

[11] 3,596,745

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 [21] Appl. No. **757,918**
 [22] Filed **Sept. 6, 1968**
 [45] Patented **Aug. 3, 1971**
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 [32] Priority **Sept. 7, 1967**
 [33] **Germany**
 [31] **G 37 918/15g**

[56]

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[54] **SOLENOID OPERATED TYPE HEAD SETTING**
ARRANGEMENT
 4 Claims, 7 Drawing Figs.

[52] U.S. Cl. **197/55,**
178/34, 340/347, 310/14, 197/18
 [51] Int. Cl. **B41j 1/26**
 [50] Field of Search **178/34;**
197/15, 18, 49, 55; 310/14, 23, 24; 340/347

ABSTRACT: The keys of a typewriter effect the energization of selected electromagnetic windings whose cores are displaced steps of different length. The cores are connected to a control element which is displaced a distance corresponding to the total of the steps made by the cores. The displaced control element sets the type head to a selected position in which a selected type face, associated with the operated key, is operative.

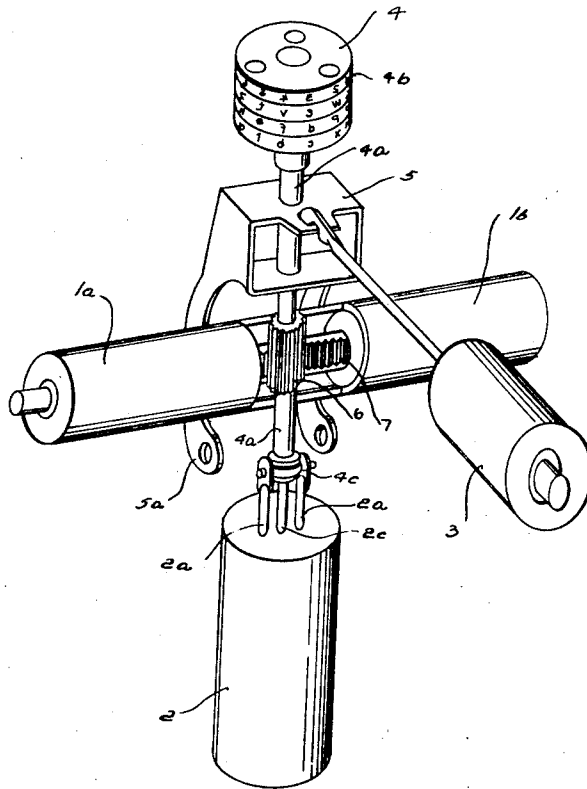
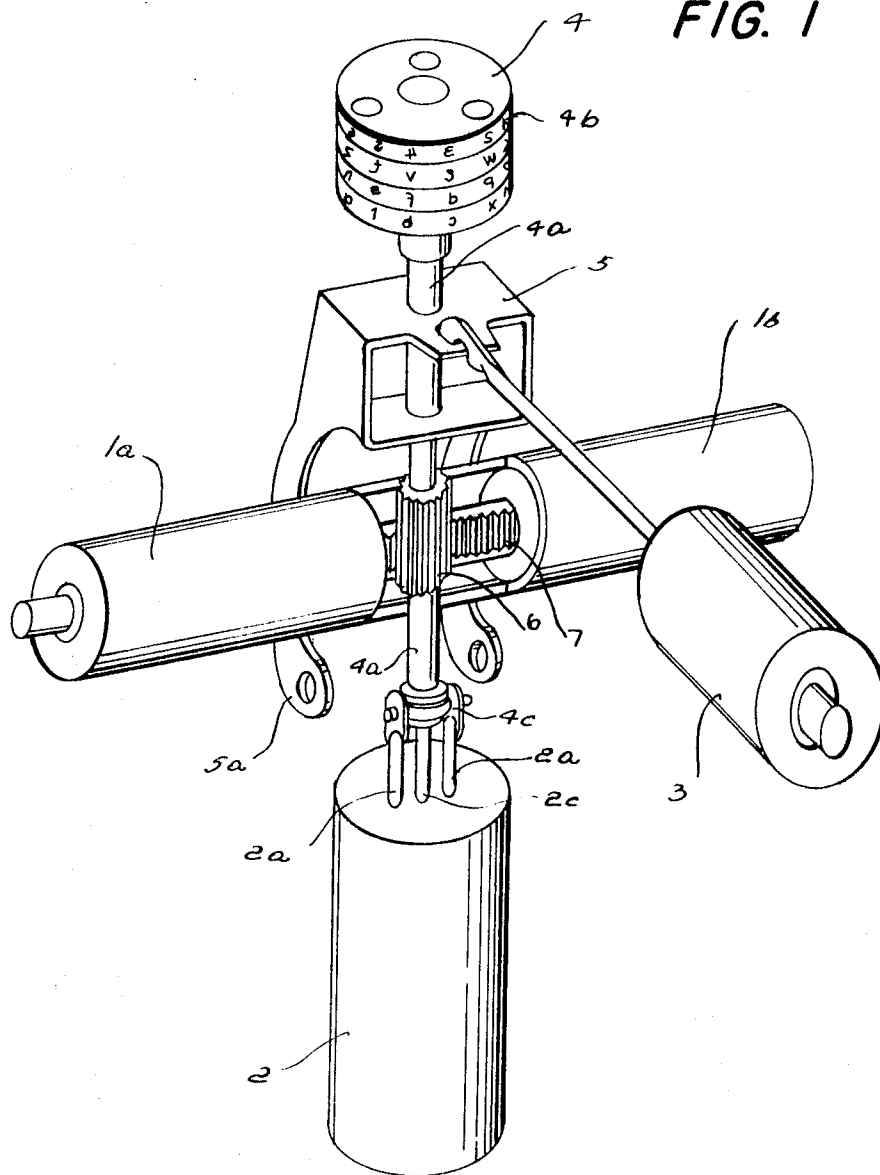
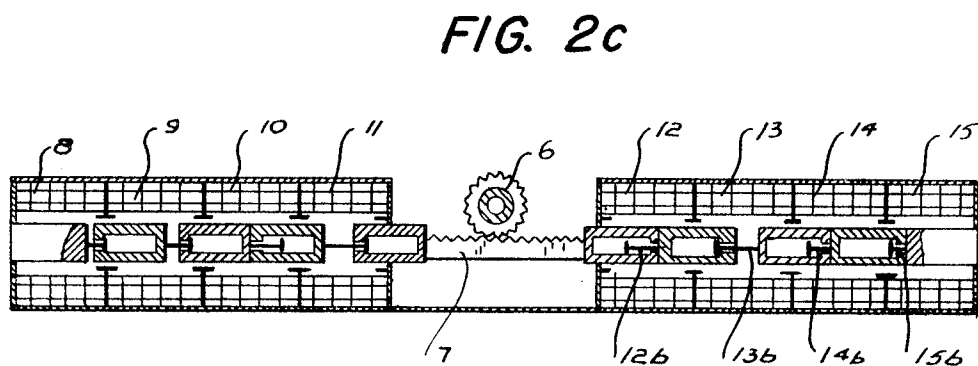
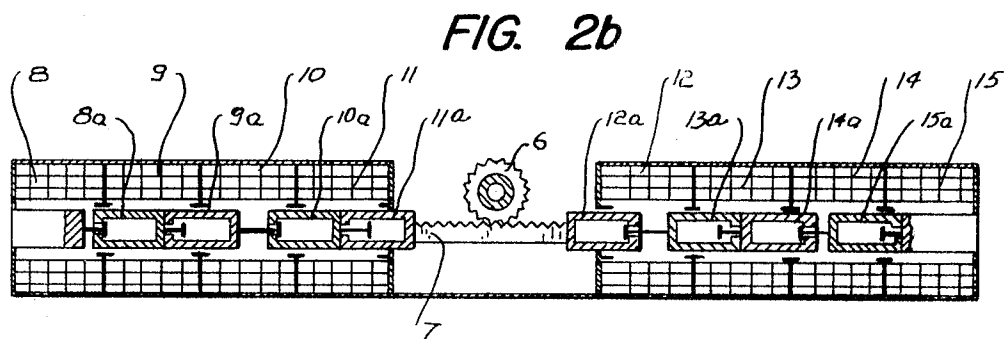
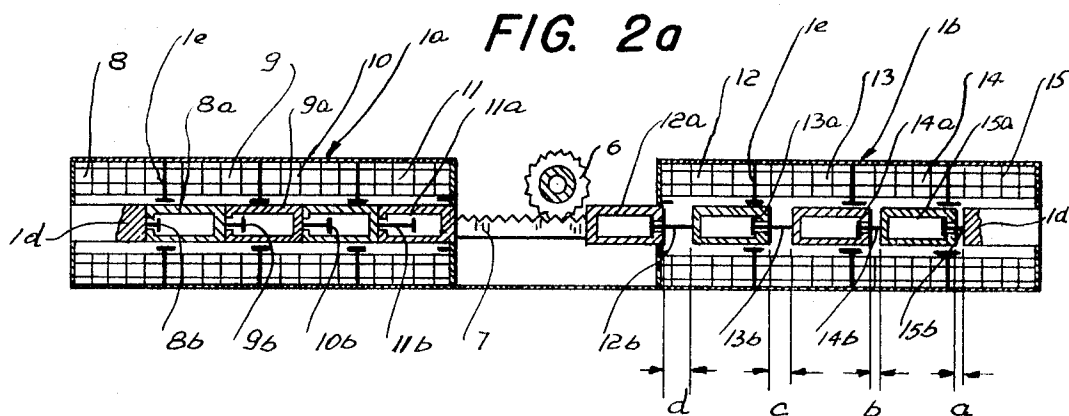


FIG. 1



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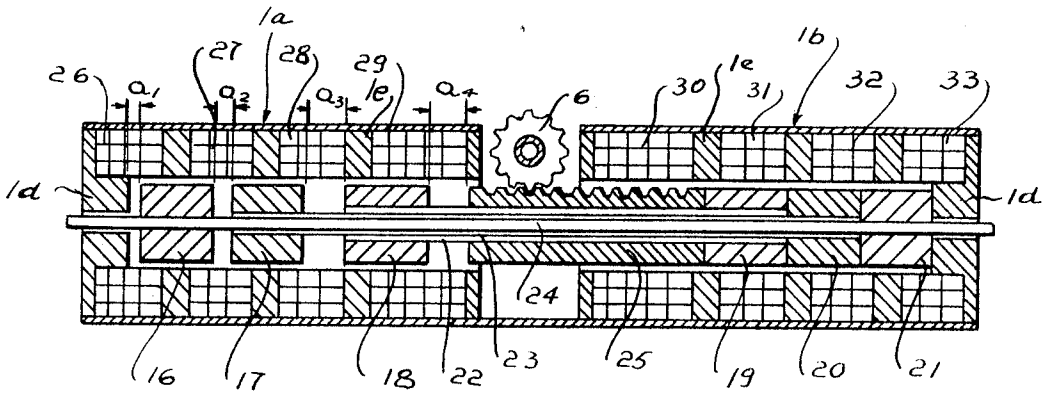


FIG. 3a

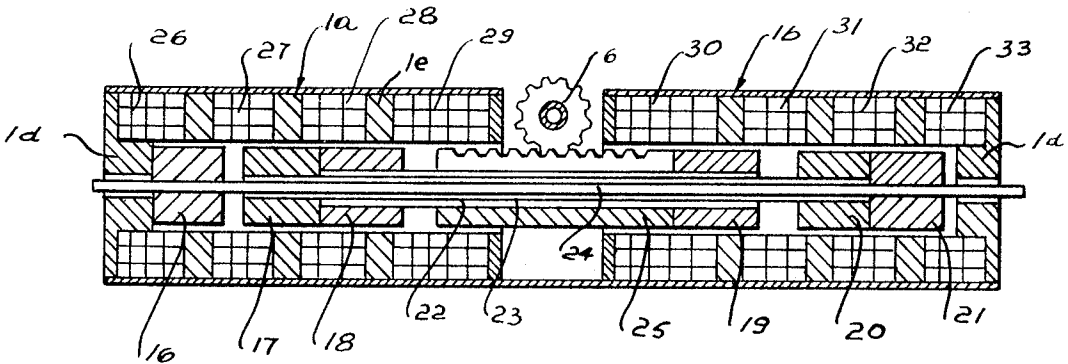


FIG. 3b

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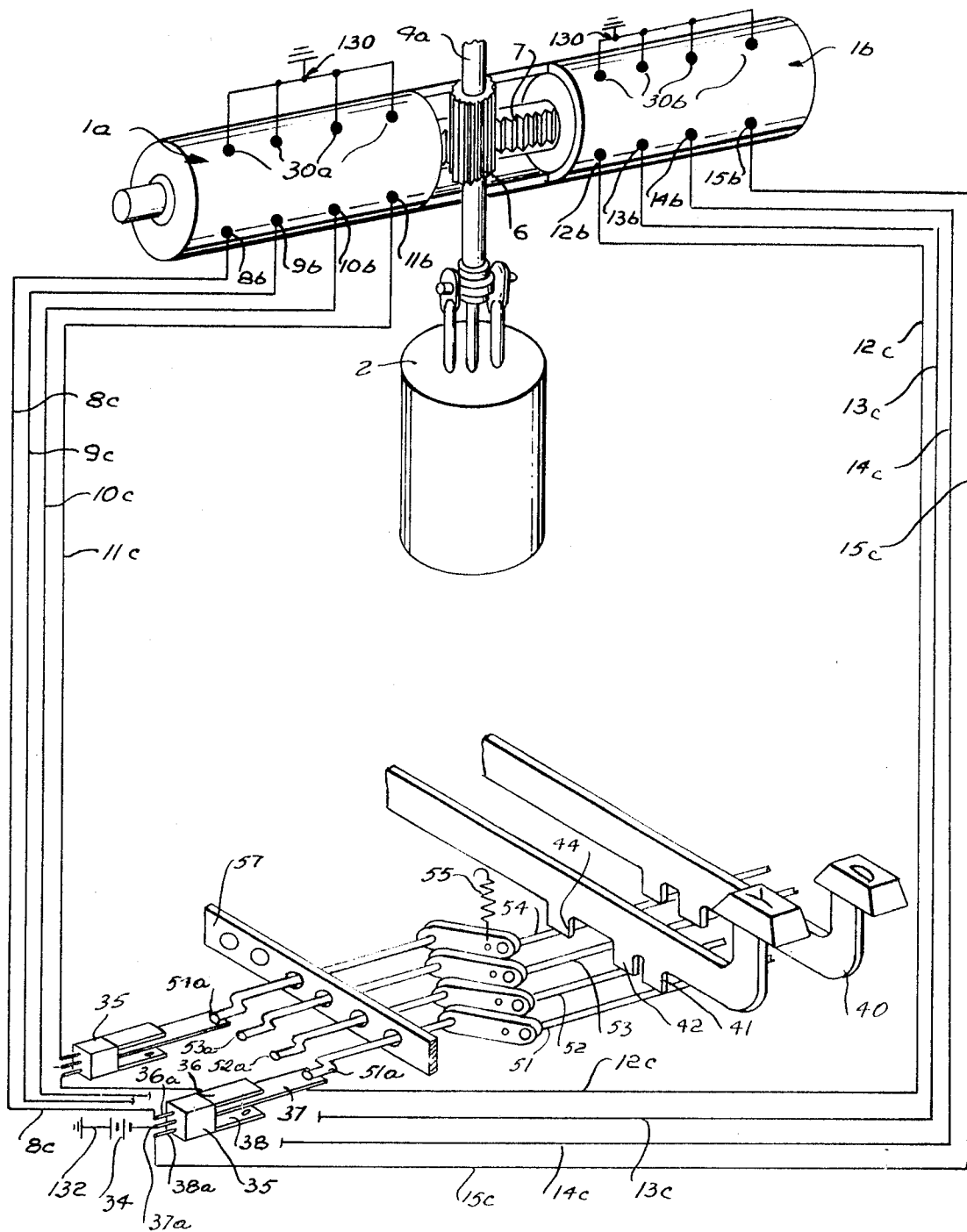


FIG. 4

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SOLENOID OPERATED TYPE HEAD SETTING ARRANGEMENT

CROSS-REFERENCES TO RELATED APPLICATIONS

An application entitled "Type Head Arrangement," filed by applicant in July 1968, and an application entitled "Pneumatic Setting Arrangement for a Type Head," which will be filed by Hebel et al. simultaneously with the present application, are directed to subject matter related with the present application.

BACKGROUND OF THE INVENTION

The present invention relates to a setting arrangement for setting a control element, and more particularly to an electromagnetic setting arrangement for a control element by which the type head of a typewriter is set to a position for printing a type face selected by operation of a key.

The German Pat. 1,108,259 discloses an electromagnetic setting arrangement for a type carrier provided in telegraphic apparatus in which every step is controlled by sequentially arranged electromagnets which are individually energized for turning the shaft of the type carrier.

It is also known to provide an electromagnet with separated cores for setting the magnetic heads on a storage drum.

SUMMARY OF THE INVENTION

It is one object of the invention to provide an improved electromagnetic setting device in which several electromagnets are simultaneously energized to move correlated cores whose displacements are added to move a control element.

Another object of the invention is to provide an electromagnetic setting arrangement in which cores of several electromagnets are disposed adjacent each other so that magnetic flux flows through all cores, and each core serves as armature for an adjacent core.

Another object of the invention is to provide a setting arrangement for setting a control element by pairs of oppositely acting setting members which are displaced by actuating members steps of different length which are added to displace a control element.

Another object of the invention is to displace setting members steps having different length in accordance with a code so that by a limited number of setting members, such as magnetic cores, a far greater number of positions of the element controlled by the setting members can be obtained.

Another object of the invention is to provide a setting arrangement in which first setting members act on a control element to move the same in one direction, and second setting members act on the control element to move the same in an opposite direction.

Another object of the invention is to provide an electromagnetic setting arrangement in which only small masses have to be displaced and accelerated, and in which the controlled element is magnetically locked in each position.

A setting arrangement according to the invention serves the purpose of moving an element in opposite direction for setting the element to one of a predetermined number of control positions. Particularly, the element may be a rack bar meshing with a gear for turning a type head between angular positions in which different type faces on the same are located opposite a printing area.

One embodiment of the invention comprises a set of first setting members and a set of second setting members, a set of first operating members and a set of second operating members respectively controlling the first and second setting members, and means for limiting the movements of the first and second setting members.

In the preferred embodiment of the invention, the first and second setting members are first and second magnetic cores, and the first and second operating members are first and second magnetic windings.

Pairs of first and second cores are symmetrically disposed at opposite ends of the controlled element, and the first and second cores of the innermost pair are connected with the ends of the same. Each energized first winding moves the respective controlled first core in one direction, and each energized second winding moves the respective controlled second core in the opposite direction. The movements of the first and second cores are limited so that the first and second cores of each pair make steps of the same length, and different pairs make steps of different length selected in accordance with a code.

By simultaneous energization of selected first and second windings belonging to different pairs, and deenergization of first and second windings forming pairs with energized first and second windings, the first and second cores of selected first and second windings are moved for displacing the controlled element to a selected control position. The distance which the controlled element is moved has a length which is the total of the lengths of the steps made by selected first cores in one direction and by selected second cores in the opposite direction.

In one embodiment of the invention, adjacent first cores, and adjacent second cores are respectively coupled to each other by first and second coupling stops. The coupling stops have different lengths selected in accordance with a code for determining the length of the steps of the cores.

In another embodiment of the invention, connecting shafts rigidly connect the first and second cores of each pair for movement together. Preferably, the shafts are hollow and receive respective other shafts for sliding movement in longitudinal direction. The length of the shafts is selected so that adjacent first or second cores have to move distances of different length to abut each other.

The electromagnetic windings are selectively energized by switches controlled by key levers which have actuating projections arranged in accordance with a code for effecting simultaneous energization of several electromagnetic windings.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary perspective view illustrating a setting arrangement for the type head of a typewriter;

FIG. 2 is a sectional view illustrating an electromagnetic setting arrangement for a rack bar element setting the type head to a selected angular position;

FIG. 2a is a sectional view corresponding to FIG. 2a, and illustrating another operational position;

FIG. 2c is a sectional view corresponding to FIGS. 2a and 2b and illustrating a further operational position;

FIG. 3a is a sectional view illustrating a modified setting arrangement according to the invention;

FIG. 3b is a sectional view corresponding to FIG. 3a and illustrating another operational position; and

FIG. 4 is partly a fragmentary perspective view illustrating a key controlled electromagnetic setting arrangement according to the invention, and partly a diagram illustrating the electric circuit of the arrangement.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, a type head 4 is mounted on a shaft 4a and carries a set of type faces 4b representing characters and digits and being arranged in circumferential circular rows and axially extending columns so that any type face can be placed in an operative position by turning type head 4 to a corresponding angular position, and by raising and lowering type head 4. Shaft 4a is pivotally mounted at 4c and passes through

a guide structure 5 which can be angularly displaced about pivots in bores 5a for tilting the type head 4 to a printing position. A printing electromagnet 3 is connected with the guide structure 5 for this purpose. Shaft 4a carries an elongated pinion 6 which meshes with a rack bar 7 so that shaft 4a with type head 4 is turned between different angular positions associated with different columns of type faces 4b when rack bar 7 is moved in longitudinal direction in opposite directions to the left or right as viewed in FIG. 1.

The teeth of pinion 6 and rack bar 7 are designed so that they remain in meshing engagement when shaft 4a is tilted to and from the printing position by the printing electromagnet 3. Due to the length of pinion 6, the meshing engagement with rack bar 7 is maintained when type head 4 is raised or lowered by an electromagnetic setting arrangement 2 by which supporting elements 2a for tilting supporting shaft 4 are raised and lowered. A rod 2c passes through the hollow shaft 4a and performs a function which is not an object of the present invention. However, rod 2c can also be operated by an electromagnetic setting arrangement according to the invention.

Rack bar 7 is moved in longitudinal direction to the left or right by an electromagnetic setting arrangement including two parts 1a and 1b by which the rack bar 7 is moved in opposite directions. Rack bar 7 and supports 2a are elements controlled by the electromagnetic setting arrangements 1a, 1b and 2, respectively, to move in opposite directions lengthwise between control positions required for setting the type head in circumferential and axial directions to a position in which a selected type head is operative and located opposite a printing area.

A first embodiment of an electromagnetic setting arrangement 1a, 1b will now be described with reference to FIGS. 2a, 2b, 2c and 4.

Parts 1a and 1b are tubular housings supporting four electromagnetic windings 8, 9, 10, 11 and four electromagnetic windings 12, 13, 14, 15, respectively. Bearing members 1e separate the windings and form central guide ways in which four cores 8a, 9a, 10a, 11a and four cores 12a, 13a, 14a, 15a, are respectively guided for axial movement within windings 8—11 and 12—15, respectively. Fixed abutments or stops 1d are secured to the tubular housings 1a and 1b and project into the outer ends of the same to limit movement of the pair of outermost cores 8a and 15a in outward direction.

The pair of innermost cores 11a and 12a is connected to the ends of rack bar 7 which meshes with pinion 6 so that when cores 11a and 12a are displaced with rack bar 7 in opposite horizontal directions, the type head 4 is turned in opposite directions to a selected angular position, as explained above. It is evident that instead of rack bar 7, another element can be substituted and operated to set the type head.

Stop means are provided for limiting the movement of each of the cores to a predetermined distance whose length is selected in accordance with a code. A coupling stop 8b having a flange is secured to abutment 1d and projects into the hollow core 8a which has an inner flange. The length of coupling stop 8b is greater than the thickness of the flange, so that core 8a can move a small step. The coupling stop 15b is secured to abutment 1d and projects into the hollow core 15a. The length of coupling stop 15b is the same as the length of coupling stop 8b, and both coupling stops permit a movement of the associated core 8a, 15a a distance a. Coupling stops 9b and 14b are secured to cores 8a and 15a and project into cores 9a and 14a. Coupling stops 9b and 14b permit cores 9a and 14a to move steps b. Pairs of coupling stops 10b, 13b permit cores 10a and 13a to move steps c. coupling stops 11b, 12b permit cores 11a, 12a to move steps d.

In accordance with the selected code, the ratio $a:b:c:d=1:2:4:5$ so that in addition to the basic position, twelve control positions of rack bar 7 are possible so that the type head can be set between 13 angular positions.

In the operational position shown in FIG. 2a, all electromagnetic windings 8, 9, 10, 11 are energized, and all electromagnetic windings 12, 13, 14 and 15 are deenergized. Cores 8a,

9a, 10a, 11a have been magnetically shifted to the left, and the outermost core 8a abuts abutment 1d. The innermost core 11a has pulled rack bar 7 to an end position so that the innermost core 12a has pulled cores 13a, 14a, 15a by the respective coupling stops 12b—15b to the illustrated position in which cores 12a—15a are fully spaced from each other, and core 15a is spaced from abutment 1d the distance a permitted by coupling stop 15b. In accordance with the selected code, core 12a and rack bar 7 have been displaced 12 units.

Pairs of windings operate pairs of cores to move the same distance determined by the length of the respective coupling stops, for example distances d for the innermost pair with coupling stops 11b and 12b. In the position of FIG. 2a, one winding 8, 9, 10, 11 of each pair of windings is energized, and the other windings 15, 14, 13, 12 of the respective pairs are deenergized so that the magnetic forces produced by the first windings 8—11 is not opposed by a magnetic force of the deenergized second windings 12—15.

In the position of FIG. 2b, first windings 9 and 11, and second windings 13 and 15 are energized, while first windings 8 and 10 and second windings 12 and 14 are deenergized. As in the position of FIG. 2a, one winding of each correlated pair is energized, and the other winding of each correlated pair is deenergized, so that the respective energized winding can displace the rack bar the distance permitted by the respective coupling stop of the deenergized winding.

As compared with the position of FIG. 2a, cores 10a and 8a have moved to the right due to the magnetic force of windings 9 and 11, while cores 15a and 13a have been shifted by the energized windings 13 and 15 to the right. Since coupling stops 8b and 15b permit one unit steps, and coupling stops 10b and 13b permit four unit steps, the rack bar is moved five steps away from the position of FIG. 2a.

In the position of FIG. 2c, the first winding 10, and the second windings 12, 14 and 15 are energized, while the second winding 13, and the first windings 8, 9, 11 are deenergized. As before, one winding of each pair of first and second windings is energized, and the other deenergized. Since coupling stop 15b permits a step of one unit, coupling stop 14b permits a step of two units, and coupling stop 12b permits a step of five units, the rack bar is moved a distance corresponding to eight steps.

In each possible position of the arrangement, four windings are energized, and four windings are deenergized so that a magnetic locking of a rack bar 7 is obtained in each position, and the position of the type head is exactly determined and maintained during the printing operation.

In the embodiment illustrated in FIGS. 3a and 3b, the tubular casings 1a and 1b have abutments 1d at the ends, and support four first electromagnetic windings 26, 27, 28, 29 and four second electromagnetic windings 30, 31, 32, 33, respectively. The inner surface of the windings, and transverse walls 1e form first and second guideways for first magnetic cores 16, 17 and 18 and second magnetic cores 19, 20 and 21.

The rack bar 25 meshes with gear 6 and is connected at one end to the innermost core 19 for movement therewith. Pairs of first and second cores are rigidly connected for movement together. Cores 18 and 19 are connected by hollow shaft 22 which is also secured in a bore of rack bar 25. Cores 17 and 20 are connected by hollow shaft 23 which is mounted for sliding movement in the hollow shaft 22. Cores 16 and 21 are connected by a shaft 24 which is slidable in the hollow shaft 23. The ends of shaft 24 are mounted in bearing bores in abutments 1d.

The lengths of shafts 22, 23, 24 are selected so that the cores are spaced from each other predetermined distances. When all second windings 30, 31, 32, 33 are energized, all cores 19, 20, 21 are urged to the right with rack bar 25 and abut each other. The outermost core 21 also abuts the abutment 1d. Due to the selected length of the shafts 22, 23, 24, core 16 is spaced a distance a_1 from abutment 1d, core 17 is spaced a distance a_2 from core 16, and core 28 is spaced a distance a_3 from core 17. Core 18 is spaced a distance a_4 from rack bar 25.

In the example illustrated in FIGS. 3a and 3b, the ratio $a_1:a_2:a_3=1:2:4:4$. This code permits a total displacement of the rack bar by 11 units so that 12 control positions of the rack bar, corresponding to 12 positions of the type head, are possible.

In the position of FIG. 3b, first windings 26 and 28, and second windings 30 and 32 are energized. Four windings are altogether energized, and four windings are deenergized. Of each pair of first and second windings, one winding is energized, and one winding is deenergized. If the position of FIG. 3b is compared with the position of FIG. 3a in which the rack bar is in one end position, it will be seen that core 21 has moved a distance a_1 away from abutment 1d of housing 1b, and that core 16 has moved the distance a_1 to the left into abutment with abutment 1d of housing 1a. Core 18 has moved the distance a_2 into abutment with core 17, and core 19 has moved the corresponding distance away from core 20. Since a_1 corresponds to one unit, and a_2 corresponds to four units, rack bar 25 has been moved by cores 18 and 19 and shaft 22 five units out of the initial position of FIG. 3a and turns the type head a corresponding angle.

As shown in FIG. 4, the housings 1a and 1b are provided with four terminals 30a and four terminals 30b which are connected to ground at 130. The four terminals 30a and 30b are respectively connected with the windings 8—11 and 12—15 of the embodiment of FIG. 2a, and with windings 26—29 and 30—33 of the embodiment of FIG. 3a. The other ends of the windings are respectively connected to terminals 8b, 9b, 10b, 11b and 12b, 13b, 14b, 15b. The terminals are not illustrated in FIGS. 2a—3b for the sake of simplicity.

The terminals 8b, 9b, 10b, 11b are connected by lines 8c, 9c, 10c, 11c to contact connectors or terminals 36a of four switches 35 which have another terminal 37a connected to a voltage source 34 which is connected to ground at 132. The third terminals 38a of the four switches 35 are respectively connected to lines 12c, 13c, 14c, 15c which lead to terminals 12b, 13b, 14b and 15b which are connected to windings 12—15.

The terminal 36 is connected to a contact 36a, the terminal 37a is connected to a contact arm 37, and the terminal 38a is connected to a contact 38. Contact arm 37 is resilient and normally in a position engaging contact 36 so that terminals 37a and 36a are connected.

In support members 57 of a typewriter frame, four bails 51—54 are mounted which respectively cooperate with projections on a key lever 40 which is mounted for pivotal movement on a shaft 40a together with other key levers. Key lever 40 is shown to have four projections 41, 42, and 44 which are respectively associated with windings 8, 9, 11 and windings 15, 14, and 12. Projections 42 and 44 are spaced a great distance so that no projection is provided to cooperate with bail 53. However, on other key levers, the projections may be arranged in accordance with a different code to obtain the energization of other groups of windings. Springs 55 secured to crank portions of bails 51—54 bias the same in counterclockwise direction so that actuating portions 51a—54a are in a raised position permitting the resilient contact arms 37 to engage contacts 36 of switches 35.

A voltage is applied by the voltage source 34 through terminals 37a, contact arms 37, contacts 36, terminals 36a, lines 8c, 9c, 10c, 11c to terminals 8b, 9b, 10b, 11b so that a current flows through all windings 8, 9, 10, 11 to ground, energizing the same and holding the controlled rack bar 7 in an end position.

If key 40 is depressed, for example, projections 41, 42, 44 engage bails 51, 52, 54 and turn the same so that actuating arms 51a, 52a, 54a displace the respective contact arms 37 to a position engaging contacts 38 of the respective three switches 35 so that a voltage is applied by voltage source 34 through terminals 37a, contact arm 37, contact 38, terminals 38a to lines 12c, 14c, 15c and terminals 12b, 14b, 15b so that windings 12, 14 and 15 are energized, and rack bar 7 is displaced eight steps as explained with reference to FIG. 2c. Winding 10 remains energized since contact arm 37 of switch

35 cooperating with actuating arm 53a continues to engage contact 36 since bail 53 was not engaged by a projection on key lever 40. By providing key lever 40 with projections in a different arrangement, different groups of first and second windings can be energized.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of setting arrangements for control elements differing from the types described above.

While the invention has been illustrated and described as embodied in an electromagnetic setting arrangement controlled by keys to operate a rack bar by which a type head is set to a selected printing position, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention.

What I claim as new and desire to be protected by Letters Patent is set forth in the appended claims.

1. A setting arrangement comprising, in combination, an element having opposite ends and being movable in opposite directions for being set to one of a number of control positions; a set of first setting means and a set of second setting means, pairs of first and second setting means being symmetrically disposed at said opposite ends of said element, the first and second setting means of one pair being connected with said ends of said element, respectively; a set of first operating means and a set of second operating means respectively controlling said first and second setting means so that each actuated first operating means moves the respective first setting means in one direction, and each actuated second operating means moves the respective second setting means in the opposite direction; first and second supporting means for movably mounting said first and second setting means and for stationarily mounting said first and second operating means, respectively; and means for limiting the movements of said first and second setting means so that the first and second setting means of each pair make steps of the same length, and different pairs make steps of different lengths selected in accordance with a code whereby by simultaneous actuation of selected first and second operating means belonging to different pairs, selected first and second setting means are moved for displacing said element to a selected control position a distance whose length is the total of the lengths of the steps made by selected first setting means in one direction and by selected second setting means in the opposite direction, said means for limiting comprising a hollow shaft connecting the innermost pair of first and second setting means which are located adjacent said element, and at least one other shaft located in said hollow shaft for axial movement and connecting another pair of first and second setting means located outward of said innermost pair of first and second setting means.

2. An electromagnetic setting arrangement comprising, in combination, an element having opposite ends and being movable in opposite directions for being set to one of a number of control positions; a set of first cores and a set of second cores, pairs of first and second cores being symmetrically disposed at said opposite ends of said element, the first and second cores of the innermost pair being connected with said ends of said element, respectively; a set of electromagnetic first windings and a set of electromagnetic second windings respectively controlling said first cores and said second cores so that each energized first winding moves the respective controlled first core in one direction, and each energized second winding moves the respective controlled second core in the opposite direction; first and second supporting means for movably mounting said first and second cores and for stationarily mounting said first and second

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windings, respectively; stop means for limiting the movements of said first and second cores so that the first and second cores of each pair make steps of the same length, and different pairs make steps of different length selected in accordance with a code whereby by simultaneous energization of selected first and second windings belonging to different pairs and deenergization of the first and second windings forming pairs with energized first and second windings, selected first and second cores of selected first and second windings are moved for displacing said element to a selected control position a distance whose length is the total of the lengths of the steps made by selected first cores in one direction and by selected second cores in the opposite direction, said stop means including first and second coupling stops connecting adjacent first and adjacent second cores, respectively, pairs of first and second coupling stops having different lengths in accordance with said code, and the first and second coupling stops of the same pair having the same length, said stop means further including

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first and second abutments on said supporting means cooperating with said first and second cores.

3. Electromagnetic setting arrangement as claimed in claim 2 wherein each first and second core is hollow and has an inner flange; and wherein each first and second coupling stop projects into a hollow first and second core, respectively, and has an outer flange cooperating with said inner flange of the same; wherein the first and second cores of the innermost pair of first and second cores are connected with the ends of said element, respectively, and the outermost pair of first and second cores cooperates with said first and second abutments, respectively.

4. Electromagnetic setting arrangement as claimed in claim 3 wherein each first and second stop means projects from the respective core inward toward said element and into the respective adjacent core.

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**UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION**

Patent No. 3,596,745 Dated August 3, 1971

Inventor(s) Hermann Waldenburger

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet [73] "Grundig E.M.V. Elektro-Mechanische Versuchsanstalt, DNH. Max Grundig, Fuerth, Bayern, Germany" should read -- Triumph Werke Nürnberg Aktiengesellschaft of Nurnberg, Germany -- .

Signed and sealed this 24th day of October 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents