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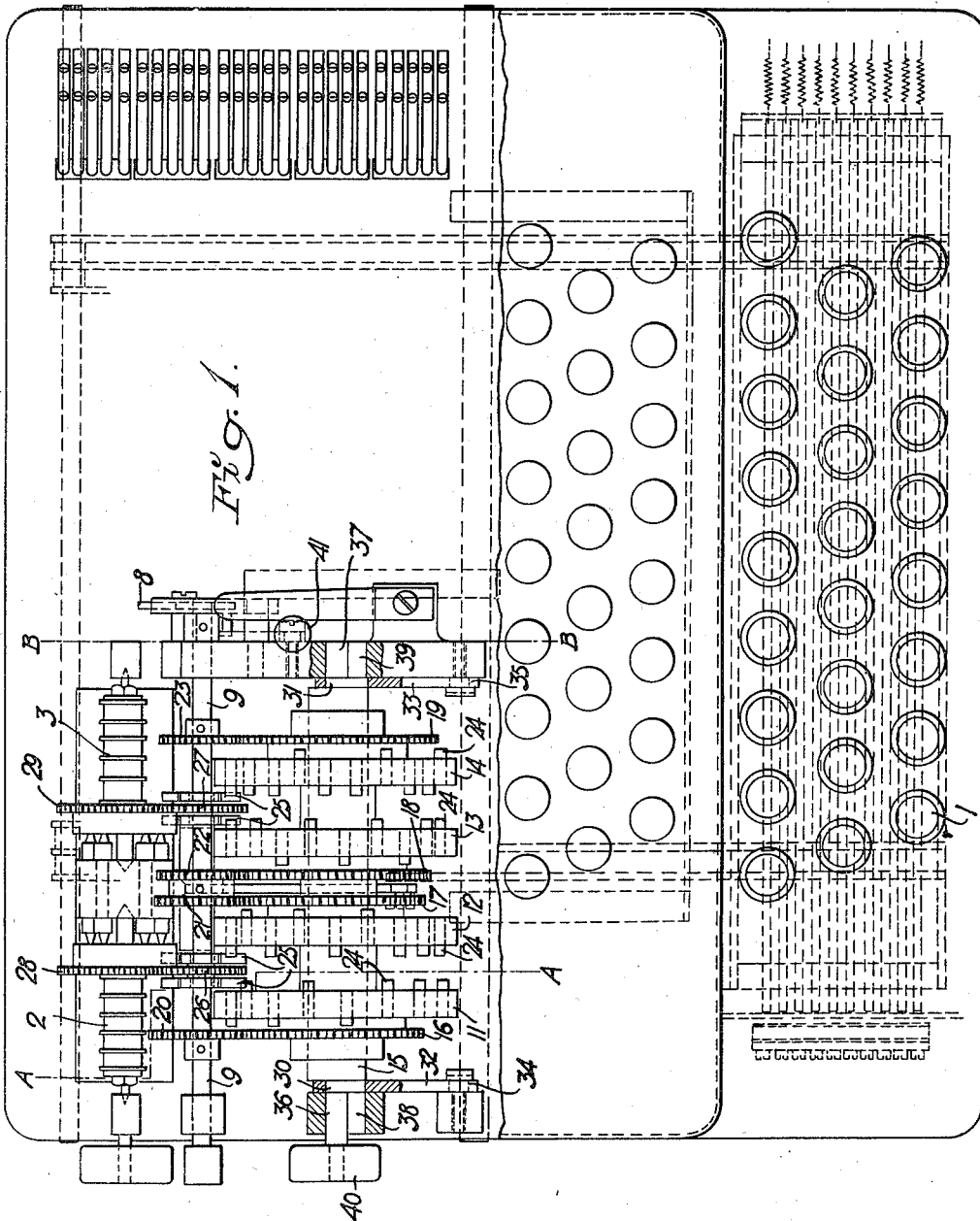
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1,846,105

CIPHERING APPARATUS

Filed May 28, 1928

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

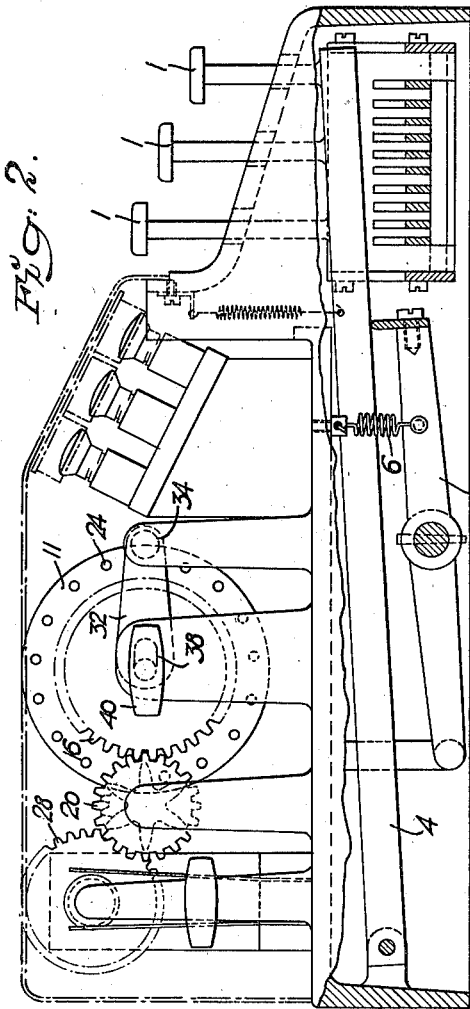


FIG. 4.

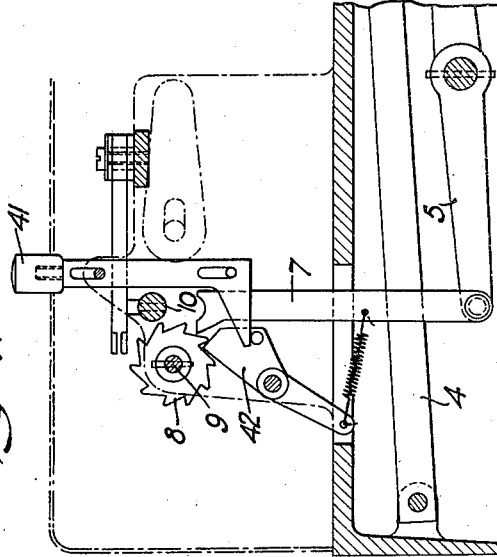
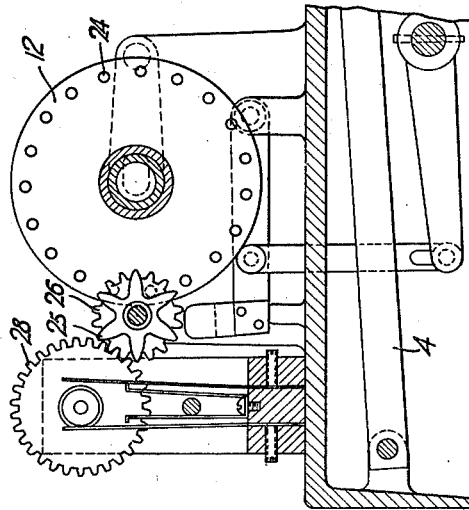


FIG. 3.



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## UNITED STATES PATENT OFFICE

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## CIPHERING APPARATUS

Application filed May 28, 1928, Serial No. 281,337, and in Sweden April 21, 1928.

This invention relates to ciphering apparatus of the kind in which intermittently movable commutator shaped ciphering cylinders are used to control electrical circuits for the production of the cipher, it may be that the latter is produced by means of a type-writer or by means of a signalling or indicating device of any kind. The movement of the ciphering cylinders is usually controlled by key wheels by which the movements of said cylinders in accordance with any desired series of signs are controlled mechanically or electrically and which are in turn controlled electrically from a key board operated in accordance with the text to be ciphered or deciphered.

This invention has for its object to provide a mechanical key wheel system to operate the ciphering cylinders of the ciphering apparatus in such a way that two or more key wheels will control one and the same ciphering cylinder in conjunction.

The invention is characterized, chiefly, in the provision of key wheels of different pitch each of which is adapted to be driven in accordance with its individual pitch from said driving shaft, said key wheels being adapted to act in pairs or in groups of more than two wheels upon the ciphering cylinders in order to effect an irregular movement thereof.

By the use of, say, two key wheels arranged in pairs the cycle of the ciphering cylinders operated thereby will be equal to the product of the pitch of each key wheel and the number of possible positions of the ciphering cylinder divided by the greatest common dividend. Preferably, such numerical proportions should be chosen that any common dividend may be avoided. By the present invention a very long cycle may thus be obtained in a simple way.

Another feature of the invention resides in that the key wheels are provided with disengaging pins by which the transmission of power to the ciphering cylinders is effected.

Another feature of the invention involves that the key wheels may be arbitrarily adjusted relatively to each other in peripheral direction.

In the accompanying drawings, a cipher-

ing apparatus having a key wheel mechanism according to this invention is illustrated by way of example.

Fig. 1 is a top plan view of the ciphering apparatus with the casing partly broken away to show the key wheel mechanism. Fig. 2 is a side elevation of the apparatus, partly in section. Fig. 3 is a sectional view, taken along the broken line A—A in Fig. 1. Fig. 4 is a sectional view taken along the line B—B in Fig. 1.

In the drawings the invention is illustrated as applied to a ciphering apparatus which as to the design of the ciphering cylinders and the circuits to control same may be similar to the ciphering apparatus shown in the U. S. Patent No. 1,663,624. It is to be noted, however, that the invention may also be used in connection with other types of ciphering apparatus.

The ciphering apparatus shown is provided with a key board comprising twenty-five keys 1 and may consequently be used for a series of 25 signs. Accordingly, the apparatus in agreement with the principle set forth in the above said patent is provided with two ciphering cylinders each comprising five contact rings with their respective contact pins. Said two ciphering cylinders are shown at 2 and 3, respectively, in the drawings.

The levers 4 of the keys 1 bear upon a common rocking lever 5 which is maintained in raised position by means of a spring 6 to hold the keys raised. The rocking lever 5 carries a spring operated pawl 7 engaging a ratchet wheel 8 on the horizontal shaft 9. A stop pin 10 is provided to limit the operative movement of the pawl. The horizontal shaft 9 constitutes a common driving shaft for four key wheels 11, 12, 13, 14 rotatably mounted on a supporting shaft 15 parallel to the shaft 9, each of said key wheels being rigidly connected to a gear wheel 16, 17, 18, 19, respectively, meshing in the gear wheels 20, 21, 22, 23, respectively, on the shaft 9. Each key wheel 11—14 is provided with a number of transmission members consisting of axial pins 24. The number of pins is different for each key wheel. The ratio of gearing between the driving gears of the various key wheels

20—16, 21—17, 22—18, 23—19 corresponds to the pitch of pins of the respective key wheels in such a way that at each step of the ratchet wheel 8 each key wheel will be moved a different step corresponding to its individual pitch.

The pins 24 of the key wheels may be moved into and out of operative position, for instance, by being displaced axially. The pins when in operative position are adapted to engage star wheels 25 rotatably mounted on the shaft 9, one for each key wheel. Those two star wheels corresponding to the key wheels 11, 12 are rigidly connected to an intermediate toothed wheel 26, the remaining two star wheels which correspond to the key wheels 13, 14 are, likewise, rigidly connected to an intermediate toothed wheel 27. The toothed wheel 26 meshes in a toothed wheel 28 rigidly connected to the ciphering cylinder 2 and the toothed wheel 27 meshes in a toothed wheel 29 rigidly connected to the ciphering cylinder 3.

In the embodiment shown the number of pins of the various key wheels is 17, 19, 21 and 23, respectively. The movement of the ciphering cylinders will, as a result, be exceedingly irregular, presenting a maximum periodicity of  $5 \times 17 \times 19 \times 21 \times 23 = 780,000$  signs.

By variation of the position and number of the pins any variation desired may be obtained. Moreover, means are provided to enable variation of the relative positions of the key wheels with respect to each other whereby a practically taken infinite number of different initial positions may be obtained without displacement of the pins. To this end the supporting shaft 15 which carries the key wheels 11—14 is mounted by means of eccentric journals 30, 31 in levers 32, 33, pivotally mounted at their opposite ends on pins 34, 35, respectively. The shaft 15 carries outside the eccentric journals 30, 31 central journals 36, 37, engaging horizontally elongated slots 38, 39 formed in the frame of the apparatus. The journal 36 carries at its outer end a handle 40 to permit rotation of the shaft 15. The shaft 15, when rotated by means of this handle through half a revolution, will be displaced in the direction away from the shaft 9 a distance such as to bring the gear wheels of the key wheels out of mesh with the gear wheels of the shaft 9 and release the pins of key wheels from their engagement in the star wheels, thereby allowing the various key wheels to be adjusted individually. Such adjustment having been completed the shaft 15 is turned back or turned half a revolution in the same direction as before, to restore the engagement with the star wheels.

Upon depression of a key 1 the rocking lever 5 is operated so as to rotate the shaft 9 one step by means of the pawl 7 and the ratchet

et wheel 8. In the embodiment shown this rotation of the shaft 9 will cover a tenth of a revolution. By the key wheels said rotation is translated to an irregular motion of the ciphering cylinders as determined by the adjustment of the pins 24 and the relative adjustment of the key wheels.

Should it be desired for any purpose, as for supervision, to rotate the ciphering cylinders backwards, this may be accomplished after depression of the releasing key 41 shown in Fig. 4. Said releasing key, when depressed, releases a pawl 42 normally engaging the ratchet wheel 8 to prevent return movement thereof, as will readily appear from the drawings.

The ciphering cylinders and their operation may, for instance, as above stated, be equal to what is described in the Patent No. 1,663,624, but may also be of different design and operation without departing from the principle of the invention.

Though in the drawings two key wheels are shown as provided for each ciphering cylinder it is to be noted that the number of key wheels and the number of ciphering cylinders too may be varied at will.

The releasing mechanism may, of course, be of another design than that shown. The key wheels may be modified as to the pins 24.

What I claim is:

1. In a ciphering apparatus the combination of a driving shaft, means to rotate said shaft step-by-step, a series of key wheels of different pitch, means to rotate said key wheels from said driving shaft at different rates corresponding to their individual pitches, intermittently movable ciphering cylinders, and means to operate each cylinder in conjunction with at least two key wheels.

2. In a ciphering apparatus the combination of a driving shaft, means to rotate said shaft step-by-step, a series of key wheels of different pitch, means to rotate said key wheels from said driving shaft at different rates corresponding to their individual pitches, intermittently movable ciphering cylinders, a driving gear for each of said cylinders, and means to operate said driving gear from two key wheels at least in conjunction.

3. In a ciphering apparatus the combination of a driving shaft, means to rotate said shaft step-by-step, a series of key wheels of different pitch having power transmission elements capable of being brought into and out of operative position, means to rotate said key wheels from said driving shaft at different rates corresponding to their individual pitches, intermittently movable ciphering cylinders, a driving gear for each of said cylinders, and means to operate said driving gear from the power transmitting elements of at least two key wheels.

4. In a ciphering apparatus the combination of a driving shaft, means to rotate said shaft step-by-step, a series of key wheels of different pitch, said key wheels having adjustable pins, means to rotate said key wheels from said driving shaft at different rates corresponding to their individual pitches, intermittently movable ciphering cylinders, a driving gear for each of said cylinders, and means to operate said driving gear from the pins of two key wheels at least in conjunction.

5. In a ciphering apparatus the combination of a driving shaft, means to rotate said shaft step-by-step, a series of key wheels of different pitch, said key wheels being shiftable relatively to each other in the peripheral direction, means to rotate said key wheels from said driving shaft at different rates corresponding to their individual pitches, intermittently movable ciphering cylinders, and means to operate said driving gear from two key wheels at least in conjunction.

6. In a ciphering apparatus the combination of a driving shaft, means to rotate said shaft step-by-step, a series of key wheels of different pitch, said key wheels having shiftable pins to act as power transmitting elements and being adjustable relatively to each other in the peripheral direction, means to rotate said key wheels from said driving shaft at different rates corresponding to their individual pitches, intermittently movable ciphering cylinders, a driving gear for each of said cylinders, and means to operate said driving gear from the pins of two key wheels at least in conjunction.

7. In a ciphering apparatus the combination with intermittently movable ciphering cylinders, of key wheels of different pitch, means to operate each of said ciphering cylinders from two such key wheels at least in conjunction, a common shaft upon which said key wheels are rotatably mounted, a common driving shaft, means to rotate said driving shaft step-by-step, means to rotate said key wheels from said common driving shaft at different rates corresponding to their individual pitches, and means to move said key wheel carrying shaft so as to bring the key wheels out of operative position.

8. In a ciphering apparatus the combination of a key board mechanism to be operated in accordance with the text to be ciphered or deciphered, a common driving shaft to be rotated step-by-step under the control of said key board mechanism, intermittently movable ciphering cylinders, a supporting shaft, wheels of different pitch rotatably mounted on said supporting shaft, gears positively driven by said driving shaft to rotate said key wheels at different rate corresponding to their individual pitches, star wheels loosely mounted on said driving shaft to be operated by

said key wheels, and means to operate each ciphering cylinders from at least two star wheels at a time.

9. In a ciphering apparatus, the combination of a key board mechanism to be operated in accordance with the text to be ciphered or deciphered, a common driving shaft to be rotated step-by-step under the control of said key board mechanism, intermittently movable ciphering cylinders, a driving gear for each cylinder, a supporting shaft, key wheels of different pitch rotatably mounted on said supporting shaft, gearing positively driven by said driving shaft to rotate said key wheels at different rate corresponding to their individual pitches, and star wheels loosely mounted on said driving shaft to transmit motion to each of said driving gears from at least two star wheels in conjunction.

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