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Behrens et al.

[11] **3,835,976**

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[54] **DEVICE FOR MOVING A PRINT ELEMENT CARRIER IN TYPEWRITERS**

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[51] **Int. Cl.** **B41j 19/00**

[58] **Field of Search** ..... 197/82, 84 R, 90, 16, 18, 197/60, 65; 74/441

[56] **References Cited**

UNITED STATES PATENTS

2,498,897	2/1950	Riedel	74/441
2,909,935	10/1959	Dodge	197/64 X
3,135,371	6/1964	Young	197/16
3,225,886	12/1965	Cetran et al.	197/84
3,313,389	4/1967	Cralle	197/82

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[57] **ABSTRACT**

In a typewriter or similar printing machine the print element carrier is moved by virtue of the cooperation between a lead screw stationarily supported in the machine frame and a rotatable nut member supported in the print element carrier and threadedly engaging the lead screw. The print element carrier supports a clutch which has two inputs including driven components continuously rotated in opposite directions. An escapement mechanism, when in its normal, non-actuated condition, locks both inputs for preventing any driving torque to be transmitted to the nut member by either continuously driven component. A two-position selector mechanism locks either the one or the other input. When the escapement mechanism is actuated, the latter is withdrawn from both inputs and, as a result, a driving torque is transmitted to the nut member solely by that clutch input which is not locked by the selector mechanism.

15 Claims, 2 Drawing Figures

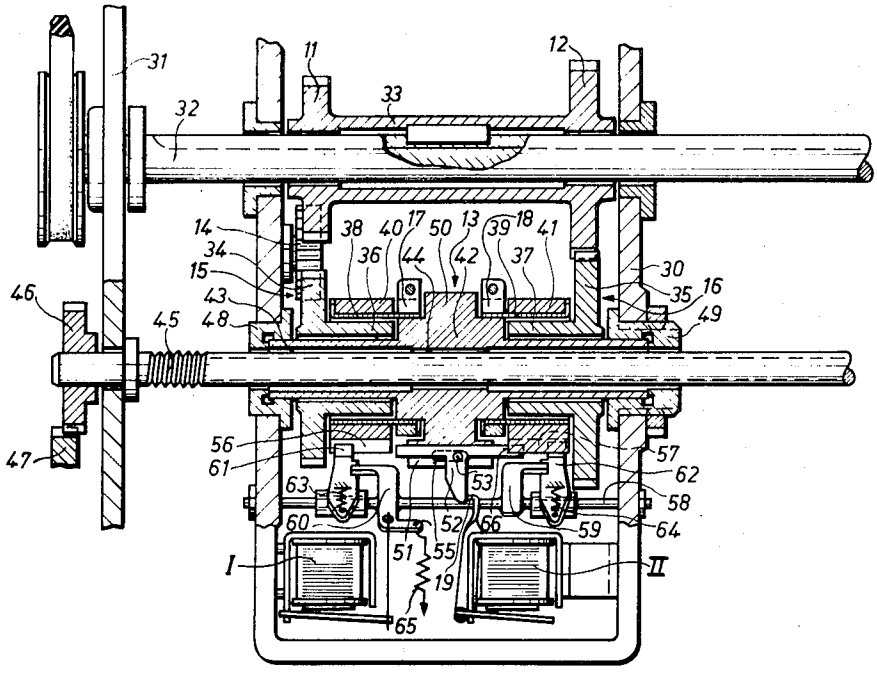
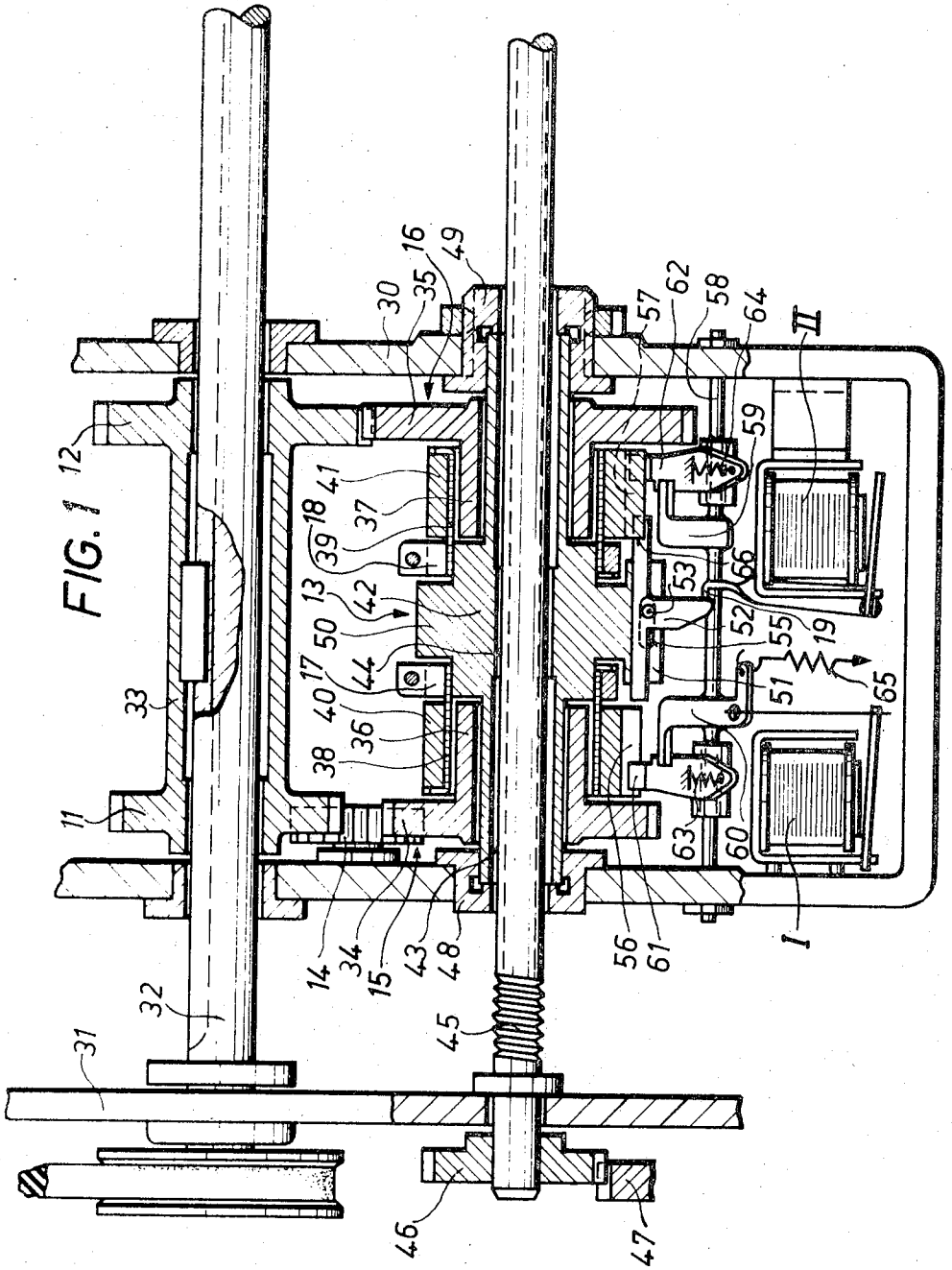


FIG. 1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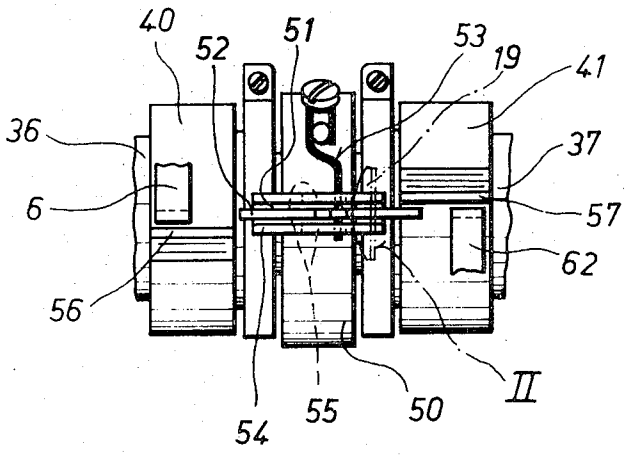

FIG. 2

DEVICE FOR MOVING A PRINT ELEMENT CARRIER IN TYPEWRITERS

BACKGROUND OF THE INVENTION

This invention relates to a device for moving the print element carrier of a typewriter or similar business machine and is of the type which has a lead screw supported by the machine frame, a nut member supported in the print element carrier coaxially with the lead screw and an actuatable driving mechanism which, for effecting stepwise or continuous movements of the print element carrier, causes a relative motion between the lead screw and the nut member selectively in one or the other direction of motion.

Carrier moving mechanisms of the afore-outlined type are known — such as disclosed, for example, in the U. S. Pat. No. 3,313,389 — in which there is provided a lead screw axially rotatably, but longitudinally non-displaceably supported in the machine frame. The lead screw cooperates with a coaxially arranged nut member which is affixed to the print element carrier. The stepwise movement of the carrier in the forward or the reverse direction is controlled by an escapement mechanism which is connected to one end of the lead screw. With the other end of the lead screw there is connected a driving or force-exerting mechanism which comprises a spring motor that moves the carrier in the forward (typing) direction by rotating the lead screw when the print element carrier is freed by the escapement mechanism for performing individual steps or a tabulating operation. Although such an arrangement has been found satisfactory, particularly with respect to a reliable and accurate operation of the escapement mechanism and in connection with the cancellation of forces generated, for example, during the braking of moving masses, it has, with respect to certain functions, significant disadvantages to be discussed hereinafter.

Typewriters of the type that have, for example, a generally spherical print element supported by the carrier, are also used as so-called line printers in data processing machines. In such line printers, in general, much higher operational speeds are required than in regular, correspondence-type typewriters. One of the most important requirements in this respect is to maintain as small as possible those masses which are to be accelerated or braked for either the stepwise movements, or the resetting or tabulating movements of the print element carrier. In prior art devices, as exemplified by the aforementioned United States patent, however, these masses are relatively large, because for each stepwise movement the lead screw has to be accelerated and then arrested. This also applies to the escapement mechanism and the driving mechanism. Further, these lead screws which are at least as long as a print line (which, in bookkeeping machines may have a length of three feet) are likely to undergo torsional oscillations which may result in noise phenomena in the entire machine and may cause an unclear, blurred print. Because of these reasons, print-ing devices having an escapement mechanism of the afore-described type can be driven only with operational speeds which are within the speed range required of correspondence-type typewriters. For a satisfactory operation of line printers, it is generally further required that the greatest possible number of components for the control of all functions

of the printing mechanism be disposed in the print element carrier itself to permit a practically universal use of the printing device, since then between a data processing machine and the printing device only electrical energy transmission means, such as a cable or the like has to be additionally provided.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a device for moving a print element carrier of the type outlined above which ensures with simple means that the masses to be accelerated and decelerated may be reduced to a minimum, and in which the means for controlling the carrier movements are arranged in the print element carrier itself.

These objects and others to become apparent as the specification progresses, are accomplished by the invention according to which, briefly stated, the print element carrier of the typewriter is moved by virtue of the cooperation between a lead screw stationarily supported in the machine frame and a rotatable nut member supported in the print element carrier and threadedly engaging the lead screw. The print element carrier supports a clutch which has two inputs including driven components continuously rotated in opposite directions. An escapement mechanism, when in its normal, non-actuated condition, locks both inputs for preventing any driving torque to be transmitted to the nut member by either continuously driven component. A two-position selector mechanism locks either the one or the other input. When the escapement mechanism is actuated, the latter is withdrawn from both inputs and, as a result, a driving torque is transmitted to the nut member solely by that clutch input which is not locked by the selector mechanism.

With the device according to the invention it is accomplished that by using a lead screw drive for triggering the carrier movements, only small masses have to be controlled and that practically all components necessary for effecting the carrier movements can be disposed on the carrier itself. An additional substantial advantage resides in the fact that the total number of required components is substantially reduced which is significant regarding economical considerations and the simplicity of the device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional plan view of a preferred embodiment of the invention.

FIG. **2** is a top plan view of a detail of the same embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to FIG. **1,** there is illustrated a preferred embodiment of a device for moving a print element carrier **30,** which is movably supported on a rail affixed to a frame **31** of a business machine. The rail is constituted by a continuously driven main drive shaft **32.** The latter also supplies the input power for other devices (not shown) controlling other functions such as print element carrier setting, margin setting, ink ribbon control and the like.

To the main drive shaft **32** there is connected a driving member **33** which rotates with the shaft **32** as a unit, and, which is, together with the print element carrier **30,** linearly displaceable along and with respect to the

shaft **32.** The driving member **33** is constituted by a gear block having two gear wheels **11** and **12** and forms, with an intermediate pinion **14,** a reversing gearing which continuously drives, in opposite directions, two inputs **15** and **16** of a single- and multi-revolution clutch mechanism **13** controllable in both rotary directions. The clutch mechanism **13** which operates as the drive means for the print element carrier **30** is formed of a yoke spring clutch of the type described in detail in German Published Patent Application No. 2,055,101 (published Mar. 16, 1972). The inputs **15** and **16** of the clutch include driven components constituted by input gear wheels **34** and **35** respectively, each provided with a respective, integral clutch sleeve **36** and **37.** The input gear wheels **34** and **35** are each connectable to an output shaft **42** by yoke springs **38** and **39.** The springs **38** and **39** are, with one of their ends, secured in a respective control sleeve **40** and **41,** and, with their other end engage the output shaft **42.** The yoke springs **38** and **39** are secured to the output shaft **42** by respective shackles **17** and **18** in an adjustable manner. The yoke spring **38** and the control sleeve **40** form a clutching member which, by virtue of mechanisms described later, is adapted to drivingly connect the input gear wheel **34** to the output shaft **42.** Similarly, the yoke spring **39** and the control sleeve **41** form a clutching member which is adapted to cause a transmission of a driving torque from the input gear wheel **35** to the output shaft **42.**

The output shaft **42** is provided with an axial throughgoing bore **43** which, in a central zone, has a threaded portion **44** which meshes with a lead screw **45** arranged coaxially with the shaft **42.** The threaded portion **44** forms, with a collar-like enlargement **50** of the shaft **42,** the nut element of the lead screw-and-nut assembly. The lead screw **45** is supported in the machine frame **31** parallel to the main drive shaft **32.** The lead screw **45** has at one end a gear wheel **46** with which it can be immoblized in two, 180° opposed positions by means of a setting member **47** that may be locked in two positions for a purpose which will become apparent later.

The output shaft **42** is rotatably supported in radial and thrust bearings **48** and **49** affixed to the printing element carrier **30.** One of the bearings **48, 49** is adjustable to set an axial play. It is thus seen that in the preferred embodiment, the screw-and-nut assembly is formed by the stationary lead screw **45** and by the rotatable nut member constituted by the components **42, 43, 44, 50.** It is noted that a lead screw-and-nut assembly, in which the lead screw is stationary and the nut member is arranged for rotation is described, for example in U.S. Pat. No. 2,498,897, issued Feb. 28, 1950 (inventor: K.A. Riedel).

Also referring now to FIG. **2,** in a projection **54** of the collar **50** of the output shaft **42,** there is provided an axially extending longitudinal groove **51** in which there is shiftably positioned a selector member or control slide **52.** The control slide **52** is provided with a bore into which extends the free leg of a spring **53** which is secured, as illustrated in FIG. **2,** to the collar **50** of the output shaft **42.** The free leg of the spring **53** projects through a slot **55** provided in the projection **54.** The slot **55** serves simultaneously to limit the linear displacement of the control slide **52** and to secure the same in the groove **51.**

The control slide **52,** dependent upon its axial position, cooperates either with a control lug **56** or a control lug **57** provided on the control sleeves **40** and **41,** respectively. The spring **53** biases the control slide **52** continuously in the direction of the control lug **57** of the control sleeve **41.** From this position the control slide **52** may be shifted to its other position (where it cooperates with the lug **56**) by means of a second triggering pulse emitter formed of a control solenoid II and a control lug **19** attached to the solenoid armature.

In the carrier **30** there is further pivotally supported an escapement bridge **58,** which is provided with escapement levers **59** and **60.** The latter cooperate with respective actuating members **61** and **62** freely rotatably supported on the escapement bridge **58.** The actuating members **61** and **62** are each urged by respective springs **63** and **64** into their operational engagement with the associated respective lugs **56** and **57** of the control sleeves **40** and **41.** The actuating members **61** and **62** may be simultaneously swung out of their operative engagement with lugs **56** and **57** against the force of the springs **63** and **64** by means of the escapement bridge **58** which, against the force of a spring **65,** is pivotable by an escapement solenoid I. The latter, the escapement bridge **58** and the escapement levers **59** and **60** constitute a first triggering pulse emitter.

For effecting a stepwise advance of the carrier **30** (i.e. the release of triggering of individual steps in the typing direction), the escapement solenoid I is briefly energized, whereupon the escapement bridge **58** lifts both actuating members **61** and **62** out of the zone of the control lugs **56** and **57.** As a result, the control sleeve **40** is freed, while the control sleeve **41** remains locked by virtue of the control slide **52.** Once freed, the control sleeve **40,** urged by the yoke spring **38,** snaps forwardly and thereby couples the output shaft **42** to the continuously driven clutch component **36.** Since the escapement solenoid I is again immediately deenergized, the actuating member **61** and also the actuating member **62** again engage the outer periphery of the associated control sleeves **40** and **41,** respectively. As a result, the output shaft **42** is arrested by the control sleeve **40** after one revolution. Since the pitch of the nut member **44** and the lead screw **45** corresponds to the desired step division, for each revolution of the output shaft **42** there is obtained one exact printing step.

If the printing element carrier **30** is to be moved rapidly in the typing direction, that is, it is to perform a continuous motion (for example, a tabulation movement), the escapement solenoid I, subsequent to its energization, remains in the attracted position whereby a continuous run of the yoke spring clutch **13** is achieved by virtue of the driving connection with the left-hand clutch component **36** until the actuating members **61** and **62** are again released by the escapement bridge **58** and are thus allowed to drop in the travelling path of the control lugs **56** and **57.**

For effecting a stepwise or a continuous movement of the carrier **30** in a reverse direction (for a reset, a carrier return or a reverse tabulation), the operation is the same as described above, with the difference that at least simultaneously, but preferably prior to the energization of the escapement solenoid I, the control solenoid II is also energized, whereby the control slide **52** is shifted against the force of its spring **53** towards the left into the zone of the control lug **56.** By virtue of the

above-described release motion of the actuating members **61** and **62** it is now the control sleeve **41** which is freed and the control sleeve **40** is locked. Once freed, the control sleeve **41**, urged by the associated yoke spring **39**, snaps forwardly and thereby couples the clutch component **37**, which rotates continuously in the reverse direction with respect to clutch component **38**, to the output shaft **42**. As a result, the output shaft **42**, its nut member **44, 50** cooperating with the stationary lead screw **45**, moves the carrier **30** in a direction opposite to the printing direction. Since the control slide **52** is secured to the output shaft **42, 50**, it executes therewith its rotary motions during which the control slide **52** is locked in its position by virtue of the lateral face **66** which forms part of the control lug **57** and which projects into the locking direction. This condition is maintained until the control sleeve **41** is again arrested by the actuating member **62**, whereupon the driving connection between the continuously rotating clutch component and the output shaft **42** is interrupted. It will thus be readily understood that for any operation involving the movement of the print element carrier **30** along the line of print (such an operation is initiated, for example, by the depression of a key on the key-board of the typewriter), the energizing circuit for the escapement solenoid is closed. If such movement by the print element carrier **30** is to be effected in a reverse direction (for example, for reset or carrier return), then, in addition to the escapement solenoid I, the energizing circuit for the selector solenoid II is also closed.

When the carrier **30** for effecting typing corrections or for the purpose of margin equalization, should be reset by half a space or should be advanced from such a half-space adjustment in normal, full-space steps, the lead screw **45** is rotated through the gear wheel **46** by the locking member **47** into a 180° opposite position in which it is locked against rotation. Since the pitch of the lead screw **45** is so designed that one relative revolution of the lead screw **45** with respect to the output shaft **42** corresponds to one typing space, such as 180° rotary adjustment of the lead screw **45** results in a half-space shift of the carrier **30.**

It will be understood that the above description of the present invention is susceptible to various modifications, changes and adaptations, and the same are intended to be comprehended within the meaning and range of equivalents of the appended claims.

We claim:

1. In a type printing business machine having a machine frame, a print element carrier arranged for movement along the line of print, a lead screw supported in the machine frame parallel to the line of print, a nut member threadedly engaging the lead screw and supported in the print element carrier, the latter being moved along the line of print upon relative rotation between the lead screw and the nut member, the improvement comprising in combination:

a. means for operationally stationarily supporting said lead screw in said machine frame;

b. first driving means supported in said print element carrier for continuous rotation in a first direction;

c. second driving means supported in said print element carrier for continuous rotation in a second, opposite direction;

d. means for imparting a continuous rotation to said first and second driving means;

e. means for rotatably supporting said nut member in said print element carrier;

f. a clutch supported in said print element carrier and including

1. a first input means having a first position for maintaining said nut member disengaged from said first driving means and a second position for drivingly connecting said first drive means with said nut member to rotate the latter in one direction;

2. a second input means having a first position for maintaining said nut member disengaged from said second driving means and a second position for drivingly connecting said second drive means with said nut member to rotate the latter in an opposite direction;

3. means urging said first and second input means into their respective said first positions;

g. first trigger signal emitting means including

1. escapement means having a first position for simultaneously locking said first and second input means of said clutch in their respective said first positions, said escapement means having a second position in which it is withdrawn simultaneously from said first and second input means;

2. means for actuating said escapement means for moving said escapement means into its said second position;

h. a selector member supported in said print element carrier and having a first position in which it is withdrawn from said first input means and locks said second input means in its first position, said selector member having a second position in which it is withdrawn from said second input means and locks said first input means in its first position; and

i. second trigger signal emitting means connected to said selector member for selectively moving said selector member from one of its said positions into the other.

2. An improvement as defined in claim **1,** said nut member including an output shaft having an axial bore, said output shaft being arranged coaxially about said lead screw, said axial bore having a threaded portion threadedly engaging said lead screw; said output shaft having, in the zone of said threaded portion, a collar-like enlargement, said threaded portion and said collar-like enlargement constituting a nut element.

3. An improvement as defined in claim **1,** wherein said first trigger signal emitting means is supported in said print element carrier.

4. An improvement as defined in claim **1,** wherein said second trigger signal emitting means is supported in said print element carrier.

5. An improvement as defined in claim **1,** said means actuating said escapement means including an energizable escapement solenoid; said escapement means including an escapement bridge pivotally supported in said print element carrier, means operatively connecting said escapement solenoid with said escapement bridge, actuating members freely rotatably supported on said escapement bridge and cooperating with said input means of said clutch, spring means urging said actuating members into a locking engagement with said

first and second input means, said locking engagement corresponds to said first position of said escapement means, said escapement means further including escapement levers affixed to said escapement bridge and operatively connected to said actuating members for moving the latter against the force of said spring means into a withdrawn position with respect to said first and second input means of said clutch in the energized condition of said escapement solenoid, said withdrawn position corresponds to said second position of said escapement means.

6. An improvement as defined in claim **1,** including axially aligned radial and thrust bearings mounted in said print element carrier; said bearings receiving axial ends of said nut member for rotatably supporting the same, one of said bearings being adjustable for setting the axial play of said nut member.

7. An improvement as defined in claim **1,** wherein said first and second input means of said clutch respectively include

a. first and second clutch input gear wheels connected for continuous, oppositely directed rotation to said first and second driving means, respectively; and

b. first and second clutching members for selectively coupling said first or said second clutch input gear wheel to said nut member for rotating the latter.

8. An improvement as defined in claim **7,** further comprising a main drive shaft supported in said machine frame parallel to said lead screw and arranged for guiding said print element carrier; means for continuously rotating said main drive shaft; a gear wheel block secured to said main drive shaft to rotate therewith as a unit, said gear wheel block being arranged on said main drive shaft for linear displacement with respect thereto, said gear wheel block having a first gear wheel constituting said first driving means and meshing with said first clutch input gear wheel, said gear wheel block having a second gear wheel constituting said second driving means and meshing with a reversing pinion, said reversing pinion meshing with said second clutch input gear wheel.

9. An improvement as defined in claim **1,** wherein the pitch of the thread of said lead screw and said nut member is of such a magnitude as to cause said print element carrier to axially shift by one typing space upon one revolution of said nut member with respect to said lead screw.

10. An improvement as defined in claim **9,** said lead screw having two operative positions **180°** apart; further comprising means for rotating said lead screw into, and immobilizing the same in either one of said two operative positions.

11. An improvement as defined in claim **1,** including spring means urging said selector member into one of its said two positions; said second trigger signal emitting means includes an energizable control solenoid having an armature connected to said selector member; said control solenoid, when energized, shifting said selector member into the other of its two said positions against the force of said spring means.

12. An improvement as defined in claim **11,** wherein said one of said two input means of said clutch includes means for preventing said selector member from being moved by said spring means from said other of its two positions to said one of its two positions for at least one revolution of said one of said two input means.

13. An improvement as defined in claim **11,** said selector member being constituted by a control slide; said nut member including means defining a groove in which said control slide is received and supported for reciprocating motion; said spring means is in engagement with said control slide to urge the latter into a position in which it locks one of said two input means in its said first position.

14. An improvement as defined in claim **13,** wherein said spring means is constituted by a spring member being affixed to said nut member and having a leg portion; said control slide including means defining an opening; said nut member including means defining a slot extending along and immediately adjacent said groove; said leg portion of said spring member passes through said slot and said opening.

15. In a type printing business machine having a machine frame, a print element carrier arranged for movement along the line of print, a lead screw supported in the machine frame parallel to the line of print, a nut member threadedly engaging the lead screw and supported in the print element carrier, the latter being moved along the line of print upon relative rotation between the lead screw and the nut member, the improvement comprsing in combination:

a. means for operationally stationarily supporting said lead screw in said machine frame;

b. means for rotatably supporting said nut member in said print element carrier;

c. a clutch supported in said print element carrier and having two input means arranged for cooperation with said nut member; each input means having a driven component;

d. means for continuously rotating said driven components of said two input means in mutually opposite directions;

e. a two-position selector means for selectively maintaining one of said input means locked and the other of said input means simultaneously unlocked; and

f. escapement means having a deenergized position for maintaining both input means disengaged from said nut member and an energized position for operatively coupling that input means to said nut member which is maintained unlocked by said selector means, whereby a driving torque of preselected sense is applied to said nut member.

* * * * *