PATENT SPECIFICATION

231,502

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COMPLETE SPECIFICATION.

Improvements in Ciphering Machines having a Plurality of Ciphering Rollers for Effecting Substitution of the Signs.

We, CHIFFRIERMASCHINEN AKTIENGESELLSCHAFT, of Steglitzerstr. 2, Berlin, W. 35, Germany, a German company, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

Ciphering machines (for example electrical ciphering machines) are already known wherein a plurality of ciphering rollers are arranged, which have on their end faces a number of contacts by means of which they touch one another. These rotatable ciphering rollers are arranged between fixed end drums. The contacts at one end of the ciphering rollers are connected with the contacts at the other end through the ciphering rollers in the most irregular manner possible and the contacts of one fixed end drum are connected with actuating points, for example key contacts, while the contacts of the other fixed end drum are connected with indicating devices, for example glow lamps, or with a writing mechanism.

In consequence of this arrangement the electric current, upon the actuating point being struck, for example upon the key of the letter *c* being depressed, passes in an irregular manner through the system of the ciphering rollers (compare Figure 1) and yields, for example at the indicating points, the letter *h*.

Now the method is also known of rotating the ciphering rollers relatively to one another during the ciphering of a rather large number of single signs, so that the system of sign substitution is altered, that is, so that at the next depression of the letter key *c*, the letter *m*, for example, appears at the indicating points.

It is further to be observed that the contact points on the ciphering rollers are provided in such numbers as correspond to the signs to be substituted, for example twenty-six contacts corresponding to the twenty-six letters of the alphabet.

In the case of such an arrangement the ciphering rollers, after a comparatively small number of ciphering operations return to their initial position so that in the case of the example selected the letter *c* again gives the code sign *h*, that is to say, the period of the ciphering recommences. The shorter the period of the ciphering is, the easier it is for an unauthorised person to decipher a coded message.

Now according to the invention an arrangement is provided which yields an exceedingly long period, so that deciphering by unauthorised persons by observing repeating substitutions is practically impossible.

Thus, care is taken to adjust the ciphering rollers easily into a definite position relatively to one another, to make this position clearly intelligable, and to return the ciphering rollers quickly to any desired initial position.

The invention is illustrated by way of example in the accompanying drawings wherein:

Figure 1 is a perspective view of four ciphering rollers with their contact points and driving mechanisms (for the better elucidation of the course of the current the ciphering rollers are shown somewhat separated from one another).

Figure 2 is a view of the ciphering rollers with part of the driving and adjusting mechanism, partly in section.

In Figure 1 for the sake of clearness only six contact points are shown, while in Figure 2 a larger number are indicated, corresponding to the practical construction of the machine.

In the case of the constructional

example selected, four ciphering rollers 1, 2, 3 and 4 are so arranged as to be rotatable about a shaft 5 between two stationary end drums 6 and 7. These ciphering rollers are provided with toothed rims 1*a*, 2*a*, 3*a* and 4*a*, and four shafts 8, 9, 10 and 11 are provided, which are set in rotation by means of toothed wheels 12, 13, 14 and 15 from the common driving point, for example, a toothed wheel 16. Onto the shafts 8—11 are fitted complete toothed wheels 17, 18, 19 and 20 and close beside them toothed wheels 21, 22, 23 and 24 which have only a few teeth with large gaps between them. These wheels will hereinafter be designated gap toothed wheels. The shafts 8—11 can be adjusted in the longitudinal direction into three different positions by means of knobs 25, 26, 27 and 28 at the end, and for securing them in each position three rests or notches 30, 31 and 32 are provided on each shaft, into which there springs any desired locking member and thus holds the shaft fast in the adjusted position. Owing to the three positions of the shafts 8—11 three sets of driving conditions can be adjusted for the ciphering rollers, namely for driving by means of gap toothed wheels, for driving by means of complete toothed wheels, and with the ciphering rollers free, that is, without any driving. The position for the time being of the driving wheels can be ascertained by looking at the machine, as distinguishing signs, for example letters, appear either at the left or at the right or in the centre at windows 33, 34 and 35 which are provided in sleeves 36, 37, 38 and 39 surrounding the knobs 25—28. The graduations on the driving wheels 12—15 and consequently on the wheels, 17—20 correspond according to the invention to prime numbers or numbers which have no common factor. Thus for example for the graduations of the said wheels the numbers 11, 15, 17 and 19 are selected.

Owing to these arrangements the period for the ciphering is particularly long, as for a complete rotation of all the ciphering rollers, that is to say, the adjustment thereof into the original initial position, the number of separate steps required corresponds to the product of these numbers, that is to say: 11.15,17.19. = 53,295 separate feed steps. The said graduation of the toothed wheels for the driving of the ciphering rollers is, according to the invention, furthermore so selected that it is not a multiple of the graduation of the ciphering rollers (contact number for example 26). Consequently the complete period of the ciphering is 11.15.17.19.26 = 1,385,670.

Now if each time, in the case of a fresh ciphering operation, a start were to be made from the same basic position, this period would exactly repeat itself each time, that is to say the order of succession of the substitution changes would always be the same within this period. Now this is prevented owing to the fact that at each ciphering operation or after a number of ciphering operations a commencement is made with a different initial position of the driving wheels.

If the shaft of the driving toothed wheels are in their left hand position, that is to say, neither the gapped toothed wheels nor the full toothed wheels are in mesh with the toothed rims of the ciphering rollers, each shaft can be separately rotated by means of its knob and a definite initial position of the driving wheels can be adjusted which can then be ascertained for the knobs from the letters in the sleeves 36, 37, 38, and 39.

In order, with this adjustment of the driving shafts, to adjust their full toothed wheels and their gap toothed wheels accurately so that by displacement of the adjusting knobs the immediate coupling with the toothed rims of the ciphering rollers is still possible and tooth does not strike against tooth, the toothed wheels 12—15, during this displacement into the left hand position, enter an auxiliary toothed wheel 40 which, owing to a locking device, only permits steps to be taken equal to the extent of one tooth each time. By drawing out the knobs and displacing the driving shafts towards the right the gap toothed wheels are then again coupled to the toothed rims of the ciphering rollers.

If the ciphering rollers are to be adjusted into a definite initial position it is only necessary, by shifting the knobs into the central position, to couple the full toothed wheels to the toothed rims of the ciphering rollers. Then by rotating the knobs and with them the driving shafts a definite position of the individual ciphering rollers can be established. In order to distinguish this position, rings 41, 42, 43 and 44 with letters are secured to the ciphering rollers and according to the adjustment of the ciphering rollers one of these letters appears in a special window 45 provided for this purpose.

In order, after effecting a ciphering operation, to bring the ciphering rollers into a definite position relatively to one another so that definite letters appear in the said windows, the following procedure is adopted:—

Into one of the adjusting knobs, for example the knob 25, a crank 46 can be

inserted, but only when the knob is in its outer position, that is, when the gap toothed wheel is in mesh with the toothed rim of the ciphering roller, for in this case the toothed wheel 12 is also in mesh with the common toothed wheel 16, and consequently upon the knob 25 being rotated, all the shafts 8, 9, 10 and 11 are rotated and therefore the ciphering rollers are also displaced relatively to one another by the gap toothed wheels.

In order to permit of such an insertion of the crank 46 into the adjusting knob 25 only in the position shown, a spring pin 47 is inserted, the outer end 48 of which is round, while its inner end 49 is kept flat.

Consequently only in the position according to Figure 2 can the slot in the crank pin of the crank 46 be slipped over the flat part of the pin 47. If on the contrary the knob is in its central or left hand position the round part 48 of this pin prevents the insertion of the crank.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A ciphering machine with a plurality of ciphering rollers for effecting the substitution of the signs, characterised by the feature that the driving of the ciphering rollers for altering the system of substitution is effected by toothed wheels, the graduations of which are prime numbers or have no common factor.

2. A ciphering machine according to Claim 1, characterised by the feature that the graduations of the driving wheels for the ciphering rollers are so selected that they are not a multiple of the number of feed steps (number of contact points on the ciphering rollers) required for one revolution of the ciphering rollers.

3. A ciphering machine according to Claims 1 and 2, characterised by the feature that for the movement of the ciphering rollers, beside gap toothed wheels full toothed wheels are arranged upon shafts driving from a common driving point and the latter are adjusted in the longitudinal direction into three different positions (gap toothed wheel or full-toothed wheel in mesh with ciphering rollers or both wheels out of mesh with ciphering rollers) and this adjustment is made visible outside the machine by means of adjusting knobs.

4. A ciphering machine according to Claims 1 to 3, characterised by the feature that when the full toothed wheels are coupled to the ciphering rollers the driving wheels (12—15) become free from the common driving wheel (16) so that each ciphering roller can be separately and independently adjusted at will.

5. A ciphering machine according to Claims 1 to 4, characterised by the feature that upon the displacement of the driving shafts, through which both the gap toothed wheels and the full toothed wheels come out of engagement with the ciphering rollers, the driving wheels (12—15) enter an auxiliary toothed wheel (40) which, owing to a locking device, only permits individual feed steps to be executed according to the graduations of the toothed rims on the ciphering rollers.

6. A ciphering machine according to Claims 1 to 5, characterised by the feature that in one of the adjusting knobs (25) a resilient peg (47) is provided having a round outer part and a flat inner part, which only permits of the insertion of a crank for the purpose of adjusting all the ciphering rollers when the knob is in its outer position.

7. A ciphering machine substantially as described.

Dated this 21st day of March, 1925.

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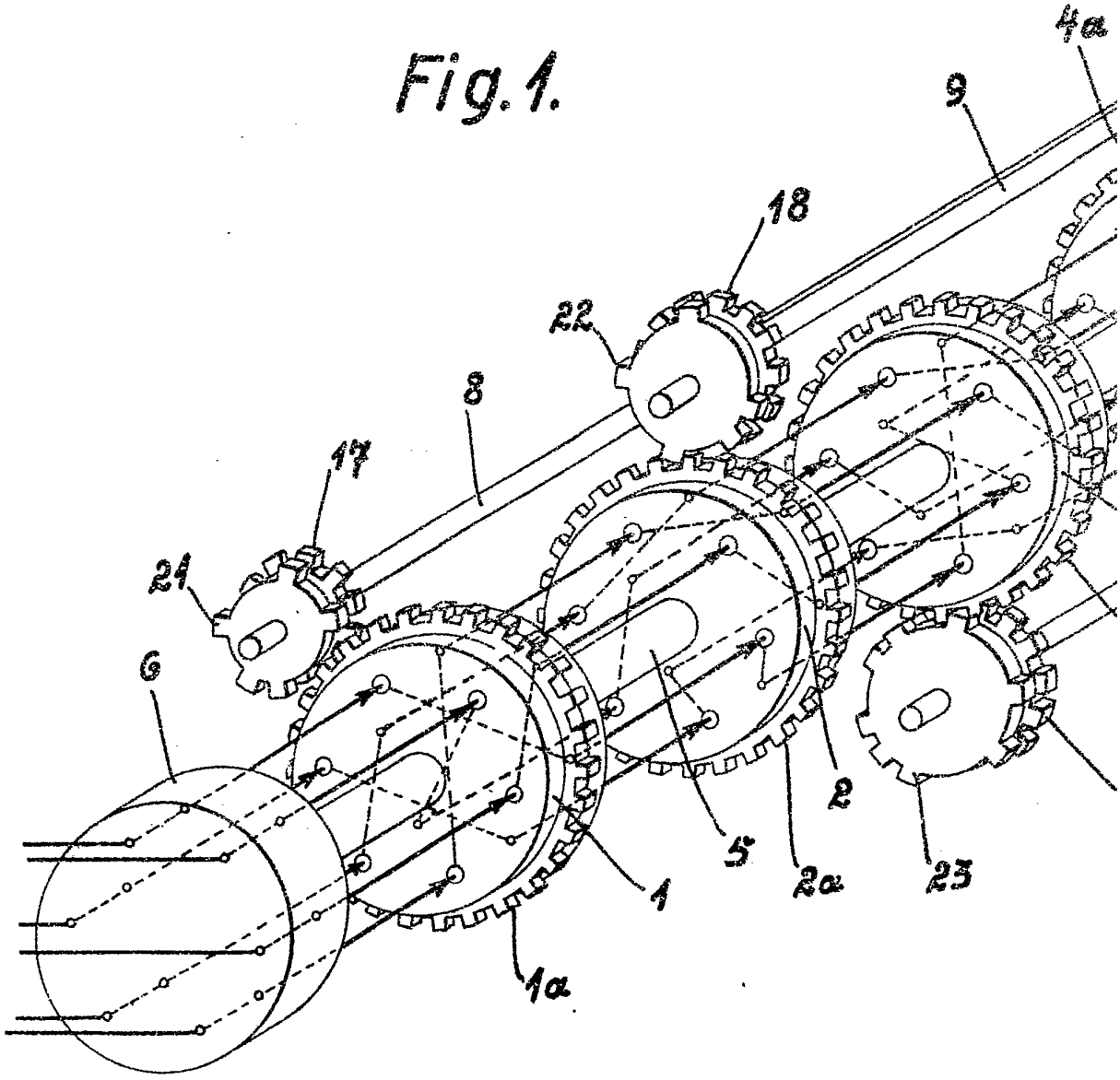
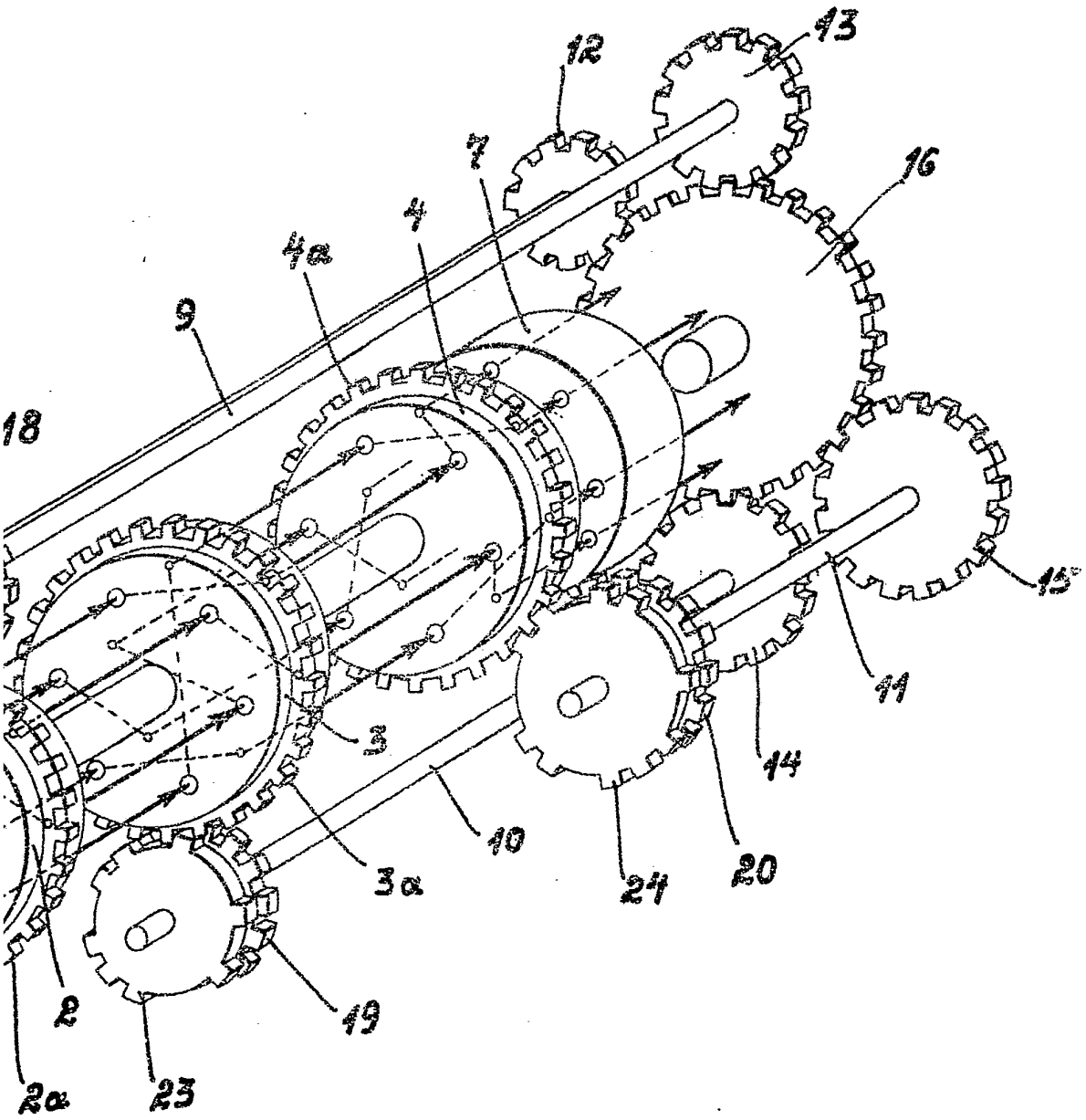
Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1925.

Fig. 1.





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[This Drawing is a full-size reproduction of the Original.]

Fig. 1.

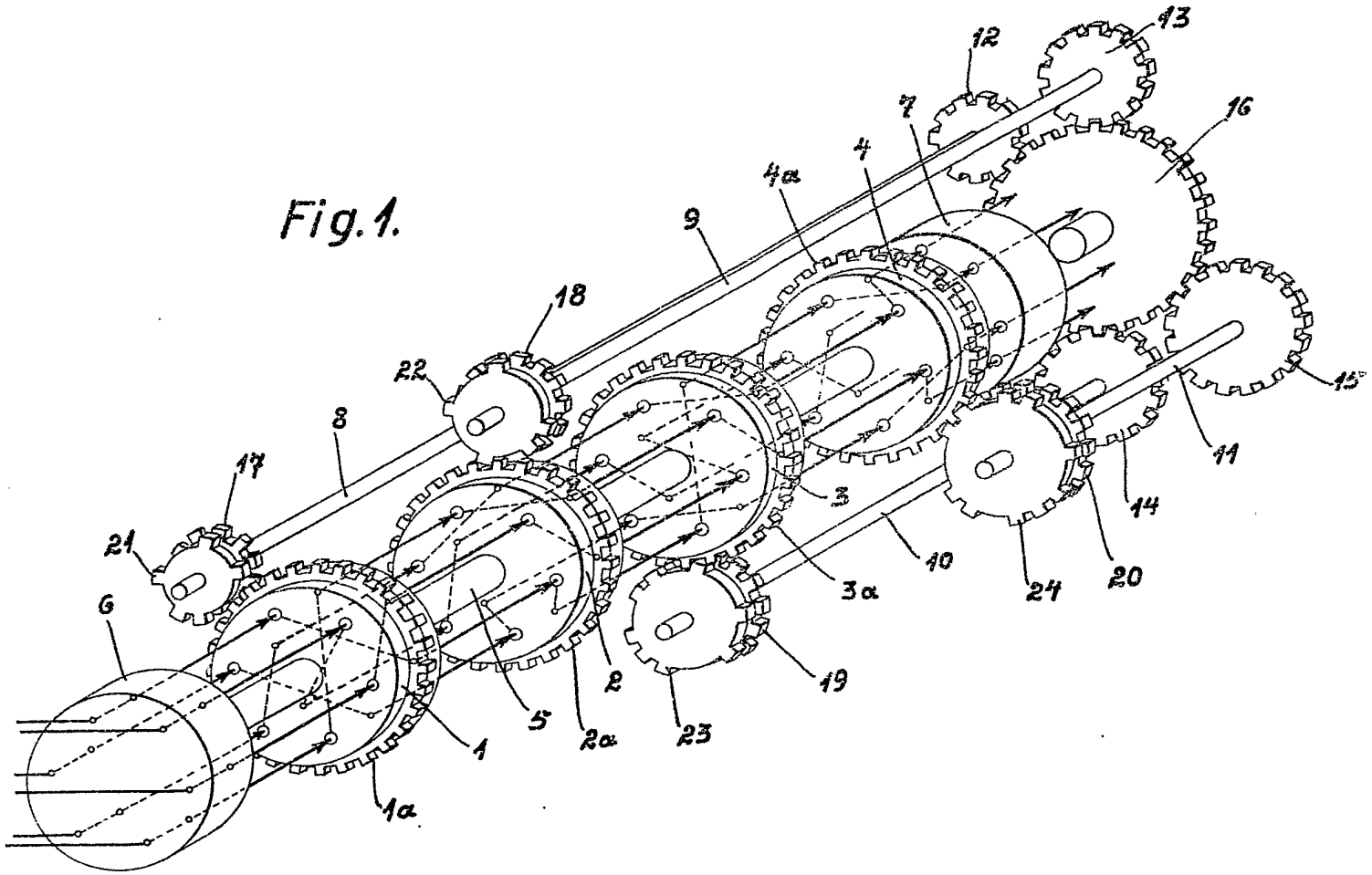

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Fig. 2.

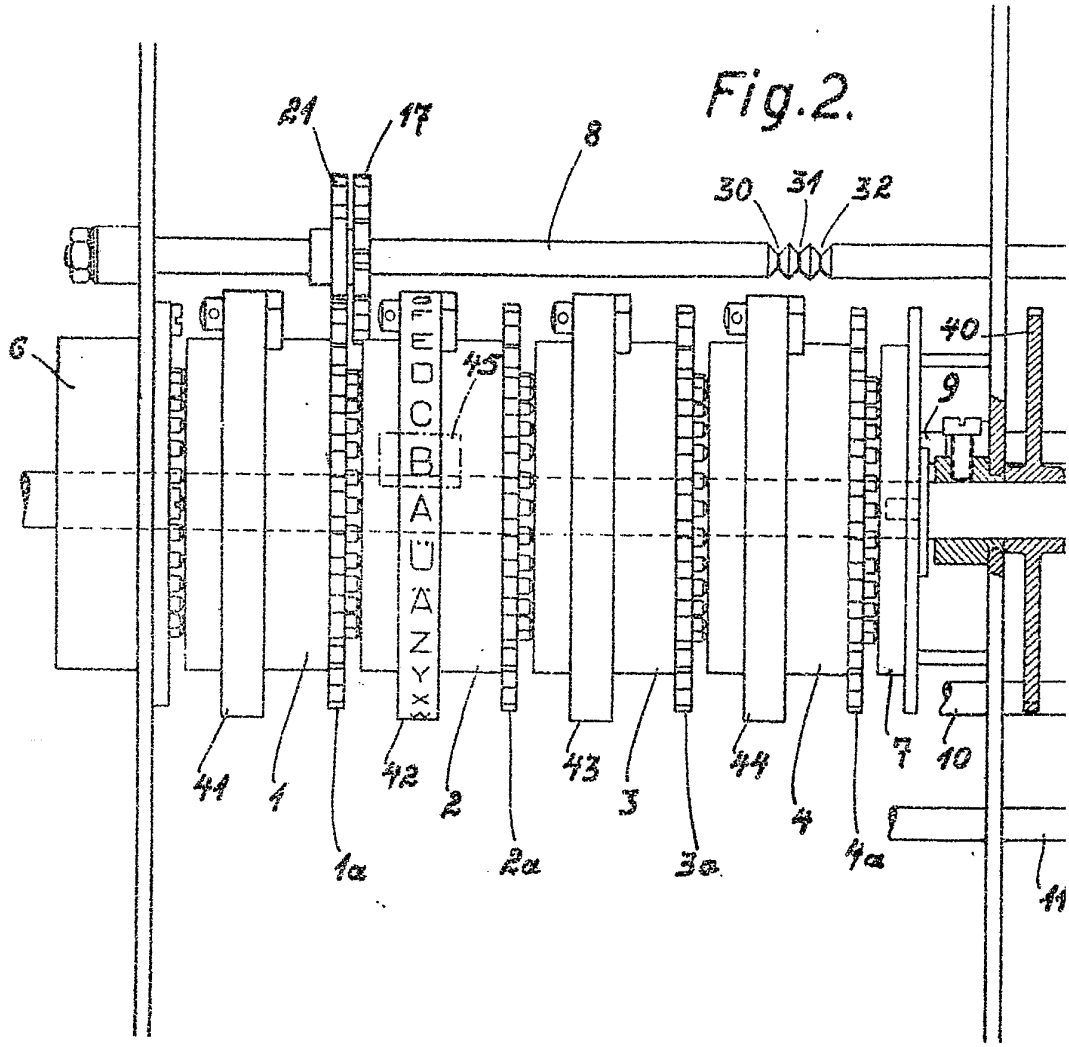

Fig.2.

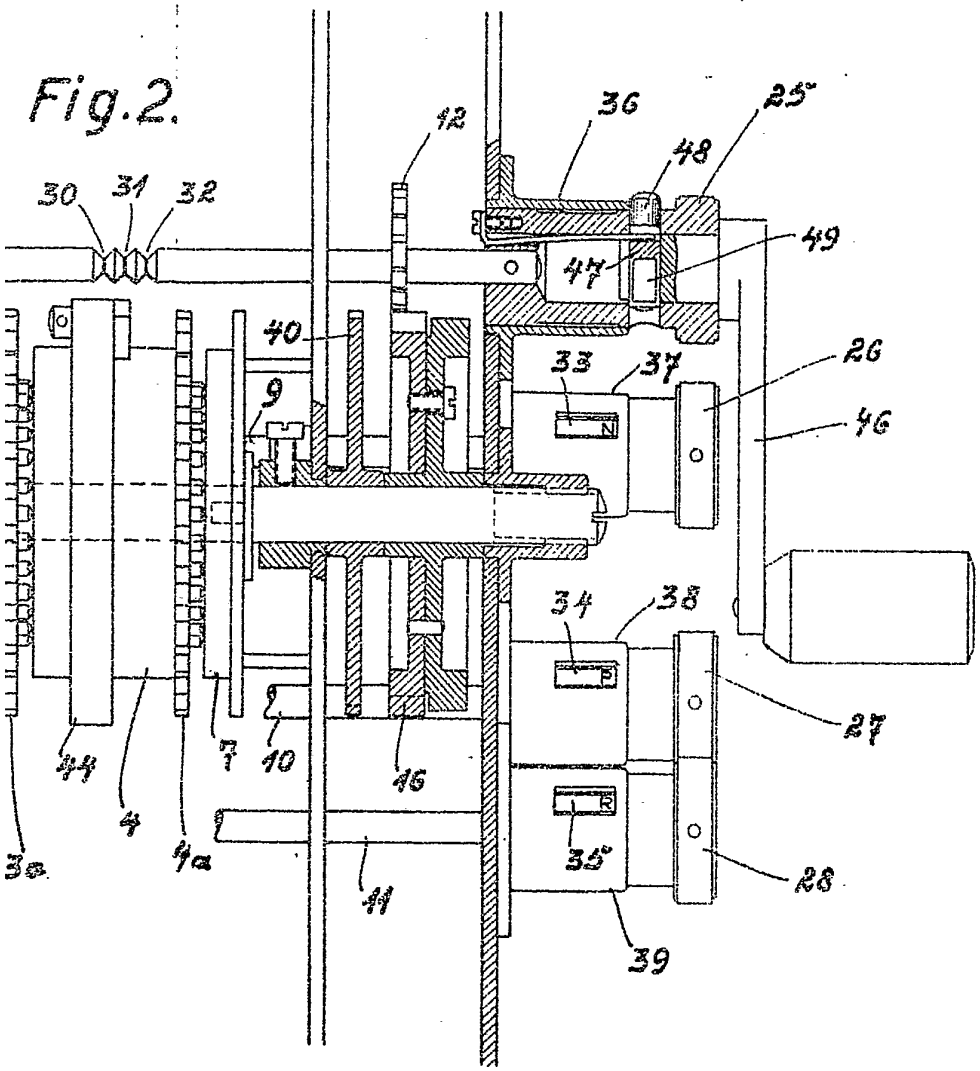

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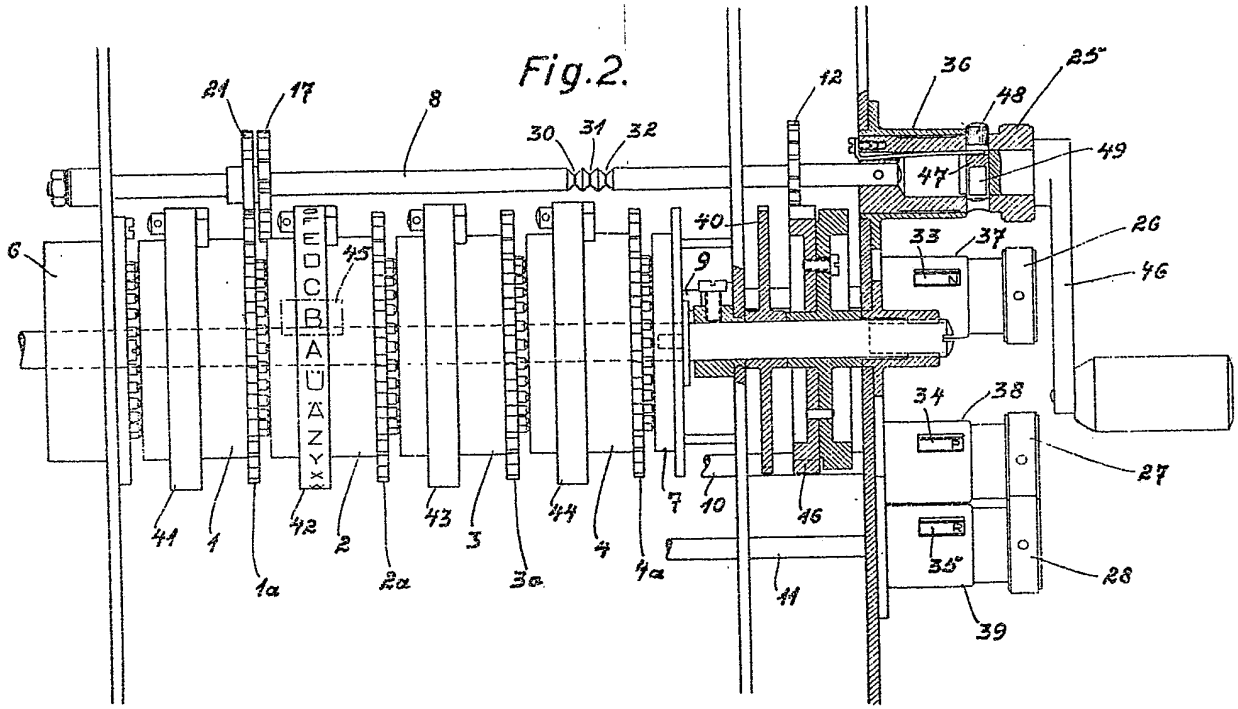
Fig.2.



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