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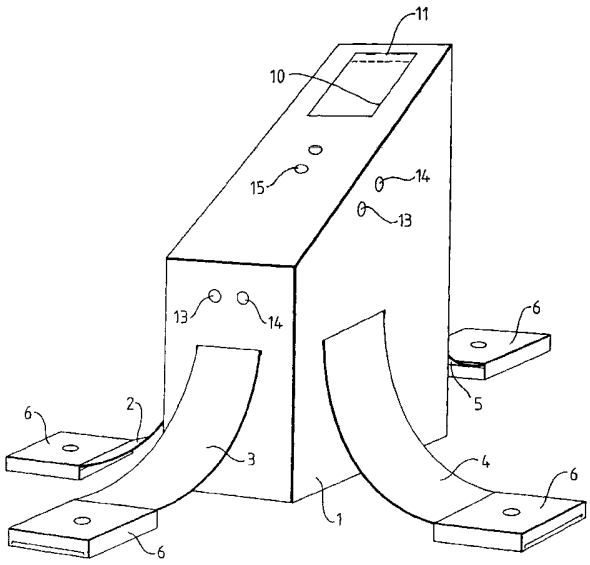
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: APPARATUS FOR DEALING CARDS



(57) Abstract: Card-dealing apparatus is described, particularly for dealing a predetermined set of bridge hands. Cards are taken sequentially from a card hopper (10), moved across a reading head, and then distributed to one of four chutes, down which each card slides to a stop rail or receptacle, thus providing each player with the required hand. The reading head senses the image of each card and the electronics decides to which chute it should be directed. Specially marked cards are not required. The selection of each hand is under software control, chosen by use of the keypad (22) and associated with information displayed on screens (21a and 21b). The apparatus operates in conjunction with an electronically readable medium (SSD, CD-Rom or similar, 35, inserted (at position 34) into the apparatus and which contains a very large number of pre-recorded hands.

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APPARATUS FOR DEALING CARDS

This invention relates to apparatus for dealing cards.

In order to play games of cards with more than one player, it is required to deal the cards, in accordance with the rules of whatever card game is played. This is normally done by hand and takes time, though it is known that it can be done mechanically - see GB - A - 2265139. Such an approach is usually entirely satisfactory when the players are happy that the cards should fall according to chance and in an unknown and unpredictable fashion. There is, however, a major area of interest in dealing hands of cards which are pre-selected to develop contract bridge playing skills and knowledge: a form of tuition.

Contract bridge has a long and distinguished history and is believed to be unique among card games in that it is played throughout the world and at a highly competitive international level. Competitive bridge requires that the outcome of games depends upon the skill of the players and not on chance, and accordingly requires that teams of

players can be dealt identical hands.

Considerable effort and ingenuity has accordingly been directed in the past to the conception and development of machines which will deal from a 'standard' pack of playing cards a set of selected hands of 13 cards to each of four players. This is reflected in the patent literature of which the following are examples:

GB-A-1176628; GB-A-1377632; GB-A-2252916; FR-A-2540737; FR-A-2576518; US-A-3814436; US-A-4534562; US-A-4822050 and GB-A-2265139 as noted above.

None of the devices described in these specifications would appear to have achieved commercial success and none is known ever to have been manufactured in any quantity. None is available for sale by bridge suppliers today. The reasons for this are not difficult to analyse:

First, the devices described in those specifications will operate only by using appropriately pre-marked playing cards so that each card identifies itself by suit and value and is then directed ('dealt') to a player indicated in a pre-recorded game (called 'a hand'). There are various methods for marking the cards (letters, figures, bar codes, physical, optical, electronic and other signs or even inserts, attachments or cuts in cards) and they have to be positioned very accurately, permanently and unobstrusively and invisible to all except the holder of the cards; these conditions are not easy to achieve in practice.

Second, some of the devices require manual action by a human 'dealer' who acts on the basis of indications given by the apparatus to deal a particular card to a particular player. This is unnatural to both

experienced and inexperienced players and, even if done slowly and with concentration, is prone to error. If that occurs and may not be apparent until the hand is nearly finished, it has to be aborted and time has been wasted. This is not conducive to concentration and enjoyment.

Third, the mechanical and constructional aspects of many such devices show that they are unlikely to operate at an acceptable speed, require careful handling and regular maintenance and can be unreliable in operation. Few of them deal the cards by placing them physically opposite each of the four players as is done when dealing by hand.

Fourth, in addition to the above defects, it is believed that the main reason for the failure of any of these devices to achieve commercial exploitation is that to be successful the apparatus must overcome the obstacles created by the commercial environment in which it must operate. That environment is characterised by:

- an ever-growing number of bridge players, currently in excess of 70 million worldwide.

- a large number of card manufacturers, probably in excess of a hundred.

- players purchasing or receiving several packs of cards (sold in pairs) per year as gifts.

- purchases are made from a huge choice of designs (both for the face and reverse side) of which at least ten thousand must exist at any time and new ones are added all the while.

- there are several hundred thousand retailers,

each with a wide choice of designs since the preferences of purchasers differ widely.

- to be commercially successful a manufacturer of a machine must sell a great many units (prices depending thereon) and each retailer must have a large stock of marked cards to meet customer desires.

Against this background it is inconceivable that a manufacturer of such apparatus can persuade a sufficiently large number of card manufacturers to adjust significantly their production to supply cards with a wide choice of designs to a sufficiently large number of retailers, each of which will be required to hold a large stock for the type of sales which can but represent, for a new apparatus, a tiny part of the demand by customers. This means that to launch the sale of the apparatus - a very costly operation - the manufacturer must himself bear a considerable extra financial burden by supplying retailers with the necessary stock of cards since the card manufacturers will not do it for him.

The problem accordingly underlying this invention is to construct a universally usable card-dealing apparatus which operates with any pack of cards and deals them sufficiently rapidly and reliably to positions in front of each of four players, and in accordance with a choice from an unlimited variety of pre-recorded hands.

Such apparatus should possess sufficient programming, computer and memory storage power to enable it to provide players not only with an enjoyable method of playing but also of improving their knowledge of the game by tuition, which is one of the major objectives of the invention. The majority of the pre-recorded hands

are created by experts (others are from major competitions) with the aim of illustrating bridge topics and lessons, thus enabling the players to learn by playing in the normal manner. Books and other systems of tuition are essentially on a one-to-one basis, far removed from normal play, and are tiring and complicated to use. This invention has the potential to revolutionise the teaching (usually by self-improvement) of the game of bridge, indeed each medium on which the pre-recorded hands are found is the equivalent of many textbooks. The hands are accompanied by books which describe each hand, the lesson it is intended to teach, and the way it is recommended that it should be played. The books have indexes which enable the players - or a third party such as a teacher - to select a series of hands applicable to the various problems which can arise. The hands vary from those of value to fairly inexperienced players to those at the topmost level. The information about each hand is examined only after the game has been played, and only if the players wish to do so. Some selected series of hands will be especially for beginners. The books can be translated easily into different languages.

The selected hands may be stored on 'Inserts' (see below) which are introduced into the apparatus, and are 'read-only'. Not only do they indicate to the apparatus how cards should be dealt for each hand, but they accompany that information with details of the recommended 'bidding' which is shown on a special screen when the hand has been played, thus enabling the players to discuss it as seen on the screen or to study the matter further by consulting the books: they have the choice. It is expected, however, that many players will use the apparatus for a lot of the time just to enjoy playing the interesting hands which are so recorded; in bridge enjoyment is sometimes reduced because the

unpredictable manual dealing of shuffled cards often produces hands which are not so enjoyable to play. Far too many players far too often spend hours 'without seeing a decent hand'. Even without using the book they can play a series of hands just for maximum enjoyment. The reference to 'bidding' is to the technical manner in which players bid to enable their partner better to assess the potential of the cards held by both of them and thus to arrive at a higher score per hand. The expert's recommended bidding, when seen on the screen of the apparatus, is a major help to learning and better play. Inserts may be created by experts who receive a royalty on their work: many will wish to extend their past and present creative work to this medium.

The players can choose certain hands/topics by consulting the book's index and 'dialling' the required reference number. On occasions, for example in competitions, selection will be made by third parties so that no player has knowledge of the choice.

Accordingly, the invention provides, in a broad aspect, a card-dealing apparatus comprising a card hopper, means for sequentially removing individual cards from a pack of cards placed in the hopper, means for detecting the suit and value of each such card, means for comparing the results of such detection with a pre-stored programme which indicates to which of four players seated at the table the card should be dealt down one of four chutes, and means for effecting such dealing.

Once each card has been identified and allocated to a player, mechanical means must be activated to direct it to the top of the respective chute. A variety of mechanical means may be employed but they should be simple and rapid acting. Two such methods are described below. Once a card has reached the top of a chute it

moves rapidly by gravity down the chute and presents itself on the table in front of the player as if dealt by hand. Means may be provided to impel the card downwards, possibly into a receptacle, thus creating a faster operation.

Such apparatus may be created in a wide variety of ways but all have the common feature of enabling the division of a pack of cards to four players in accordance with a pre-stored programme.

The mechanical means may vary widely. Preferably, the hopper is designed to take a pack of cards facing downwards, with each card being removed individually from the pack until all the cards have been dealt. The hopper may be of fixed size matched to the standard size of playing cards or it may be provided with adjustable guides to enable precise matching of packs of different card sizes. The cards may be displaced from the bottom or top of the pack. The system of appropriate pinch wheels, levers or the like will remove the cards sequentially, reliably and rapidly regardless of their size or condition (different surface etc). The essential advantage of the invention is that it will do so with non-marked cards i.e. with any pack of cards.

Examples of apparatus constructed and programmed to operate in accordance with the present invention are illustrated in the accompanying drawings, in which:

Figure 1 shows a diagrammatic perspective of the Main Unit of the apparatus.

Figures 2 and 2a are vertical sections showing the card selection, detection, processing and manipulation parts of the invention.

Figure 3 is a view of the separate Control Unit, and

Figure 4 is a view of an alternative mechanical system for use in card manipulation in the apparatus according to the invention.

The apparatus as shown in figures 1 & 2 consists basically of a box-like casing 1, housing the mechanical and electronic components. Each of its four walls has a chute North 2, East 5, South 4 and West 3. Each chute is made of or faced with low friction material so that a card will drop rapidly to the bottom where it will enter a receptacle 6 with a hole in the middle so that a finger can press the cards upwards for easier collection, or be arrested by friction on the surface of the table in front of a player. The chutes may be detachable from the box 1 for ease of storage and transport.

It has a hopper 10 which contains cards 12 (figure 2) and with a hinged lid 11 to be closed after inserting the pack of cards. It has two lights on each side facing the players (NESW). The first one 13 (Figure 1) indicates which player is the dealer, thus enabling the apparatus to be placed on the table facing the correct direction towards the players so that the cards are as dealt manually by that person; if that person is N the first cards will go to E. In the centre of the top of the unit are two lights 15 which show after the cards have been dealt that the deal has been error-free or not (green light or red light) - sometimes a card may have been dropped without the players realising it, thus causing an incomplete deal.

Figure 2 shows the internal operations of the apparatus with a pack of cards 12 inserted in the hopper 10 and the lid 11 which will be closed. To one side of the

bottom of the hopper is located a pushing wheel mechanism 7, 8 and 9 (indicated schematically), and a pair of pinch wheels 23 to ensure that only one card at a time is processed, and which may be contra-rotating to facilitate passage. The card is moved to position 24, prevented from going too far by a wall, whilst it is prevented from falling by rails 25 which swing aside to allow the card to drop under gravity on to a plate 26, the inclination of which is controlled by four solenoids 27, each controlling a lever which is connected to a corner of the plate so that it can be inclined in any direction N E S or W towards the appropriate chute (figure 2).

A variant of this system is described in figure 4 to replace the gravity system, which tends to slow down the pace of operation, by the card being moved to the top of the required chute by pushing or pulling levers operated by the solenoids, i.e. the lever moves above or below the card and displaces it by pulling or pushing. There are similar levers for North and South. If desired, a single lever can be replaced by two or more to cope better with cards with different surfaces or conditions.

Located (figure 2) near the base of the hopper 10 and upstream from the pinch rollers 23 is a sensor 28 consisting of a CCD, a scanner, a digital camera or similar system which scans and records an image of the card during its passage to position 24. These systems need operate only for a black and white image, using less storage space than for a colour one; they require to record only a small part of the card sufficient for identification purposes (playing cards are symmetrically printed).

In this connection, the use of standard OCR (optical character recognition) technology can be employed with a

view to recognising the letter or number conventionally printed at the corners of each card, and analogously the suit identifier printed next door to it.

The operation of the apparatus (pushing wheel, rails, solenoids etc) is controlled by an integrated microelectronics unit 29, powered by a suitable power supply 30, which, for ease of use may be battery based e.g. with an internal (within the Main Unit 1 or the Control Unit 16 (Figure 4)) re-chargeable battery pack or fed with energy of the mains supply. The connections between unit 29, pushing wheel 28, solenoids 27, sensor 28, display screens 21a and 21b (figure 3) and the keypad 22 (figure 3) are shown diagrammatically. Omitted for sake of clarity are the connections between 29 and the respective lights 13, 14 & 15 etc.

Likewise omitted for the sake of clarity in Figure 2 are support plates located between the slots in the casing 1 adjacent the top of chute 5 and pairs of pinch rollers located along the four sides of plate 26, of which rollers, however, two pairs 31 and 32 are shown, located to the left and right of plate 26.

When the apparatus is to be used the switch 20 (figure 3) is activated and an appropriate but vacant display lights up at 21a. Using the keys at 22 the appropriate reference number of the selected pre-recorded hand is chosen from an index by a player or a third party as being of interest. Once a pack of cards 12 placed in the hopper 10 and the lid closed 11 and a hand chosen by its reference number being dialled on the keypad (figure 3) an actuating button on the keypad 22 causes the apparatus to deal the cards of the chosen hand into four places, one in front of each player.

The pinch rollers 23 as well as 31 & 32 are driven by

means not shown. The pushing wheel 7, 8, 9 is actuated under command of 29 to push sequential lowermost (or topmost) cards off the bottom (or top) of the pack 12 across the sensor 28. As they pass over it the control 29 receives signals which are compared with a library of pre-stored signals which enable each card to be identified. As the card reaches position 24 the software programmed into 29 (loaded therein via suitable conventional means such as a disc drive, CD-ROM drive, solid state disc SSD or other mass data storage system - not shown) decides to which of the four players the card is to be dealt down the respective chute.

So that the card moves on to the appropriate chute the plate 26 is tilted by the actuation of at least two of the solenoids 27 so that when the card drops on to plate 26 it slides to the top of one of the chutes 2, 3, 4 or 5. As it slides off the plate 26 it may be gripped by a pair of continuously driven nip rollers 31 & 32 which accelerate it across support plates (not shown) to the top of the required chute. The card then travels down the chute until it rests in front of the player. Meanwhile, the next card is being evaluated by 28 and is treated in the same manner.

When the 52 cards have been processed the green or red lights 15 will indicate that the deal has been successful or otherwise (meaning that each player has received 13 cards). At the same time the indication of which partnership(s) is/are 'vulnerable' will appear in the lights 14 and 37 (figures 1 and 3). In addition, the number of the chosen hand will appear in window 21a and the recommended bidding in window 21b, but both will have been hidden by the players by covers 21c and 21d until after the hand has been played.

The apparatus is then lifted from the table and placed

nearby until the next hand, whilst the Control Unit 16 is retained on the table near one player for easy consultation after the hand has been played (the 'bidding').

Further sophistication and mechanical features can be incorporated easily such as a simple system in each chute to indicate if a blockage has occurred.

The apparatus is programmed to control several 'modes' chosen by control switch 17 or by the keypad 22 (figure 3). In the priming mode, an essential part of the operation to identify each card, the deck of cards 12 is inserted into the hopper 10. This is done in a pre-determined order (such as ace of spades through to 2 of clubs) and processed as above, except that for this mode all the cards are ejected through one chute where they are easily collected. As each card passes through sensor 28 its image is captured and stored within 29, which is aware of the pre-determined order so can identify each card and link it to its image. When this has been done the pack is shuffled and re-inserted. Then control 17 is switched to 'verify' and the apparatus will deal all the spades to N, the hearts to E etc, thus showing the players that it functions in a programmed manner without error. The priming mode is used only once until the pack of cards is changed, when priming will again be necessary since packs of cards can have different patterns, which need to be identified by the priming procedure. It takes but a few seconds. Packs of cards are not usually changed during a session, if then.

After verification the apparatus can be switched (17) to the 'play mode'. The choice of the next hand will be made and dialled by its reference number on keys 22 and the procedures will be repeated. The cards never require to

be shuffled and the programming will deal the chosen hand regardless of the order in which the cards are put in the hopper.

Numerous variations are possible so the examples are not limited. The apparatus produces rapidly, with various surface qualities and thickness of cards, a hand for four players corresponding to the pre-selected hand chosen. It is able also to make a random choice of the pre-recorded hands chosen by the computer ('random mode' on 17) or to 'shuffle' thus producing a unique hand ('shuffle mode') which the apparatus is geared to repeat if the players so wish, thus improving their learning ability. The apparatus can also enable the players to play hands ('consecutive mode') from bridge sessions at an international level, thus enabling the players to play the hands in the correct order and compare their scores with those of the competitors.

Furthermore, it is possible oneself to record any number of hands which can be used for future play. Many players, and also professional and semi-professional teachers of the game (who use the chosen hands with their pupils), like to record hands which they have seen in books or articles or which they have conceived themselves. This is done (with 'DIY mode' on 17) by putting the cards destined for each player in separate piles and picking up the piles in consecutive order of players and processing them in the usual manner. The apparatus will record the hand and number it for future play. This can be done as 'read only' or to be erased if no longer required. The apparatus will also prepare packs of cards which are identical ('duplicate mode' on 17). For certain competitions all the players play at some stage during the session the same hand, thus making it possible at the end of the session to compare the scores of all partnerships and see which one obtained

the best total score. For this form of competition it is necessary to have a large number of pre-prepared packs which are identical. Usually this is done by hand and is very time-consuming as well as prone to error. The apparatus can prepare as many identical packs as are required with the certainty that they will be identical. This is done either by choosing a hand from the pre-recorded hands or recording under 'DIY mode'. Once this is done the control 17 is set to 'duplicate mode' and when started it will produce as many identical copies as are inserted into the hopper, one after the other. All the cards of each pack will be dealt through the same chute and receptacle 6 so that the packs can be picked up and handled as required (see figure 2a).

With the system of Figure 2a used for 'duplicate' bridge, the 4 chutes are disconnected and replaced by a small box composed of four drawers, each to contain the cards of North, East, South or West.

When 13 cards have been delivered to each drawer, it is possible to remove them to form a complete deal. The cards are then dealt by hand, the top 13 going to North and so on.

The program is altered to ensure that the moving platform can slide the cards into the appropriate drawer instead of to the 4 chutes.

With these four drawers, the programme can be altered to ensure that the machine will produce as many copies of one selected deal as are required by the players - sometimes up to a dozen or more tables.

As the packs are removed from the machine, they are wrapped by a rubber band and a numbered ticket is attached to identify the deal.

When the deal has been played at one table, the cards are returned to the machine which can produce more numbered deals.

The very great advantage is that the players are not obliged to follow the complex rules of play which are needed when the deals are passed from one table to another.

Figure 3 shows the face of the Control Unit 16 which can contain a part of the electronics to operate the apparatus. The two Units are connected either by cable 18 or by a modulated infra red link 19 such as is used to connect computers. The Control Unit 16 consists of a housing which may or may not contain the source of power.

The face includes a light with the on/off switch 20, the diode windows 21a & 21b as explained above, the 'vulnerable' indicators 37 and 14, the key board 22 and the mode selector switch 17 as well as the window cover lids 21c and 21d. The keyboard consists of the figures 0 to 9 plus asterisk and hash keys; it is used either to dial a hand from a pre-recorded 'Insert' 35 or one can dial the various modes by using the rotating selector switch 17. Insert 35 may take a variety of forms, and may by physically configured to fit uniquely into a reception aperture 39 in the control unit 16. As shown, the side of the housing in figure 3 contains a socket or slot 39 into which is introduced a mechanical Insert card 35, the size of a small credit card, which is an electronically readable storage device such as a SSD containing the pre-recorded hands. Many such cards can be inserted, thus providing an unlimited number of hands. A whole library of Inserts may be envisaged, by various authors. The card medium can be replaced by other systems such as inserted cartridges, magnetic

discs or by connecting to normal or laptop computers containing the required hands. Selection of a particular hand from pre-recorded hands will be made by a user of the apparatus by dialling the reference number of the hand on the keypad 22. Apparatus according to the invention adapted to accept an electronically readable medium (SSD, CD-ROM etc) containing pre-recorded hands should, of course, incorporate the software to process and act on that information. The insert 35 may be programmed to provide an electronic key to operate an electronic "lock" incorporated in the control unit, either as well as or instead of any physical interfitting configuration.

The above description concerns sophisticated models but for commercial reasons various models can be made available at different cost levels, some with less sophisticated facilities. Some might operate with pre-marked cards which could be sold with the apparatus, whilst some might be sold with a possibility to upgrade, thus encouraging an expansion of the market. At some stage it will be commercially viable to replace the accompanying book with tuition commentaries by electronically operated optical systems which replace printed books.

While this description concerns the game of bridge the apparatus can be adjusted easily for other card games.

CLAIMS

1. Card-dealing apparatus comprising a card hopper, means for sequentially removing individual cards from a pack of cards placed in the hopper, means for detecting the suit and value of each such card, means for comparing the results of such detection with a pre-stored programme to provide a signal representative of the place to which the respective card is to be dealt, four downwardly inclined chutes each facing one player N E S or W within stop or receptacle at the foot, and means for directing each card in response to the signal on to the top of one of the required chute.

2. Apparatus according to Claim 1 and which includes means for removing each card during the dealing process from the top or bottom of the pack until all have been removed.

3. Apparatus according to Claim 1 or 2 and which includes a means to identifying cards by sensing the normal markings on them by suitable sensors located near the hopper which provide a signal characteristic of the suit and value of each card.

4. Apparatus according to any one of Claims 1 to 3 and which includes a means to direct each card to the top of the required chute.

5. Apparatus according to any one of Claims 1 to 4 and in which the electronics are so configured that it can be switched to a variety of functions or 'modes'.

6. Apparatus according to Claim 5 and which includes the means to effect the correlation between a library of signals and all the cards in the pack.

7. Apparatus according to any one of the preceding Claims and which identifies before the dealing commences who is 'dealer'.

8. Apparatus according to any one of the preceding Claims and which reads the data from a protected storage medium containing pre-stored hands.

9. Apparatus according to any one of the preceding Claims and which includes a touchpad, keypad or keyboard and associated screens, to enable the required instructions to be given and their effects optionally shown on suitable display screens.

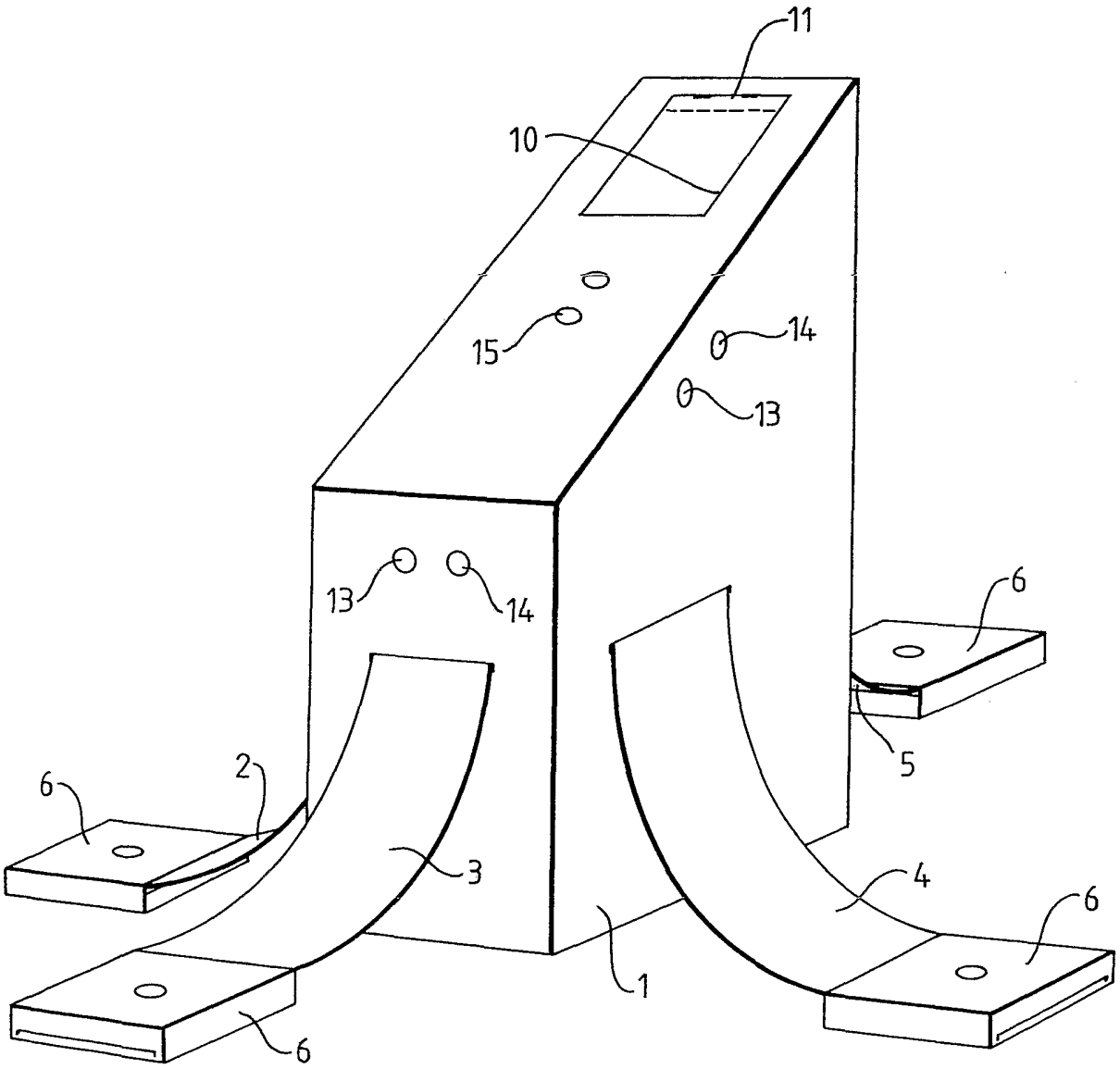


FIG. 1

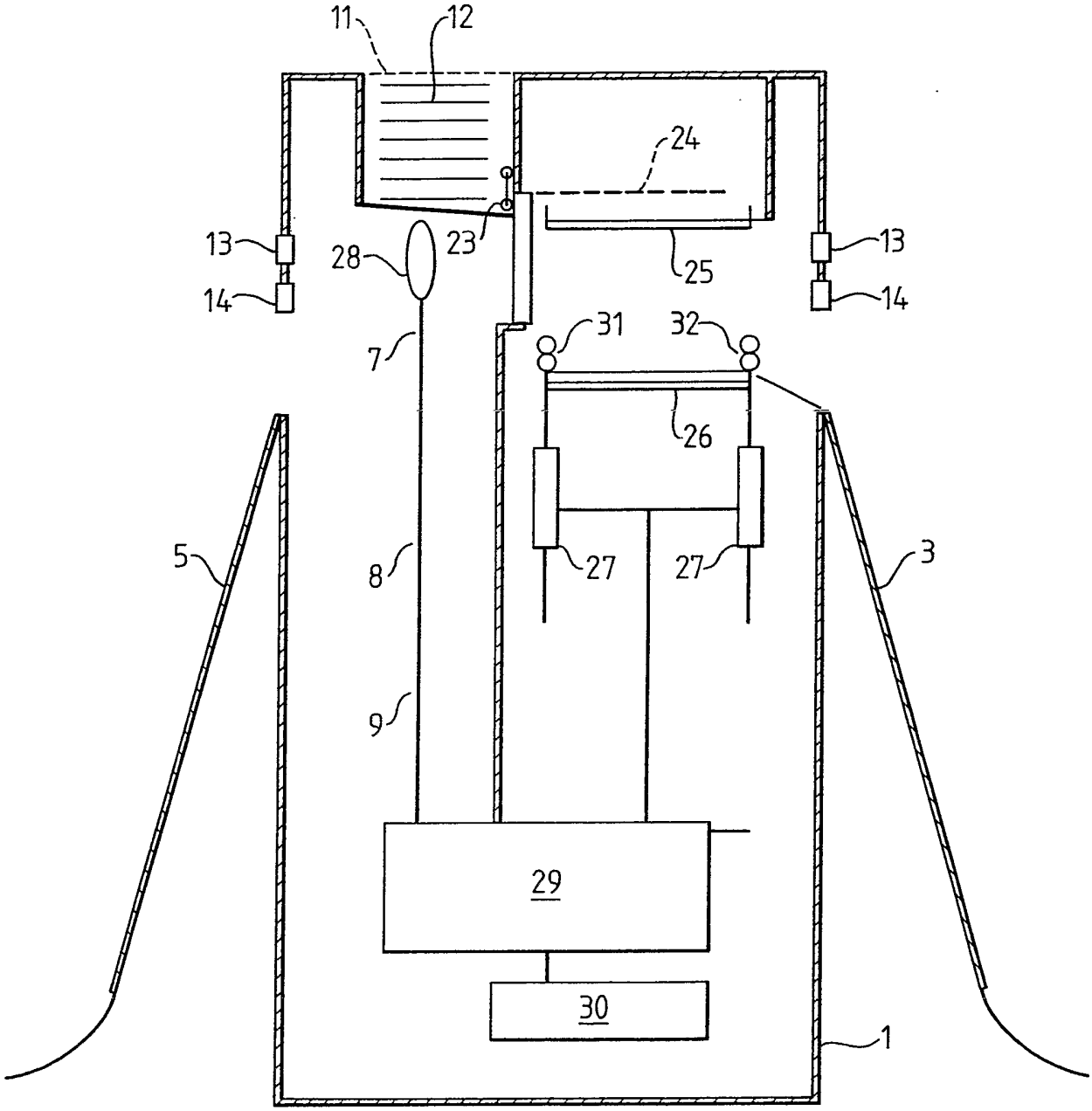
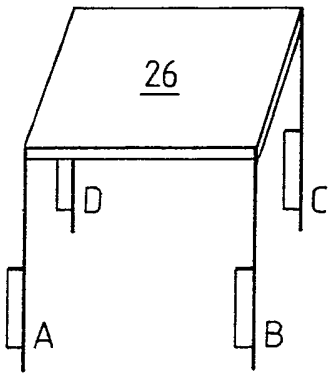


FIG. 2



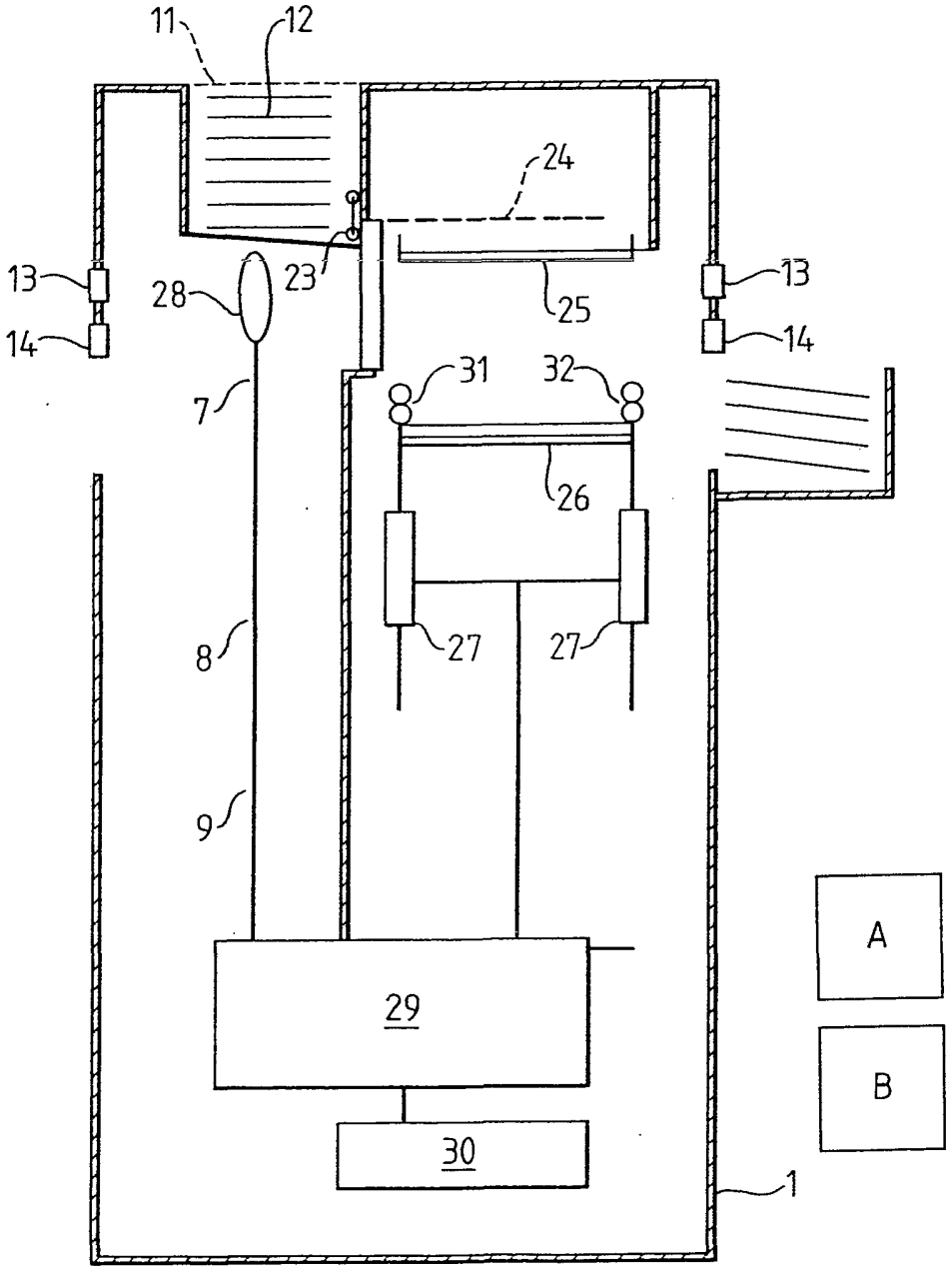
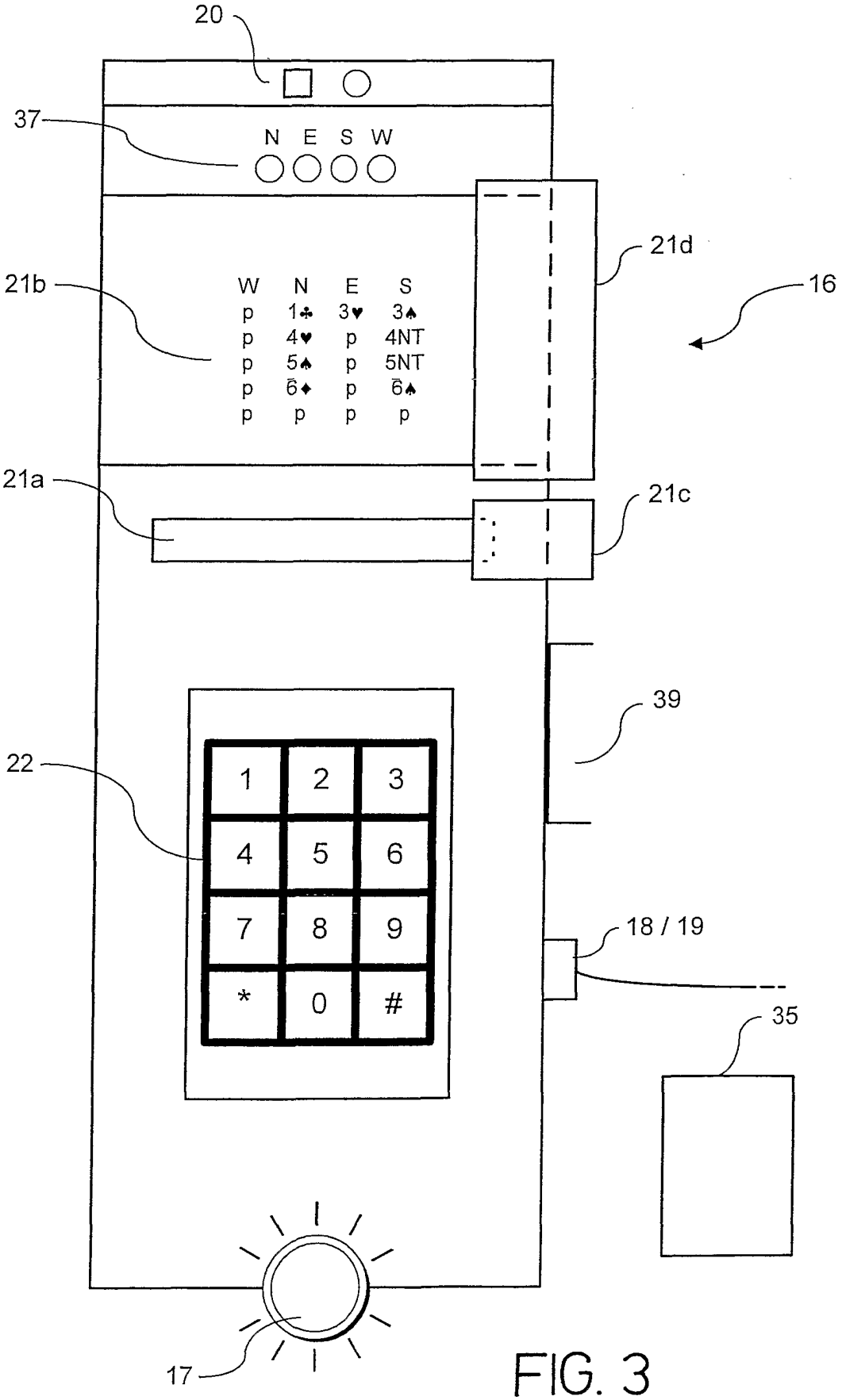


FIG. 2a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37
N E S W
21d
16
21b
W N E S
p 1♣ 3♥ 3♠
p 4♥ p 4NT
p 5♠ p 5NT
p 6♦ p 6♠
p p p p
21a
21c
39
22
1 2 3
4 5 6
7 8 9
* 0 #
18 / 19
35
17

FIG. 3

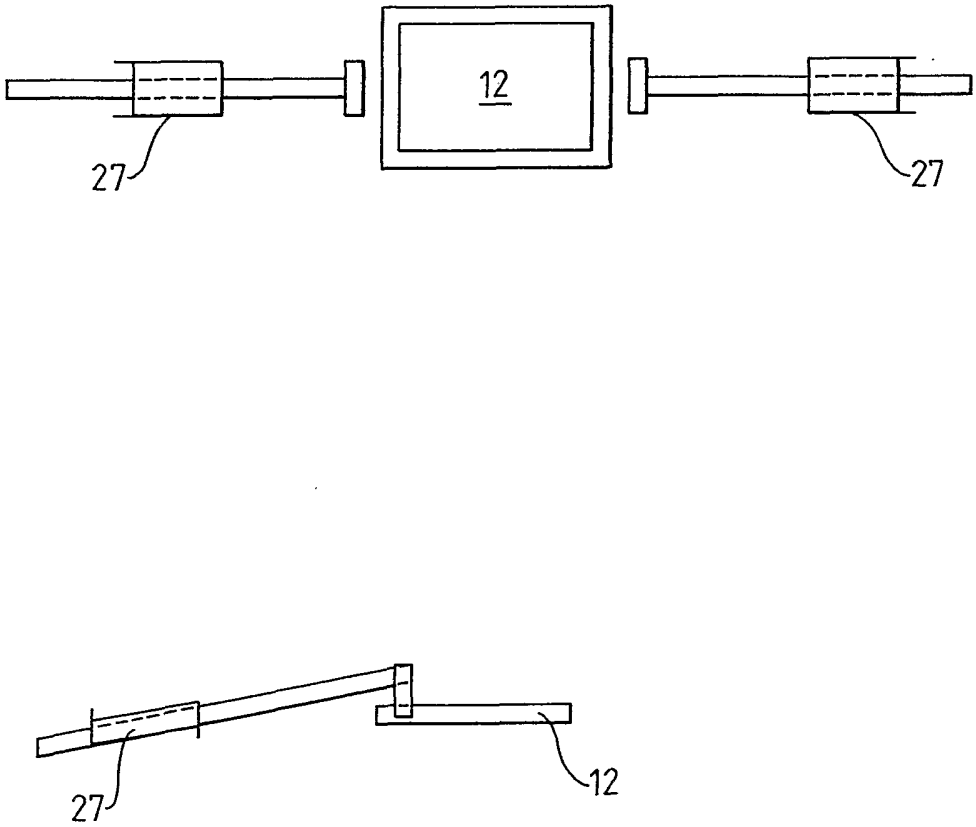

FIG. 4

INTERNATIONAL SEARCH REPORT

Int ɔnal Application No
PCT/GB 01/02938

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A63F1/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A63F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
WPI Data, PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	US 5 431 399 A (KELLEY KALON L) 11 July 1995 (1995-07-11) column 4, line 16 - line 34 column 4, line 52 -column 5, line 45; figures	1,3-6,8, 9 2,7
Y	GB 2 265 139 A (FAIRFORM MFG CO LTD) 22 September 1993 (1993-09-22) cited in the application page 2, line 18 -page 4, line 19 page 5, line 13 -page 8, line 11; figures	1,3-6,8, 9
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[X] Further documents are listed in the continuation of box C.

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18 April 2002	29/04/2002

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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