United States Patent

Englund et al.

[15] **3,668,692**
[45] **June 6, 1972**

[54] CONVERTING DEVICE

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[73] Assignee: **Svenska Dataregister AB,** Solna, Sweden

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[30] **Foreign Application Priority Data**

June 28, 1968 Sweden.....8847/68

[52] **U.S. Cl.**.....**340/347 P,** 350/273, 340/357
[51] **Int. Cl.**.....**G08c 9/06**
[58] **Field of Search** .....235/92, 1, 65, 10; 340/347 A–347 D, 357 DR; 350/269, 273; 250/233, 227, 236

[56] **References Cited**

UNITED STATES PATENTS

3,070,303	12/1962	Schad	235/92
3,248,727	4/1966	Anastasia	340/347

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Attorney—Norman Friedman, Stephen E. Feldman, Morris I. Pollack, Arthur T. Groeninger and Philip Furgang

[57] **ABSTRACT**

A device for converting the value in a mechanical register into electrical output signals. The value in the register is transferred to coded means, each one cooperating with a number of wires and set to an operative or inoperative position, (being able to cover or uncover apertures in a stationary disc). A rotating sensing finger, comprising optical fibers, scans the apertures in sequence and depending on the apertures being covered or exposed transmits light from a stationary light source to a stationary light sensitive device to generate electrical signals. These signals represent the value in the register.

9 Claims, 8 Drawing Figures

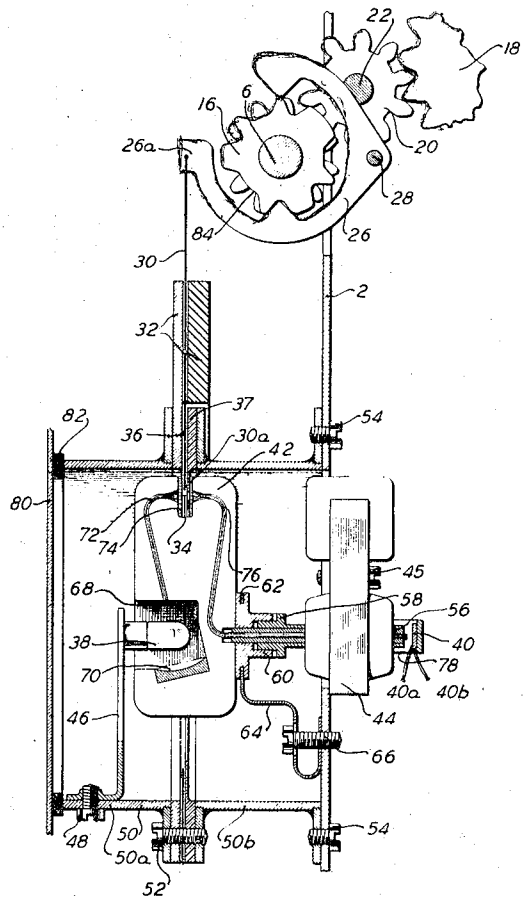


FIG. 1

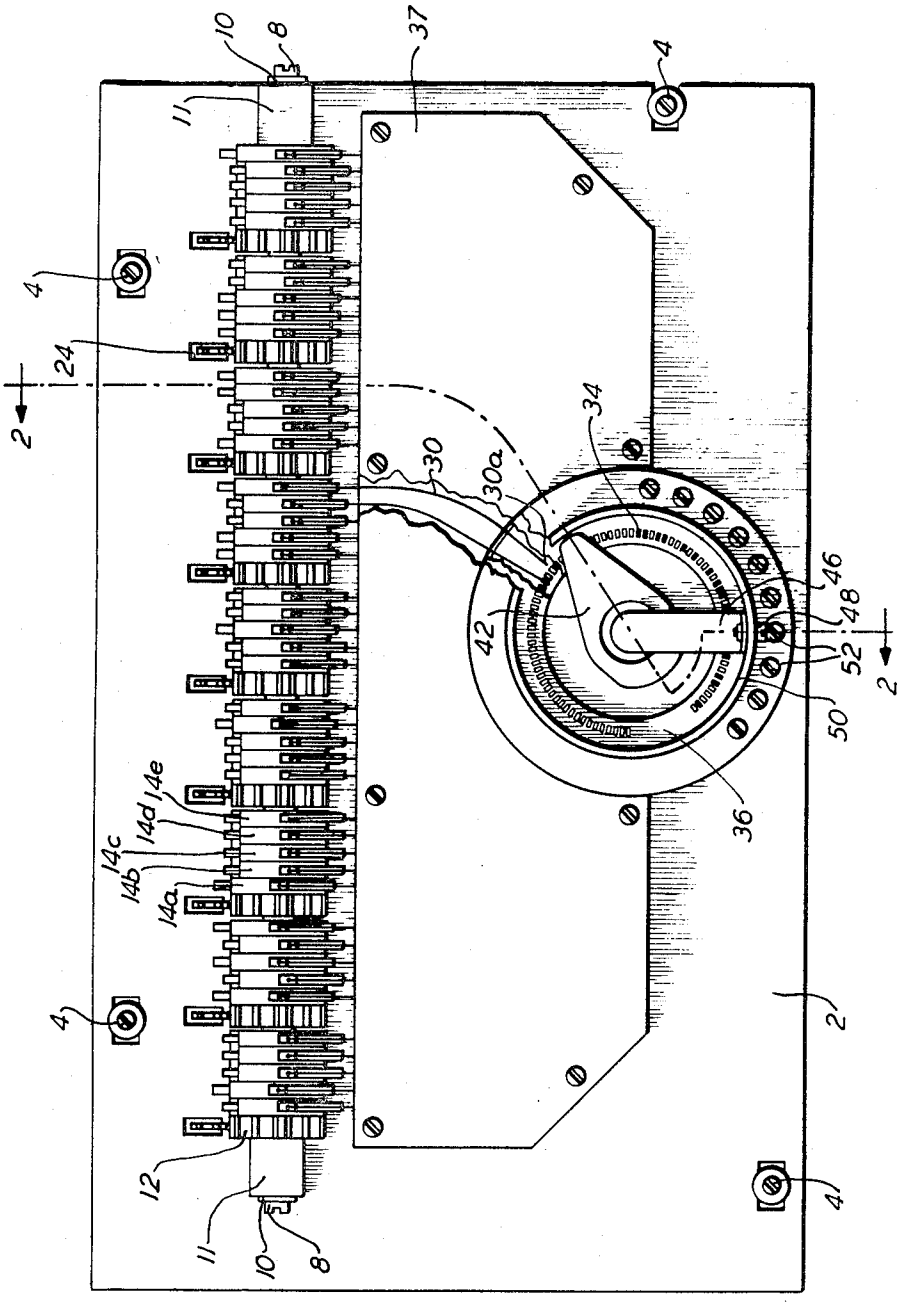

10
8
37
4
11
4
24
2
34
30
30a
46
48
42
52
2
50
14e
14d
14c
14b
14a
36
4
2
12
11
10
8
4

FIG. 2

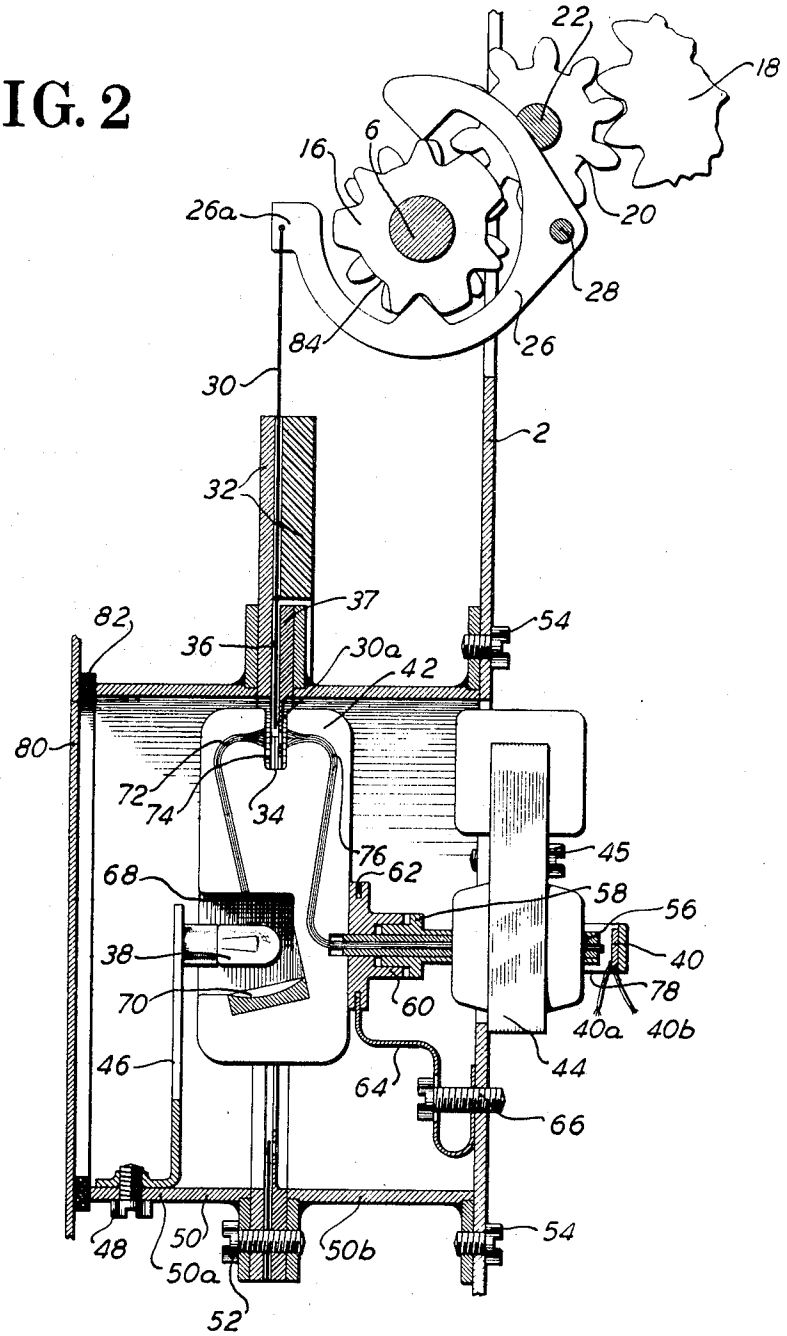

22
18
16
6
20
26a
28
84
26
30
2
32
37
82
36
30a
42
54
80
72
74
34
76
62
45
68
58
56
38
40
78
70
60
40a
40b
46
44
64
66
48
50
50a
50b
54
52

FIG. 3A

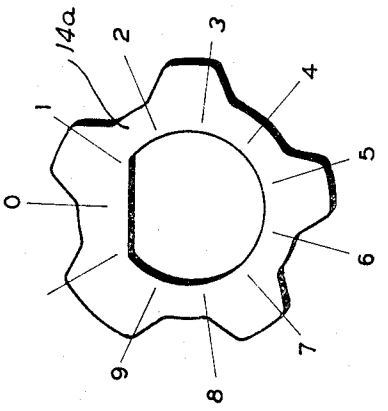


FIG. 3B

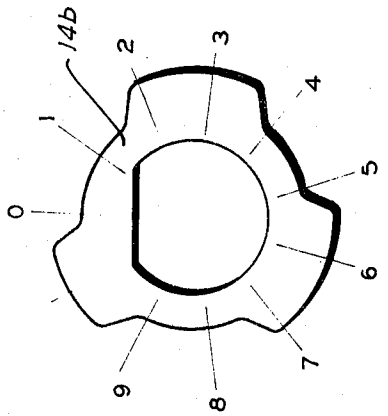


FIG. 3C

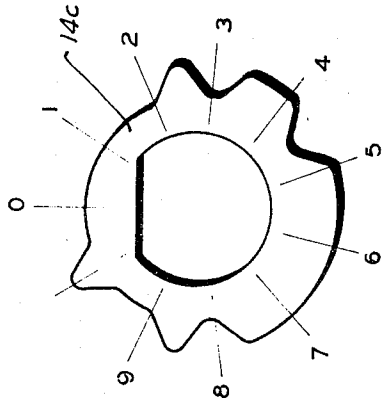


FIG. 3D

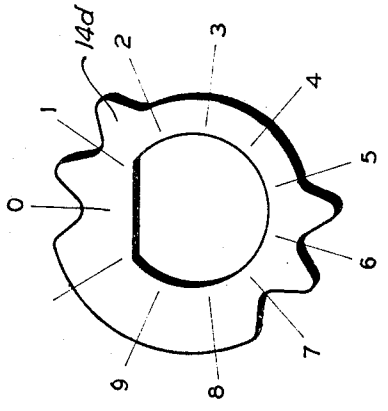


FIG. 3E

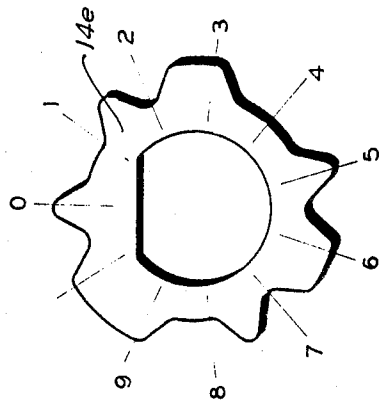
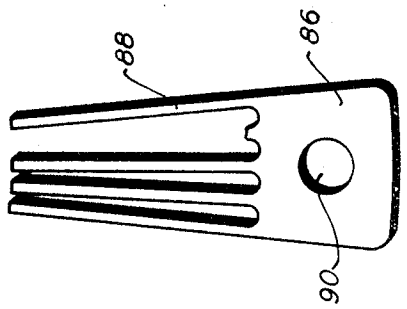


FIG. 4



CONVERTING DEVICE

Devices are known which can convert information in an Office machine, for example a cash register, to electrical signals which, for example, can be stored in a storage register for subsequent treatment in a computer. Such a device is described in U. S. Pat. application Ser. No. 740,175 owned by the assignee of the present application. In this device information in an office machine, particularly in a cash register, is transferred to a number of gearlike code rolls having different decimal digits representing tracks in the tooth gaps, the tracks being sensed by a sensing means running in the tracks and forming part of a photo-electric converter in which the sensing means, depending upon the binary coded information in the tracks, alternately admits and blocks a light ray from a light source to a photosensitive device. Every number set on the code rolls is converted to electrical signals in sequence in that the track set on each code roll aligns to form a continuous track in which the sensing means will run, driven by the machine motor. In the embodiment especially described in the U.S. application mentioned above the light source, being a filament lamp, and the photosensitive device, being a photocell, move together with the sensing means on a runner. With this arrangement difficulties arise in obtaining a sufficient degree of mechanical strength for the lamp and photocell when the runner accelerates and decelerates.

The present invention pertains to a device for converting information from mechanical form into electrical form, where the conversion is accomplished in a new way. In the device of the invention the problems arising when accelerating and decelerating a runner supporting the sensing means are eliminated in that the sensing means is stationary. Moreover, with the device according to the invention the same information can be converted into electrical signals more than once as the sensing means is rotating continuously, driven by a separate motor. In the device described in the mentioned U. S. Pat. application Ser. No. 740,175 owned by the assignee of the present application, the same information can be converted into electrical signals only once.

Another advantage achieved with the invention is that, in addition to information obtained from a cash register or the like, also exchangeable fixed information can be provided in the path for the sensing means. Such fixed information can be, for example, a number for identifying the office machine cooperating with the converter.

The device according to the invention is characterized in that means are provided for transferring the information to a series of coded means, the coded means being sensed by first sensing means, at least one provided for each one of the coded means, the first sensing means cooperating with a transmitter and a receiver in such a way that by a second rotating sensing means, depending upon the setting of the first sensing means, the communication between the transmitter and the receiver in different positions along the path sensed by the second sensing means is established or blocked, causing the receiver to generate electrical signals corresponding to the information.

A better understanding of the invention will be obtained from the following description of an embodiment of the invention in connection with accompanying drawings in which:

FIG. 1 is a plan view of a mounting plate supporting the converter and being mounted to the back of a cash register;

FIG. 2 is a sectional view, taken along lines 2—2 of FIG. 1;

FIG. 3 shows a number of coded discs being parts of the mechanical-to-electrical converter;

FIG. 4 shows a part useful for entering fixed information in the converter.

In FIG. 1 a mounting plate 2 supports the various parts of the mechanical-to-electrical converter. Plate 2 is fastened to the back of a cash register by means of screws 4. A shaft 6 (FIG. 2) is, by means of screws 8, secured to brackets 10 which in turn are secured to the mounting plate 2. Shaft 6 supports a number of gears 12, one gear being provided for each decade in the cash register. Each gear 12 is fixedly secured to

five coded discs or cams 14*a–e* forming a cam group. In order to axially align gears 12 and coded discs 14 on shaft 6, spacers 11 are provided adjacent to the supported ends of shaft 6. The five cams in each cam group, according to any suitable code and in equally spaced positions along the periphery, together represent the digits 0–9. For that purpose cams 14*a–e* are provided with cut-outs 16 in certain positions which will be described in greater detail later in connection with FIG. 3.

Gears 12 and thus cams 14 are set by gears 18 in the register via intermediate wheels 20 supported on a shaft 22. Intermediate wheels 20 are extending through cut-outs 24 in mounting plate 2 and are meshing gears 12.

To sense the angular position of gears 12 cam followers 26 are provided which follow each cam 14*a–e*. Cam followers 26 are supported on a shaft 28 (FIG. 2), concentric with respect to the cams, and surround about three-fourths of the periphery of the cams. A part 26*a* of cam follower 26, displaced 180° from the supporting end of the follower, retains a wire 30 which extends through a guiding plate 32 having separate passages for each wire. The free end 30*a* of each wire, dependent upon the position of cam follower 26, takes a position in which the end covers holes 34 in discs 36, 37 or a position adjacent to the holes.

The electrical part of the converter is of the photoelectric kind and comprises a filament lamp 38, a photoelectric device 40 and a rotating sensing device 42. The sensing device 42, in the following also called the rotor, is driven by a motor 44 secured to the mounting plate 2 by means of a screw 45. Filament lamp 38 is supported by a lamp-holder 46 secured to a tube-shaped part 50 which acts as an enclosure for the electrical parts. Tube-shaped part 50 consists of two parts 50*a*, *b* which are clamped together by means of screws 52. Part 50*b* is fastened to mounting plate 2 by means of screws 54. The two parts 50*a* and 50*b* between themselves hold the two discs 36, 37 which are annular and have holes 34 spaced along their peripheries. Wires 30 from cam followers 26 go through the passages in guiding plate 32 and between discs 36, 37 into the positions in which the free ends of the wires cover or do not cover the holes 34.

Rotor 42 is connected to shaft 56 of motor 44 by means of a coupling comprising a coupling part 58 secured to the motor shaft and another coupling part 60 secured to rotor 42 and cooperating with coupling part 58. Coupling part 60 has a groove 62 in which a plate spring 64 engages. Spring 64 is secured, at the other end, to mounting plate 2 and by adjusting an adjusting screw 66 the spring can be displaced in a direction parallel to the motor shaft. The displacement of the spring permits the axial position of the rotor to be adjusted as the two coupling parts 58, 60 can be moved in relation to each other.

Filament lamp 38 is placed in a central recess 68 of rotor 42. In the recess is provided a reflector 70 which concentrates the light from the lamp to a point in which a light conductor ends in the recess. Light is conducted through the light conductor to one side of a peripheral groove 74 in the rotor 42, the groove surrounding the holes containing parts of discs 36, 37. From the other side of the groove light is conducted through motor shaft 56 to the photoelectric device 40, being for instance a photo-resistor, the connections to which are designated 40*a*, *b*. The photoelectric device 40 is enclosed in an enclosure 78 secured to motor 44. To prevent dust and dirt and also light from entering the enclosure for rotor 42, filament lamp 38 and annular discs 36, 37 formed by mounting plate 2 and tube-shaped part 50, a cover 80 is provided which with intermediate gasket 82 contacts tube-shaped part 50. The arrangement of the rotating sensing device with the axial input and output of light yields, as mentioned above, an important advantage in that both the filament lamp and the photoelectric device can be stationary. As a result no problems will arise which are connected to the acceleration and deceleration of lamp and photocell as is the case with the device described in the mentioned U. S. Pat. application Ser. No. 740,175 owned by the assignee of the present application.

As described above each gear **12** is coupled to five coded discs or cams **14***a–e* which are shown in greater detail in FIG. **3**. The cams have eleven pitches, ten of which are used for binary representation of the digits 0–9. Each cam has peripheral cut-outs **16** in the positions where a binary "0" is to be represented. The remaining positions which are lacking a cut-out represent a binary "1." The binary code used is a common one comprising five bits, one of which is used for parity control. The binary code is shown in the following table.

Decimal Digit	Binary Code 1 2 4 8 P
0	0 0 0 0 1
1	1 0 0 0 0
2	0 1 0 0 0
3	1 1 0 0 1
4	0 0 1 0 0
5	1 0 1 0 1
6	0 1 1 0 1
7	1 1 1 0 0
8	0 0 0 1 0
9	1 0 0 1 1

The parity control infers that for each digit in each decade the number of binary "1" or "0" is either odd or even whereby a control can be made that the number set in each decade is correctly converted into electrical signals. In this particular embodiment, the number of binary "1" for each digit is always odd and the conversion of a set number of nine digits is controlled, for example, in that the electrical signals which correspond to binary "1" affect a flip-flop, the end condition of which indicates if the number of signals is odd or even. How this control can be performed is known to those skilled in the art and will not be described in any greater detail.

In FIG. **3** cams **14***a*, **14***b*, **14***c* and **14***d* indicate the presence or absence of the decimal digits **1**, **2**, **4** and **8**, respectively, and cam **14***e* indicates the presence or absence of a parity digit. The five cams are fixedly secured to each other and to one of gears **12**, and the decimal digits 0–9 are disposed clockwise along the circumference, the digit 0 being in position "twelve o'clock" and with the position "eleven o'clock" being empty.

FIG. **4** shows a comb-shaped part **86** provided with initially five pins **88** corresponding to the five coded discs in each decade. Comb-shaped part **86** has a hole **90** used for fixing, by screw **52**, part **86** between annular discs **36**, **37** so that pins **88** cover corresponding holes in the discs. A plurality of comb-shaped parts **86** can be arranged along the periphery of discs **36**, **37** and fixed between discs **36**, **37**, as described, by means of screws **52**. The comb-shaped parts **86** are used to place fixed information, for example register number, in the path of sensing device **44** and parts **86** are coded by removing one or more of pins **88**.

The function of the apparatus of the invention will be described in the following assuming that the nine-digit number 251843970 has been transferred from the cash register to gears **12** via intermediate wheels **20**. Each group of cams **14***a–e* has then been rotated into a position representing the respective digit of the number. Each cam follower senses its cam in the position "twelve o'clock" and from FIG. **1** it appears that cam followers **26** take upper position corresponding to binary "1" and lower positions corresponding to binary "0." In the upper positions the free ends of wires **30** are positioned adjacent to holes **34** in discs **36**, **37** while in the lower positions the free ends are covering holes **34**. As also appears from FIG. **1**, only every other hole **34** is cooperating with a wire **30**. The remaining holes are always open and are provided for generation of clock signals for timing of the information signals from the holes **34** cooperating with wires **30**. The clock signals and the information binary "1"-signals are obtained when light from filament lamp **38** via light conductor **72** in rotor **42** is let through holes **34** in discs **36**,**37** and via light conductor **76** reaches photocell **40**, while the binary "0"-signals are obtained when no light is let through holes **34** in discs **36**, **37**.

Rotor **42** rotates at a constant speed and when the rotor arm in sweeping over discs **36**, **37** the digits set in each decade in sequence are converted into light pulses of two different levels the pulses being converted to electrical signals by photocell **40**. The continuous rotation of rotor **42**, as mentioned above, yields the advantage that the same information can be converted into electrical signals more than once. This is of great importance when information from a plurality of cash registers is to be transferred to a computer at the same time causing a queing-up.

The positions on cams **14** which correspond to the set number 251843970 causes cam followers **26** to take the positions shown in FIG. **1**. The corresponding positions for the free ends of wires **30** are shown in FIG. **1** for two wires only but the remaining wires **30** take the corresponding positions in which their free ends **30***a* according to the code chosen (see the table) cover or do not cover the corresponding holes **34**.

The present invention is not intended to be limited by the described embodiment but only by the scope of the accompanying claims. For example, the construction of the rotating sensing device, or the device for transferring the information in the cash register to the wires, or the choice of code (see the table) might be easily varied by those skilled in the art without departing from the idea of invention.

While a specific embodiment of my invention has been illustrated, it will be appreciated that my invention is not limited thereto since many modifications may be made by one skilled in the art which come within the spirit and scope of the invention.

I claim:

1. A device for converting mechanical information into electrical information comprising

coded means;

means for transferring information to said coded means;

a stationary disc having apertures therein;

elongated means for transferring information from said coded means to the apertures in said disc, said elongated means having a first position and a second position, in said first position said elongated means covers an aperture in said stationary disc and in said second position it exposes the aperture in said stationary disc;

a rotating sensing means having an area which scans the apertures in the disc in sequence;

a stationary light source which illuminates the apertures in said disc;

a light sensitive means;

first light conducting means for conducting light that passes through the exposed apertures to said light sensitive means;

said light sensitive means converting the light that passes through the exposed apertures in sequence and represents information in said coded means into electrical information signals.

2. The device of claim **1** wherein the rotating sensing means includes a second light conducting means for conducting light from the stationary light source to the area.

3. The device of claim **2**, wherein the disc is provided with a circular opening around which the apertures are disposed, the rotating sensing means being positioned in the opening and the area on the rotating sensing means being a slot which, at least partly, surrounds the part of the disc which is provided with apertures.

4. The device of claim **3**, wherein the light source is positioned in a central recess in the rotating sensing means, the light-sensitive means is positioned on the side of a motor which drives the rotating sensing means, the second light conducting means extending from the central recess to the part of the area situated on one side of the disc and the first light conducting means extending from the part of the area situated on the other side of the disc through the motor shaft of said motor to the light-sensitive means.

5. The device of claim **4**, wherein the coded means consists of cams which are sensed by cam followers to which the other ends of the elongated means are connected.

6. The device of claim 5, wherein the elongated means consist of wires extending from the cam followers through slots in a guide plate to the positions in which the wire ends cover or expose the respective apertures in the disc.

7. The device of claim 6, wherein alternating holes in the disc are provided for the generation of synchronizing signals so that only alternating apertures cooperate with the elongated means.

8. The device of claim 7 wherein comb-shaped means are

arranged to permanently cover, by means of pins preselected holes in the disc for the conversion of fixed information into electrical signals.

9. The device of claim 7 wherein four cams in each decade are arranged to binarily represent the digits 0–9 and where the elongated means are arranged by decade in sequence to allow the information to be converted in series.

* * * * *