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ELECTROMECHANICAL INTERFACE FOR A TYPEWRITER

Filed July 17, 1967

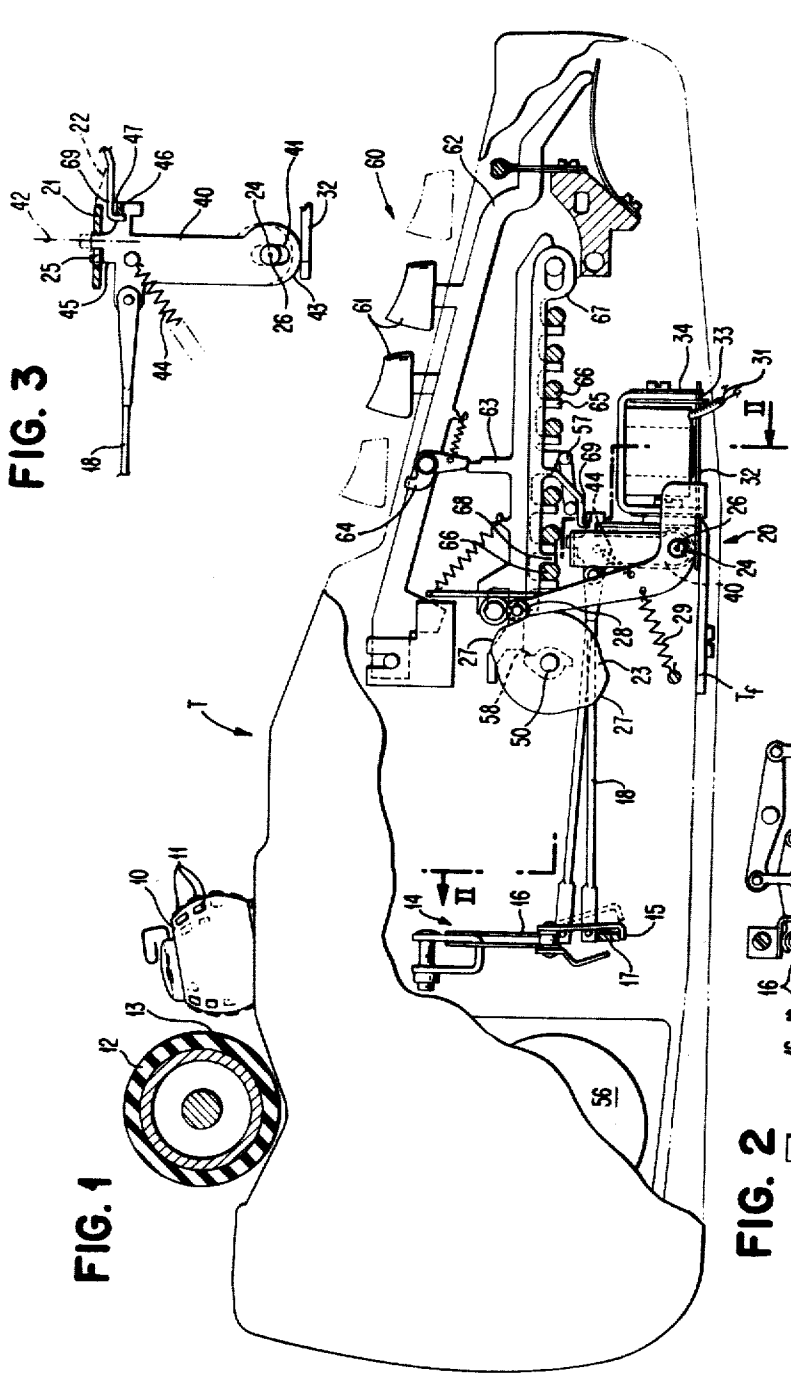

FIG. 1

FIG. 3

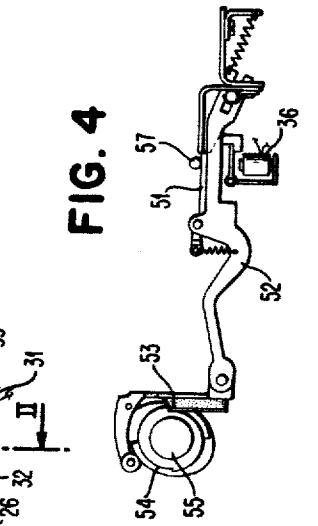

FIG. 4

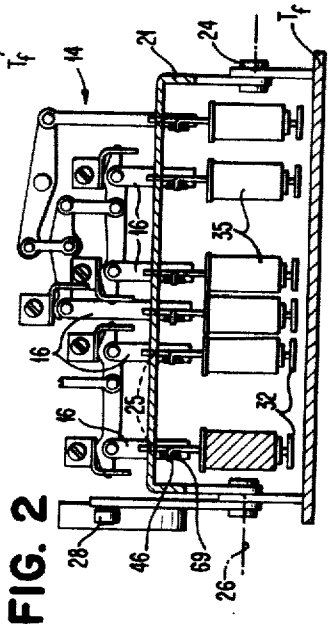

FIG. 2

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ELECTROMECHANICAL INTERFACE FOR A TYPEWRITER

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10 Claims. (Cl. 197—19)

ABSTRACT OF THE DISCLOSURE

A low energy interposer bank is employed to deliver coded representations of characters to the selection mechanism of a single type matrix typewriter. The interposer bank includes an oscillating cage in which are slidably mounted a group of bidirectionally movable interposer links. Electromagnets drive individual interposer links longitudinally within the cage to a position intersecting the path of oscillation of the cage to provide a positive mechanical connection for operating the typewriter selection mechanism. Manual control of the typewriter employs the same interposer links as a direct connection from an existing mechanical keyboard encoder.

Disclosure of the invention

This invention provides a compact interconnection between a group of electromagnets designed for speed rather than power, and a corresponding group of binary mechanical input latches to a so-called "whiffletree" character selector as described in U.S. Patent 2,919,002, issued Dec. 29, 1959, to L. E. Palmer and entitled, "Selection Mechanism for a Single Printing Element Typewriter."

There are many constructions known for interconnecting electromagnets with typewriters for remote control. The value of any such interconnection can be measured by considerations of cost, speed of serviceability, and long term reliability. My construction optimizes these factors of value by employing a self-contained unit construction which is operable with parts manufactured to relatively wide tolerances and assembled in a self-aligning structure. The entire mechanism is removable as a unit for servicing and is sufficiently compact to fit within the normal covers of a standard office electric typewriter. My construction employs the electromagnets as an information source only and does not require a power output of any significance therefrom. Furthermore, mechanical output from my interface is positively taken from a cam drive rather than relying on an impositive spring drive.

A principal phase of my invention involves the construction of a group of bidirectionally movable interposer links supported in an oscillating cage. Each interposer link is driven longitudinally within the cage by a flat electromagnet armature to provide a low friction rolling contact with the armature. Movement of the interposer link positions a drive surface in the path of oscillation of the cage to provide selective motion output therefrom.

These and other objects, features and advantages of my invention will be apparent to those skilled in the art upon reading the following description of a preferred embodiment of my invention wherein reference is made to the accompanying drawings of which:

FIGURE 1 is a side elevational view of a typewriter equipped with an electromechanical interface mechanism constructed in accordance with my invention wherein certain parts of the typewriter are broken away or eliminated for ease of understanding;

FIGURE 2 is a front elevational cross-sectional view of the interface mechanism shown in FIGURE 1 taken along lines II—II thereof;

FIGURE 3 is an enlarged fragmentary view of an interposer link and associated mechanism employed in my interface mechanism; and

FIGURE 4 is a partial side elevational view of a portion of the typewriter shown in FIGURE 1 which is separated therefrom for clarity.

Referring now more specifically to the drawing, in FIGURE 1 there is shown a typewriter or character-by-character printer T of basic construction like that described in aforesaid U.S. Patent 2,919,002. The typewriter T is characterized by a multi-character single type matrix or print element **10** having a plurality of character masters **11** positioned about its surface. The character masters **11** are selected by rotation and tilting of the element **10** and printing is accomplished by impact of the element **10** against a platen **12** at printing position **13**. A whiffletree selection mechanism **14** (shown more completely in FIGURE 2 and more completely described in aforesaid Patent 2,919,002) serves to convert information provided in the form of a six bit parallel code, into a discrete combination of angular displacements of the element **10**. The whiffletree mechanism **14** includes a plurality of dual input latches or hook control members **15** which control individual pull bars **16** of the whiffletree mechanism **14**. A chopper bail or drive member **17** oscillates down and up each printing cycle to downwardly drive those latch members **15** positioned thereunder and thereby select an individual character master **11** for printing.

This invention deals with an input means or interface **20** for pulling selected latches **15** from under the path of the chopper bail **17** in response to electrical signals applied at input wires **31**.

The interface mechanism **20** includes a plurality of vertically extending interposer links **40** which are individually connected, as by rods **18**, to corresponding latches **15**. The interposer links **40** are mounted for bidirectional movement in a cage or carriage **21**. The cage **21** is pivotedly supported on the typewriter frame T_f for reciprocating pivotal movement along a path **22** under the control of a half revolution cam **23** mounted on a selectively cyclically rotatable shaft **50** of the typewriter T.

As best shown in FIGURES 2 and 3, the interposer links **40** are longitudinally slidably supported on the pivot shaft **24** of the cage **21** by an elongated slot **41** and in a guide slot **25** that permits low friction movement of the interposer links **40** along individual paths **42** that are substantially normal to the path **22** of cage **21**.

One end of a horizontally extending, magnetizable armature **32** (see also FIGURE 1) rollingly engages circular surface portion **43** of the interposer links **40** and is pivotally mounted at its other end by a slot **33** in a stationary bracket **34**. A plurality of electromagnets or solenoid actuators **35** are individually positioned above, and between the ends of, respective armatures **32**. When an armature **32** is magnetically attracted by its electromagnet **35**, its left end is raised in the direction of interposer path **42**. This movement raises an associated interposer link **40** against spring **44** to present a control shoulder or drive surface **45** in alignment with the cage **21** as shown by the broken line in FIGURE 3. Clockwise oscillation of the cage **21** about pivot axis **26** drives the raised interposer link **40** clockwise therewith to produce a pull on the connecting rod **18** connected thereto and move a latch **15** to its broken line position shown in FIGURE 1. If, however, an interposer link **40** has not been lifted by its magnet armature **32**, the space within the guide slot **25** will allow motion of cage **21** to be

wasted, and no output will be produced at the respective pull rod **18**. Obviously, the operation of the mechanism can be reversed by mounting interposer links **40** in a normal position of interception with the cage **21** and selectively moving the interposed links to a position of non-interception therewith.

Input or control operation of electromagnets **35** is accompanied by generally simultaneous operation of a cycle-start electromagnet or solenoid actuator **36**, see FIGURE 4. Electromagnet **36** pulls down on clutch latch trigger **51** to release clutch latch link **52** to move downwardly and to the right pulling holding-latch **53** from the sleeve of normally disengaged clutch **54**. A cycle shaft **55** is thus connected to typewriter motor **56** through the clutch **54** all as more completely described in aforesaid U.S. Patent 2,919,002. Cycle shaft **55** is drivingly connected to the shaft **50** for controlling cyclic motion thereof.

Operation of the mechanism thus far described is as follows: A source of parallel electrically coded data, such as from a magnetic tape unit as described in U.S. Patent 3,297,124, issued to D. E. Sims on Jan. 10, 1967, and entitled, "Data Recording and Printing Apparatus Capable of Responding to Changed Format," operates the six electromagnets **35** and the clutch start electromagnet **36** to initiate rotation of shafts **55** and **50**. Substantially simultaneously therewith, the selectively activated electromagnets **35** pivot their respective armatures **32**, and raise their respective interposer links **40** to the broken line position shown in FIGURE 3 wherein shoulder **45** lies in the path **22** of cage **21**. Cam **23** rotates to bring a lift or rise portion **27** under cam follower **28** to positively drive follower **28** clockwise against its spring **29**. Cage **21** is thus driven clockwise carrying with it those interposer links **40** which were previously raised by their armatures **32**, while those interposer links **40** which were not lifted will remain relatively stationary. Any interposer link **40** which was lifted and hence intercepted by the cage **21** will pull its associated rod **18** to withdraw the respective latch **15** from under the chopper bail **17**. Later in the cycle, chopper bail **17** will descend as described in aforesaid U.S. Patent 2,919,002 and pull downwardly on all latches **15** which have not been withdrawn as described.

It is also desirable that the typewriter T be operable from the usual keyboard **60** without interference from the electromechanical interface **20**. The keyboard **60** shown in FIGURE 1 provides encoding means substantially like that shown and described in U.S. Patent 2,919,002. The keyboard **60** includes a plurality of individually depressable keybuttons **61** carried on keylevers **62** which activate associated encoding interposers **63** through non-repeat dobbers **64**. The encoding interposers **63** have a selected plurality of downward projections **65** that cooperate with encoding bails or rods **66** to produce a mechanically coded binary representation of a character represented by a depressed key. Depression of keylever **62** depresses its associated encoding interposer **63**. A clutch control bail **57** (see also FIGURE 4) is depressed by operation of any encoding interposer **63** to trip clutch latch trigger **51** and a cycle of operation is thus initiated. Cycle shaft **55** and shaft **50** are rotated and through a fluted drive portion **58**, the depressed encoding interposer **63** is moved to the right of FIGURE 1 driving with it those encoding bails **66** which are adjacent the downward extensions **65**.

My invention provides for the interposer links **40** to effect a direct connection from the mechanical encoder thus described to the latches **15** to provide for alternate remote or manual typewriter control. The encoding bails **66** thus are connected to respective ones of a group of transfer links or output members **67** which are individually associated with each of the bails **66**. The transfer link **67** shown in FIGURE 1, for example, is provided with a downward projection **68** to the right of the leftmost bail **66**. Accordingly, that transfer link **67** will move to the right each time that bail **66** is driven to the right by any of the encoding interposers **63**. Rightward motion of the transfer link **67** is communicated to its respective selection latch **15** by a projecting hook **69** which engages a bent tab **46** of the associated interposer link **40** to provide a force transfer connection therebetween. Note that clearance **47** (see FIGURE 3) is provided between the hook **69** and tab **46** to eliminate interference by hook **69** with operation of the interposer link **40** by its electromagnet **35**.

It will be recalled that a cycle of operation under control of the manual keyboard **60** included operation of the drive shaft **55**. Accordingly, at the time that transfer link **67** is pulling interposer links **40** to the right, cam **23** will also be driving cage **21** to the right, out of the way of the interposer links **40**.

Those skilled in the art will recognize that I have provided a compact, low cost electromechanical interface that is inherently reliable due to the continuous guiding and intercooperating relationship between the interposers and their support and drive cage. Also, it will be recognized that I have provided a unique mechanism for allowing both manual and electrical control of a typewriter selection mechanism. While a specific embodiment of my invention has been shown herein for purpose of illustration, it is to be understood that various modifications, additions, and deletions can be made thereto without departing from the scope and spirit of my invention as limited only by the appended claims.

I claim:

1. A printer having a multi-character print element that is differentially movable to selectively present different ones of a plurality of character masters to a printing position, and a plurality of dual input position control members cooperatively connected to said print element for controlling character selecting movement thereof, wherein the improvement comprises input means for selectively moving said control members between their dual positions and having:

a cyclically reciprocable cage movable along a predetermined path and having a plurality of guide slots therein,

a plurality of interposer links slidably mounted in the guide slots of said cage for movement along paths substantially normal to said cage path, each of said interposer links having a control shoulder surface extending substantially normal to said cage path,

means connecting individual ones of said interposer links to individual ones of said control members for moving said control members from one input position to the other input position thereof upon movement of said interposer links in the direction of said cage path, and

means for selectively individually moving said interposer links along said normal path to selectively position the respective control shoulder surfaces thereof in or out of said cage path.

2. A printer as defined in claim **1** wherein said control shoulder surface of said interposer link is normally positioned out of said cage path, and said individual interposer link moving means selectively moves its respective interposer shoulder surface into said cage path.

3. A printer as defined in claim **1** wherein said cage and interposer links are supported for movement in the direction of said cage path about a common pivotal axis.

4. A printer as defined in claim **1** wherein said means for moving said interposer links along said normal path comprises a plurality of electromagnets each associated with an individual one of said interposer links and being cooperatively connected therewith for moving its associated interposer link in one direction along said normal path, and spring means resiliently urging each of said interposer links in the other direction along said normal path.

5. A printer as defined in claim **4** wherein the improvement further comprises:

a keyboard having a plurality of individually depressable keybuttons,

a plurality of output members at least equal in number to said interposer links and encoding means operable upon depression of a keybutton for moving a combination of said output members representative thereof, and

means connecting individual ones of said output members to respective ones of said interposer links to move the respective interposer links in the direction of said cage path upon movement of said associated output member.

6. A printer as defined in claim 3 having a motor, a selectively rotatable shaft and normally disengaged clutch means for selectively drivingly connecting said shaft with said motor wherein the improvement further comprises:

means responsive to depression of any of said keybuttons for causing engagement of said clutch means, and

further electromagnetic means operative substantially simultaneously with said first named electromagnets for alternatively operating said clutch engagement causing means.

7. A printer as defined in claim 6 further comprising:

a cam mounted on said shaft for rotation therewith, said cam having a rise portion thereon,

a follower operatively engaging said cam and drivingly connected with said cage for moving said cage along its path in an interposer link driving direction under control of said cam rise portion, and

a spring resiliently urging said follower against said cam for returning said cage along its path.

8. A printer as defined in claim 4 wherein said electromagnet connecting means comprises:

a magnetizable armature substantially normal to said interposer link normal path and engaging said interposer link at the other end thereof, and

said electromagnet being positioned adjacent said armature between its pivoted support and interposer engaging end for pivotally displacing said armature by magnetic interaction therewith.

9. A printer as defined in claim 8 wherein each of said interposer links have a substantially circular surface portion for rollingly engaging their respective armatures.

10. A printer as defined in claim 9 wherein said cage and interposer links are supported for movement in the direction of said cage path about a common pivotal axis.

References Cited

UNITED STATES PATENTS

2,919,002	12/1959	Palmer	197—16
3,233,715	2/1966	Flieg	197—19
3,353,744	11/1967	Becking et al.	197—20 XR

ROBERT E. PULFREY, *Primary Examiner.*

E. S. BURR, *Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,391,774 July 9, 1968

Donald L. Greer

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

Column 3, line 5, "interposed" should read -- interposer --. Column 5, line 13, the claim reference numeral "3" should read -- 5 --.

Signed and sealed this 20th day of January 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents