(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 527 631 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **92307315.9**

(51) Int. Cl.5: **G09F 11/26**

(22) Date of filing: **11.08.92**

(30) Priority: **12.08.91 JP 226580/91**

(43) Date of publication of application:
17.02.93 Bulletin 93/07

(84) Designated Contracting States:
DE FR GB

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(54) Display elements.

(57) With a view to enabling five or more colors to be displayed and to reliably sealing display elements so that they have high durability, each display element has a belt-like body (3) having a plurality of serially arranged display screens (3a) with different display colors. The belt-like body is driven on the basis of detection by a position-detection sensor (8) in order to transport selected display surfaces to a display position.

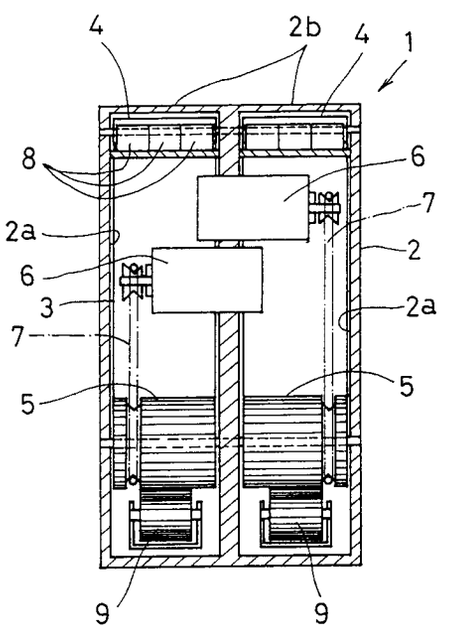

Fig 2

EP 0 527 631 A1

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION:

The present invention relates to display elements which form dots of a display screen and, more particularly, to display elements which are capable of displaying a plurality of colors.

DESCRIPTION OF THE RELATED ART:

Generally, display elements of this type are formed in display apparatuses for displaying characters, symbols, graphics and the like as a result of a plurality of them being arranged on a display surface. However, in the prior art, since the aforesaid display elements are formed from light-emitting elements, such as light-emitting diodes, there are problems in that not only is visibility during daytime and sharpness poor, but large amounts of power are consumed and running costs are considerable. Therefore, in recent years, display elements of what is commonly called a magnetic inversion type have been proposed in which a block-like body having different display colors thereon is rotatably supported and the body is magnetically inverted in order to display a plurality of colors. However, since these display elements can provide only four display surfaces at a maximum, there is a drawback in that the range of display colors is limited and a vivid graphic display or the like cannot be achieved. In addition, since all of the display elements are not covered by a casing, they are not reliably sealed and thus have low durability.

SUMMARY OF THE INVENTION

The present invention has been developed in light of the above-described circumstances.

An object of the present invention is to provide display elements which solve the above-mentioned problems of the prior art.

According to one aspect of the present invention, there are provided display elements which form dots on a display screen, a belt-like body having a plurality of serially arranged display surfaces with different display colors, transport means for selectively transporting the display surfaces of the belt-like body to display positions, and belt position detecting means for detecting the position to which the belt-like body is transported being installed inside a casing for the display elements.

According to another aspect of the present invention, there are provided display elements, wherein the belt-like body has the form of an endless loop wound around a driving pulley and a driven pulley.

According to a further aspect of the present invention, there are provided display elements, wherein the belt position detecting device is formed of a reflection type photosensor for detecting the position of the belt on the basis of reflected light from a reflection section provided on the reverse surface of the belt-like body.

According to a still further aspect of the present invention, there are provided display elements, wherein a motor for each pair of the display elements, which motors form the transport means, is put into the casing of the other pair of display elements when the plurality of display elements are combined to form a unit.

According to a yet still further aspect of the present invention, there are provided display elements, wherein the plurality of display elements are operated by a single motor and a clutch mechanism for discontinuing/continuing power transmission is disposed in respective transmission paths from the single motor to each pair of the display elements when the plurality of display elements are combined to form a unit.

With the construction described above, in the present invention, display of five or more colors is made possible, and as the display elements are reliably sealed, they have high durability.

The invention will be described now by way of example only, with particular reference to the accompanying drawings. In the drawings:

It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front view of a display unit;

Fig. 2 is a horizontal sectional view of the display unit;

Fig. 3 is a vertical sectional view of the display unit;

Fig. 4 is a development illustrating the reverse surface of a belt body;

Fig. 5 is a front view illustrating a display unit of a second embodiment;

Fig. 6 is a horizontal sectional view of the display unit of the second embodiment;

Fig. 7 is a vertical sectional view of the display unit of the second embodiment;

Fig. 8 is a rear view of the display unit of the second embodiment;

Fig. 9 is a development illustrating a belt body of the second embodiment;

Fig. 10 is a vertical sectional view of a drive unit of the second embodiment;

Fig. 11 is a view illustrating the state in which the power of the drive unit is being transmitted;

Fig. 12 is a plan view illustrating an essential portion of the drive unit, and

Fig. 13 shows a display panel formed from a plurality of display elements.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The first embodiment of the present invention will be explained below with reference to the accompanying drawings. In the figures, reference numeral 1 denotes a display unit. A casing 2 of the display unit 1 has a pair of housing sections 2a and 2a on the right and left sides thereof so that one unit is formed by a pair of display elements. The front sides of each of the housing sections 2a is formed into substantially square display sections 2b which are permeable to light.

Reference numeral 3 denotes a belt-like body formed from a tape material in the form of an endless loop. The outer peripheral surface of the belt-like body 3 has a plurality (5 in this embodiment) of serially arranged display areas or surfaces 3a which are wider than the display sections 2b. Different display colors ("red", "yellow", "blue", "white" and "black" in this embodiment) are displayed on each of the display surfaces 3a. Inside the housing sections 2a, the belt body 3 is wound around a driven pulley 4 which is supported on the right and left ends of the display sections 2b and a driving pulley 5 supported on the innermost portion of the housing sections 2a. That is, the belt body 3 is transported along a continuous endless path by the driving of the driving pulley 5, and each of the display surfaces can be selectively stopped on the display section 2b. Thus, a plurality of colors are displayed on the display sections 2b.

Reference numeral 6 denotes a motor, one of which is provided for each display element in order to drive the driving pulley 5 forward or backward via a transmission belt 7. In this embodiment in which a pair of display elements are formed into a unit, each of the motors 6 extends into the housing section 2a of the other motor 6 in order to effectively utilize space.

Reference numeral 8 denotes a position-detection sensor for detecting the position of the belt body 3. The position-detection sensor 8 is formed of a reflection type photosensor in a triple-sequence form provided in such a manner as to face the reverse surface of the belt body 3. That is, the position-detection sensor 8 has three pairs of light-emitting elements and photoreceptors and detects the position of the belt body 3 by reading a reflection code 3b reflected by a pattern corresponding to each of the display surfaces 3a on the reverse surface of the belt body 3. Reference numeral 9 denotes a pinch roller which resiliently presses the belt body 3 by the energizing force of a resilient mechanism 10 in order to prevent the belt body 3 from slipping.

In the embodiment of the present invention constructed as described above, a plurality of the display units 1 are arrayed on a display surface to form a display panel 101 as shown in Figure 13, and connected to display control apparatus 100. When the display control apparatus 100 outputs an operation signal on the basis of display data which has been prepared beforehand and a feedback signal from the position detection sensor 8, each display element displays a plurality of colors, thereby displaying characters, symbols, graphics and the like on a display screen as a whole.

In the present invention, as described above, the display unit 1 which is capable of displaying a plurality of colors is formed. The display unit 1 comprises the belt body 3 having serially arranged display screens 3a with different display colors and switches the colors to be displayed by selectively transporting the display screens 3a of the belt body 3 to the display section 2b. Therefore, problems can be solved such as the limitation of the range of display colors and the inability to make a vivid graphic display. Therefore, the problems of magnetic inversion type display elements which display a plurality of colors by magnetically inverting a block body can be solved. As a result, the image representation performance of the display panel formed by the display unit 1 can be remarkably increased.

In addition, the display unit 1 is formed in such a manner that all parts are housed inside the casing 2 without exposing the display surface or the like to the outside as in magnetic inversion type display elements. Thus, the drawback of each section being exposed to water and corroded can be reliably prevented, thus enhancing its durability.

When forming a pair of display elements into a unit in this embodiment, since each of the motors 6 provided in each pair of the display elements extends into the housing section 2a of the other motor 6, space is efficiently utilized, and miniaturization is effectively achieved.

Next, a second embodiment of the present invention will be explained with reference to the accompanying drawings. In the figures, reference numeral 11 denotes a display unit. A casing 12 of the display unit 11 has a pair of housing sections 12a and 12a so that one unit is formed by a pair of display elements. Each of the front sides of the housing sections 12a is formed into a substantially square display section 12b which is permeable to light.

Reference numeral 13 denotes a belt-like body in the form of an endless ring formed from a tape material. The outer peripheral surface of the belt-

like body 13 has a plurality of display areas or surfaces 13a, and different display colors are displayed on each of the display surfaces 13a. Inside the housing sections 12a, the belt body 13 is wound around a driven pulley 14 which is supported on the right and left ends of the display section 12b and a driving pulley 15 supported on the intermediate portion of the housing sections 12a.

Reference numeral 16 denotes a pinch roller. It is supported on a swinging case 17 swingably supported on the housing section 12a, and is resiliently brought into abutment with the belt body 13 wound around the driving pulley 15 by the energizing force of a resilient mechanism 18 for energizing the swinging case 17. The rotation of the pinch roller 16 is transmitted by gears to an input shaft 21 via an intermediate gear 18 and a pair of bevel gear 19 and 20 provided in the innermost portion of the housing section 12a. That is, the pinch roller 16 is rolled in linkage with the input shaft 21, and switches the positions of the display surfaces 13a by forcibly moving the belt body 13 when the pinch roller 16 is rotating.

The input shaft 21 is supported on the back end of the casing 12 in such a manner as to face forward and backward, and a projecting coupling 22 is integrally mounted on the extreme end portion exposed from the casing 12. The shaft-supporting portion of the input shaft 21 is formed into an elliptic engaging projection 12c which projects from the back end portion of the casing 12. In addition, a sealing member 23 is mounted on the outer peripheral surface of the engaging projection 12c. Reference numeral 24 denotes a connector provided on the back end portion of the engaging portion 12c.

Reference numeral 25 denotes a position-detection sensor for detecting the position of the belt body 13. It is formed by what is commonly called transmission type photosensors which face each other with the belt body 13 inbetween. That is, the position-detection sensor 25 has light-emitting elements and photoreceptors, and detects the position of the belt body 13 by detecting a transparent window 13b provided at a certain position of each of the display surfaces of the belt body 13.

In this embodiment, only the transparent window 13b in the red display surface 13a is elongate and its long axis extends in a belt moving direction. The position of the display surface 13a is detected by detecting said long-formed transparent surface 13b.

Reference numeral 26 denotes a drive unit, on which eight display units are assembled in one piece in such a way that there are four columns with two units in a row in each column. Thus, a display unit is formed on which 16 display elements are arranged in four columns with four units in a row in each column. That is, eight engagement recesses 27a are formed on the front side of a casing 27 which forms the drive unit 26. The engaging projection 12c of the display unit 11 is engaged with the engagement recesses 27a.

Reference numeral 28 denotes a motor integrally assembled on the rear side of the drive unit 26 via a motor base 29. The motor 28 outputs motive power from a pinion gear 30 disposed on a motor shaft 28a. The outputted motive power is distributed to a total of 16 intermediate shafts 31 supported inside the casing 27 so that the shaft core conforms to the input shaft 21 of each display unit 11. That is, after the motor power is transmitted from the pinion gear 30 to a first intermediate gear 32 having a large diameter, it is transmitted to four second intermediate gears 33 which are concurrently engaged with the first intermediate gear 32. Thereafter, it is transmitted to each intermediate shaft 31 via four third intermediate gears 34 which are concurrently engaged with the second intermediate gears 33.

Reference numeral 35 denotes an output shaft interlocked to the intermediate shaft 31 via a clutch mechanism 36 which will be described later. The front end portion of the output shaft 35 projects into the engagement recesses 27a, and is engaged with the coupling 22 of the display unit 11 via the coupling 37. Thus, the power of the motor 28 can be transmitted to the input shaft 21 of each pair of the display elements. The coupling 37 is formed with a recessed shape which corresponds to a projection on the coupling 22 on the side of the display unit. It is mounted on the output shaft 35 in such a manner as to freely project or recess along the shaft core and is energized toward the projection side at all times by a resilient mechanism 38. For this reason, even if the coupling angles are not matched, the assembly of the display unit 11 (the engagement of the engagement projection 12c with the engagement recess 27a) is permitted on the basis of the recessing of the coupling 37, it is automatically projected and engaged with the coupling 22 on the side of the display unit when the coupling angles are matched by the motor being driven after the assembly.

The clutch mechanism 36 comprises facing ring-shaped electromagnetic coils 39 with a small gap on the outer peripheral surface in the front end portion of the intermediate shaft 31, a dish-shaped attraction plate 40 integrally disposed on the front end of the intermediate shaft 31, and a clutch plate 41 which faces the attraction plate 40 and is connected in a state in which one-piece rolling on the shaft core with respect to the back end portion of the output shaft 35 and sliding in the direction of the shaft core are possible. In a state in which the

electromagnetic coil 39 is energized, the clutch plate 41 is integrally magnetically connected to the attraction plate 40 as the attraction plate 40 is magnetized. Whereas the motor power is transmitted from the intermediate shaft 31 to the output shaft 35 on the basis of the one-piece magnetic attachment, the transmission of power from the intermediate shaft 31 to the output shaft 35 is discontinued because the clutch plate 41 is separated from the attraction plate 40 in a state in which the electromagnetic coil 39 is not energized. Reference numeral 42 denotes a connector disposed on the bottom of the engagement recess 27a, which connector is connected to a connector 24 on the side of the display unit 11.

In the embodiment of the present invention constructed as described above, a plurality of the display units 11 are arrayed on the display screen to form a display panel, and characters, symbols, graphics and the like are displayed as each pair of the display elements switches colors to be displayed. The display units 11 form a unit in which eight of them are assembled for each drive unit 26 and display elements are arrayed in four row and four columns. Each pair of the display elements which forms each unit is operated by the power transmitted from the single motor 28, and operated in accordance with the discontinued/continued operation of the clutch mechanism 36. Consequently, not only is the incorporation of a motor into each display element as is required in the first embodiment not needed so that the construction is simplified and the number of parts and assembly steps reduced, but also commonly used inexpensive motors can be used in place of expensive motors for position control. As a result, the cost of manufacturing display panels can be decreased considerably.

In addition, since the display unit 11 is formed separately from the drive unit 26 and can be releasably mounted as desired, it can be easily maintained and the replacement of each display unit 11 can be performed easily.

The coupling 37 of the drive unit 26 permits the display unit 11 to be assembled even when the coupling angle of the coupling 37 does not match that of the coupling 22 of the display unit 11 in accordance with the recessing against the resilient mechanism 38. That is, the recessed coupling 37 is automatically fitted to the coupling 22 of the display unit 11 when the coupling angles are matched by the driving of the motor after assembly of the display unit 11. Therefore, it is not necessary to confirm the coupling angle during the assembly of the display unit 11. As a result, assembly and maintenance thereof can be made considerably easier.

It is a matter of course that the present invention is not limited to the above-described embodiment. For example, the number of display colors of the belt body is obviously not limited to five colors, but may be increased or decreased as desired. When, for example, display colors, such as "cyan (bluish green)", "magenta (reddish purple)", and "green" are added so that a total of eight colors are used, the level of display approaches a gravure representation, and thus representation capability can be increased remarkably. In addition, the belt body does not have to be formed in the shape of an endless loop or ring, as the end portion of the belt may be connected to the take-up and supply mechanism to move the belt body. Also, it is possible to change the direction of power transmission so that instead of the power being transmitted from the motor to the driving pulley, it is transmitted from the transmission belt to chains, toothed belts, gears or the like. Further, the position-detection sensor may be formed of sensors other than reflection type photosensors or transmission type photosensors, and the positions at which these are disposed may be changed. If a photosensor is disposed in the innermost portion of a casing instead of the front portion thereof, such a drawback by which the detection accuracy is decreased because of light which enters from the display section can be reliably eliminated.

With the above-described construction of the present invention which displays a plurality of colors, the range of display colors is not limited and displaying of five or more colors is possible since the display elements of the present invention comprise a belt body having a plurality of serially arranged display surfaces with different display colors, and the display surfaces of the belt body are selectively moved to display positions. Thus the problem where the range of display colors is limited and vivid graphic display cannot be performed as in the case of magnetic inversion type display elements which display a plurality of colors by magnetically inverting a block body can be solved. As a result, the power of representation of a display panel formed of display elements can be increased remarkably. In addition, since the display surfaces of the display elements are not exposed to the outside as in the magnetic inversion type display elements and all parts thereof are installed within a casing, each section of the present invention is prevented from being exposed to water and corroded, thus enhancing its durability considerably.

When a plurality of display elements are operated by a single motor and each pair of the display elements is operated by the discontinuation/continuation operation of a clutch mechanism, it is not required that a motor be incorporated into each pair of the display elements. As a result, the construction of the present inven-

tion can be simplified, the number of parts reduced, and the assembly steps simplified. In addition, commonly used inexpensive motors can be used instead of expensive motors for position control, thus reducing costs considerably.

Many different embodiments of the present invention may be constructed without departing from the spirit and scope of the present invention. It should be understood that the present invention is not limited to the specific embodiments described in this specification. To the contrary, the present invention is intended to cover various modifications and equivalent arrangements included with the spirit and scope of the claims. The following claims are to be accorded a broad interpretation, so as to encompass all such modifications and equivalent structures and functions.

Claims

1. Display elements which form dots on a display screen comprising a belt-like body having a plurality of serially arranged display areas or screens with different display colors, transport means for selectively transporting the display screens of the belt-like body to display positions, and belt position detecting means for detecting the position to which the belt-like body is transported being installed inside a casing for the display elements.

2. Display elements according to Claim 1, wherein the belt-like body has the form of an endless loop wound around a driving pulley and a driven pulley.

3. Display elements according to Claim 1, wherein the belt position detecting means comprising a reflection type photosensor for detecting the position of the belt on the basis of reflected light from a reflection section provided on the reverse surface of the belt-like body.

4. Display elements according to Claim 1, wherein the transport means comprises a motor for each belt-like body, and wherein a display unit is formed by a plurality of display elements, each motor of the display elements of a unit extend into the casing of the other display elements of the unit.

5. Display elements according to Claim 1, wherein the plurality of display elements are operated by a single motor and a clutch mechanism for discontinuing/continuing power transmission is disposed in respective transmission paths from the single motor to each pair of the display elements when the plurality of display elements are combined to form a unit.

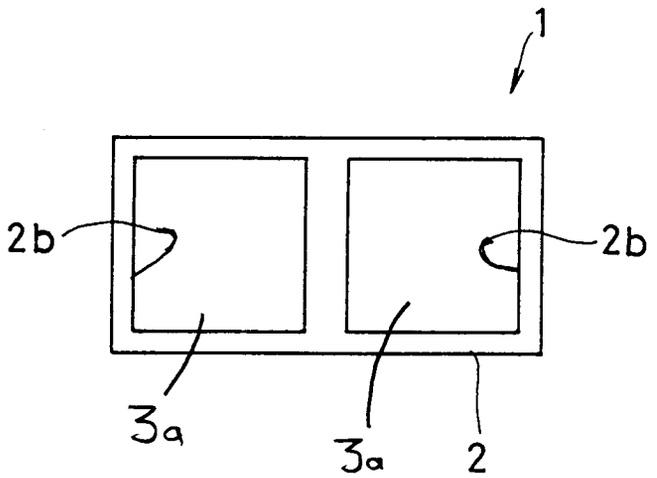

Fig 1

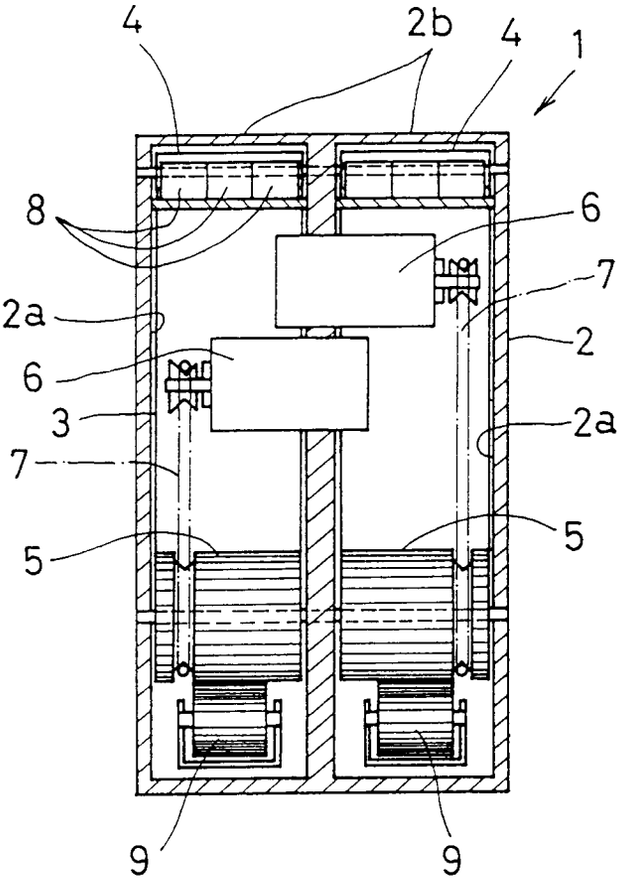

Fig 2

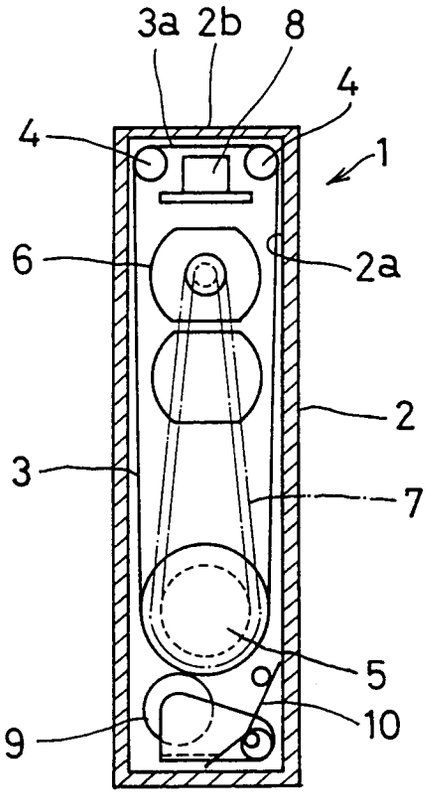

Fig 3

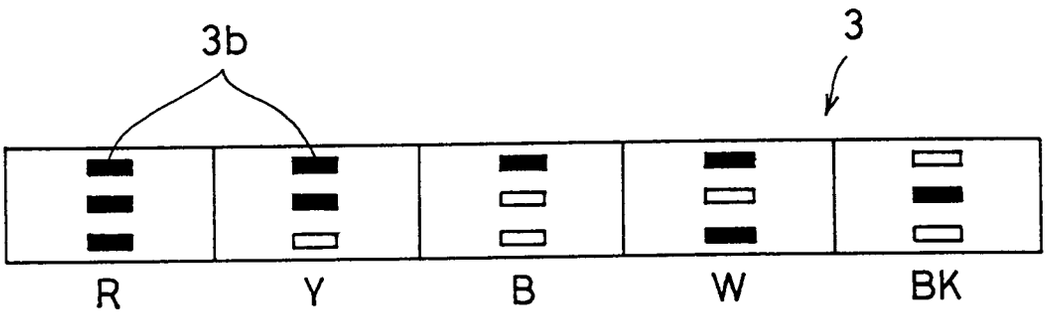

Fig 4

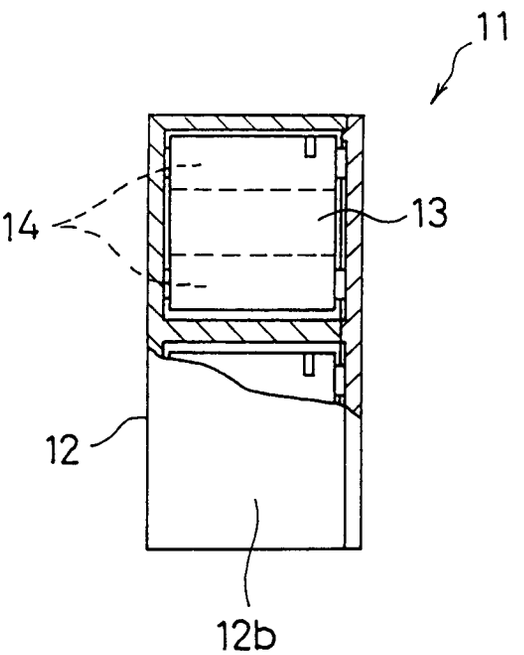

Fig 5

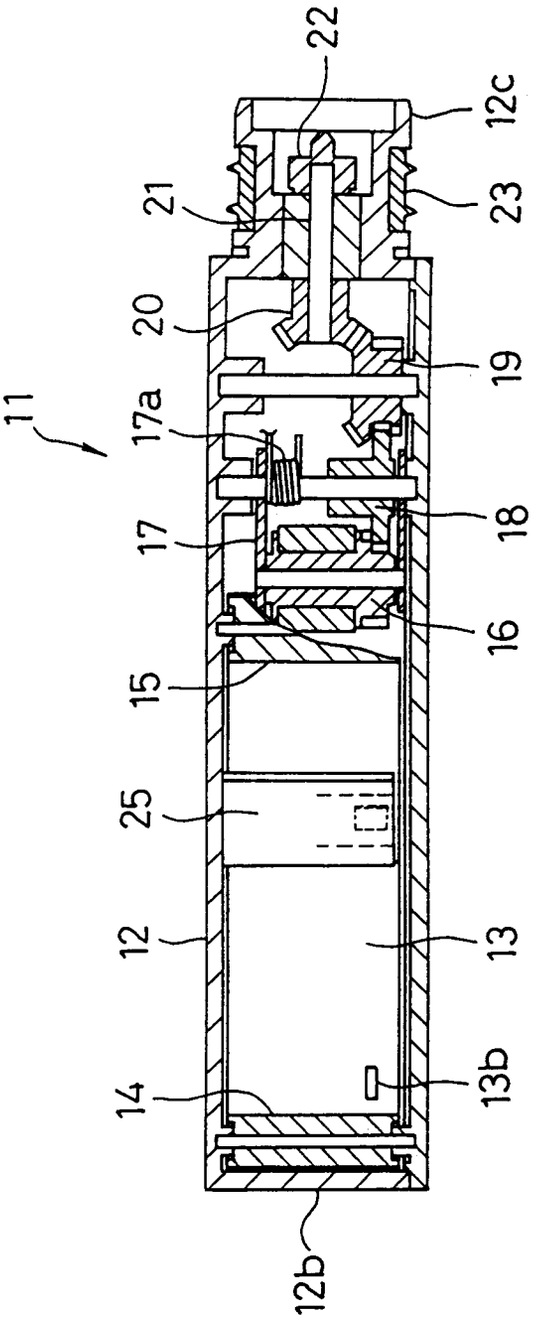

Fig 6

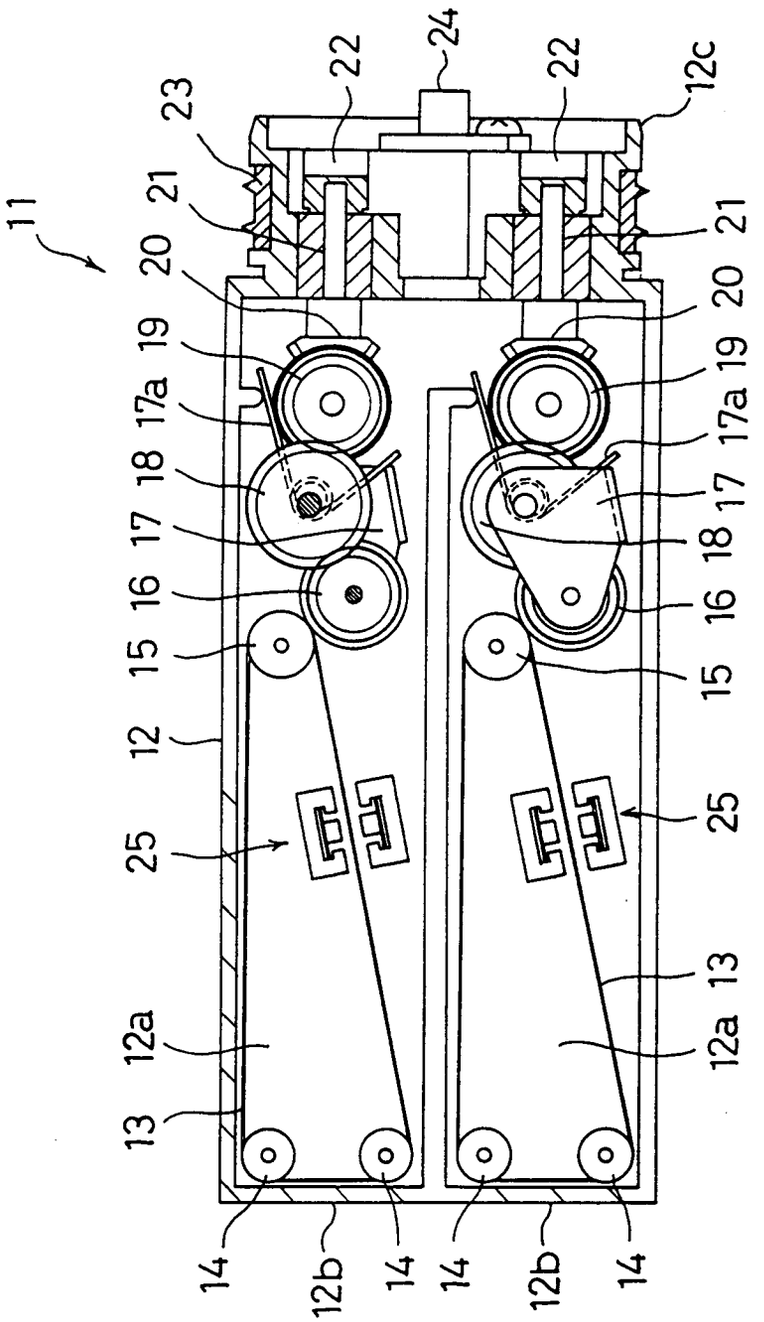
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Fig 7

Fig 8

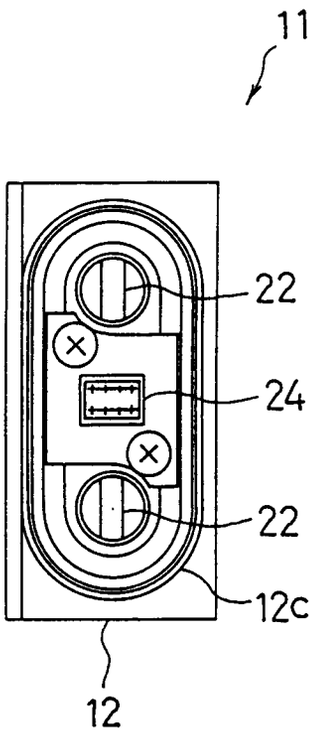

Fig 9

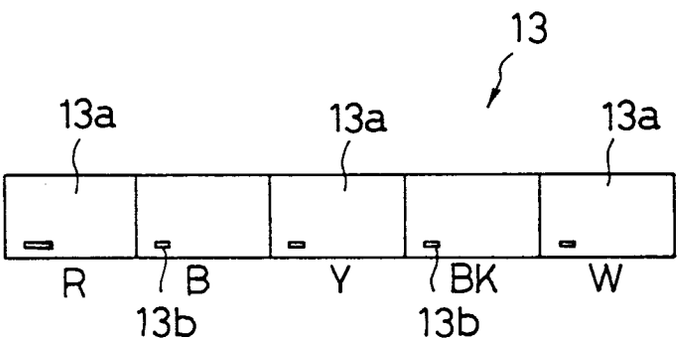

Fig 10

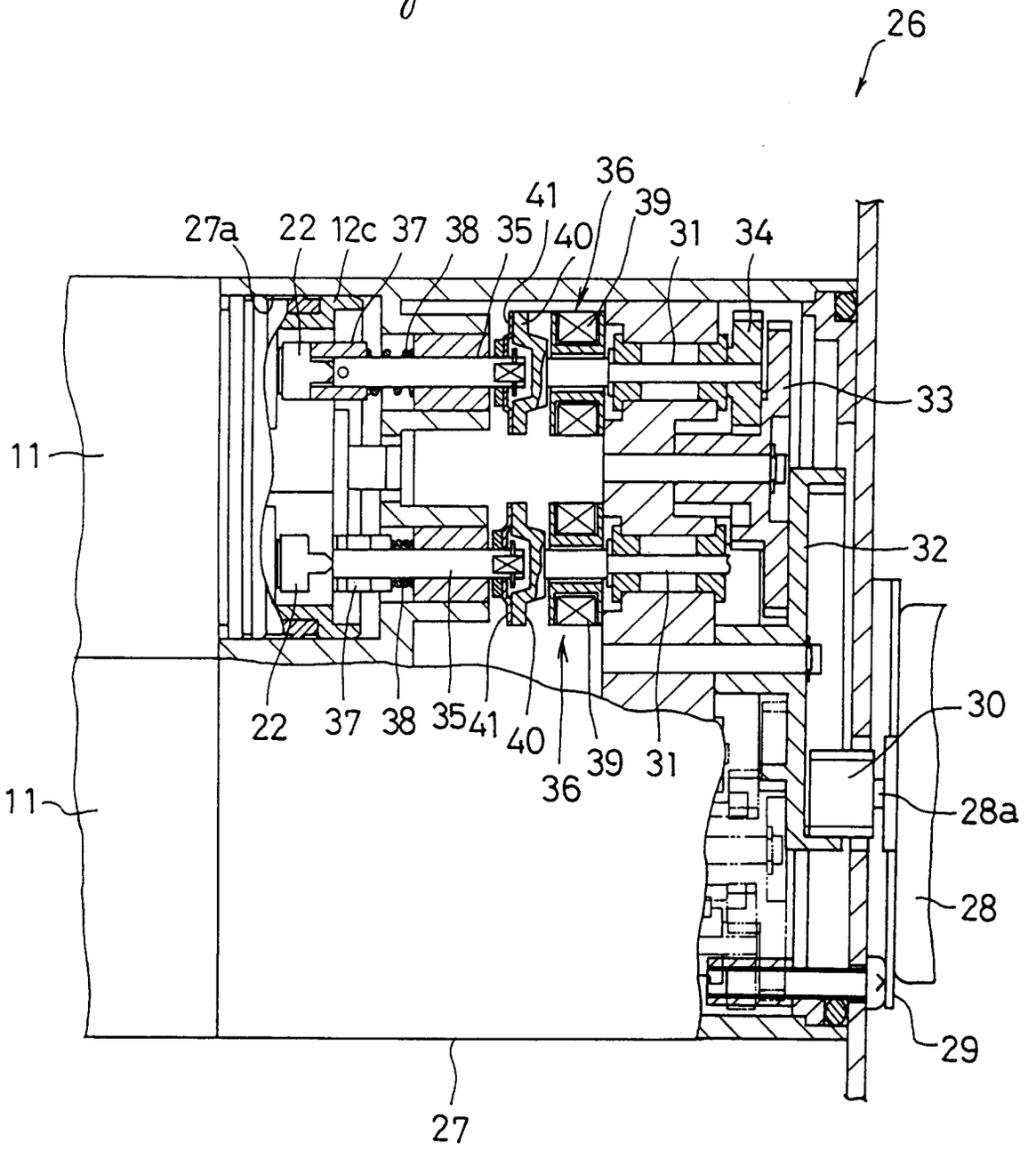
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Fig 11

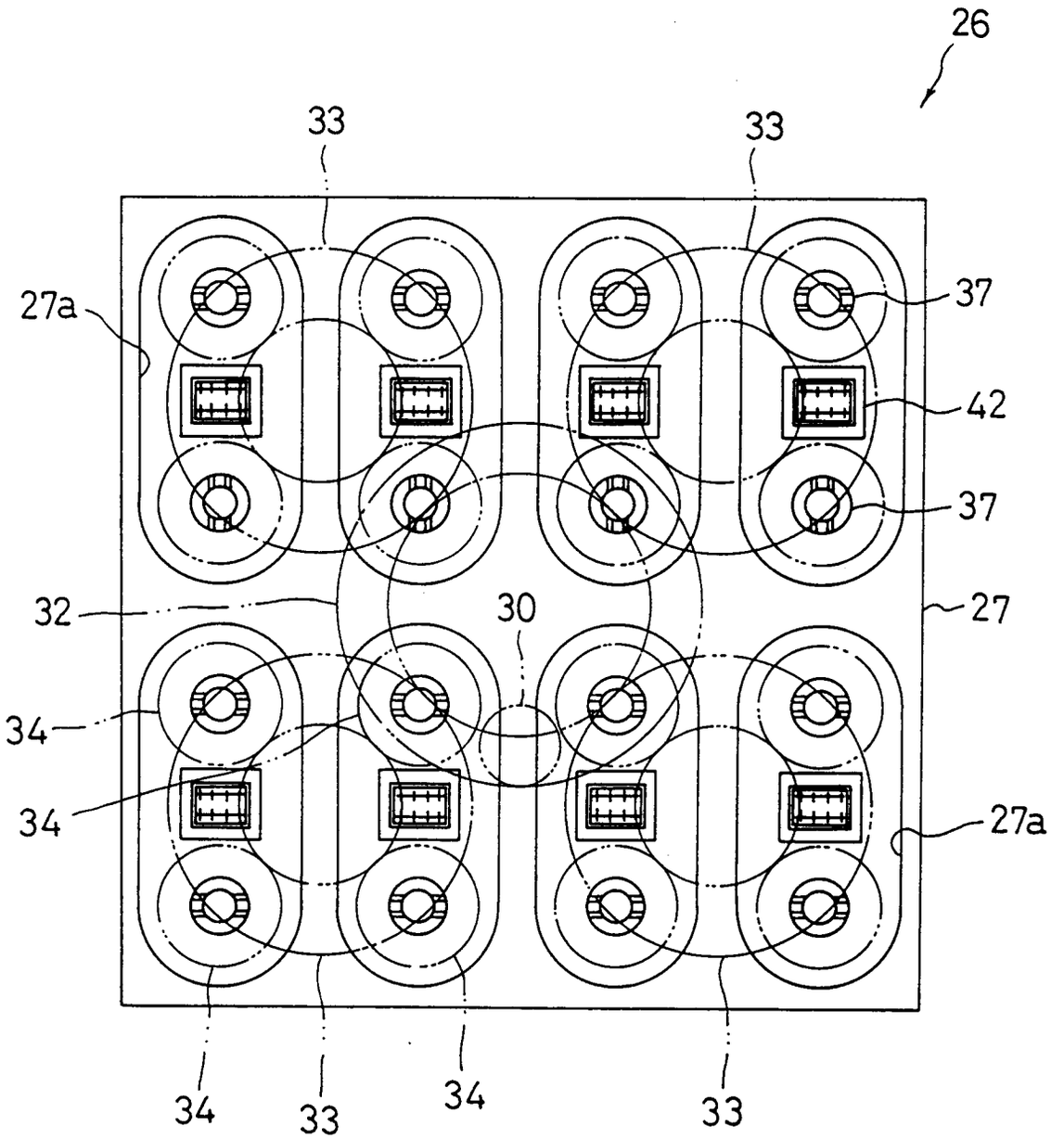


Fig 12

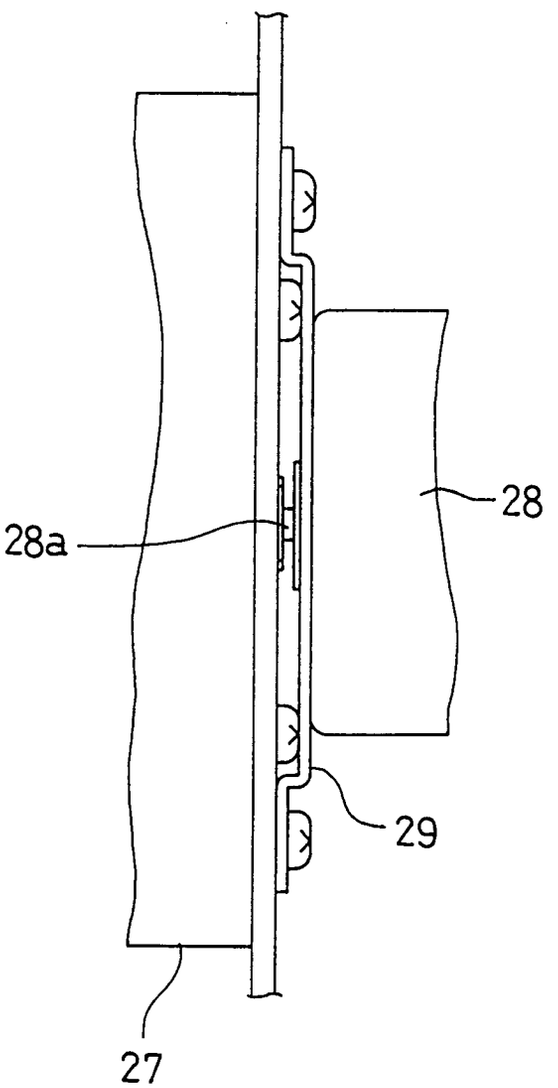
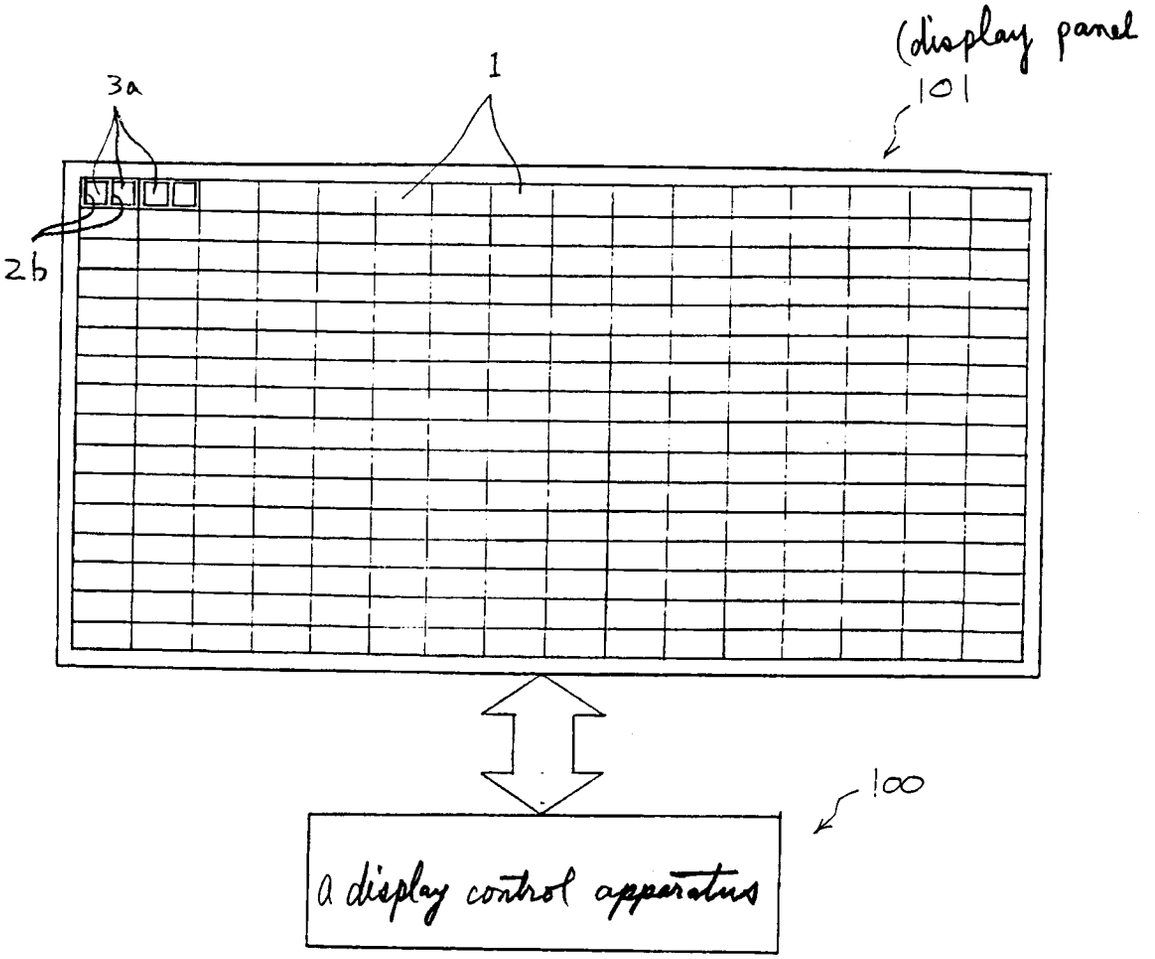


Fig 13



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 30 7315

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	PATENT ABSTRACTS OF JAPAN vol. 14, no. 88 (P-1008)19 February 1990 & JP-A-12 97 671 (CANON INC) 30 November 1989 * abstract * ---	1-4	G09F11/26
A	PATENT ABSTRACTS OF JAPAN vol. 14, no. 419 (P-1103)10 September 1990 & JP-A-21 62 394 (BROTHER IND LTD) 21 June 1990 * abstract * ---	1-4	
A	US-A-3 965 593 (R.J.HARRUFF) * the whole document * ---	1,2,4	
A	EP-A-0 238 936 (ROBERT SEUFFER GMBH &CO) * abstract; figures 1,7 * ---	1,2,4	
A	DE-A-2 728 157 (SIEMENS AG) * the whole document * -----	1,2,4	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

G09F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	03 NOVEMBER 1992	P.TAYLOR

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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L : document cited for other reasons

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