signals for generating enciphered signals.

3. In a telegraph ciphering device, a set of members controlled by code signals, a set of key coding instrumentalities for providing key code signals, said set of key coding instrumentalities being positionable to a variety of positions to provide different key code signals, means for advancing said key coding instrumentalities in unison one or more positions to said variety of positions or for restraining the advancement thereof, and means controlled by both said code signal controlled members and said key code signals for generating enciphered signals.

4. In a ciphering selector, a plurality of code combination controlled selecting members, a plurality of key code combination controlled selecting members, a key coding device for controlling said key code combination controlled selecting members positionable to a variety of positions to provide different key code signals, means for changing the position of said key coding device one or more positions or restraining the change of position thereof, and a plurality of members under the joint control of both of said sets of selecting members for generating enciphered signals.

5. In a ciphering transmitter, a plurality of permutation bars operable according to significant code combinations, an equal number of selecting fingers controlled by said permutation bars, a series of key code combination responsive ciphering levers, a key ciphering device for operating said ciphering levers comprising a set of key coding instrumentalities for providing key code combinations positionable to a variety of positions to provide different key code combinations, means for variably advancing said key coding instrumentalities to said variety of positions, and a set of transmitting levers operable under the joint control exercised thereover by said selecting fingers and said ciphering levers for generating enciphered signals.

6. In a ciphering transmitter, a set of members controlled by code signals, a set of key code drums for providing key code signals, said key code drums being positionable to a variety of positions to thereby provide a variety of key code signals, a first stepping device, a variable feed control operated by said first stepping device, a second stepping device for stepping said key code drums, said variable feed control being effective to enable a variable stepping of said key code drums by said second stepping device to said variety of positions, and transmitting means controlled jointly by said sets of code signal controlled members and key code signal controlled members for generating enciphered signals.

7. In a ciphering transmitter, a set of members controlled by code signals, a set of key code drums for providing key code signals, a set of members controlled by said key code signals, said key code drums being positionable to a variety of positions to thereby provide a variety of key code signals, a first stepping device, a variable feed control operated by said first stepping device, a second stepping device for stepping said key code drums, said variable feed control being effective normally to enable a variable stepping of said key code drums by said second stepping device to said variety of positions, selectively operable means for disabling said second stepping device whereby said key code drums are stepped uniformly under control of said first stepping device, and transmitting means controlled jointly by said sets of code signal controlled members and key code signal controlled members for generating enciphered signals.

8. In a ciphering transmitter, a set of members controlled by code signals, a set of key code drums for providing key code signals, a set of members controlled by said key code signals, said key code drums being positionable to a variety of positions to thereby provide a variety of key code signals, a first stepping device for stepping said key code drums, a variable feed control operated by said first stepping device, a second stepping device for stepping said key code drums, said variable feed control being effective normally to enable a variable stepping of said key code drums by said second stepping device, selectively operable means for disabling either said second stepping device or both said stepping devices whereby said key code drums are either stepped uniformly under control of said first stepping device or remain stationary upon the disablement of both of said stepping devices, and transmitting means controlled jointly by said sets of code signal controlled members and key code signal controlled members for generating enciphered signals.

MARTHA W. C. POTTS,
Executrix Under the Last Will and Testament of Louis M. Potts, Deceased.

No references cited.