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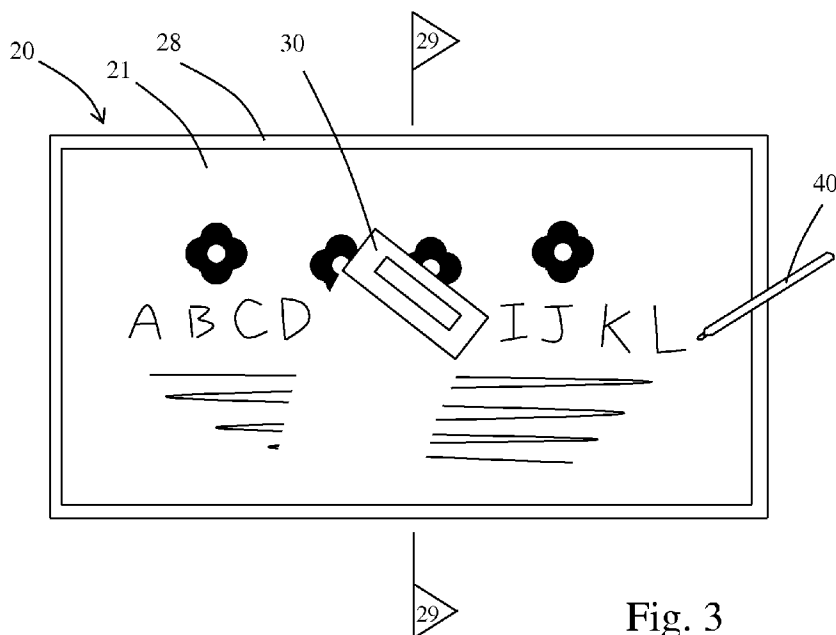


Fig. 3

(57) Abstract: The front erase magnetic drawing board comprises of magnetic drawing panel, magnetic pen and magnetic eraser. It allows drawing using magnetic pen and erasing from the front using the magnetic eraser. The magnetic eraser has a front magnet in front of the magnetic drawing panel and a back magnet beneath the magnetic drawing panel. The front magnet can be moved around from the front of the drawing board. The back magnet will follow the front magnet due to the magnetic attraction between them and erase the drawing in its path. The magnetic drawing board can have long spans with the incorporation of stiff eners. The front erase magnetic drawing board can be further adapted by including an electromagnet layer and front drawing magnet, and

sensor layer to allow it to display saved images or to save drawn images.

Description

FRONT ERASE MAGNETIC DRAWING BOARD AND MAGNETIC ERASER

Technical Field

- [1] The present invention relates to an image forming and erasing apparatus and, more specifically, although of course not solely limited thereto, this invention relates to a front erase magnetic drawing board and magnetic eraser and its electronic adaptation.

Background Art

- [2] Conventional erasable drawing boards such as black boards and white boards are useful for capturing or communicating ideas. Drawings drawn on the boards can easily be erased and new drawings drawn. The disadvantages of conventional erasable drawing boards are that they require consumables such as black board chalk or white board markers and produce pollutants such as chalk dust in chalk or solvents in markers in which some people are sensitive to.
- [3] Erasable magnetic drawing boards are alternatives to conventional erasable drawing boards. They do not require consumables and do not create pollutants in the process of using. The most common and successful erasable magnetic drawing boards are those used as children's drawing boards. A magnetic pen can be applied to the front of the magnetic drawing board to create an image. A magnetic strip can be used to slide behind the magnetic drawing board to erase the image. The magnetic drawing board is white while the drawing is black.
- [4] US Patent No. 4,143,472 is one such example. Referring to FIG. 1, the patent discloses an erasable magnetic drawing board apparatus **1**, comprising a magnetic panel **2**, which is made up of a plurality of honeycomb cells, each cell being filled with a masking liquid, which is usually white in color, and magnetic particles, which are usually black in color. Drawing instrument such as a magnetic pen **3** is used to attract the black magnetic particles forward to reveal the black particles in the white fluid to display an image. The erasing of the image is by sliding a strip of magnet **4** behind the back of the magnetic panel **2**. This attracts the black magnetic material back, hiding the black particles in the white fluid. The magnetic panel **2** and magnetic slider **4** are enclosed in a rectangular frame **5**.
- [5] The methods of drawing and erasing on erasable magnetic drawing boards have largely remained the same, although improvements have been made to the drawing panel itself. US Patent No. 5,972,493 discloses a microcapsule magnet sheet which can be used in place of the magnetic panel in erasable drawing boards. The sheet comprises a layer of microcapsules between 400 and 800 microns, each microcapsule containing

a dispersion liquid with non-magnetic white particles and black magnetic particles. The advantage of using microcapsule magnet sheet as drawing panel is that it is thinner and uses less material. The disadvantage is that the contrast between black and white is not as good due to its thinness. In any case, the method of drawing and erasing are the same as before. A magnetic pen is used to attract the black magnetic particles in the microcapsules forward to reveal the black particles to form an image. A magnetic strip is used to slide behind the microcapsule magnet sheet and attract the particles back to erase the image.

- [6] A further improvement to microcapsule magnet sheet is disclosed in US Patent No. 7,070,856. It discloses a front face erasable microcapsule magnet display sheet. The microcapsule magnet display sheet comprises a layer of microcapsules, each microcapsule comprising dispersion liquid, white particles, and black magnetic particles of at least two sizes. Drawing on the microcapsule magnet display sheet is same as before. As for erasing, weak horizontal magnetic field acting on the sheet will cause the microcapsules to become white. Referring to FIG. 2, the microcapsule magnet display sheet **6** is made up of a layer of microcapsules **7**. An erasing magnet **8** placed above a non-magnetic material **9** ensures that the erasing magnet **8** is at the required distance above the microcapsule magnet display sheet **6** and the magnetic field reaching the microcapsules **7** are weak. The erasing magnet **8** generates magnetic field lines **10** and **11**. The weak horizontal magnetic field **10** acting on the microcapsule magnet display sheet **6** and microcapsules **7a** will cause the microcapsules **7a** there to become white, thus erasing any image there.

Disclosure of Invention

Technical Problem

- [7] The first problem with current erasable magnetic drawing board is that the erasing is by way of sliding a magnetic strip behind the magnetic panel. Such an erasing method is not localized and cannot erase only the desired area without erasing other areas. For example, if the user only wants to erase a small area in the middle of the drawing, it is not possible. The user will need to start sliding the magnetic strip from one end to the middle of the board, and erases half the drawing before the user actually erases the part in the middle.
- [8] Another problem with using a magnetic slider is that such an erasing method limits the size of the drawing board. Taking into account human strength and alignment issue of magnetic slider, magnetic sliders typically are not longer than 200 mm and do not slide more than 300 mm. Similarly, the drawing area of magnetic drawing boards using magnetic sliders is typically smaller than 300 mm wide and 200 mm high. It is not practical to make a larger erasable magnetic drawing board with magnetic slider such

as 2000 mm wide by 1000 mm high for meeting room or classroom as it is difficult to slide the magnetic slider behind the magnetic drawing panel and the magnetic drawing panel is too flimsy.

- [9] Although the front face erasable microcapsule magnet display sheet allows for front erasing, the color states of the microcapsules are very sensitive to the magnetic fields. It is a fact that magnetic field lines from a magnet are not uniformly distributed in density and direction. Referring to FIG. 2, the microcapsules **7a** underneath the magnet **8** experience weak horizontal magnetic field **10** and will turn white. However, the microcapsules further out experience non-horizontal or vertical fields **11** and might turn from white to black. This is an unintended effect and might result in 'dirty' erasing, whereby the display sheet is not totally white after erasing but white with black specks. This further reduces the viewing quality of microcapsule display sheet as the contrast for microcapsule display sheet is already not as good as other magnetic panels. Even in the case of writing with a magnetic pen, the removal of the magnetic pen from the display sheet might cause some microcapsules to change from black to white because they will experience a change in the magnetic field from strong vertical magnetic fields to weak horizontal magnetic fields. While the front erasable microcapsule magnet display sheet has advantages, it suffers from other disadvantages not found in earlier magnetic display panels or microcapsule magnet sheets.

- [10] Another important limitation is that conventional erasable drawing boards and erasable magnetic drawing boards are not able to display stored images or to capture images drawn on the drawing boards.

Technical Solution

- [11] A new type of magnetic eraser is invented to solve the problem of non-localize erasing. The new magnet eraser allows for localized and front face erasing. The new magnetic eraser comprises of a magnet in front of the erasable magnetic drawing panel and a magnet behind the erasable magnetic drawing panel. The front magnet can slide over the erasable magnetic drawing panel. The back magnet will follow the front magnet due to the magnetic attraction between. By making the back magnet stronger or larger than the front magnet, the magnetic particles in the magnetic drawing panel will be attracted back and the drawing erased when the magnetic eraser slides over the magnetic drawing panel.
- [12] In order to have bigger drawing boards, the flimsiness of the magnetic drawing panel can be reduced by increasing the second moment of area of the magnetic drawing panel. This can be achieved by increasing its thickness or adding stiffeners to it. The increased second moment of area of the magnetic drawing panel will help it to resist bending during drawing or erasing.
- [13] To capture or save images drawn on the magnetic drawing board, a layer of sensors

under the magnetic drawing board can be used to detect whether each cell or zone is black or white. This information can be captured and saved to disk or processed or printed.

- [14] As for displaying a stored image from a computer or other electronic devices, the apparatus will further need a layer of electromagnets under the magnetic drawing board and a front drawing magnet at the front of the drawing panel. Each electromagnet can be turned on or off and can be used to attract the front drawing magnet. It is possible for a processor to control the sequence the electromagnets are turned on and off. In so doing, it is possible to control the movement of the front drawing magnet on top of the magnetic drawing panel using the electromagnets beneath the magnetic drawing panel. Depending on the relative strength of the electromagnet and the front drawing magnet, the path that the front drawing magnet takes on top of the magnetic drawing panel can be made to be white or black. If the magnetic strength of the front drawing magnet is stronger than the electromagnet, then the black magnetic particles in the cell or zone in the magnetic drawing panel will be attracted forward and the cell or zone will become black. Conversely, if the magnetic strength of the front drawing magnet is weaker than the electromagnet, then the black magnetic particles in the cell or zone in the magnetic drawing panel will be attracted backward and the cell or zone will become white. A whole image can thus be drawn on the magnetic drawing panel using the electromagnets to control the front drawing magnet.

- [15] Another method to display an image is by first making the whole drawing black and then using the electromagnets to make the desired areas on the magnetic display panel white just as in the image.

Advantageous Effects

- [16] With the new magnetic eraser, localized erasing can be done from the front. This provides users better control and ease of use. Furthermore, this allows large erasable magnetic drawing boards, which do not consume consumables and are non-polluting unlike traditional black boards or white boards, to be used in meeting rooms and classrooms.
- [17] Furthermore, with layer of sensors and electromagnets, the erasable magnetic drawing board can save and display saved images. This greatly increases the versatility and usefulness of the erasable magnetic drawing board.

Description of Drawings

- [18] The accompanying drawings are solely for purposes of illustrating the concepts of the invention and are not drawn to scale. The embodiments shown in the accompanying drawings, and described in the accompanying detailed description, are used as illustrative embodiments and should not be construed as the only manner of practicing

the invention. Also, the same reference numerals, possibly supplemented with reference characters or characters with numbers where appropriate, have been used to identify similar parts. The '+' and '-' signs used in the drawings refer to the north and south polarities of magnets. These and other objects and features of this invention will be clear and apparent to those skilled in the art upon reading the detailed description together with the drawings, wherein:

- [19] FIG. **1** shows an example of a prior art toy erasable magnetic drawing board;
- [20] FIG. **2** shows a partial cross sectional view of a prior art front face erasable microcapsule magnet sheet with erasing magnet;
- [21] FIG. **3** shows a front view of an example of a front face erasable magnetic drawing board;
- [22] FIG. **4** shows a cross sectional view **29-29** of FIG. **3**;
- [23] FIG. **5a** to **5c** show partial cross sectional views of various stiffeners;
- [24] FIG. **6** shows a cross sectional view of an alternative magnetic front erase eraser;
- [25] FIG. **7** shows a view of the electromagnet layer; and
- [26] FIG. **8** shows a cross sectional view of the front erase magnetic drawing board with electromagnet layer.

Best Mode

- [27] Referring to FIG. **3**, it shows a front view of an example of the present invention of a front erase magnetic drawing board apparatus **20**. The front erase magnetic drawing board **20** comprises of a magnetic drawing panel **21** enclosed within a frame **28**, magnetic pen **40**, and magnetic front erase eraser **30**.
- [28] The magnetic drawing panel **21** referred here is used as a generic term to mean any erasable magnetic drawing material that allows the use of magnet to draw from the front and any magnet to erase from the back. Such magnetic drawing materials have been around and are well known in the art. The magnetic drawing panel could refer to the magnetic display panel disclosed in US Patent No. 4,143,472. The magnetic display panel comprises of a layer of multi-cell structure sandwiched between two substrates. Each cell is filled with masking white liquid and black or colored magnetic particles. Such magnetic display panels are about 1.5 mm to 2.0 mm thick. The magnetic drawing panel **21** could also refer to the microcapsule magnet sheet disclosed in US Patent No. 5,972,493. The microcapsule magnet sheet comprises a layer of microcapsule, each microcapsule being filled with white masking fluid and black magnetic particles. Such microcapsule magnet sheets are about 0.4 mm to 0.8 mm thick. There are many other magnetic drawing materials around with different qualities and thickness and could be used as well. This invention is not restricted to use only existing magnetic display sheets or magnetic display panels, but could also use newer or better magnetic drawing materials when they become available. The magnetic

drawing panel **21** is also not restricted to only a single color but could also be of any color or colors.

- [29] The magnetic pen **40** has a magnet at the tip of a non-magnetic rod and can be used to draw lines on the magnetic drawing panel **21**. In fact, any magnet can be used to draw on the magnetic drawing panel **21**. These magnets used for drawing can be generically termed as magnetic drawing instruments. Other examples of magnetic drawing instruments are magnetic stamp and magnetic rollers. Magnetic stamp has a flat magnetic surface of a certain shape or design, and can be stamped repeatedly on the magnetic drawing panel **21** to create same images. Magnetic roller has a roller wrapped or coated with magnetic material, and can be used to roll over the magnetic drawing panel **21** to create repeated rolling patterns. Magnetic drawing instruments are well known in the art. Markers can also be used on the magnetic drawing panel **21**. Markers can provide additional drawing colors to the existing color provided by the magnetic drawing panel **21**. More often than not, the use of markers will be very limited as the bulk of most drawings or writing will be of the same color.
- [30] The magnetic front erase eraser **30** is used to erase any image drawn on the apparatus **20**.
- [31] Referring to FIG. **4**, it shows a cross-sectional view **29-29** of FIG. **3**. The front erase magnetic drawing board **20** comprises the magnetic drawing panel **21**, the frame **28**, stiffener **22**, back panel **25** and magnetic front erase eraser **30**.
- [32] The magnetic front erase eraser **30** comprises a front magnet **31** in front of the magnetic drawing panel **21** and a back magnet **35** underneath the magnetic drawing panel **21**. The front magnet **31** can slide over the surface of the magnetic drawing panel **21**. The back magnet **35** will follow the front magnet **31** under the magnetic drawing panel **21** due to the magnetic attraction between the front magnet **31** and the back magnet **35**. If the magnetic field acting on the magnetic particles in the magnetic drawing panel **21** is stronger from the back magnet **35** than the front magnet **31**, then the magnetic particles will move backwards and the drawing in the path of the magnetic front erase eraser **30** will be erased.
- [33] The front magnet **31** further comprises a magnet holder **32** so that it is easier to hold and use. The magnet can also have a layer of marker eraser **34** between the magnet and the magnetic drawing panel **21**. This is useful if markers are used on the magnetic drawing panel **21** and the magnetic front erase eraser **30** can then erase both magnetic drawings and marker drawings at the same time.
- [34] The front magnet **31** can be soft magnets such as iron or steel or can be permanent magnets such as rubber magnet, ferrite magnet, alnico magnet or neodymium magnet. The main purpose of the front magnet **31** is to attract the back magnet **35**. The magnet holder **32** can be made from plastic, although wood, aluminum or other materials are

also acceptable as its purpose is to increase the ease of holding and use of the magnetic front erase eraser **30**. The layer of marker eraser **34** can be made from cloth, fabric, sponge, or any other material that can erase marker drawings.

- [35] The back magnet **35** can be any type of permanent magnet, such as rubber magnet, ferrite magnet, alnico magnet or neodymium magnet. The back magnet **35** can further have a non-magnetic layer **36**. The non-magnetic layer **36** can protect the magnet **36** from frictional wear and tear. The thickness of the non-magnetic layer **36** can also be varied so that the desired magnetic field reaches the magnetic drawing panel **21** and the erasing effect is optimized.
- [36] The front magnet **31** and back magnet **35** work together and their relative strengths are important to ensure erasing is achieved. The back magnet **35** is preferred to be stronger than the front magnet **31**. One possible combination is to use ferrite magnet for the front magnet **31** and neodymium magnet, which is very strong, for the back magnet **35**. Other material combinations are also possible. The front magnet **31** and back magnet **35** can also be of the same material such as both are ferrite magnets. In such situations, the back magnet **35** should be larger in terms of surface area or thickness so that the desired effect of erasing is achieved.
- [37] It should be appreciated that depending on the thickness and material of the magnetic drawing panel **21** and the stiffener **22**, different solutions for the magnetic front erase eraser can be found to work.
- [38] The front erase magnetic drawing board **20** could be used in classrooms or meeting rooms and could be more than 2,000 mm wide and more than 1,000 mm high. The magnetic drawing panel **21** by itself could be flimsy as its thickness could be about 0.5 mm. The stiffener **22** is used to make the magnetic drawing panel **21** less flimsy and more stiff or rigid. For small sized front erase magnetic drawing board **20**, it is possible to do away with the stiffener **22** if the magnetic drawing panel **21** sufficiently stiff, such as thicker magnetic drawing panel **21**. The stiffener **22** is preferably made of non-magnetic material such as aluminum or wood or plastic.
- [39] Stiffener **22** can be of different shapes and sizes. One example is the shape of a flat plate, such as the stiffener **22** in Fig. 4. FIG. 5a to 5c show other examples of stiffeners. Stiffeners such as rows of ribs **22a**, plate with ribs **22b**, front plate and back plate connected by cylindrical studs **22c** are alternatives. The shape of the stiffener rib is curved shaped so that the back magnet **35** can still slide over them as shown in FIG. 5b. Basically the stiffeners **22** increase the second moment of area of the magnetic drawing panel **21** so as to reduce bending during drawing and erasing. The magnetic front erase eraser can be varied to take into overcome obstacles provided by the stiffeners. For example the stiffener **22c** has front plate **22c1**, back plate **22c2** and cylindrical studs **22c3**. In such a case, back panel **25** in FIG. 4 is not required as the back

plate **22c2** can fulfill the function of the back panel. The magnetic front erase eraser **30a** has two front magnets **31a** held together by the magnet holder **32a**, and two separate back magnets **35a**. When the front magnets **31a** move over the area where the cylindrical stud **22c2** is, the two back magnets **35a** can move apart and around the stud **22c2** and still follow the front magnets **31a**. The area in the magnetic drawing panel above the stud **22c2** will be erased without problem.

- [40] In the above examples, the back magnet fulfils two functional needs, which include following the front magnet and erasing the magnetic drawing panel. It is possible to separate the two functions by introducing additional back magnets. Referring to FIG. 6, it shows the front magnet **31** and back magnets **35b** and **35c**. The back magnets **35b** and **35c** are attached to the non-magnetic layer **36a** and held in place relative to each other. The back magnet **35b** is attracted to the front magnet **31** and follows the movement of the front magnet **31**. The back magnet **35c** serves to erase the magnetic drawing panel. The back magnets **35c** will move together with the non-magnetic layer **36a** and the back magnet **35b**. The magnet holder **32a** serves to also indicate to the user the area under which the magnetic drawing panel will be erased.

Mode for Invention

- [41] The front erase magnetic drawing board can be adapted to allow for stored images to be displayed. This is achieved by adding a layer of electromagnets and a front slave magnet. Referring to FIG. 7, the electromagnet layer **50** comprises rows of electrical conductors **51** (such as **51a** and **51b**), columns of electrical conductors **52** (such as **52a** and **52b**), and electromagnets **53** (such as **53a** and **53b**). Each electromagnet **53** has input and output electrical connectors and is electrically connected to a row electrical conductor **51** and column electrical conductor **52**. Other electrical and electronic components such as processor, current driver, row and column decoder, power supply, diodes, resistors and transistors, etc are not shown. They are widely available and known in the art and can be incorporated. Each electromagnet **53** can be turned on by creating a voltage potential difference between the row electrical conductor **51** and column electrical conductor **52** the electromagnet **53** is connected to. Current will flow through the row **51** and column **52** electrical conductors and electromagnet **53** and the electromagnet **53** will generate a magnetic field. The electromagnet **53** can be turned off as well by removing the potential difference between the row **51** and column **52** electrical conductors.
- [42] Referring to FIG. 8, the electromagnet layer **50** can be placed behind the magnetic drawing panel **21**. Stiffener can be used as before if required. The other components like frame **28** and back panel **25** are similar. The front slave drawing magnet **60** is for drawing and can be controlled by the electromagnets. For example, referring to FIG. 7, by turning on electromagnet **53a** then **53b**, the front slave drawing magnet **60** will

move from above electromagnet **53a** to above **53b**. The front slave drawing magnet **60** has a stronger magnetic field than the electromagnet **53** and as such will cause the path on front erase magnetic drawing board **20a** that it slides over to become drawn. To erase any part of the front erase magnetic drawing board **20a**, the electromagnet **53** under that part can be turned on and the image there will be erased. The whole front erase magnetic drawing board **20a** can be erased very quickly by turning the electromagnets on in sequence. However, the processor needs to make sure the front slave magnet **60** does not interfere with the erasing.

- [43] The front erase magnetic drawing board can also be adapted to allow for the saving of drawings drawn on the magnetic drawing board. A layer of sensors arranged in grid form under the magnetic drawing panel, each sensor able to detect the color state of the area on the underside of the magnetic drawing panel. Similar to the electromagnet layer, there are rows of electrical conductors and columns of electrical conductors and each sensor is connected to a row electrical conductor and a column electrical conductor. For simple sensors, it can differentiate between black and white. When the sensor detects black color, the front of the magnetic display panel above the sensor is actually white, or the reverse of what the sensor detects. When the sensor detects white color, the front of the magnetic display panel above the sensor is black in color. For more advanced sensors, it can provide feedback on the darkness of the area, which means it can not only detect black and white but also detect the level of grayness. Each sensor can represent a pixel of the drawing. A processor can read off the feedback from the sensors in sequence, process them and store them. The information stored represents the image in digital form.

Industrial Applicability

- [44] The front erase magnetic drawing board can replace existing blackboards and whiteboards, which require consumables and emit pollutants. The front erase magnetic drawing board can also be adapted so that it can save images drawn or display digital images from saved storage.

Claims

- [1] 1. A magnetic front erase eraser comprising:
 - a front magnet; and
 - a back magnet;wherein said front magnet is able to slide on top of magnetic display panel; and wherein said back magnet is able to slide underneath magnetic display panel and able to be attracted to said front magnet and follow the sliding movement of said front magnet.
- [2] 2. The magnetic front erase eraser of claim 1, wherein said front magnet is made of soft magnetic material such as iron or steel.
- [3] 3. The magnetic front erase eraser of claim 1, wherein said front magnet is permanent magnet such as rubber magnet, ferrite magnet, alnico magnet or neodymium magnet.
- [4] 4. The magnetic front erase eraser of claim 1, wherein said front magnet further comprising a holder.
- [5] 5. The magnetic front erase eraser of claim 1, wherein said front magnet further comprising a marker erasing surface.
- [6] 6. The magnet front erase eraser of claim 4, where said front magnet further comprising a marker erasing surface.
- [7] 7. The magnetic front erase eraser of claim 1, wherein said back magnet is permanent magnet such as rubber magnet, ferrite magnet, alnico magnet or neodymium magnet.
- [8] 8. The magnetic front erase eraser of claim 1, wherein said back magnet further comprising a non-magnetic layer, wherein said layer is between said back magnet and said front magnet.
- [9] 9. The magnetic front erase eraser of claim 1, further comprising additional back magnets.
- [10] 10. The magnetic front erase eraser of claim 9, wherein said additional back magnets are physically fixed in location relative to each other.
- [11] 11. The magnetic front erase eraser of claim 4, further comprising additional front magnets, said front magnets are physically held together by said holder.
- [12] 12. The magnetic front erase eraser of claim 11, further comprising additional back magnets; said back magnets are not physically held together and able to move closer and further apart from each other so as to move around obstacle.
- [13] 13. A front erase magnetic drawing board comprising:
 - a magnetic drawing panel;
 - a magnetic drawing instrument; and

a magnetic front erase eraser.

[14] 14. The front erase magnetic drawing board of claim 13, further comprising stiffener behind said magnetic drawing panel.

[15] 15. The front erase magnetic drawing board of claim 14, wherein said stiffener is shaped as a plate.

[16] 16. The front erase magnetic drawing board of claim 14, wherein said stiffener is shaped as a plate with ribs.

[17] 17. The front erase magnetic drawing board of claim 14, wherein said stiffener comprises:

a front plates;
a back plate; and
studs;

wherein said studs connect said front plate and said back plate.

[18] 18. The front erase magnetic drawing board of claim 14, wherein said stiffener comprises plurality of ribs.

[19] 19. The front erase magnetic drawing board of claim 13, further comprising:
a back panel; and
a frame.

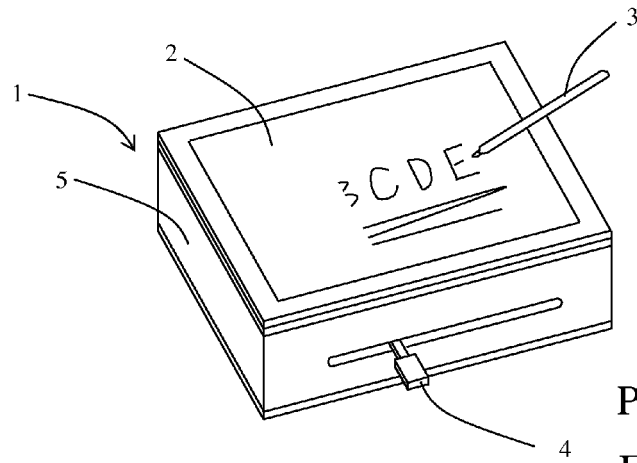
[20] 20. The front erase magnetic drawing board of claim 13, further comprising an electromagnet layer behind said magnetic drawing panel.

[21] 21. The front erase magnetic drawing board of claim 20, further comprising a front slave drawing magnet.

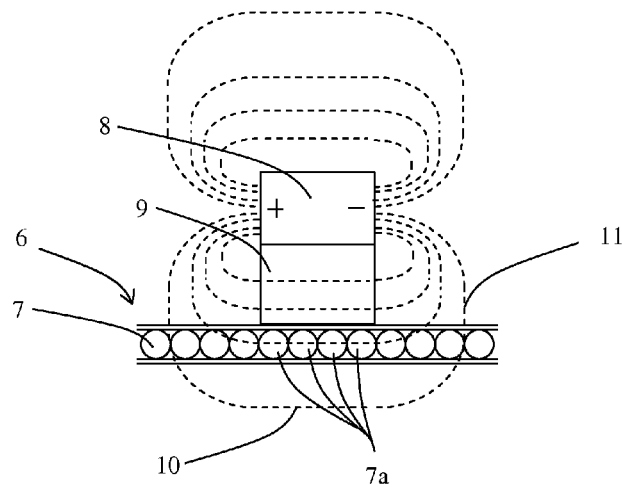
[22] 22. The front erase magnetic drawing board of claim 21, further comprising a sensor layer behind said magnetic drawing panel.

[23] 23. The front erase magnetic drawing board of claim 13, further comprising a sensor layer behind said magnetic drawing panel.

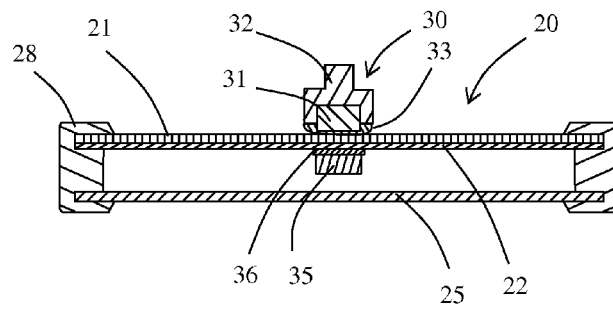
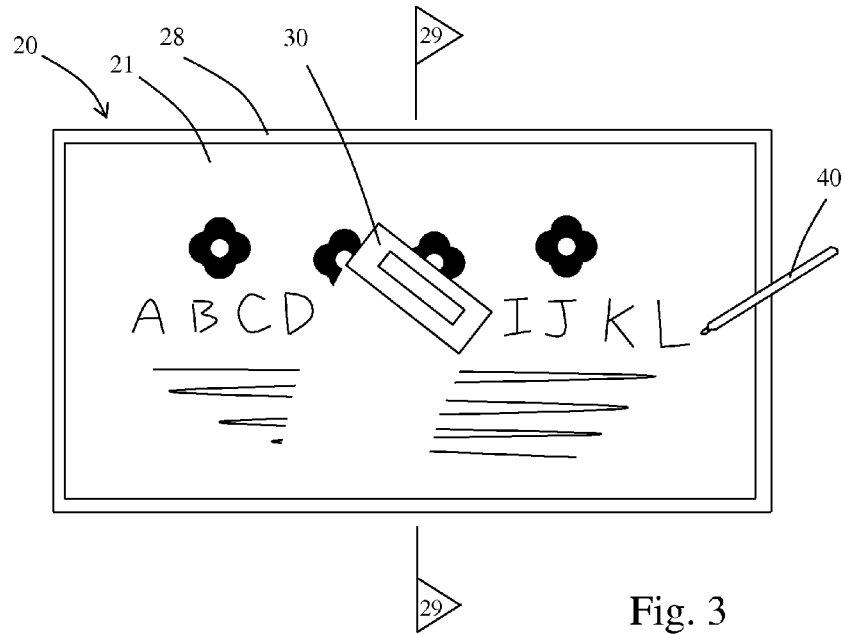
[24] 24. An electromagnetic display panel comprising:
a magnetic drawing panel;
an electromagnetic layer; and
a front magnet.



Prior Art
Fig. 1



Prior Art
Fig. 2



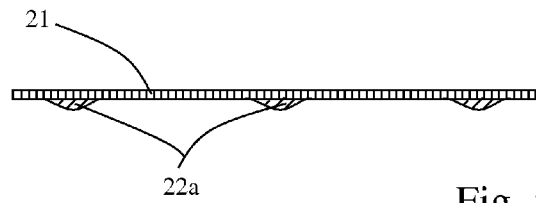


Fig. 5a

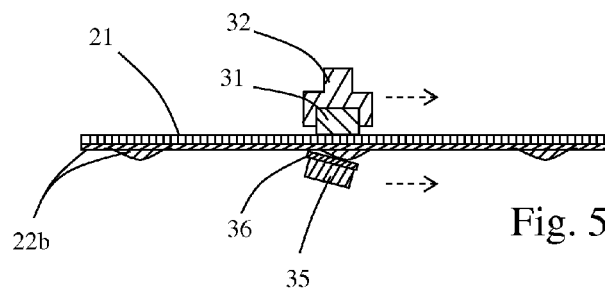


Fig. 5b

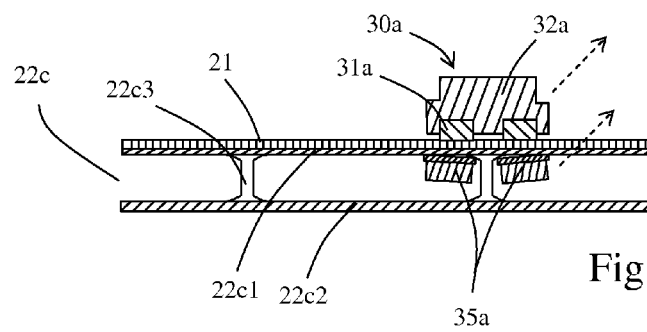


Fig. 5c

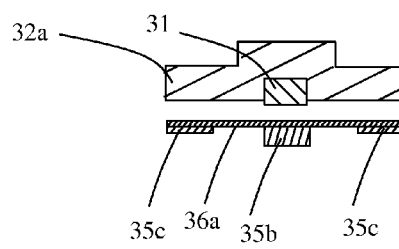


Fig. 6

