United States Patent

[11] 3,621,966

[72] Inventor **Jean-Pierre Murat**
Argenteuil, France

[21] Appl. No. **13,613**
[22] Filed **Feb. 24, 1970**
[45] Patented **Nov. 23, 1971**

[73] Assignee **Societe D'Applications Generales D'Electricite Et De Meranique**
Paris, France

[32] Priority **Feb. 26, 1969**
[33] **France**
[31] **69-04887**

[54] **SELECTOR FOR TYPE WHEEL PRINTING MACHINE**
6 Claims, 10 Drawing Figs.

[52] **U.S. Cl.** **197/18,** 178/34, 197/48
[51] **Int. Cl.** **B41j 1/46**
[50] **Field of Search** 197/18, 48, 49, 55; 178/34

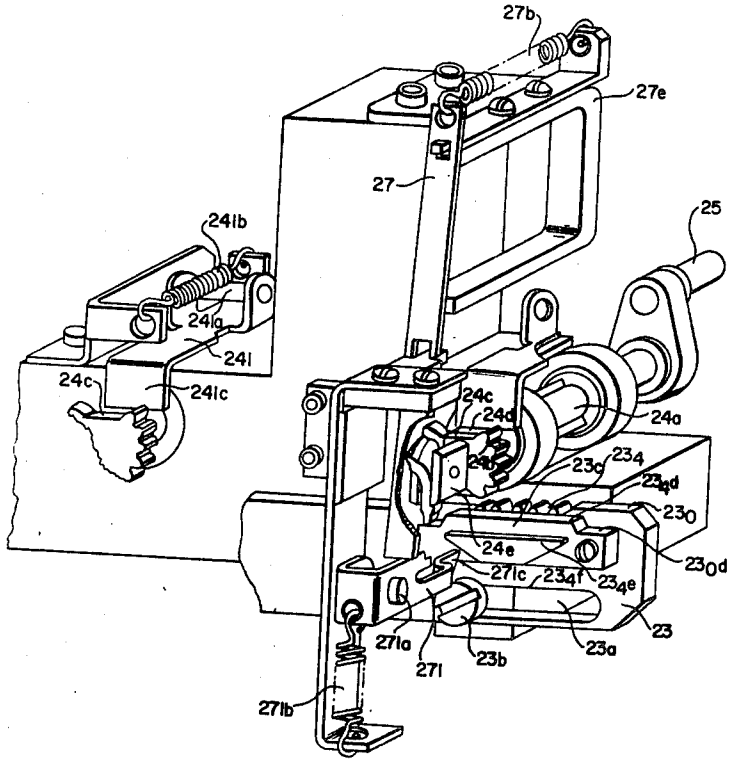
[56] **References Cited**

UNITED STATES PATENTS

1,548,168	8/1925	Pfannenstiehl	178/34
1,623,810	4/1927	Pfannenstiehl	178/34
1,714,334	5/1929	Wheeler et al.	178/34
2,093,873	9/1937	Salmon	178/34
2,210,641	8/1940	Thompson et al.	178/34
2,892,031	6/1959	Arko et al.	178/34
2,939,912	6/1960	Durkee	178/34
3,307,676	3/1967	Hickerson	197/18
3,310,147	3/1967	Clary et al.	197/55
3,353,648	11/1967	Amada et al.	197/55
3,404,765	10/1968	Gassino et al.	178/34 X

Primary Examiner—Edgar S. Burr
Attorney—Abraham A. Saffitz

ABSTRACT: Selectors for a printing machine having a plurality of type-carrying wheels mounted in a printing carriage. A transversing selector selects a particular type wheel out of all the type wheels and a rotary selector selects a particular type out of all the types carried by the selected type wheel. These two selectors comprise a toothed rack, means for imparting to said rack a reciprocating movement, a plurality of pinions toothed around two opposite sectors and untoothed around two sectors interlaced with the previous sectors and engaging with said rack except when one untoothed sector is opposite the rack, a plurality of two arm levers pivotally mounted respectively on said pinions and terminated by a toothed-shaped extension at both ends of the arms thereof, a plurality of projections along the rack selectively cooperating with the lever teeth, a plurality of electromagnets respectively associated with said levers, means for selectively placing one of the teeth of the levers on to the path of the rack projections and for selectively allowing the pinions to rotate a half turn and means for converting the discrete rotation angles of the pinions of the rotary selector into a digitalized angular movement for positioning the type-carrying wheels and the discrete rotation angles of the traversing selector into a digitalized rectilinear movement for positioning the printing carriage.



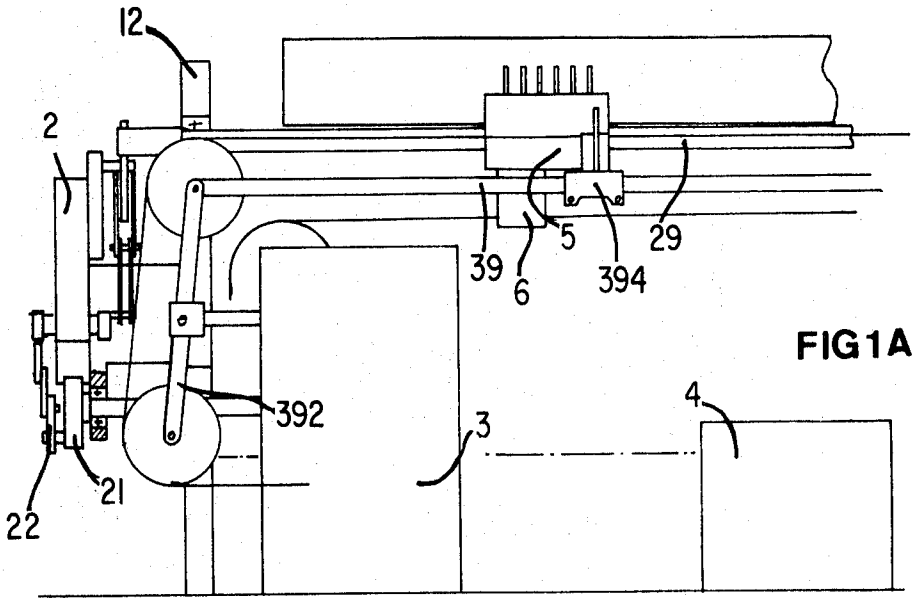


FIG 1A

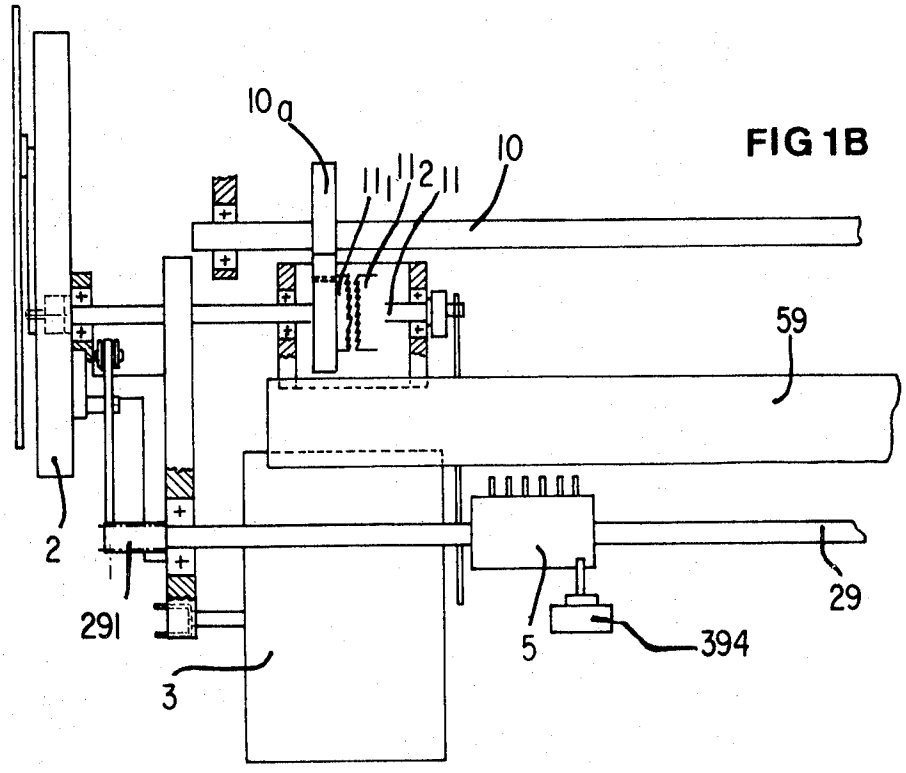


FIG 1B

INVENTOR:
JEAN-PIERRE MURAT
By Abraham A. Saffitz
ATTORNEY

FIG 2

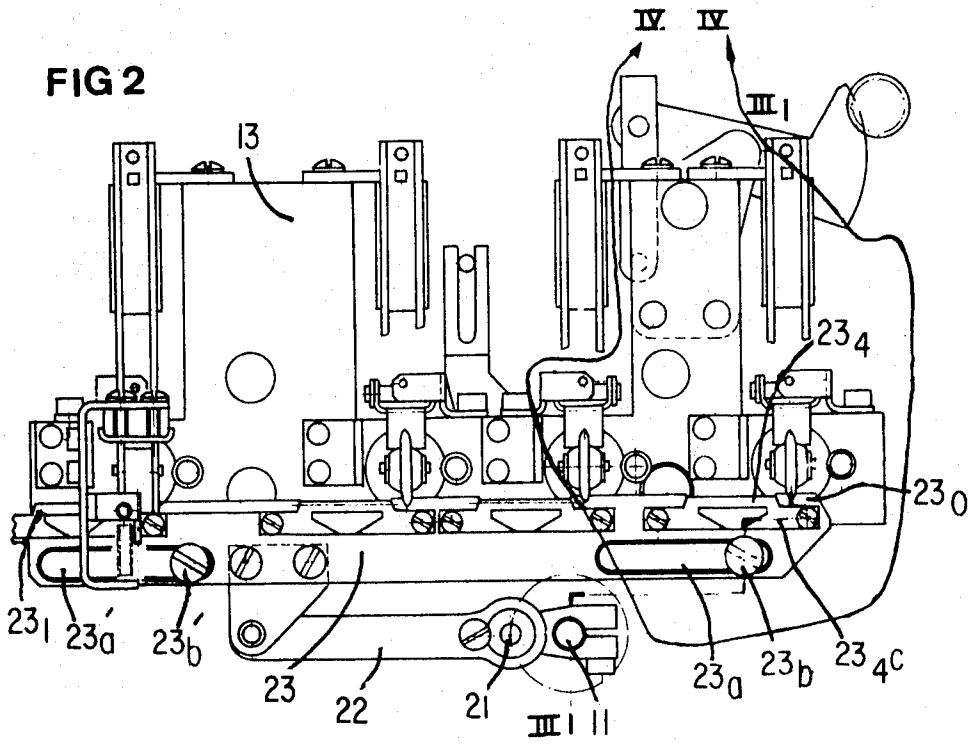
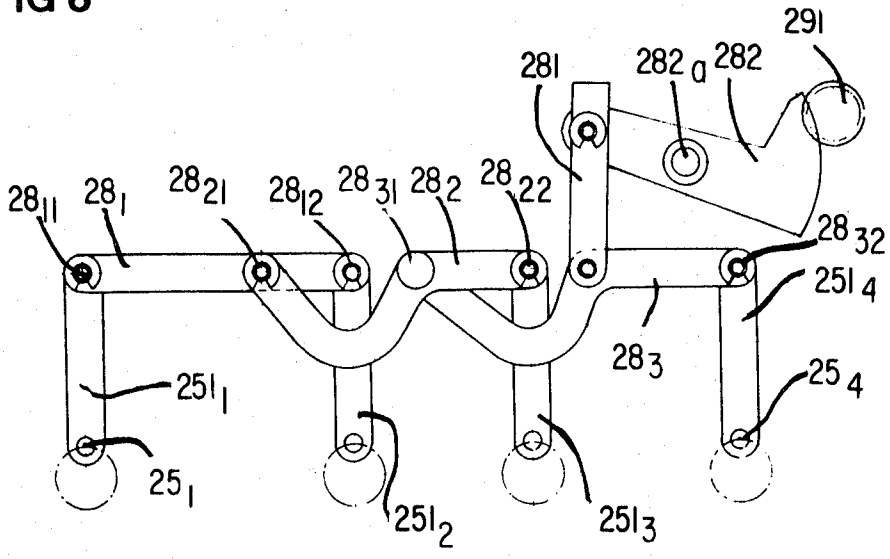


FIG 6



INVENTOR:
JEAN-PIERRE MURAT
By Abraham A. Saffitz
ATTORNEY

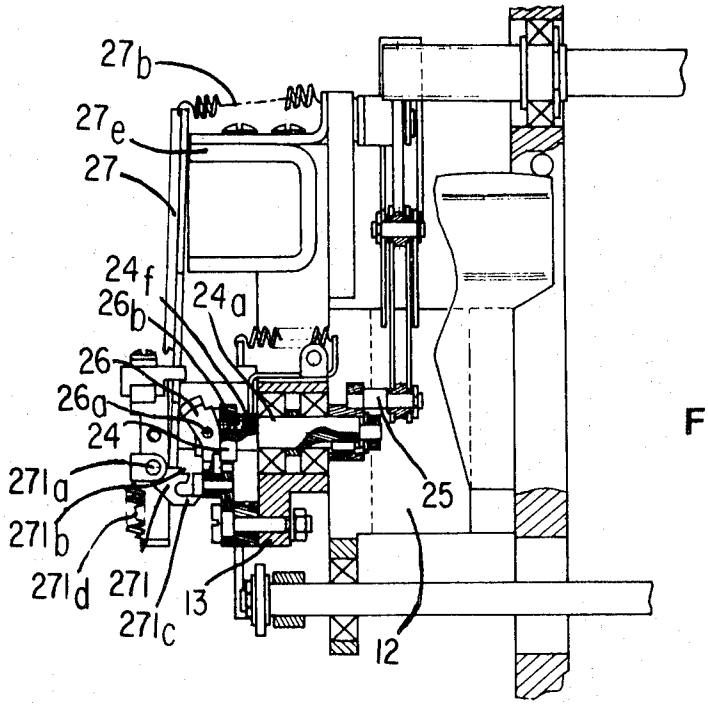


FIG 3

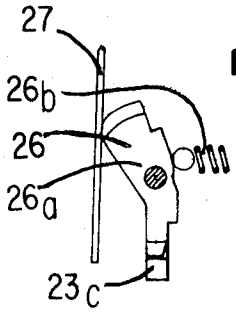


FIG. 5B

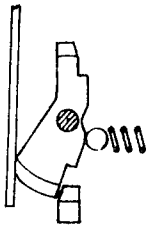


FIG. 5A

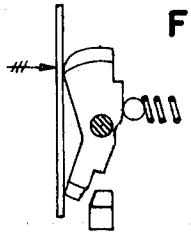


FIG. 5D

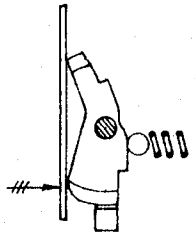
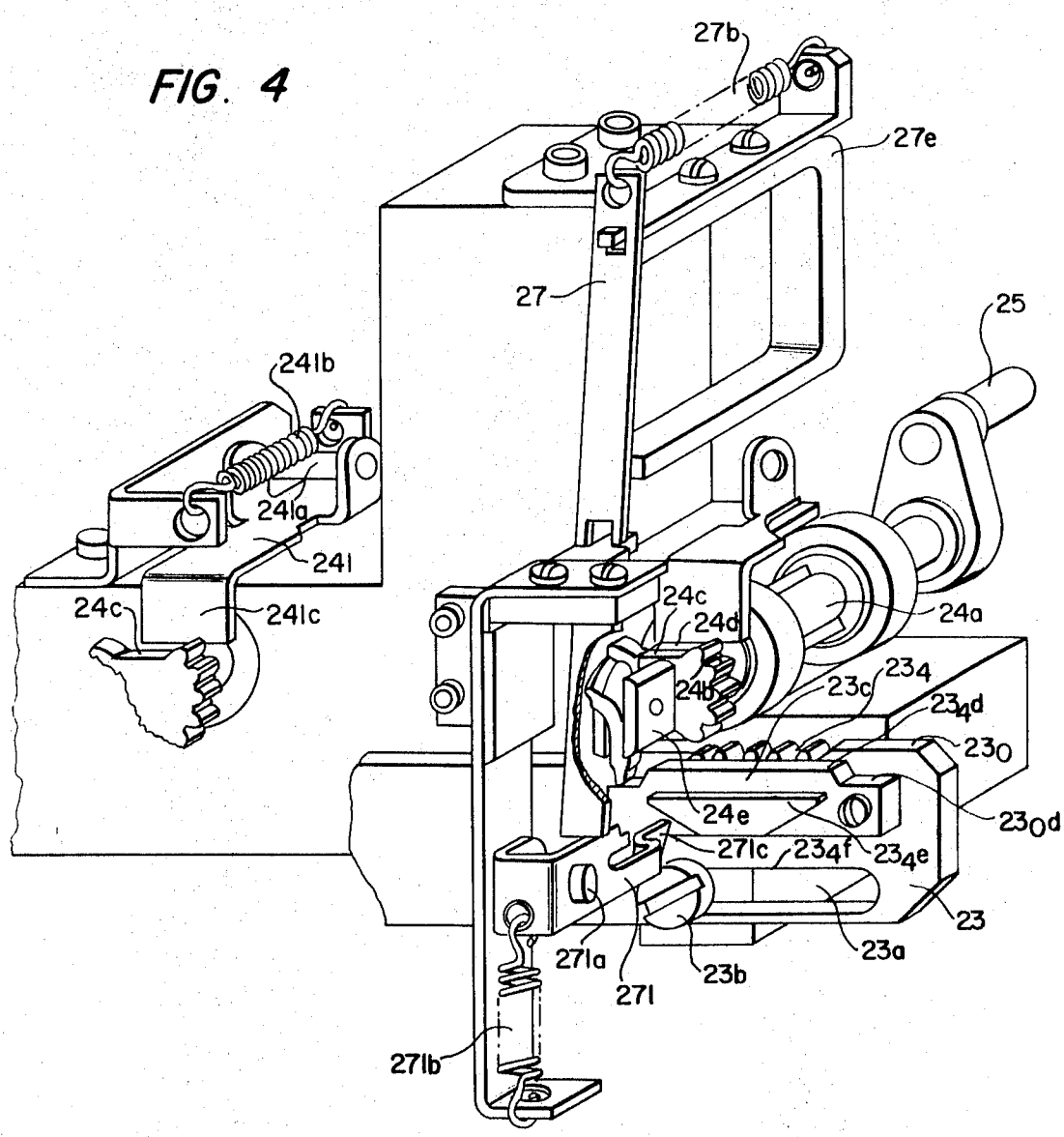


FIG. 5C

INVENTOR:
JEAN-PIERRE MURAT
By Abraham A. Saffitz
ATTORNEY

FIG. 4



INVENTOR:
JEAN-PIERRE MURAT
By Williamson & Lafferty
ATTORNEY

SELECTOR FOR TYPE WHEEL PRINTING MACHINE

The invention relates to a printing machine of the kind having a number of type or character wheels each including a group of characters, a digitalized traversing selector for selecting a particular type wheel out of all the type wheels, a digitalized rotating selector for selecting a particular character out of all the characters borne by the selected type wheel and a striker system for throwing the selected character of the selected type wheel against a paper reel.

Printing machines of this kind are known in the prior art and are for example disclosed in U.S. Pat. application Ser. No. 860,524 filed on Sept. 24, 1969 by the present applicant and assigned to the same assignee as the present application. In these machines the type wheels are mounted in a shiftable printing block the position of which is controlled, through an articulated parallelogram, by the traversing selector and the rotation of the type wheels is controlled, through a rotating shaft, by the rotary selector.

Known selectors for said printing machines comprise a number of couplings, each having associated therewith a pinion in which the teeth are omitted around two opposite sectoral portions, each of said couplings being controlled by an associated electromagnet in order to cause or not to cause a positional change of an associated decimal-binary mechanical converter stage during each cycle, from the position taken by the said associated stage during the preceding cycle.

These machines have the advantage of working without "return to zero" of the selectors during each cycle and of reducing the number of couplings effecting the positional changes during each cycle to a strict minimum, a fact which permits an improvement of the printing rhythm and a considerable reduction of wear of the moving members at the same time. However, in the known machines of this category, the moveable equipment, the displacement of which permits the positional change, is bulky and its inertial is thus relatively high and the coming into action of this equipment is effected with a constantly rotating gear system so that the action of displacement of positional change will produce a jolt.

The present invention provides a printing machine of the type concerned comprising a shiftable block including a plurality of rotatable type wheels, a rotation and a traversing selectors respectively for these type wheels, controllable during each printing cycle by electromagnets controlled by the pulses of a coded signal representing a character, each of the selectors comprising a number of couplings, between a common rack and a plurality of pinions deprived of teeth around two opposite sectors thereof and electromagnets associated to and controlling said couplings in order to cause or not to cause a positional change of an associated decimal-binary mechanical converter element during each cycle, from the position taken by the same associated element during the preceding cycle, characterized in that each of said couplings comprises the said pinion forming the driven element, a toothed portion of the common rack adapted to carry out a stroke during each cycle and forming the driving element, which is capable of cooperating with said associated pinion, and a toothed lever connected to said pinion, terminating in a toothlike construction shaped as an involute of a circle and which is mounted pivotally between two fixed positions under the action of said associated electromagnet and of a return spring urging it back to its position of rest and capable of cooperating with at least one side of an untoothed projection of said toothed rack, to initiate at the start of the stroke of the toothed rack, if required a positional change of said pinion, followed by the cooperation of said pinion and said toothed portion, or else so as not to be influenced by the stroke of the toothed rack any more than said pinion, in such a manner that, dependent upon whether said electromagnet remains at rest or is operated, said pinion assumes or maintains respectively a first or a second of its two fixed positions.

The invention will now be described by way of an example with reference to the accompanying drawings in which:

FIGS. 1A and 1B are diagrammatical front and top plans respectively of the left hand portion of a printing machine according to the invention;

FIG. 2 is a bottom plan view partly in section of the machine, showing the rotation selector unit;

FIG. 3 is a sectional view of the rotation selector on line III—III of FIG. 2;

FIG. 4 is a perspective view, partially broken away of that portion of the machine contained in the closed curve IV—IV of FIG. 2;

FIGS. 5A through 5D are intended to illustrate the possible positional changes of parts of the rotation selector during each printing cycle and shows the four possible positions of a toothed lever with respect to a toothed rack at the start of the cycle, and

FIG. 6 is a diagrammatical view showing rocking levers of the rotational selector in detail.

Reference will first be made to FIGS. 1A and 1B showing the important elements of a printing machine according to the invention.

In a frame, only fragments of which are shown, rotates a shaft **29**, the angular position of which is controlled by way of a pinion **291** by the rotation selector **2**. Shaft **29** controls the angular position of type wheels mounted in a printing block **5**. Shaft **29** of FIG. 1A is the same as shaft **29** in FIG. 1 of the above-mentioned U.S. application.

In a vertical plane situated at a small distance from the shaft **29**, is disposed an articulated parallelogram **39**, the lower links of which are mounted on stationary axes and the left hand leg **392** of said parallelogram being positionally controlled by the traversing selector **3**. Leg **392** of FIG. 1A is the same as leg **392** in FIG. 1 of the above-mentioned U.S. application. The traversing movement is transmitted to the printing block **5** by means of a curser **394**.

The figures also show a paper or printing roll **59**, a step-by-step driving device **4** and a striking device **6**. Devices **4** and **6** are identical with the devices bearing the same reference numerals in the above-mentioned U.S. application.

A continuously rotating drive shaft **10** carries a gear wheel 10_a. On an intermediate shaft **11** parallel to shaft **10** is mounted a driving clutch 11_1 and a driven clutch 11_2, mounted respectively loosely and fixedly on the shaft **11**, which, when operated, drives shaft **11** for half a turn. This shaft **11** forms the common input shaft for the selectors.

The rotation selector **2** is constituted as follows (see FIGS. 2, 3 and 4).

On one end of the intermediate shaft **11** which is journaled in a sideplate **12** of the frame, is mounted a cam **21** which via a rod **22** drives a toothed rack **23**. Two apertures **23***a*, **23**′*a* pass through the toothed rack **23** and cooperate with two guide members **23***b*, **23**′*b* so that the rack **23** is guided and "carded" during its horizontal longitudinal sliding movement in its own plane which is vertical. The members **23***b*, **23**′*b* are mounted on an outer face of a block **13**, the cross section of which is substantially U-shaped, and has a base extended on either side parallel to the sideplate **12**. The drive through members **21–22–23** are brought about in such a manner that upon each half turn of the cam **21**, the toothed rack **23** carries out a stroke extending in one or other direction.

The upper face of the toothed rack **23** has four toothed portions 23_1–23_4, these portions being situated between upper flat faces such as 23_0 which extend in the same plane, and the level of which is slightly higher than that of the apices of the toothed portions. The reason for this will be described later. On its large vertical face opposite the sideplate **12**, the toothed rack **23** carries by means of spacers vertical plates or "covers" such as 23_4c fixed to the rack, e.g. by screws. Each cover such as 23_4c has on its upper face an untoothed trapezoidal projection, such as 23_4d (see FIG. 4), limited by horizontal flat recesses, such as 23_0d, and which correspond to the above-stated toothed projections, such as 23_4, in the sense that any imaginary horizontal straight line extending perpendicularly to 23_4 and 23_4d and supported on the outline of the second

projection, also meets the outline of the first projection, including the outer walls of the teeth on either end. Each cover, such as 23_3c, has on its large outer vertical face and slightly below each untoothed projection, such as 23_4d, a flat boss, such as 23_4e, of greater thickness and of a substantially triangular cross section, a round lower end of this boss forming the point of connection of the two ramps, such as 23_4f, of opposite inclines, which are symmetrical with respect to the median plane of the boss under consideration. The role of the two untoothed projections and of the bosses of the cover will become apparent later.

At midstroke of the toothed rack in one or the other direction, the median plane common to each portion 23_n ($n = 1, 2, 3, 4$) and to the corresponding projection 23_{nd} of the toothed rack 23, coincides with a fixed vertical plane which has been taken as a vertical sectional plane through the top of FIG. 2. In this plane a horizontal shaft 24_n rotates freely in ball bearings in the base of the block 13. The shaft 24_n has fixed thereon on the side of the block 13 opposite the sideplate 12, i.e. on the side of the toothed rack 23, an interrupted pinion 24 or, more precisely, a pinion deprived of teeth around two sectoral portions which extend symmetrically to its geometrical axis. The pinion 24 is located in the same plane as the toothed rack 23; its toothed portions are designated by 24*b* and its nontoothed plane portions by 24*c*.

On the inner side of pinion 24, the shaft 24*a* comprises two parallel flattened portions 24*d*, the planes of which coincide with the planes of the nontoothed portions 24*c*. On its outer side, pinion 24 comprises a projection 24*e* in the form of a diametrical plate. The plate is perpendicular to the flat portions 24*d* of shaft 24*a*. The shaft 24*a* carries on the other side, i.e. on the side of the block 13 facing the sideplate 12, a cam 25, the eccentricity of which extends in a direction at right angles to the flat portions 24*d*, thus parallel to the plate 24*e*.

The flat portions 24*d* cooperate with a retaining element or positioner 241 in the form of a shutter which is pivotally mounted on the block 13 about an axis 241*a*, biassed by a a tension spring 241*b* which is attached on the other side to a flange connected to said block so that a bent-down edge 241*c* is supported on one or the other of the flat portions 24*d*.

On a small axle 26*a* freely rotatable in the plate 24*e* extending from the pinion 24, a small toothed lever 26 is loosely mounted, which is flat, and has two arms each ending in a gear tooth formed as an involute of a circle. On the side of the front surface of the pinion 24, the arms of lever 26 have two projections with rectilinear edges, which form therebetween an obtuse angle and cooperate with said front surface so as to define two end positions of said lever with respect to said pinion, these positions being fixed.

On one side the lever 26 is urged by a compression spring 26*b* in a blind hole 24*f* of the pinion 24 to assume a first fixed position; on its other side the lever 26 cooperates by means of the face of one of its arms which is larger than the other arm, with an armature 27 of an electromagnet 27*e* which, when operated, causes the lever 26 to assume its second fixed position.

At rest, the pinion 24 is in one or the other of two positions, at 180° from each other, in which positions the flat portions 24*d* extend horizontally due to the fact that one of them cooperates with the positioner 241 and the cam 25 is at a low dead center position or at a high dead center position, corresponding respectively to the binary digits zero and one.

When referring now to FIG. 5, it is apparent that at the start of the cycle the lever 26 can be in one or another of the four following positions: 0 or 1 if the electromagnet 27*e* has remained at rest, 0′ or 1′ if the electromagnet 27*e* has been operated, the positions being thus denominated because they correspond to the positions of the same names of the cam 25. In the positions 0 and 1′ of the lever 26, the lower arm of this lever has its tooth outside the path followed by the projection 23_4d of the toothed rack 23; so that the toothed rack 23 carries out its stroke in one or the other direction without influencing the unit 24–26 and that, in particular, the cam 25 has its position unchanged at 0 or 1 respectively. In contrast, in the positions 1 and 0′ of the lever 26 the lower arm of this lever has its tooth within the path followed by the projection 23_3d of the toothed rack 23; so that the thus initiated rotation of the pinion 24 is followed by the cooperation of the toothed section 24*b* of the pinion 24 with the toothed portion 23_4 of the toothed rack 23, the unit 24–26 carries out a rotation through 180° and the cam 25 changes to the position 0 or 1 respectively. Accordingly dependent upon whether at the start of the cycle, the electromagnet 27*e* has remained at rest or been operated, the cam 25 preserves or assumes, after displacement of the toothed rack, the position 0 or 1.

The armature 27 of the electromagnet 27*e* is in usual manner urged back into its position of rest by a tension spring 27*b*. In practice the electromagnet 27*e* if operated only receives an energizing impulse but when this impulse has occurred, the time that armature 27 remains in the working position is protracted by a pawl 271. The pawl 271 has a protracted notch 271*b* cooperating with the armature 27 and a lower lip 271*c* cooperating with the boss 23_4e of the toothed rack 23. The pawl 271 is mounted pivotally about an axle 271*a* carried by the block 13 and urged by a tension spring 271*d* to rotate anticlockwise (shown in FIG. 3). It will readily be seen in these conditions that once the armature 27 is attracted, it will be retained by the notch 271*b* of the pawl which has pivoted under the action of its spring, which ensures the immobilisation of the toothed lever 26 at the start of the stroke of the toothed rack and that the release of the armature 27 is effected during the first half of the stroke of the toothed rack, due to the fact that one or the other of the ramps of the boss 23_4e thereof cooperates with the lip 271*c* of the pawl in order to cause the latter to pivot against the action of its spring and to clamp it by means of the end portion of the armature 27.

As has already been said, the toothed portion 23_4 of the toothed rack has untoothed portions such as 23_0 at its opposite ends, the level of each of which is slightly higher than the apex of the toothed portion 23_4. It is the object of this feature to make, at the end of the stroke of the toothed rack in one or the other direction, the plane portion—such as 23_0—which follows the toothed portion 23_4, to cooperate with the first tooth of the toothed section of the pinion 24 which was not engaged with the rack teeth during the stroke in order to immobilize the latter at the end of its travel, against its inertia and that of the associated rotary members.

As has already been stated, the subunit which has been described with reference to the toothed portion 23_4 of the toothed rack and which has a cam as its output element, is repeated four times in the rotation selector under consideration. Thus, the selector has four cams 25_1–25_4 (see FIG. 6), each capable of assuming independently of one another one of the two states 0 (low point) or 1 (high point) after each stroke of the toothed rack 23 which represents a total of $2^4 = 16$ combinations, i.e. the desired number for the selection in rotation of the type wheels.

To each of the cams 25_1–25_4 is articulated one end of a rod 251_1–251_4, which rods are articulated at their other ends to rocking levers 28_1–28_3 as indicated in FIG. 6, and more precisely in the following manner: the rods 251_1, 251_2 are articulated to the two ends 28_{11}, 28_{12} respectively of the rocking lever 28_1. The rod 251_3 is articulated to the end 28_{22} of the rocking lever 28_2 which is itself articulated at its end 28_{21} to a point situated at one-third of the serviceable length of the rocking lever 28_1 starting from 28_{12}. The rod 251_4 is articulated to the end 28_{32} of the rocking lever 28_3 which is itself articulated at its end 28_{31} to a point situated at four-sevenths of the length of the rocking lever 28_2, starting from 28_{21}. It is known and can readily be verified that in these conditions the point situated at eight-fifteenths of the rocking lever 28_3, starting from 28_{31}, can assume sixteen regularly spaced levels which form the decimal translation of the binary number, the first bit of which is represented by the state (0 or 1) of the cam 25_1, the next bit by the state of the cam 25_2, and so on.

A rod 281 is articulated between the point at eight-fifteenths of the rocking lever 28_3 and one of the ends of the toothed sector 282, mounted rotatable about an axle 282*a* connected to the frame. The toothed sector 282 meshes with the above-stated pinion 291, the shaft 29 of which forms the output shaft of the rotation selector.

The transfer selector 3 has a structure which is identical with that described above, with the sole exception that in this case the number of subunits positioning the cams is reduced to three and that of the rocking levers to two, which permits $2^3 = 8$ combinations, i.e. a more than sufficient number for the selection of the number of translation steps of the printing block 5.

Furthermore, the toothed sector 282 is useless and rod 281 can be connected directly to leg 392 of the articulated parallelogram 39.

The rocking lever unit has been disclosed in relation to FIG. 6 in the case of four cams, four rods and three rocking levers. In the general case where there are n cams, n rods and $(n-1)$ rocking levers, the jth rocking lever ($j = 1, 2, \ldots (n-1)$) is divided into two sections whose lengths are $2^j/(2^{j+1}-1)$ $(2^j-1)/(2^{j+1}-1)$ the end of the longer section being connected to the preceding rocking lever and the end of the shorter section to the $(j+1)$th rod.

What I claim is:

1. In a printing machine comprising a plurality of type-carrying wheels mounted in a printing carriage, a transversing selector for selecting a particular type wheel out of all the type wheels and a rotary selector for selecting a particular type out of all the types carried by the selected type wheel, said traversing selector and said rotary selector each comprising a toothed rack, means for imparting to said racks a reciprocating movement, a plurality of pinions deprived of teeth around two diametrically opposite sectors thereof and engaging with said racks except when said tooth-deprived sectors are opposite the racks, a plurality of two arm levers pivotally mounted respectively on said pinions and terminated by a tooth-shaped extension at both ends of the arms thereof, a plurality of projections along the racks selectively cooperating with said tooth-shaped extensions, a plurality of electromagnets respectively associated with said levers, means for selectively placing one of said tooth-shaped extensions in the path of said rack projections and for selectively allowing the pinions to rotate a half turn and means for converting the rotation angles of the pinions of the rotary selector into a digitalized angular movement for positioning said type carrying wheels and the rotation angles of the pinions of the traversing selector into a digitalized rectilinear movement for positioning said printing carriage.

2. A selector for a printing machine according to claim 1 in which the means for converting the rotation angles of the pinions into a digitalized rectilinear movement comprises a plurality of cams respectively connected to said pinions, a plurality of rods cooperating with said cams, and a plurality of rocking levers of equal length, the jth rocking lever of the plurality having its ends respectively connected to the $(j+1)$th rod and to an intermediate point of the $(j+1)$th rocking lever dividing said rocking lever into two sections whose lengths are respectively proportional to $2^{j+1}/(2^j+1)$ and $(2^{j+1}-1)/(2^j-1)$, the intermediate point of the last rocking lever having imparted thereon said digitalized rectilinear movement.

3. A selector for a printing machine according to claim 1 in which the means for converting the rotation angles of the pinions into a digitalized angular movement comprises a plurality of cams respectively connected to said pinions, a plurality of rods cooperating with said cams, a plurality of rocking levers of equal length, the jth rocking lever of the plurality having its ends respectively connected to the $(j+14)$th rod and to an intermediate point of the $(j-1)$th rocking lever dividing said rocking lever into two sections whose lengths are respectively proportional to $2^{j+1}/(2^j-1)$ and $(2^{j+1}-1)/(2^j-1)$, a pivotable toothed sector connected to the intermediate point of the last rocking lever and an output pinion cooperating with said toothed sector, said output pinion having imparted thereon said digitalized angular movement.

4. A selector for a printing machine according to claim 1 in which each toothed rack comprises along its length toothed sections having the same number of teeth as each of the two toothed sectors of the pinions separated by the tooth-deprived sectors and cooperating with said pinions and untoothed sections on both sides of said toothed sections and the level of which is slightly higher than that of the apices of the toothed sections, whereby after each engagement of a toothed sector of a pinion with a toothed section of its rack the first tooth of the nonengaged toothed sector abuts against an untoothed section of the rack thereby stopping the pinion.

5. A selector for a printing machine according to claim 1 in which each pinion comprises a collar with two parallel flat portions, the selector further comprising a positioner member in the form of a shutter with a bent-down edge which cooperates with the flat portions of the collar, and a return spring for urging the positioner against said flat portions.

6. A selector for a printing machine according to claim 1 in which the means for selectively placing one of the teeth of a two arm lever in to the path of a rack projection comprises a ramp on the toothed rack and a pawl cooperating with the electromagnet and said ramp for locking the armature of the electromagnet when the same is operated and for unlocking the armature when the ramp engages the pawl.

* * * * *