

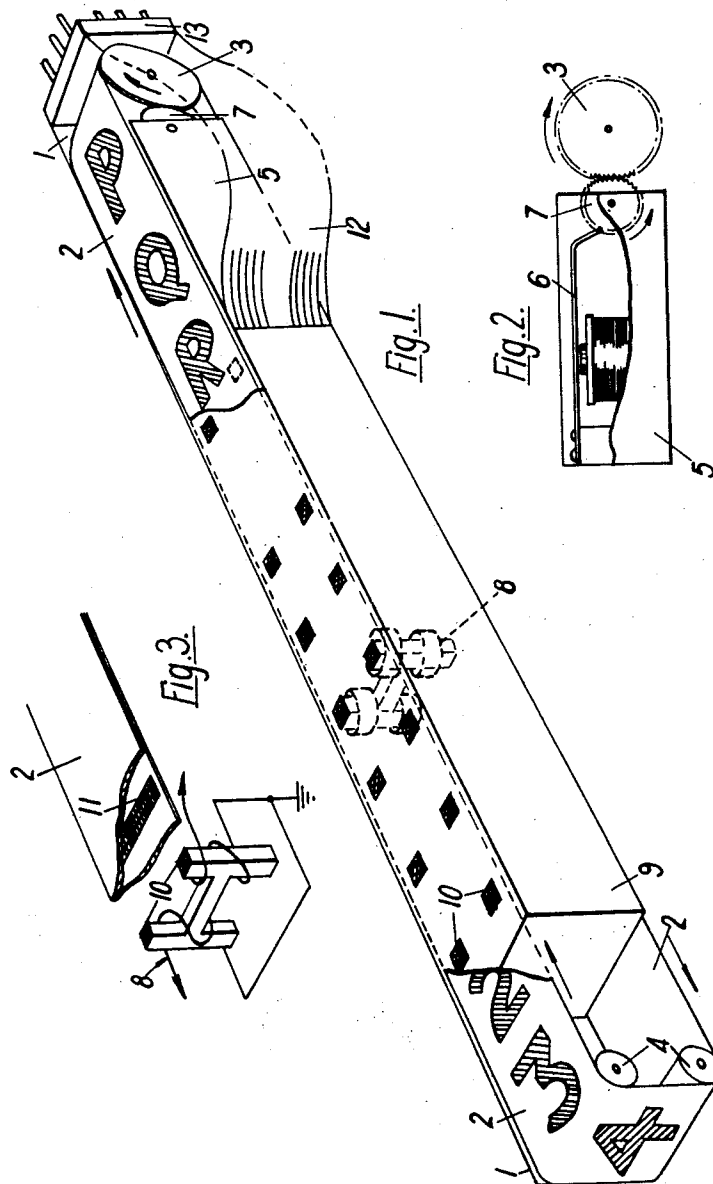
July 27, 1965

K. H. SIMPKIN

3,197,765

ELECTROMAGNETIC INDICATORS OR READOUT DEVICES

Filed July 6, 1962



1

3,197,765

ELECTROMAGNETIC INDICATORS OR
READOUT DEVICES

Kenneth Henry Simpkin, Aylesbury, England, assignor to
General Precision Systems Limited, Aylesbury, England
Filed July 6, 1962, Ser. No. 207,957

Claims priority, application Great Britain, July 7, 1961,
24,736/61; Feb. 7, 1962, 4,733/62
6 Claims. (Cl. 340—348)

This invention relates primarily to digitally controlled display devices in which an endless band carrying a succession of characters or symbols is motor-driven past a window, and which delivers, as each character occupies the window, a digital code readout signal identifying that character, so that when the readout signal corresponds with one registered or set up in an associated control system as defining a selected character to be held displayed, the control system may automatically arrest the motion of the device for this purpose and until the selection is changed.

It is often required that such devices be suitable for packing closely together so that they may in conjunction display readily legible words and/or decimal numbers. In such a case it is desirable that each device be not substantially larger in cross-section than its display window (although its length is of less consequence) and the problem of accommodating band, motor drive and readout signal generating equipment which will be fast-acting, accurate and durable is a severe one. The present invention comprises constructional features which are particularly, though not exclusively, of advantage in this respect in such devices.

According to the invention, there is provided an electromagnetic indicator or readout device including a member movable through a succession of settings with respect to readout means for generating a corresponding succession of electrical binary digital code signals respectively signifying such settings, in which the readout means comprises a group of transformers each so constructed and placed as to function to deliver a particular signal bit only in the proximity of an unbalancing element carried by the movable member, and the movable member carries a plurality of such elements disposed in a pattern which is so related to the grouping of the transformers as to provide for said succession of signals to be obtained from their secondary circuits, taken together, by jointly pulsing their primary circuits when the movable member is at each setting.

Other features of the invention will be apparent from the following description of one miniature form of device in accordance therewith, this device being illustrated in the accompanying drawings, of which:

FIGURE 1 is a general perspective view,

FIGURE 2 is a side view showing the nature of a driving motor of the device, and

FIGURE 3 illustrates the principle of each pulse transformer and its co-operation with an endless moving band.

In the particular device illustrated, the parts are carried between two side plates 1, of which the nearer has been omitted in FIGURE 1 for clarity. An endless band 2 passes round a driving roller 3 at the rear of the device and over two small-diameter rollers 4 at the front; a total of 40 alphabetical characters, numerals and other symbols is evenly spaced along the outer face of the band and these are selectively displayed at the front window, i.e. where the numeral "4" is shown in FIGURE 1. The whole of the band-driving and position-readout equipment is within the space enclosed by the band and rollers 3, 4, and is as follows.

The driving motor 5 (see FIGURE 2) is a simple uni-directional stepping type comprising an electromagnetic

2

buzzer having a natural frequency of 500 to 1000 cycles per second when excited by the appropriate D.C. voltage. Its reed armature 6 has its free end bent down to peck at a ribbed pinion 7 geared to the roller 3. When the read is vibrating it drives the band 2 in the direction of the arrows; when it is stationary, it acts as a locking detent.

The readout system comprises a row of seven miniature pulse transformers 8 encapsulated within a block 9. Each transformer is wound upon an H-core, conveniently of ferrite, and is orientated as illustrated in FIGURE 3, that is to say in a plane transverse to the direction of travel of the belt. The upper ends of the vertical limbs of the H form pole faces 10 (FIGURE 1) which are flush in the upper face of the block 9 and thus close against the band. This does not apply at the underside of block 9, since the transformers are of a vertical dimension appreciably less than that of the block.

Each transformer is provided with opposite-handed windings in series on one vertical limb of the H and similar-handed windings in series on the other limb; these windings are shown diagrammatically in FIGURE 3, but of course the actual construction employs four miniature wound bobbins.

In a contemplated use of the device, it is functionally connected to controlling equipment which sends 50-micro-second interrogation pulses 500 times per second through all the transformer primary windings. A transformer will respond to this however only when it is unbalanced by the presence across its poles 10 of a transverse strip 11 of a low reluctance material carried by the band 2. This strip may conveniently be of thin mu-metal scored or slitted to give it flexibility and sandwiched between two plies of nylon plastic material of which the band is made. It can also be formed by making the band temporarily adhesive and printing on its with a high-permeability sintered ferrous dust.

The seven transformers require to be served with a single lead to supply the interrogation pulses to their primaries, and seven leads to return responses from their individual secondaries. These, together with a D.C. lead to the motor 5 and a common earth, make a total of ten leads, which are conveniently provided in the form of a flexible printed circuit ribbon 12 taken back to a multi-pin plug 13 forming the rear end of the device. The ribbon 12 will of course lie flat under a plastic side plate 1 and is slotted to clear the spindles of the pinion 7 and roller 3 and any assembly screws.

The device forms a unit having dimensions $1\frac{1}{16}$ inch high by $\frac{9}{16}$ inch wide and 9 inches long. It may be conveniently protected from dust and damage by a removable cover in the form of an open-ended rectangular-section plastic tube pushed over it so that its rear end seats on the plug base 13 and its front end forms the display window. This cover has been omitted from the drawings for clarity, but can readily be visualised.

A strip 11 is present at, or absent from, each symbol position on the band, and the readout transformers 8 are likewise placed in the block 9 at this modular distance apart except that (in the example illustrated) one of the end transformers is doubly spaced from its neighbour.

The particular arrangement shown of seven readout transformers with one double-width gap will readily permit 40 different band positions to be signalled, assuming a suitable pattern of magnetic patches. Moreover, this is possible even providing for a "parity check," that is to say for using only digital numbers which all contain an even number of "1's" or all an odd number of them.

In operation the band will run until the readout system delivers a digital number identical to a "demanded" one in a register in controlling equipment, whereupon the latter (which forms no part in itself of the present inven-

tion) will switch off the motor 5, and hold the band to display the relevant symbol, until the demand is changed.

This technique of generating the digital identifying code has the advantage, compared with conventional readout heads and magnetic tape, of continuing functional if interrogated while the band is stationary and the controlling system possibly switched to serving other purposes. In other words, the information visually displayed by a bank of the devices, having been set in by operation of a keyboard type controller (for example), will continue to be available for automatic use in data-processing or other equipment associated with the display.

This result has previously been sought, in devices of this kind, by cutting edge castellations in the band through which spring feelers can make electrical contacts as required. However, this affects the durability of the band and reduces the width available for the characters on it; also, response rate is restricted by the tendency of the feelers to jump the apertures if the band is driven fast. Increasing the stiffness of the feelers to overcome this will aggravate destructive wear on the band and load on the motor. Photoelectric equivalents are obviously difficult or impossible to pack into the space available, and would involve a maintenance problem.

The novel readout technique here proposed is clearly superior in these respects; indeed it may with advantage be applied to other devices and systems in which discrete positions of a member have to be digitally signalled whether it is moving or stationary, and the invention extends to such applications.

I claim:

1. An electromagnetic indicator, comprising, in combination: an endless flexible band bearing a succession of symbols and a succession of patches of low magnetic reluctance; means for moving said band to move said symbols successively to a viewing area, and a plurality of magnetic circuits spaced along and adjacent said band

at fixed positions, whereby different positions of said endless flexible band result in various of said patches altering the reluctance of various of said magnetic circuits.

2. Apparatus according to claim 1 in which each of said magnetic circuits comprises a transformer wound on an H-core having upper and lower pairs of legs, and in which movement of said endless flexible band to selected positions results in various of said patches of low magnetic reluctance tending to magnetically short across the legs of one of said pairs of legs of said core.

3. Apparatus according to claim 1 in which said magnetic circuits are spaced along the direction of movement of said band at a spacing corresponding to the spacing, or a multiple of the spacing, of said patches on said endless flexible band.

4. Apparatus according to claim 1 in which each of said magnetic circuits includes a first magnetic path adapted to be bridged by various of said patches at different positions of said band; a primary winding adapted to be excited by an alternating current; and a secondary winding adapted to provide an output signal.

5. Apparatus according to claim 1 in which the spacing between successive of said symbols along said band corresponds to the spacing of successive of said patches along said band.

6. Apparatus according to claim 1 in which the spacing between successive ones of said magnetic circuits are all equal to the spacing between successive of said symbols on said endless band with one exception, which is twice that distance.

References Cited by the Examiner

UNITED STATES PATENTS

35	3,016,526	1/62	Hailey et al.	340—324
	3,067,409	12/62	Hellstrom et al.	340—174.1

NEIL C. READ, *Primary Examiner.*