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CA 2425062 A1 2004/10/10

(21) 2 425 062

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(22) Date de dépôt/Filing Date: 2003/04/10

(41) Mise à la disp. pub./Open to Public Insp.: 2004/10/10

(51) Cl.Int.^{7}/Int.Cl.^{7} E21B 7/02

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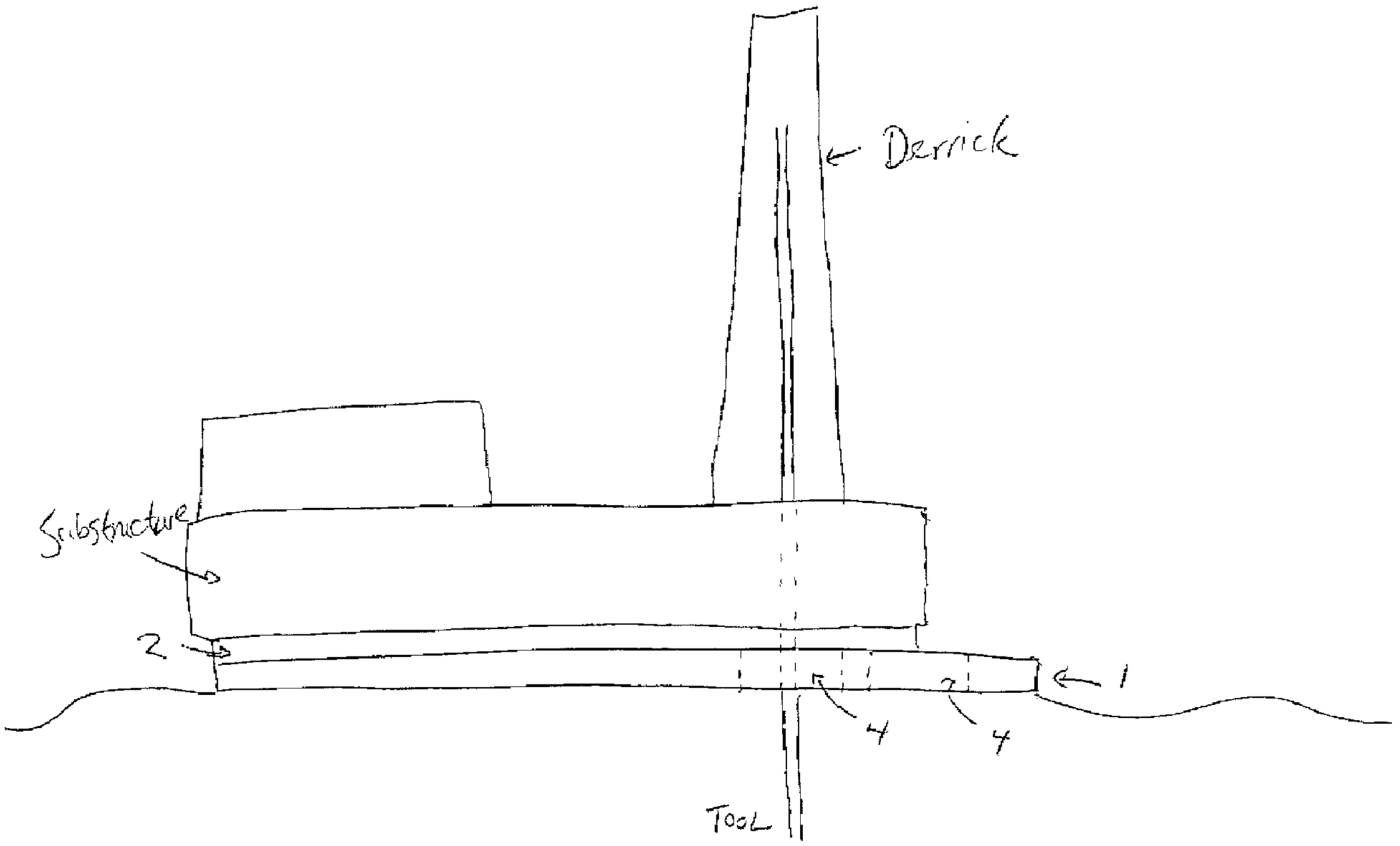
(54) Titre : METHODE ET APPAREILS POUR LE DEPLACEMENT DE MATERIEL DE FORAGE ENTRE EMPLACEMENTS ADJACENTS

(54) Title: METHOD AND APPARATUS FOR MOVEMENT OF DRILLING EQUIPMENT BETWEEN ADJACENT LOCATIONS



(57) Abrégé/Abstract:
Disclosed is an apparatus and method for the movement of drilling equipment between topographically adjacent drilling locations. A transportable planar surface is positioned over the adjacent drilling locations between which it is desired to move said equipment - ports or other access areas extending through the planar surface to the drilling locations below are provided. The equipment to be

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(57) Abrégé(suite)/Abstract(continued):
moved is placed on top of the planar surface and is provided on its bottom wish a low-drag surface which can slide across the planar surface. The equipment can be moved from one desired drilling location to another by sliding it between locations on top of the planar surface. When all of the drilling is completed, the equipment can be struck for transport and the planar surface disassembled and moved to a new drilling area. Various power or drive methods to move the equipment could he used.

ABSTRACT

Disclosed is an apparatus and method for the movement of drilling equipment between topographically adjacent drilling locations. A transportable planar surface is positioned over the adjacent drilling locations between which it is desired to move said equipment - ports or other access areas extending through the planar surface to the drilling locations below are provided. The equipment to be moved is placed on top of the planar surface and is provided on its bottom with a low-drag surface which can slide across the planar surface. The equipment can be moved from one desired drilling location to another by sliding it between locations on top of the planar surface. When all of the drilling is completed, the equipment can be struck for transport and the planar surface disassembled and moved to a new drilling area. Various power or drive methods to move the equipment could be used.

METHOD AND APPARATUS FOR MOVEMENT OF DRILLING EQUIPMENT BETWEEN ADJACENT DRILLING LOCATIONS

This invention relates to the field of oilfield exploration and equipment and more particularly deals with methods and apparatus for the movement of heavy stationary drilling equipment between adjacent locations.

BACKGROUND

One of the many operational difficulties in oil and gas exploration activities is the movement of drilling rigs between adjacent drilling locations. For example it may be determined that within a relatively small geographic area there are two or more possible drilling locations, and once ranked in order of likelihood of success a drilling rig might be set up to first drill on one location and if satisfactory results are not achieved then the rig might be moved to the next preferred adjacent location and a new well drilled with the hope of achieving better results.

Certain exploration activities may also require the drilling of more than one well in close proximity and again

the locations of those wells might be relatively close together (as in only a number of feet or yards apart).

Where conventional drilling equipment is used, drilling of the typical well would start with the erection of the rig equipment over the well center and then the well could be drilled. The typical conventional drilling rig would include a substructure and derrick which would be erected into position such that the well could be drilled below the also include other supporting or service outbuildings or ancillary equipment or supply tanks or racks, all of which would need to be appropriately positioned around the main substructure in order to properly drill the well.

If it is at some point determined that satisfactory results are not being achieved at that particular drilling site, or if it is otherwise required within the site drilling plan, it may be necessary or desirable to move the rig to an adjacent drilling position, or an adjacent well center, and try to drill again. As outlined above, in many cases these adjacent well centers could be in relatively close proximity but regardless of the close proximity or location of the adjacent proposed well center, where a conventional drilling rig was being used it would be necessary to disassemble a large portion of the equipment, including potentially taking down the derrick and taking apart other

pieces of the substructure, moving the substructure and supporting equipment to the new well center and reassembling the remainder of the equipment. This is obviously a time intensive process which results in a relatively long period of time being required to move the rig between drilling sites. Also, given the significant degree of disassembly which is required in this type of the movement, the wear and tear on the drilling equipment itself from its movement between sites is increased.

Another alternative type of equipment which has been designed to make it easier to move the drilling rig between adjacent drilling locations are various types of rigs which allow for the lifting of the rig using hydraulic legs or the like, to disengage the rig from the ground surface, and then physically pushing the rig to the new location using heavy equipment or the like. While this to some extent will alleviate the problems associated with complete or nearly complete disassembly of a drilling structure to move it between adjacent drilling locations, it creates its own set of problems. For example, where the rig itself is to be lifted and then pushed or dragged into a new location, it is necessary to minimize, or at the very least be cognizant of issues related to, the overall weight of the drilling substructure and any remaining attachments when it is to be moved. For example, it is not possible in this type of a movement arrangement to keep large quantities of

pipe in the derrick while the unit is moved, since the substructure needs to be properly engineered to accommodate the weight. There are also concerns associated with the types of equipment needed to push the equipment between locations as well as proper weight distribution of the entire device onto a relatively small surface area such as the bottom of a series of lifters or feet which might be used to lift the rig structure off of the ground surface.

This method of lifting and moving a rig between drilling locations has been tried in the other types of equipment as well, for example it is known that in certain cases a set of rails or the like has been disposed beneath the rig. Again the rig needs to be lifted from the ground and then moved along the rails, and then set back down at the new location. Lifting of the rig limits the weight which can be moved, and introduces great stability, safety and equipment wear concerns. Another problem with a rail movement arrangement is that the rig can only be moved in one direction, that is in a single linear direction such as forward and back, while it cannot be moved from side to side. There are also similar weight distribution issues with this type of a movement arrangement.

It would be desirable to be able to provide an apparatus and method for the movement of a drilling rig between adjacent drilling locations that overcame the limitations

of the use of conventional drilling equipment insofar as the difficulties in moving those rigs between adjacent drilling locations, and also to potentially address the issues which are associated with other current methods of movement of drilling rigs which are specifically manufactured for the purpose of movement between adjacent drilling locations by lifting them from the earth and moving them that in some fashion either by rails or by pushing or pulling them using heavy equipment or built-in motor systems.

SUMMARY OF THE INVENTION

It is the object of the present invention to provide a method and apparatus for the movement of drilling equipment between adjacent drilling locations which allows for the movement of a drilling rig or the like in substantially its assembled form, without requiring significant disassembly to allow for the movement of the rig substructure between adjacent drilling locations.

It is the further object of the present invention to provide a method and apparatus for the movement of drilling equipment between adjacent drilling locations without requiring significant disassembly thereof, which would allow for the movement of the rig substructure or other

equipment between a plurality of adjacent drilling locations which were not all in the same linear direction, that is to say that there could be two directions of movement of the rig in relation to the ground surface.

It is the further object of the present invention to provide a method and apparatus for the movement of drilling equipment between adjacent drilling locations without requiring significant disassembly thereof which would allow for the retrofitting of the method and apparatus of the present invention to a conventional drilling rig substructure.

DESCRIPTION OF THE DRAWINGS:

While the invention is claimed in the concluding portions hereof, preferred embodiments are provided in the accompanying detailed description which may be best understood in conjunction with the accompanying diagrams where like parts in each of the several diagrams are labeled with like numbers, and where:

Figure 1 is a top view of one embodiment of a rig pad of the present invention;

Figure 2 is a side view of the pad of Figure 1, in direction 2-2 of Figure 1;

Figure 3 is another view of the embodiment of the pad of Figure 1, also showing a rig base;

Figure 4A demonstrates the embodiment of Figure 3 with the rig base in a first position A;

Figure 4B demonstrates the embodiment of Figure 3 with the rig base in a first position B;

Figure 4C demonstrates the embodiment of Figure 3 with the rig base in a first position C;

Figure 4D demonstrates the embodiment of Figure 3 with the rig base in a first position D;

Figure 5 is a side view of the embodiment of Figure 3, showing a derrick and rig substructure in place on the rig base;

Figure 6 is a plan view of another embodiment of the pad with closable drilling location apertures disposed thereon;

Figure 7 shows another embodiment of the invention, wherein two pads are connected end to end resulting in a longer degree of end to end movement being available to the rig between drilling locations;

Figure 8 shows another embodiment of the invention, wherein two pads are connected side to side resulting in a longer degree of side to side movement being available to the rig between drilling locations;

Figure 9 shows another embodiment of a pad which is dividable for transport; and

Figure 10 shows the pad of Figure 1 with anchor points thereon to allow for the hydraulic cylinder movement of a rig structure thereon.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS:

The following, while it is an incomplete specification, is an enabling disclosure of a new method and apparatus for the movement of drilling equipment between adjacent drilling locations.

General apparatus:

The method and apparatus of the present invention are directed to the provision of a movable drilling derrick which can be moved between adjacent drilling locations without the need to disassemble or lift the derrick, substructure or other surrounding equipment.

In terms of describing the apparatus and method of the present invention it will first of all be appropriate to understand the concept of adjacent drilling locations. As described in some detail above, it may in certain circumstances be desirable to move the drilling rig from one drilling location or well center onto another drilling location or well center which is an adjacent location, from which the second well can be drilled. It may be desirable to be able to move a drilling rig or derrick between a plurality of such drilling locations in the course of one particular drilling job or at one general drilling sites or area. It is the method and apparatus for movement of the drilling rig itself between these adjacent drilling locations to which the present invention is directed.

The first component of the apparatus of the present invention is a pad [1]. The pad [1] provides an approximately planar surface [3] upon which the drilling rig itself can rest. The Figures of this disclosure show the pad [1] being rectangular in shape. It will be

understood that if a different pattern of drilling locations or well centers was desired, or if it was desired to cover or accommodate drilling sites or locations of varying shapes or sizes that a pad [1] of a different shape could be made without departing from the scope or intention of the present invention.

Figure 1 shows a top view of one embodiment of a pad [1] of the present invention. In the embodiment of Figure 1, there are four closely spaced drilling location apertures [4] shown, disposed in a grid pattern near one end of the pad [1]. The drilling location apertures [4] provide an access area through the surface [3] of the pad [1] extending down to the ground beneath the pad [1], through which drilling equipment resting on the top surface [3] can reach down to the ground below.

The placement of the drilling location apertures [4] in the embodiment of Figures 1 and 2 was determined by the approximate shape of the typical substructure of an existing conventional drilling rig. It will be understood however that the placement of the drilling location apertures [4] could really be anywhere on the upper surface [3] of the pad [1], provided that there was sufficient room on the upper surface [3] surrounded the drilling location aperture [4] in question to allow for the proper

positioning of the rig base [2] over top of the drilling location aperture [4] in question.

Drilling location apertures [4] would be placed anywhere through the pad [1] where it would be desired to drill through. Figure 2 shows a side view of the pad [1] of Figure 1. This figure is shown along line 2-2 of Figure 1. The extension of the drilling location apertures [4] through the pad [1] is shown in dotted relief in this Figure.

In terms of on-site set up, the most essential issue in the assembly of the apparatus of the present invention would be the proper placement of the pad [1], so that the drilling location apertures [4] were properly located over the precise topographical locations at which it was desired to and the drilling equipment was assembled thereon; the equipment could be moved around on the upper surface [3] of the pad [1] to the appropriate open drilling location aperture [4] through which it was desired to drill.

Once the pad [1] was placed on the site, the next piece of the apparatus of the present invention which would be added would be the drilling rig or rig equipment [5] which it was desired to use at the site in which it was desired to employ the method and apparatus of the present invention to

quickly and easily move between drilling locations. As will be discussed in further detail below, a specific rig apparatus might be employed with the pad [1] of the present invention, or alternatively many conventional drilling rig apparatus could be retrofit or otherwise modified to be used in accordance with the present invention. A rig base [2] might be used either as a separate component, in the case of a retrofitted conventional piece of equipment, or the bottom surface of the rig itself might be adapted for use as the rig base [2].

The key to the rig base [2], whether that be a separate component used to retrofit a conventional drilling rig assembly, or whether there was a specific drilling rig assembly manufactured for use with the pad and other components of the present invention, would be that the bottom surface of the rig base [2], coupled with the upper surface [3] of the pad [1] would cooperate in a low friction relationship such that the equipment on the top of the rig base [2] could be effectively "slid" around on the upper surface [3] of the pad [1] without needing to lift the rig structure. Weights could be increased and the stability would not suffer by removing the need to lift the rig.

It will be understood that any type of a rig base [2] which accomplished the object of allowing for the movement of a

piece of equipment about on the upper surface [3] of the pad [1] would be contemplated within the scope of the present invention.

Figure 3 demonstrates one embodiment of the pad [1] of the present invention, such as a shown in Figure 1 and Figure 2, with a drilling structure and rig base [2] positioned thereon. The pad [1] which is shown in Figure 3 is a pad similar to that Figure 1 insofar as there are four drilling location apertures [4] shown thereon nearer to one end of the pad [1] - these are lettered A through D for reference. Again in this particular Figure, the placement of the drilling location apertures [4] closer to one end of the pad [1] is related primarily to the positioning of the derrick on the typical oil rig substructure at one end of the substructure. It will be understood that the drilling location apertures [4] could be located anywhere on the pad [1] again so long as the rig base [2] is capable of properly locating the drilling equipment in question over top of a desired drilling location aperture [4].

In Figure 3, drilling location aperture A. is the one which is currently in use. It will be understood that drilling location aperture B. could be accessed by the rig by sliding the rig base [2] towards the other end of the pad [1] in direction H. From location A., the rig could be moved to location C. by sliding the rig base [2] down in

direction V. By sliding the rig down and over in both directions H. and V., drilling location aperture D. could be accessed from location A. referring to the embodiment of the pad [1] and the rig base [2] shown in Figure 3, Figures 4A through 4D show the equipment/rig base [2] in the four positions outlined herein. Effectively the four positions of the rig base [2] shown in these figures are the four quadrants of the pad [1].

Figure 5 shows the embodiment of Figure 3 from the side, and demonstrates the approximate location of the derrick and the remainder of the rig substructure.

Method of rig movement:

Various apparatus and methods which could be used to actually move the rig or drilling equipment of bottled on the upper surface of the pad [1], between locations, can be contemplated. In the simplest possible embodiments, the rig or drilling equipment might actually just be moved around on the top surface of the pad [1] using winches or heavy equipment to drag the equipment around on the top surface of the pad [1]. Various more methodical or mechanical methods of movement can also be contemplated. It will be understood however that this simplest method of movement of the drilling rig or structure between adjacent

drilling locations on the surface of the pad, namely by disengaging the drilling equipment from the ground through the present drilling location aperture and then basically dragging the rig structure or the rig base around on the upper surface of the pad to its new drilling location such that the tools can be reengaged with the ground through the new drilling location aperture, using winches or other equipment on or adjacent to the pad, is contemplated within the scope of the apparatus and method of the present invention insofar as the creation of an apparatus or a low friction relationship between a rig base and a pad surface such as is contemplated herein, regardless of the method of power used to move the rig base or rig structure in this fashion, is novel and it is intended to be contemplated within the scope of the present invention.

One particular method of moving the rig or drilling equipment about on the upper surface of the pad [1] might involve the use of hydraulic cylinders to "push" the equipment, on the rig base [2], about on the surface of the pad [1]. Other methods of hydraulic power hydraulic movement could also be contemplated, involving pushing the rig base [2] about the surface of the pad [1] from fixed points on the surface of the pad [1], or alternatively by providing some type of the drive mechanism on the drilling equipment or rig itself which could "pull" were driving the rig base about on the upper surface of the pad [1].

Referring to Figure 10 there is shown an embodiment of the present invention using a pad [1] with four drilling location apertures [4] extending their through. On the upper surface [3] of the pad [1], there are shown a number of anchor points to which hydraulic cylinders could be anchored at one end. The other end of the cylinder could be anchored to a pin point on the rig base [2], and then by extension or retraction of the hydraulic cylinder or cylinders in question, the rig base [2], and any equipment attached thereto, would be horizontally maneuvered about on the planar surface of the pad [1]. It may be necessary in the course of a move of the rig base [2] from one location to another on the surface of the pad [1] to move the structure part way and then detach the hydraulic cylinders and reattach them to a new set of anchor points either on the rig base [2], or on the surface [3] of the pad [1], and then continued movement of the structure or the rig base [2] in relation to the pad [1] could be accomplished by continued manipulation of the hydraulic cylinders. It is contemplated that in a simple embodiment, two hydraulic cylinders could be used to manipulate the entire rig structure about on the upper surface [3] of the pad [1].

Retrofitting the apparatus to conventional drilling rigs:

One of the prime benefits of the system of the present invention is that can be retrofitted for use with a conventional drilling rig, rather than requiring the use of the specific type of the rig substructure or drilling apparatus to accomplish the benefits offered by the present invention. Not only will this make it easier to continue to use older or legacy drilling equipment with the new method of the present invention, it will also provide great flexibility in terms of the particular types of drilling or exploration that can be undertaken with this type of device were method. For example drilling rigs or drilling equipment used in different types of drilling, such as for gas, oil, water or other types of materials could all be used in this type of the situation. The pad [1] would likely be the same in the only difference would be the production of an alternative rate base [2] to attach to the rig to allow the rig to move a belt on the pad [1].

The apparatus of the present invention allows for the use of conventional drilling rigs or other legacy equipment in quite a simple fashion. Basically, rig base [2] is produced or attached to the existing substructure of a drilling rig or the like and the major requirement for the rig base [2] is to be capable of sliding on the pad [1] so that the rig base [2] the attached rig or substructure their above can be moved a belt on top of the pad [1] between various drilling locations located thereon.

In the embodiments which are demonstrated in the present disclosure, the rig base [2] which has been fashion is a pair of pontoons. These pontoons can be attached to the existing substructure of an existing drilling rig and the pontoons would allow for an appropriate weight distribution of the weight of the substructure in the drilling rig itself across the pad [1], and at the same time with their relatively small surface area allow for a relatively low coefficient of drainage across the surface of the pad [1] as the substructure drilling equipment attached thereto is moved.

The rig base [2] could be further enhanced by providing for a coating or surface on the bottom thereof which would further enable the movement of the rate on pad [1]. For example, and when an ultra high molecular weight polymer surface on the bottom of the pontoons might provide one example of a low friction surface which would lend itself

It will be understood that the pontoons which are discussed herein would only be one possible type of rig base [2]. It may even be the case that a typical drilling rig of a conventional style may just be set down on the pad [1], and the bottom surface of the existing substructure of the rig

would then become the rig base [2] in terms of this disclosure. Again, that surface might the augmented or optimized for use in accordance with the method of the present invention by adding some type of a low friction surface thereto but it will be understood the particular type of a rig base [2] which has the effect of allowing for the movement of the rig or other equipment attached thereto about on a pad [1] between various locations on the pad [1] will be contemplated within the scope present invention.

Portability of the apparatus:

One of the major benefits of the apparatus of the present invention, in addition to the great simplicity with which rig moves between adjacent drilling locations can be accomplished, is the portability of the entire apparatus. As has been outlined above, the apparatus of the present invention can either be retrofitting to a typical conventional drilling rig apparatus, or a specific rig substructure might also be designed to be used in accordance with the method and apparatus of the present invention. In either case, the apparatus of the present invention where conventional drilling rig was used would basically consist of whatever rig base [2] was designed to attach to the typical rig substructure and which rig base [2] could then slide upon the pad [1]. In the figures

shown, the rig base [2] is a pair of pontoons which can be fitted to the substructure of a rig and set down upon the pad [1]. Obviously these pontoons [2] are simply transportable, given the transportability of the remainder of the far larger and more complex equipment involved in a typical drilling site.

The second piece of apparatus of the present invention which is also easily rendered transportable is the pad [1]. The pad [1] might be transported simply by packing it up onto a trailer or the like, if it was of a size or shape that could be easily transport without a further breakdown. Alternatively, the pad [1] could be made transportable by manufacturing it in more than one piece which could then be bolted together on the site when the structure of the present invention was assembled for use. For example Figure 9 shows a pad [1] built in two smaller rectangular halves [1A] and [1B], each of which would approximately fit on a flatbed trailer or the like for transport, and these two smaller rectangular halves could then be bolted together at the drilling site to render the complete, full-sized pad [1].

Extended apparatus allowing extended moves:

It is further contemplated that by use of a plurality of patents [1], the utility of the invention could be further extended, by allowing for the movement of the rig base [2] and any equipment supported thereon longer distances. Figures 7 and 8 demonstrate two such configurations.

Figure 7 shows an embodiment of the present invention in which two pads [1] are used, and they are attached together in a horizontal fashion, which would allow for the extended horizontal movement of the rig base [2], for example from the location lettered in the Figure as Location A., to Location B. at the far other end of the 2nd pad [1]. By attaching a 2nd pad [1] to the end of the first pad [1], if the right type of a drive mechanism or method of movement of the rig base [2] were employed, the rig or structure could effectively be moved all the way down the first pad and onto the 2nd pad to a drilling location aperture [4] thereon.

Figure 8 shows a similar configuration albeit in an "vertical" configuration or joining of the two pads [1].

It can be seen that by employing a number of two or more of these pads [1], the rig or structure which is supported on the rig base [2] could be moved relatively long distances without the requirement to disassemble the rig structure. Using two pads [1], once the rig base [2] moved all the way

from the first pad [1] onto the 2nd pad [1], the first pad could be disconnected and moved then to the opposite end of the 2nd pad and reconnected, and potentially the rig structure could be moved right on across the 2nd pad, back [illegible] the first pad which is now resting in a third

Pad with optional well centers:

The apparatus of the present invention could be rendered further flexible by designing a pad [1] which had a large number of closable drilling location apertures [4] contained therein. For example a pad [1] could be manufactured the entire base of which was a grid of drilling location apertures [4], selected ones of which well centers could be opened dependent upon where was desired to position the rig on the top of the pad [1]. By making the drilling location apertures [4] closable, simply by providing for the placement of a plate or some other type of a cover in denying used well center drilling location when it was not in use, the pad [1] could be made even more universal and more flexible insofar as the addition of more drilling locations to the pad [1] would make it even these here to use the apparatus of the present invention to drill even more wells without an elaborate move of the pad [1] and the rig thereon.

To demonstrate this possibility, Figure 6 shows a pad which has 15 drilling location apertures [4] disposed throughout in a grid pattern, with covering plates thereover. In the embodiment shown, three of the total of 15 possible drilling location apertures letters A, B and C are open, with the remainder being covered (and numbered 1 through 12). By simply closing and opening other combinations of drilling location apertures [4], this pad[1] could add significant additional flexibility to the device.

Adaptability of the apparatus and method to a variety of equipment:

It has already been outlined above that the primary purpose of the apparatus and method of the present invention is to provide for a method of simplified movement of a drilling rig or similar equipment between adjacent drilling locations. However it will be understood that beyond using it simply for the support and/or simplified movement of an actual drilling rig structure, the method or apparatus of the present invention can also be adapted for use with other similar types of supporting equipment, or even for use in other applications altogether, and these are also contemplated within the scope of the present invention.

To summarize the invention then, at its broadest, the invention is an apparatus for the movement of a drilling rig or similar equipment between adjacent drilling locations which effectively comprises a pad with a relatively planar upper surface upon which a rig or other equipment can be slid between adjacent drilling locations located thereunder by moving to the rig structure of bulk on the top surface of the pad. The top surface of the pad and/or the bottom surface of the rig, being the rig base, would be of proper materials to provide for a low friction relationship which would simplify the movement of the rig and the rig base across the pad surface.

The pad itself would have a plurality of drilling location apertures passing therethrough. Each drilling location aperture would basically be a hole extanding through the pad which would allow a tool or other type of access from the drilling equipment or rig on top of the pad, through the pad to the ground below. Any number of drilling location apertures could be contained on a particular pad and could be placed in a number of different patterns thereon, depending upon what the needs of the operator were.

Using more than one pad, a rig or rig structure could be potentially moved relatively large distances by staggering

the movement of the rig structure on its rig base across the surface of more than one pad, and as the rig departed the surface of the last pad, disconnect the net and moving it to the opposite end of the pad on which the rig was then resting to provide further room for the rig to move as it continued.

Various methods of moving the actual rig or equipment across the top surface of the pad could be used. Where a fixed number of drilling location apertures were contained on the surface of the pad one method of movement of the drilling rig itself which is specifically contemplated is the development or placement of a series of Anchor positions at appropriate positions on the surface of the pad, to which anchor positions hydraulic grams could be attached, the other end of the cylinders being attached to the rig base or the rig structure itself and the rig's could then be extended or contracted to move the rig structure in one axis of direction of the time. No one of the major benefits of this particular system over the other efforts that previously been made, in addition to the fact that this particular type of an apparatus does not require the lifting of the rig structure which and its significant safety instability to a rig move in addition to streamlining the process and act and decreasing, sometimes, but another major benefit of this system is that the rig structure on its rig base [2] can be moved in the two

directions required to accomplish a movement to basically any adjacent drilling location aperture and, whether that requires movement of the structure from side to side or from the back in terms of the pad itself.

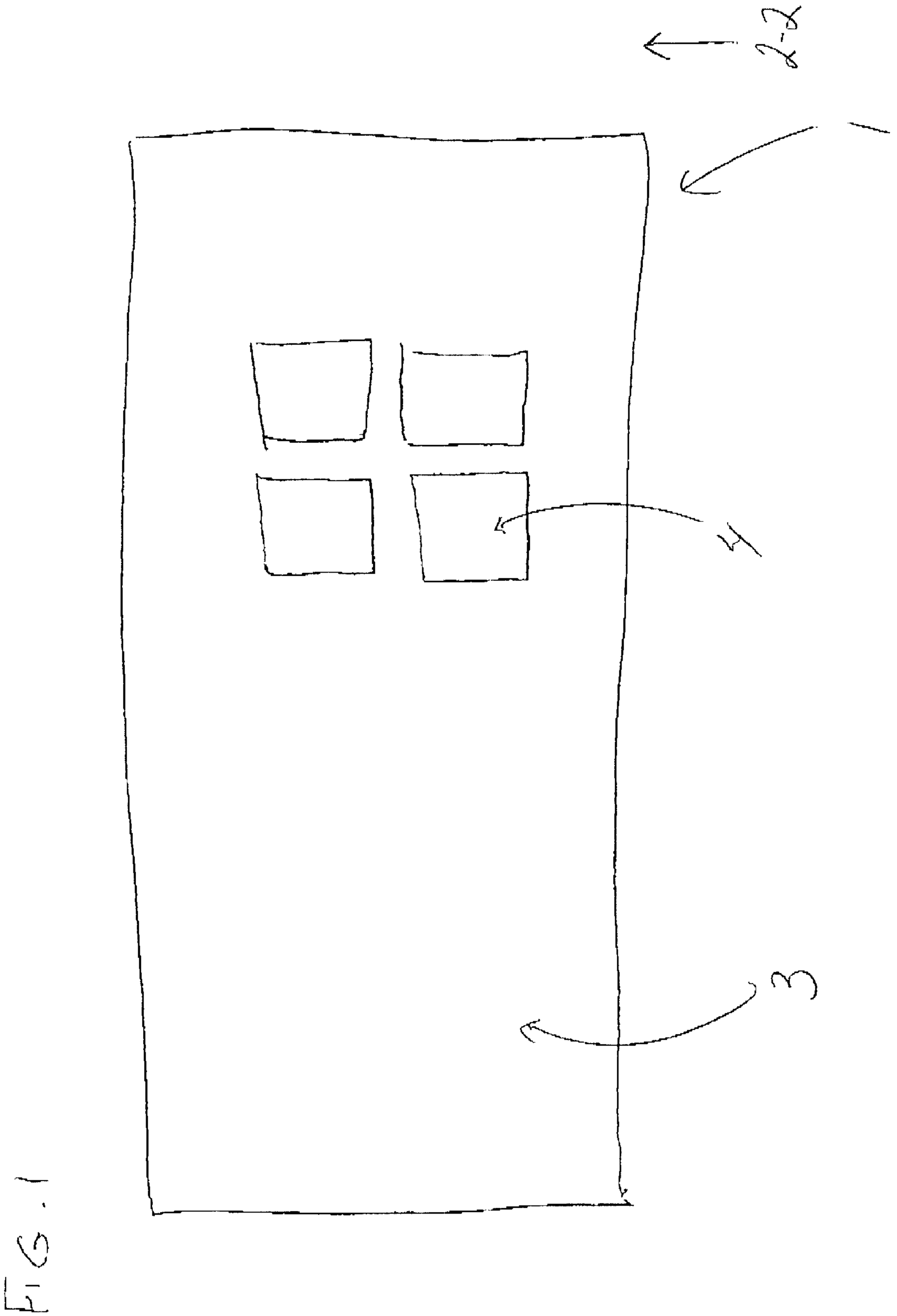
Conventional rigs could be retrofit for use in this invention, or a customized apparatus could be designed.

Also disclosed herein and a portion of the present invention is the method of moving a rig or drilling apparatus between adjacent drilling locations by providing a planar surface upon which the rig or structure can rest, with a plurality of drilling location apertures extending their through. The method to further comprises moving the rig or structure between adjacent drilling locations by a horizontal movement of the structure across the surface of the pad to the new desired drilling location, at which point the tools of the rig or structure can be extended through the new drilling location aperture to access the ground below.

The method of moving a rig between adjacent drilling locations using the equipment of the present invention is also contemplated within the scope hereof.

Thus it can be seen that the invention accomplishes all of its stated objectives. The foregoing is considered as

illustrative only of the principles of the invention. Furthermore, since numerous changes in modifications will be obvious to those skilled in the art, it is not desired to limit the invention to the exact construction operation showman described, and accordingly all suitable changes in modifications and structure operation which may be resorted to are intended to fall within the scope of the claimed invention.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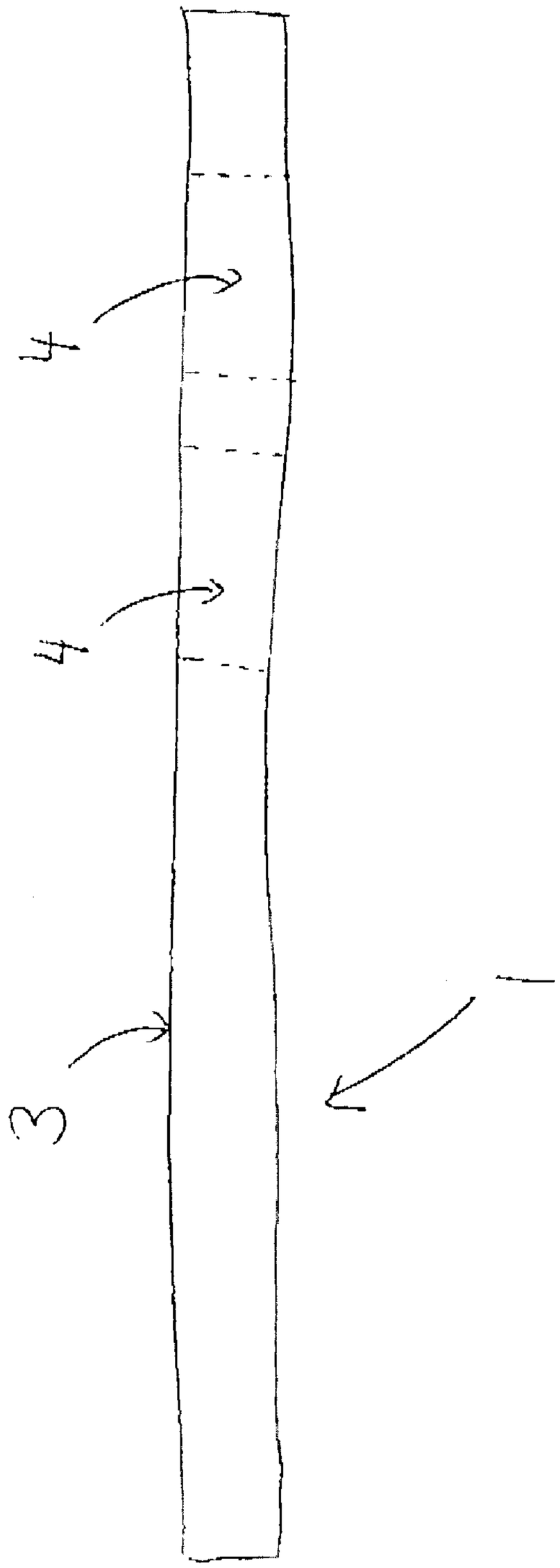
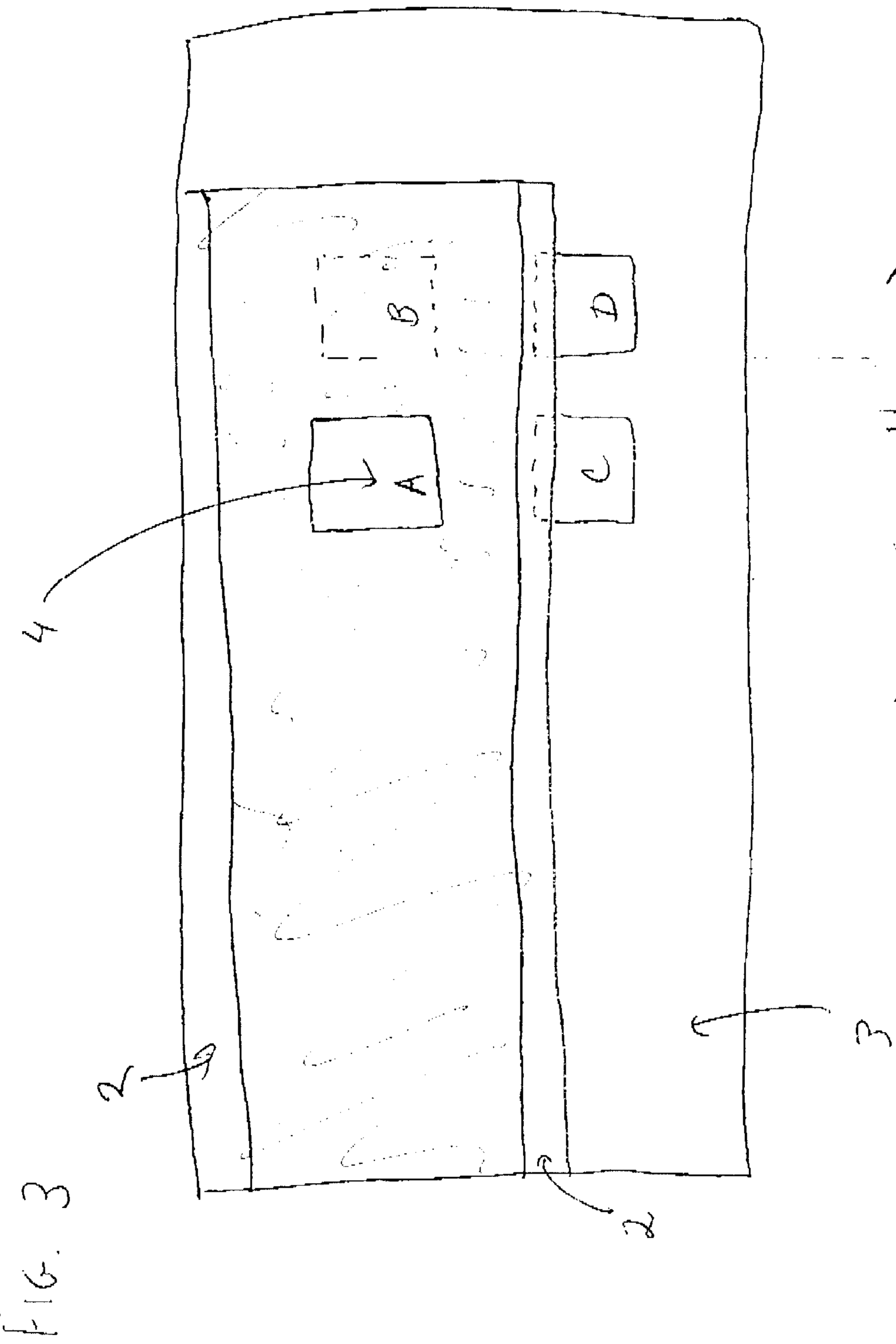


FIG. 2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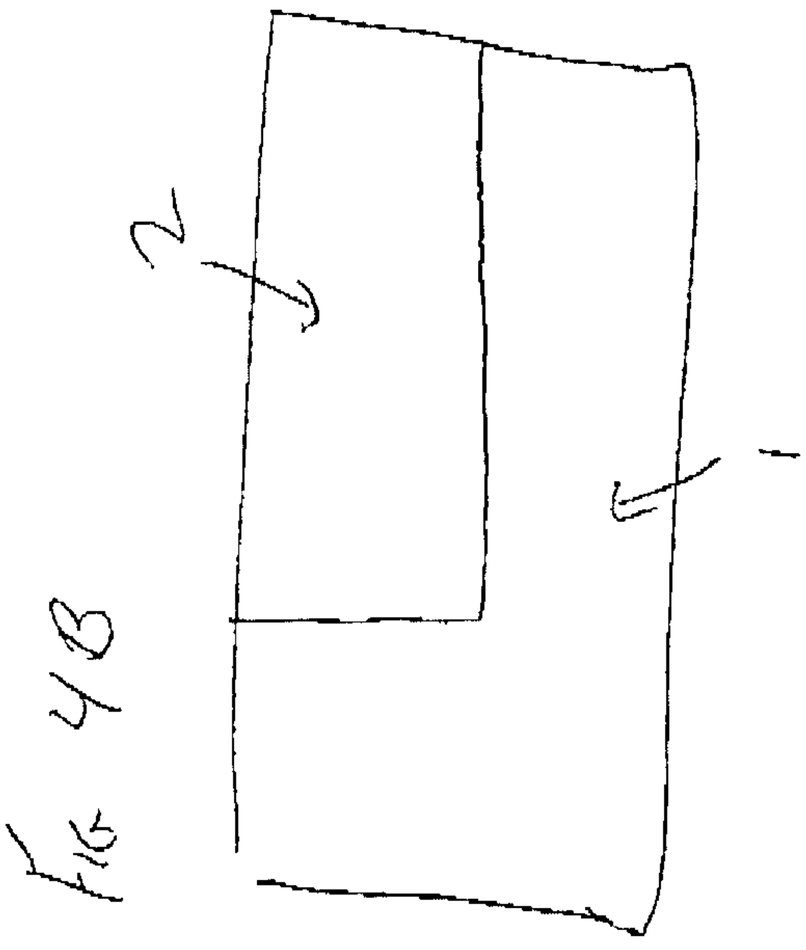


FIG 4B

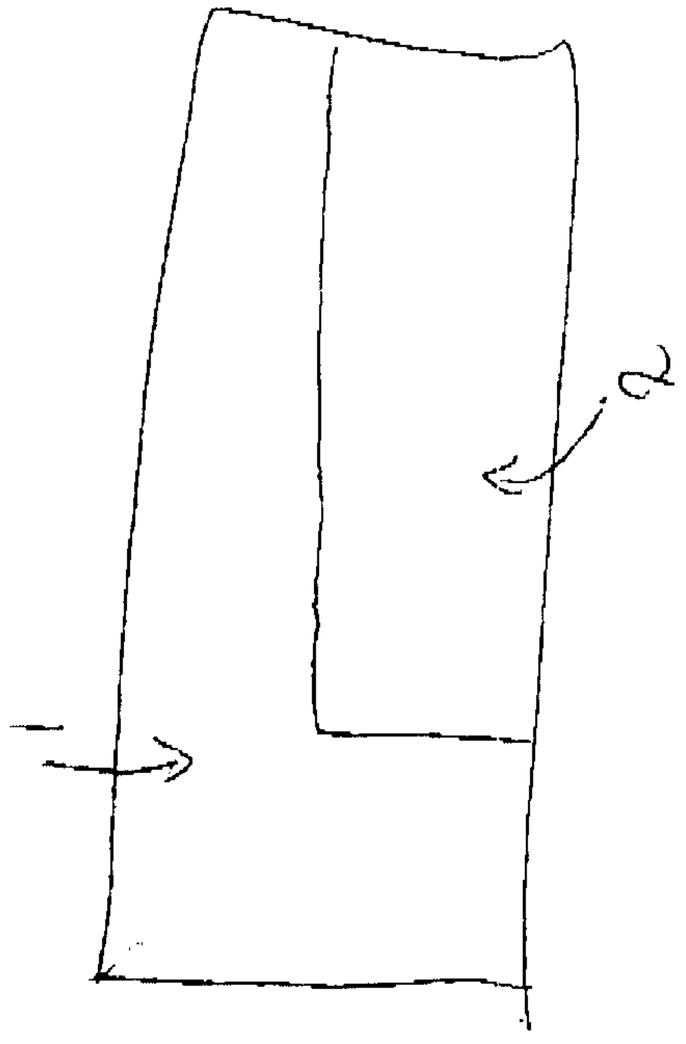


FIG 4D

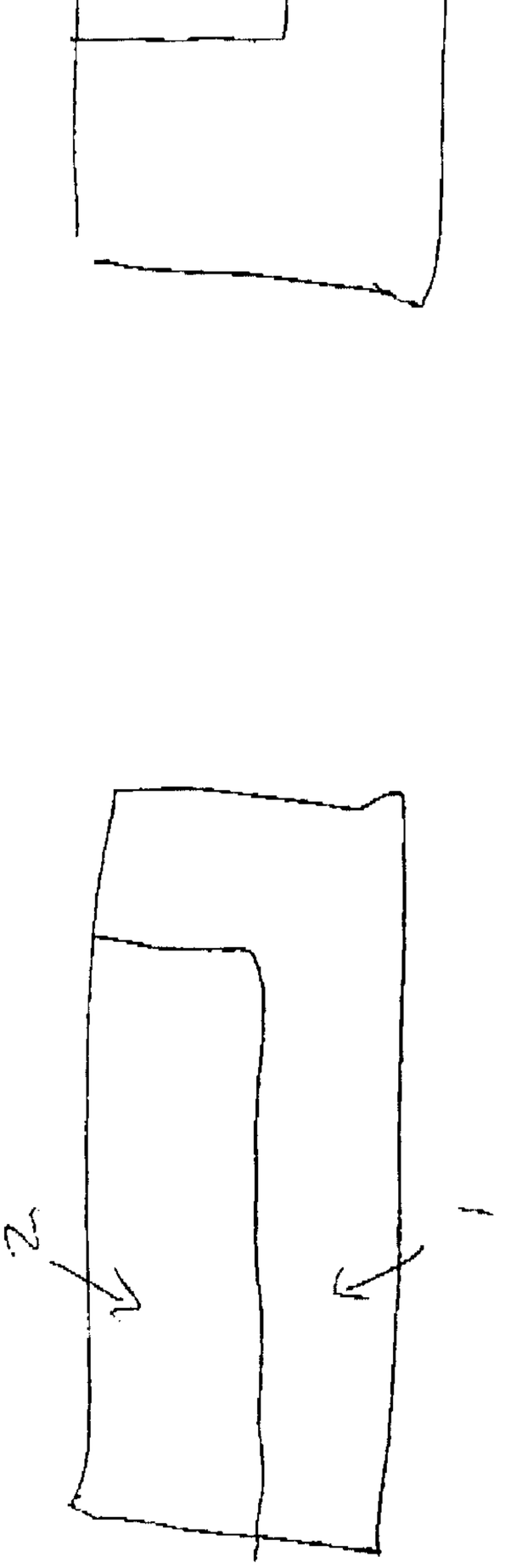


FIG 4A

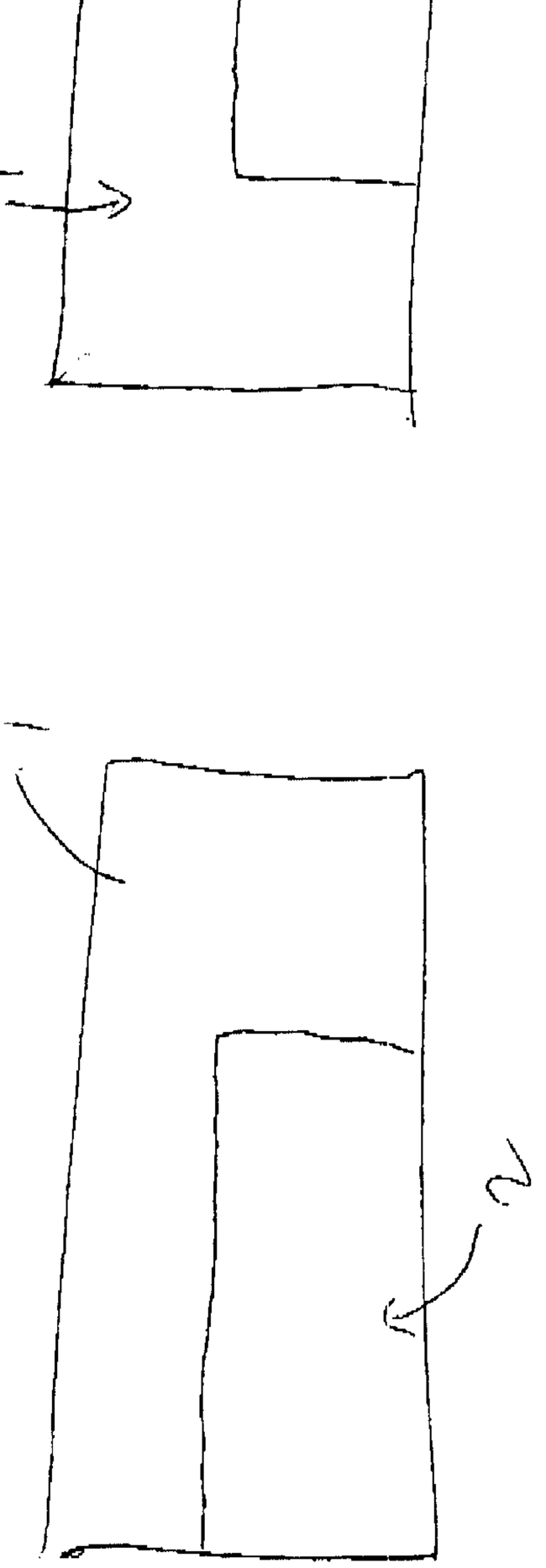


FIG 4C

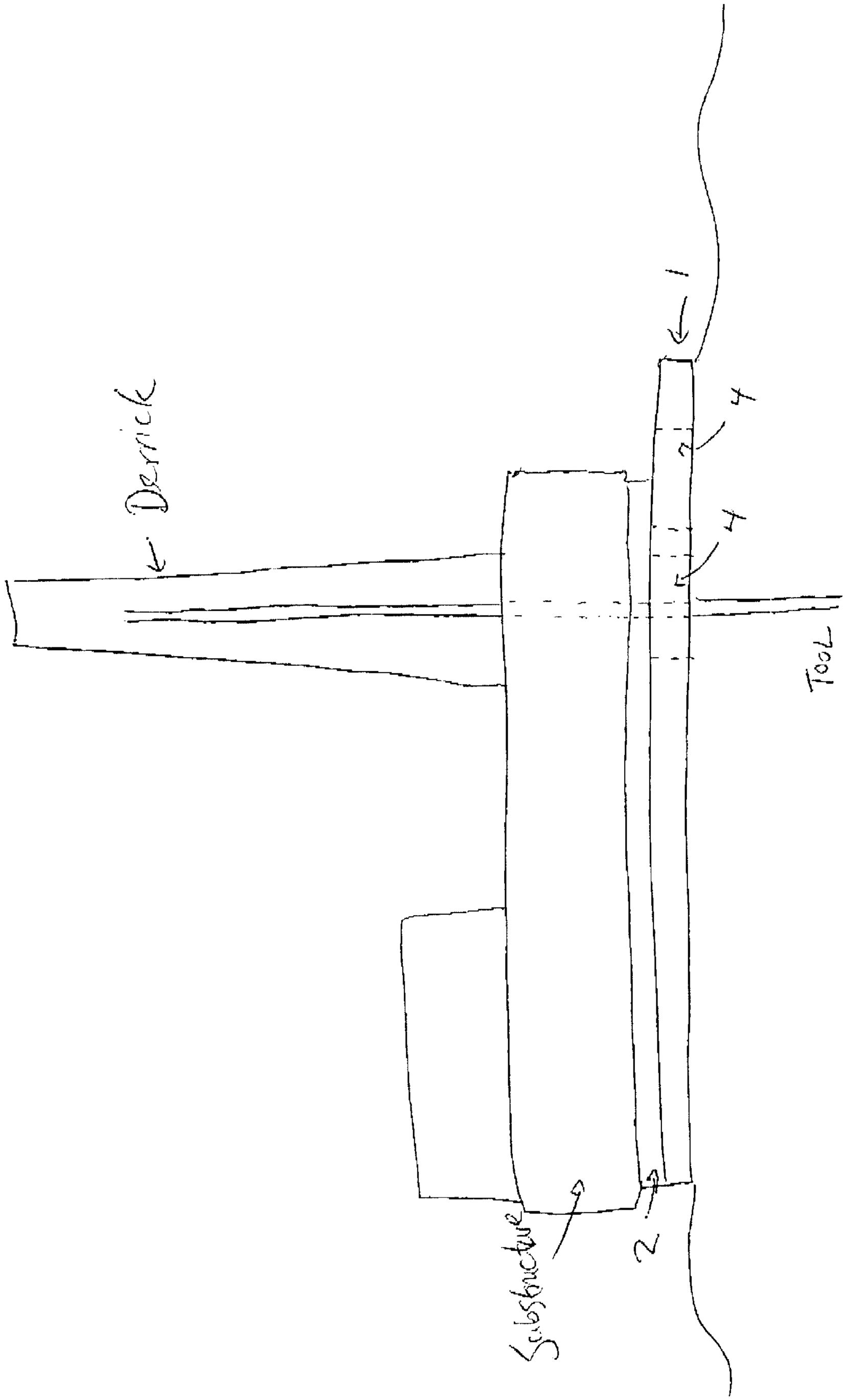


FIG. 5

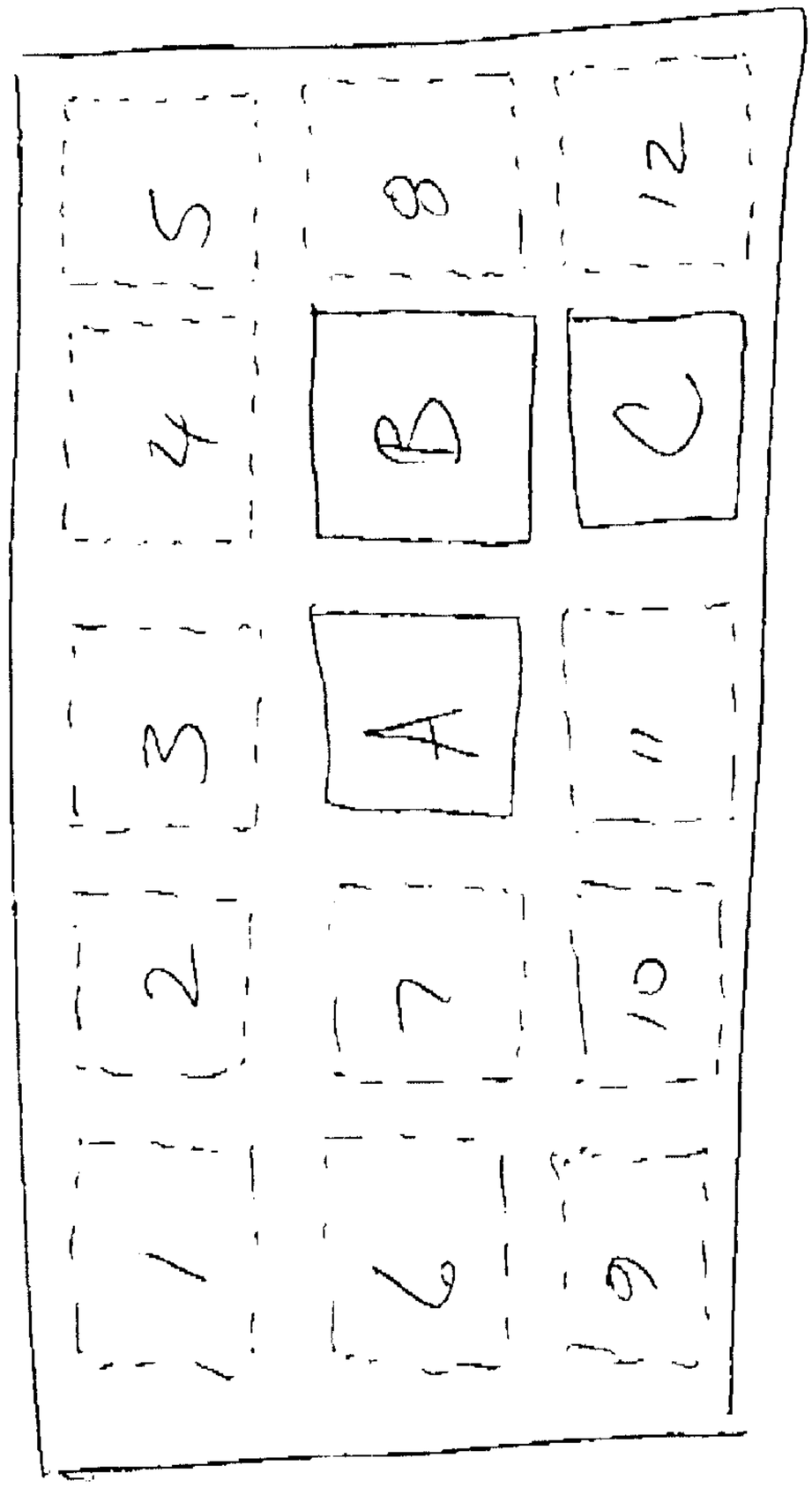
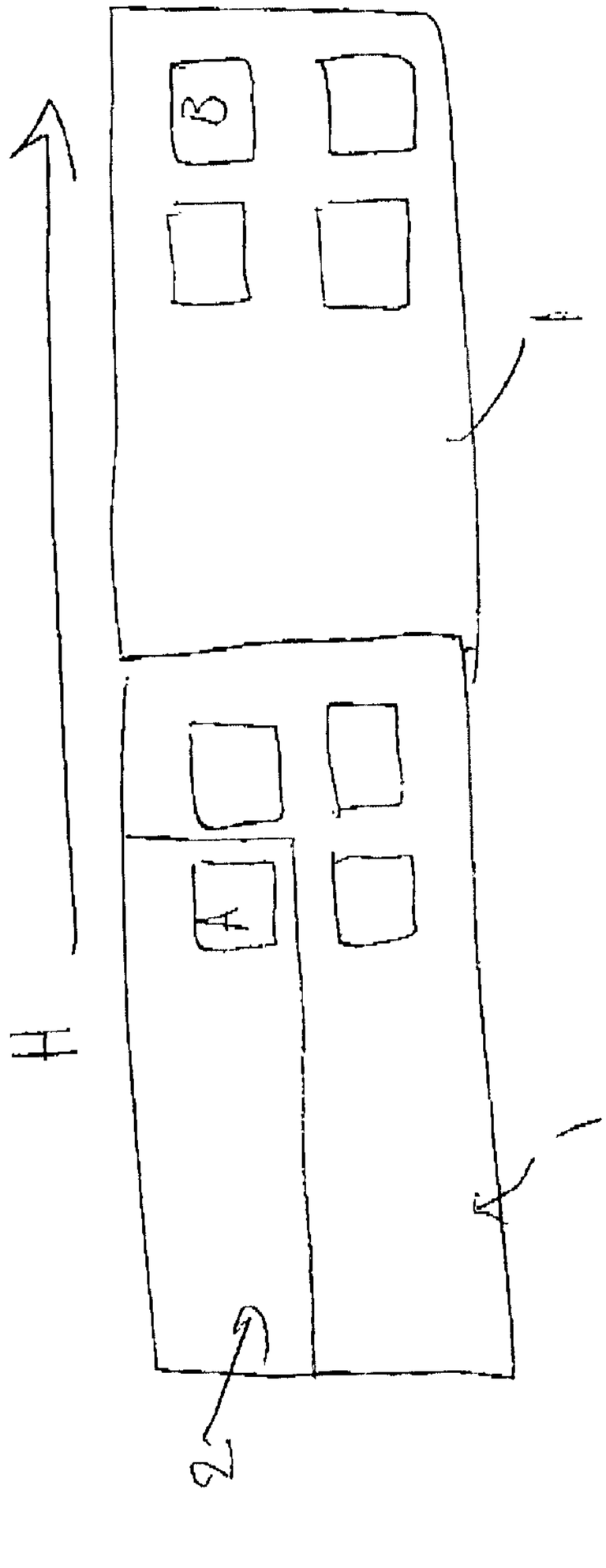


Fig. 6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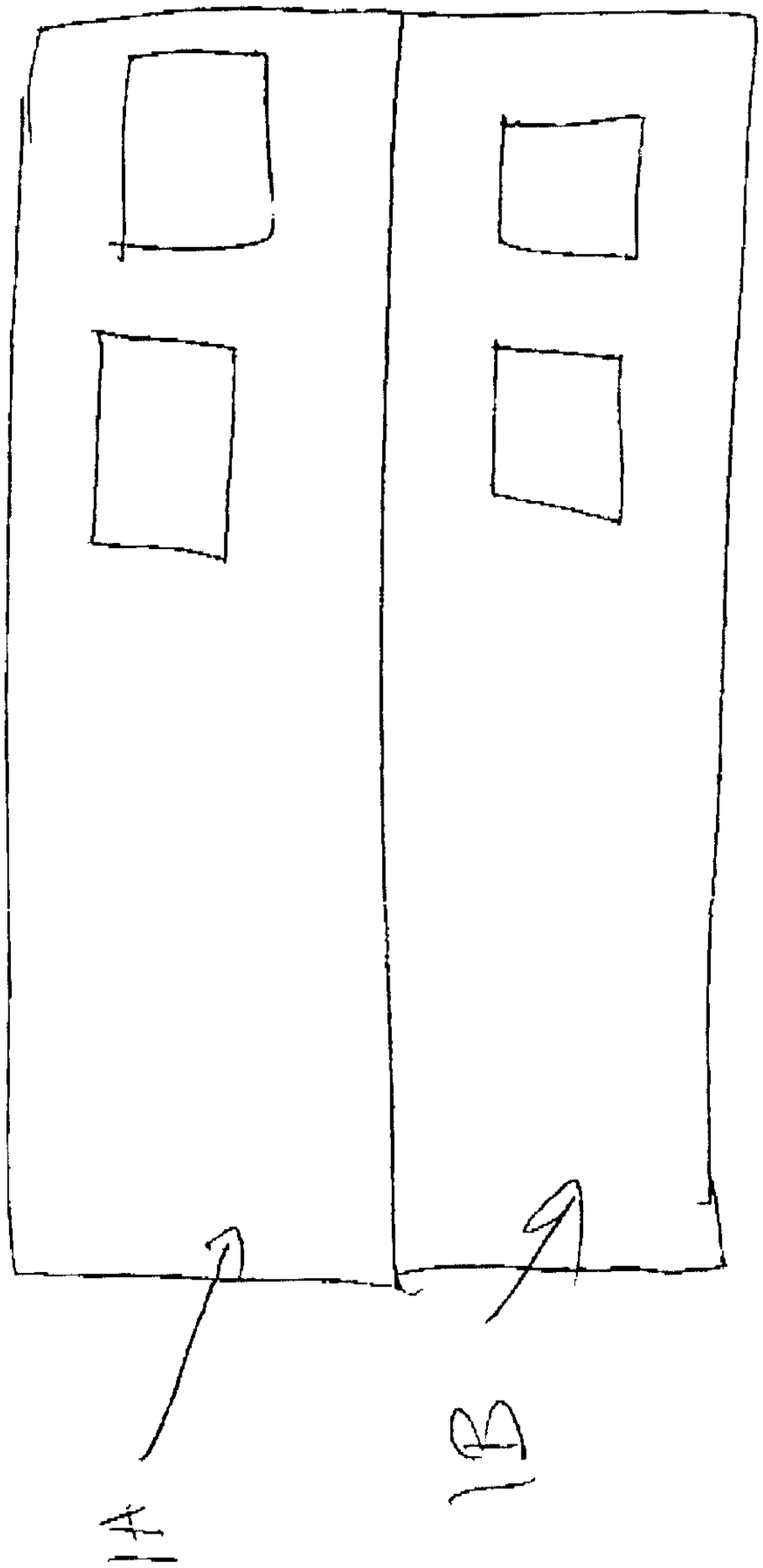


FIG. 5

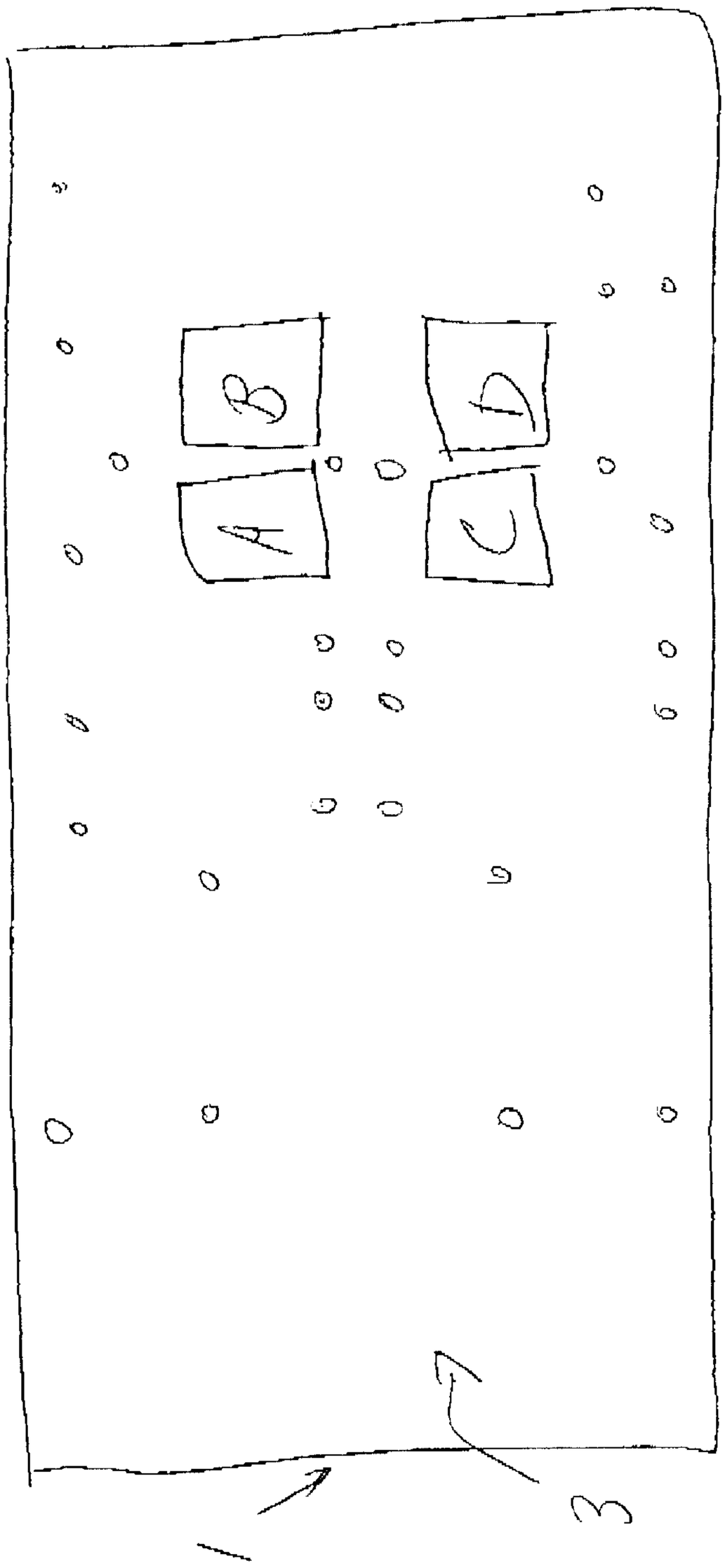
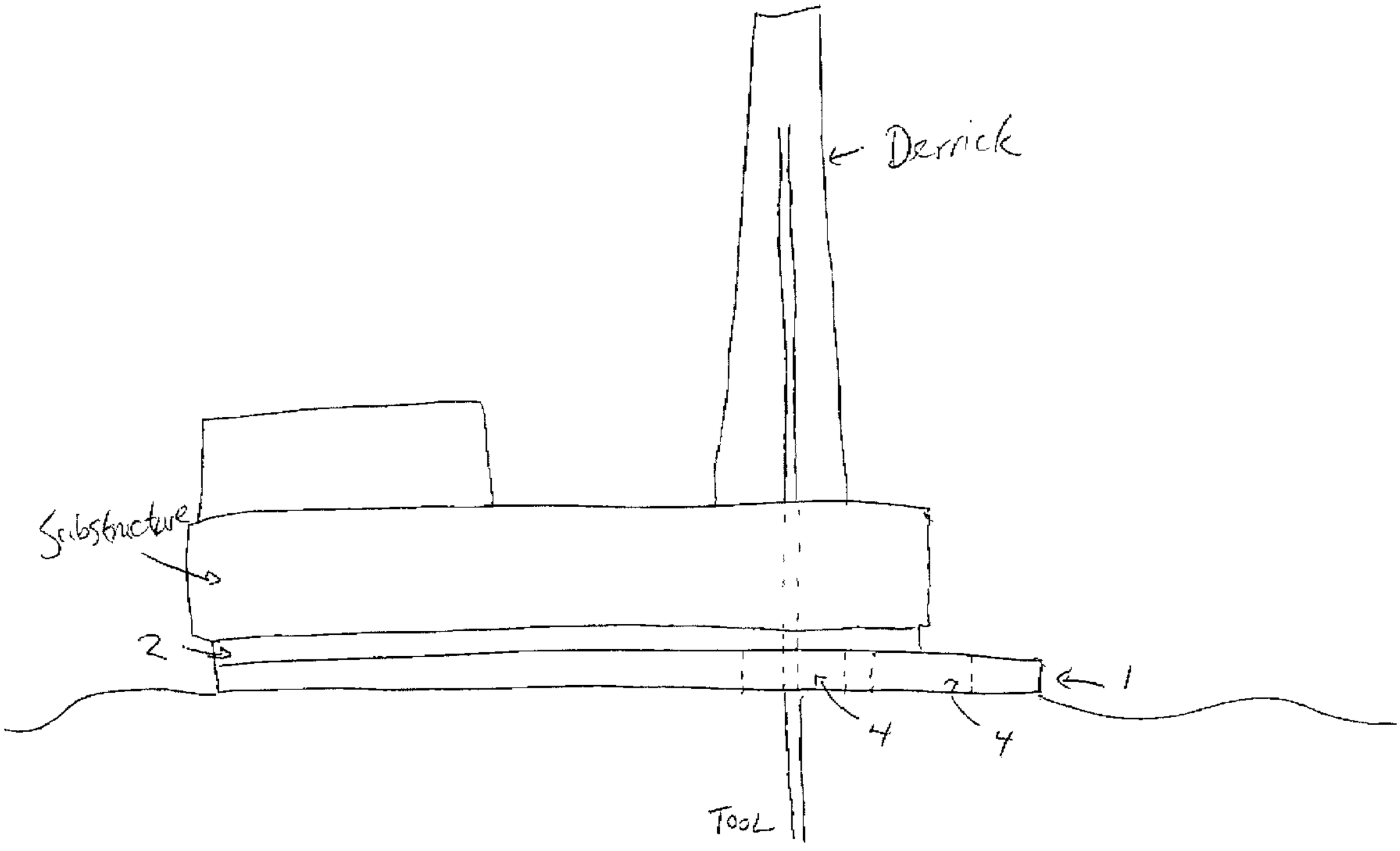


FIG. 10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