May 27, 1924. 1,495,576

A. C. CREHORE

PUZZLE

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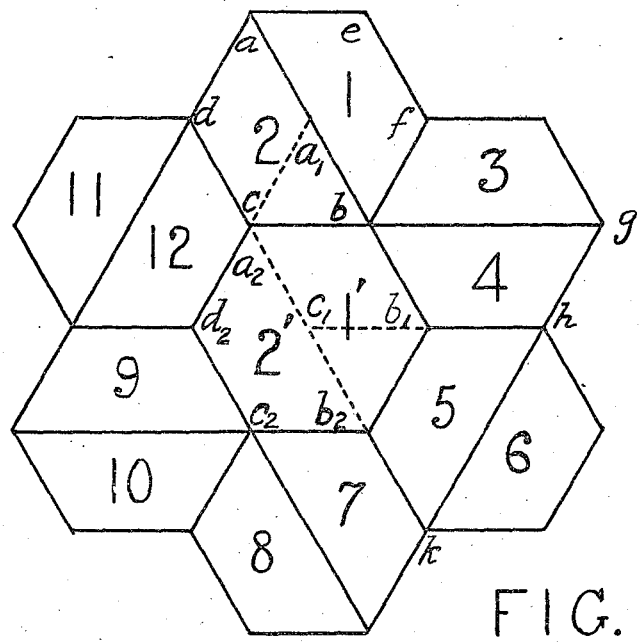

FIG. 1

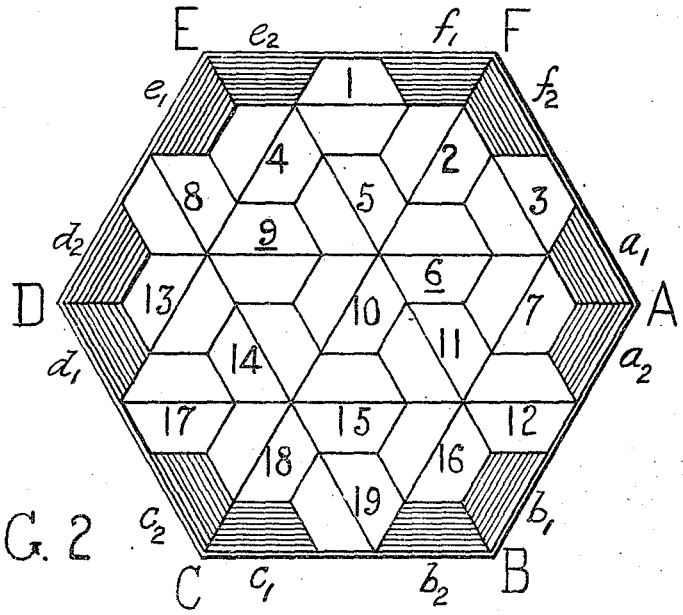

FIG. 2

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UNITED STATES PATENT OFFICE.

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PUZZLE.

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To all whom it may concern:

Be it known that I, ALBERT C. CREHORE, a citizen of the United States, and a resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new Puzzle, of which the following is a specification.

The object of the invention is to afford instruction, entertainment or amusement. The puzzle may be likened to a game of solitaire.

To illustrate the puzzle and state the rules to be followed and material to be employed reference will be made to one specific example of it, though many obvious variations from this one form are possible without departing from the fundamental principles of this invention as set forth in the claims. A reference to the well known sixteen-block puzzle will assist in explaining the new one. In that puzzle a shallow square box is filled with sixteen square blocks numbered from one to sixteen, all being laid in one layer on the plane surface of the bottom of the box, the sixteen blocks almost exactly filling it and forming a square with four blocks on each side. One of these blocks is then removed from the box, say number sixteen, thus making it possible to slide one of the adjacent blocks either in a vertical column or in a horizontal row along the smooth surface of the bottom of the box into the place left vacant by the absence of block number sixteen. In this manner by a succession of moves sliding different adjacent blocks into the one always vacant square the original order of arrangement of the blocks may be completely changed. The puzzle is to arrange the blocks according to any predetermined order or sequence after placing the blocks in the box at random, and to do so by executing successive moves as described, moving but one block at a time into the one vacant square without lifting any block from contact with the bottom of the box.

Such a puzzle or problem may evidently be worked out on an ordinary checker board by providing fifteen numbered men and exercising some care not to disarrange the men by improper moves, or by jarring the board. The evident purpose of the box above mentioned is to prevent automatically any improper moves due to possible accidents. It appears at once to one using a checker board that a similar puzzle might be proposed by using a square of three, five, seven or eight on a side instead of a square of four on a side, or by using some other limitation of the indefinite board such as a rectangle instead of a square, or several rectangles combined. With the square of three, however, the problem has no solution generally, since by observing the rules any random order of the men cannot be converted into any predetermined order.

In the invention now to be described and claimed use is made of a hexagon board instead of one based upon the square referred to above. Just as is the case with a collection of square blocks, so a collection of hexagonal blocks can be laid adjacent to each other to cover a given area leaving no interstices or open spaces between blocks. When one hexagon block is removed from the midst of such a collection of hexagon blocks closely packed, none of the six blocks adjacent to this one can be slid into the space thus vacated without disturbing the other blocks. This is a new condition that does not apply to a formation using square blocks. To facilitate the transfer of other blocks into a vacant hexagonal space without raising any block off from the surface it is proposed to use split or half hexagon blocks intesad of complete hexagons, each hexagon to be divided by a diagonal through its center from point to point of the hexagon, this being the longest straight line that can be drawn within the hexagon.

In the accompanying drawings Figure 1 illustrates the hexagon board and the method by which one hexagon may be moved into an adjoining vacant hexagonal space by the use of split hexagon blocks.

Figure 2 shows one form of the puzzle, or game of solitaire based upon the hexagonal board.

In Figure 1 is shown a central hexagon, $cbb_1b_2c_2d_2$ with its center c_1 at the center of the whole figure. This is surrounded by six other equal hexagons, of which *aefbcd* is one, each divided into two halves as represented by a full diagonal line through its center. The dividing line for the hexagon *aefbcd* is the diagonal *ab*, and the half hexagon *aefb* representing one block is given the number 1. The other half of this hexagon, *abcd*, representing a separate block is given the number 2. Each of the

other five hexagons surrounding the central one is similarly divided by one full diagonal line, thus representing the half hexagon blocks numbered 3, 4; 5, 6; 7, 8; 9, 10 and 11, 12 in pairs.

The group of seven hexagons shown in Figure 1 is typical of and may represent a portion of an indefinite hexagon board. Surrounding these there may be any number of other equal hexagons with which we are not now concerned, except that, when they represent blocks closely packed in a box, they serve the purpose of holding each block firmly in its place. Let it now be supposed that the central hexagon $cbb_1b_2c_2d_2$ of Figure 1 is a vacant space not occupied by blocks, while all other spaces upon the board are filled with blocks. It is evident that none of the six blocks adjacent to this vacant space could be slid into the vacant space without moving any of the other blocks or rasing any from the surface, provided these blocks where complete undivided hexagons. And it is also evident that, if such hexagon blocks are divided by diagonal lines into split hexagon blocks as shown in Figure 1, some of them may be slid into the central vacant hexagonal space immediately in one move or operation, while others cannot be thus immediately moved but require a succession of moves. A block which may be thus immediately moved is the half hexagon *abcd* designated by the number 2. This may be slid first so that the point a moves to a_1, b to b_1 and c to c_1, the new boundaries of this block being indicated in the figure by dotted lines. It may be slid second so that the point a_1 moves to a_2, b_1 to b_2 and c_1 to c_2, which locates the final position of block 2, designated by 2′ in its new position, namely $a_2b_2c_2d_2$ filling half of the central hexagon originally vacant.

In a similar manner it is evident that the half hexagon block *aefb* numbered 1 may be slid into the position 1′ thus filling the rest of the central hexagonal space and completely vacating the space *aefbcd* at first occupied by the blocks 1 and 2. In like manner it is evident that the surrounding adjacent hexagons 3, 4; 7, 8; or 9. 10 might have been transferred by sliding into the vacant hexagonal space at the center, but that the blocks 5, 6 and 11, 12 could not have been thus directly transferred because of the way or the direction in which the diagonals of these hexagons lie. To effect an immediate transfer of a block the line of division or the diagonal of the hexagon must point towards or touch the vacant hexagonal space with one of its ends. There are but three possible relative directions that the line of division or the diagonals of the hexagons may take, and these are shown in Figure 1 by the blocks 1, 3 and 5, each having a different direction for its diagonal, *ab* for block 1, *bg* for 3 and *hk* for 5, making angles of 120° with each other. When the direction of the diagonal of a hexagon block is once assigned, it will keep this direction throughout the whole series of moves to be executed because there is no way to turn one of the blocks around through 120° without disturbing other blocks or lifting a block out of its place, which is not supposed to be allowed. In placing a collection of split hexagon blocks in a box designed to hold them the directions of the diagonal lines of division of the hexagons make a difference, and afford much flexibility in the design of any specific puzzle, for these directions may either be regarded or disregarded.

A preferred form of hexagon board consists of a central hexagon surrounded by six other adjacent hexagons, as described in Figure 1, and these again surrounded by twelve other adjacent hexagons as shown in Figure 2. A preferred way of arranging the diagonals of the split hexagons is also illustrated in Figure 2, each hexagon having but one diagonal line drawn across it as representing its line of division. The nineteen hexagon spaces thus required are filled with split hexagon blocks, which are numbered consecutively from one to nineteen, one number only being placed upon one half only of each split hexagon block, its other half being left blank.

The blocks may be held in their places by any suitable box whose interior boundary conforms to the outer boundary of the group of nineteen hexagons. A neat form of box is shown in Figure 2 in outline. Its outer boundary has the form of a hexagon five times the linear dimensions of the small hexagon blocks, and is shown at ABCDEF. In each of the six corners of this enclosing shallow hexagon box may be glued or otherwise fixed two split hexagon blocks of the same size as all the other blocks, shown by the hatched areas at a_1a_2; b_1b_2; c_1c_2; d_1d_2; e_1e_2 and f_1f_2, these blocks thus forming a part of the box or container which fit the contour of the group of nineteen hexagons shown. Any suitable cover may be provided for the box which completely covers all of the blocks so that they will remain in their places when the box is transported as in mailing, for example.

It is to be noticed that all the numbers are placed upon the blocks in Figure 2 so that they are right side up when EF is taken as the top of the box and BC the bottom of it. This placing of numbers or characters in fixed positions on each block makes it possible to be sure that the diagonal lines of division of each hexagon have the directions assigned to them in Figure 2, for when the numbers are seen right side up the directions of their diagonals also correspond with their directions as drawn in

Figure 2. To assist in distinguishing the blocks numbered 6 and 9, which figures resemble each other when one of them is inverted a dash is placed underneath each of these figures.

To operate the puzzle empty all the blocks out of the box and place them face downwards upon a table or other suitable surface. The cover of the box may be used for this purpose conveniently. Pick them up at random and place with the numbers right side up in the box, always matching a blank half hexagon with a numbered half to form a complete hexagon, to which only one number is assigned. In this manner the whole box may be filled with the blocks with every number right side up, but the order of the numbers taken at random will differ from the regular sequence shown in Figure 2. Then remove from the box one complete hexagon, say number nineteen, and by moving one block at a time into the space thus made vacant, and another block into the space left vacant by the first move proceed to arrange all of the blocks in the exact order shown in Figure 2 without lifting any block off from the bottom of the box.

What I claim as my invention is:

1. The herein described block puzzle employing blocks having the shape of half a regular hexagon the said hexagon blocks having been divided by a diagonal line from point to opposite point, arranged in close proximity to each other so as to cover the surface of a suitable container and to form hexagons leaving no appreciable interstices between the blocks, with the single exception that one complete hexagonal space is to be left vacant, into which space some one of the adjacent blocks may be moved along the surface of the container without disturbing the positions of the other blocks, as and for the purpose described.

2. The herein described puzzle employing blocks having the shape of half a regular hexagon the said hexagon blocks having been divided by a diagonal line from point to opposite point, arranged in close proximity to each other so as to cover the surface of a suitable container and to form hexagons leaving no appreciable interstices between the blocks with the single exception that one complete hexagon space is to be left vacant, the directions of the diagonals or longest sides of the split hexagon blocks being fixed in accordance with any predetermined scheme, as and for the purpose described.

3. The herein described puzzle employing split hexagon blocks, the line of division of the hexagon being a diagonal line from point to opposite point, to form a compact group of hexagons covering the surface of a suitable container without interstices between the blocks except that one complete hexagon space is to be left vacant when operating the puzzle, each hexagon space being assigned a number or character, there being as many numbered blocks less one as there are hexagon spaces in the container, as and for the purpose described.

4. The herein described puzzle employing split hexagon blocks arranged in hexagons in compact form so as to cover the flat bottom surface of a suitable container, but half of the blocks being given a number or character, each hexagon space in the container except one being filled by two half hexagon blocks, the one having a number or character and the other being left blank, as and for the purpose described.

ALBERT CUSHING CREHORE.