March 20, 1973 C. J. YOUNG 3,721,446

INTERLOCKING PUZZLE

Filed March 24, 1971 2 Sheets-Sheet 1

Fig. 1.

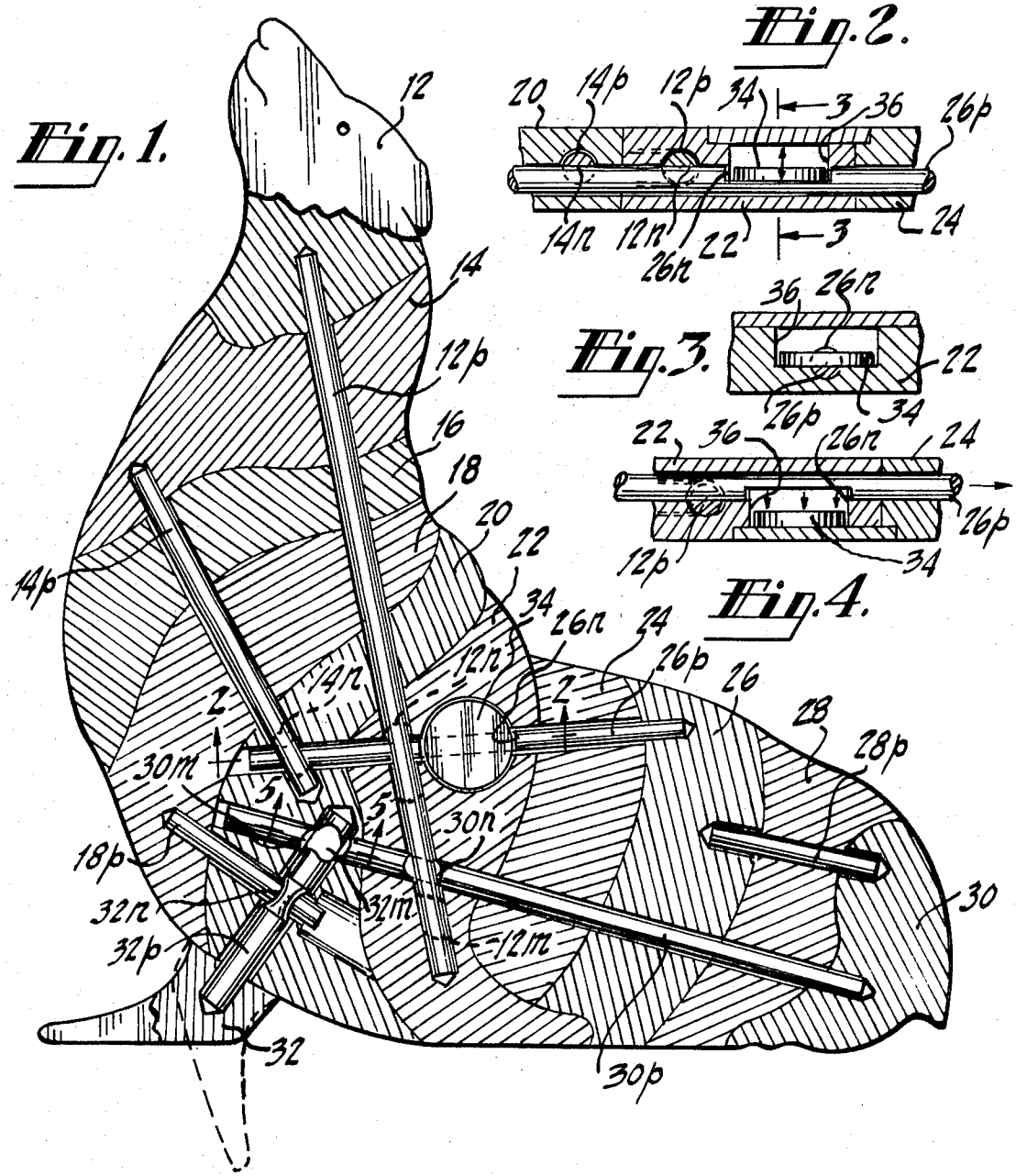
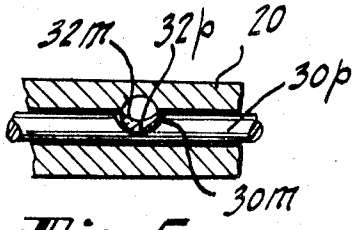


Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.



INVENTOR.
CHARLES J. YOUNG

AGENT

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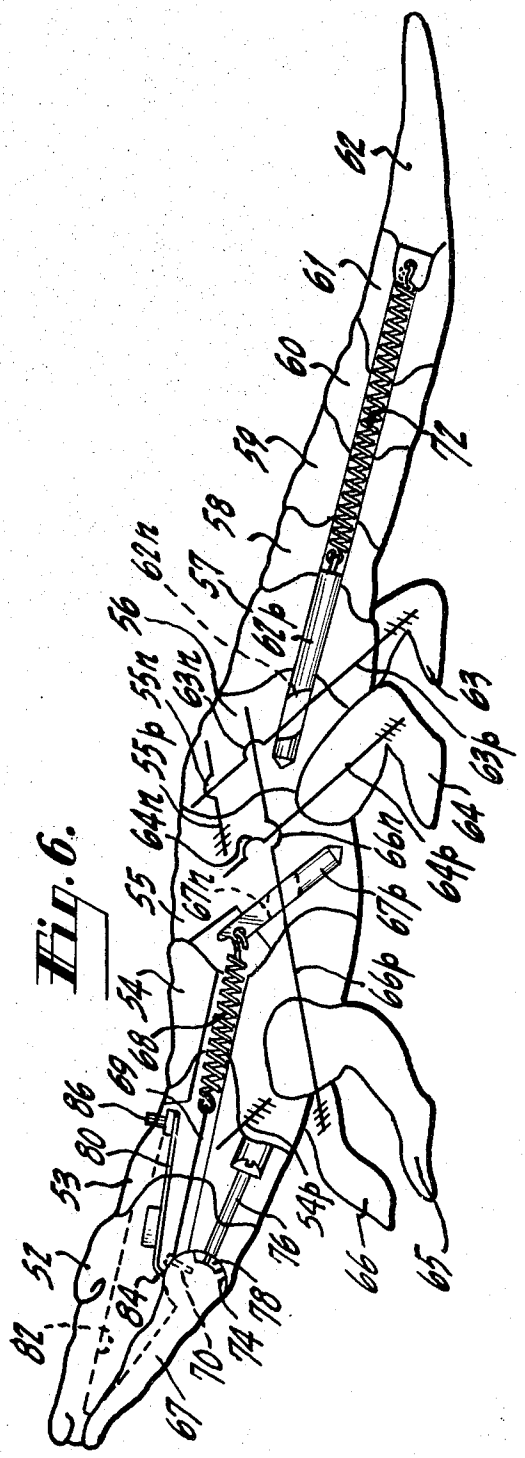


Fig. 6.

INVENTOR.
CHARLES J. YOUNG
Joel D. Johnson
AGENT

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INTERLOCKING PUZZLE

Charles J. Young, 78 Stockton St.,
Princeton, N.J. 08540

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ABSTRACT OF THE DISCLOSURE

A puzzle formed of a plurality of interfitting pieces which are interlocked with pins. The pins are attached to corresponding puzzle pieces. Each of the pins have portions formed with a notch. The pins extend through holes in one or more of the adjacent interfitting pieces and locking means, such as other pins extend through the notches to lock together the pins and the pieces to which they are attached. The puzzle can be unlocked by the removal of the pieces in a definite sequence.

This invention is directed to a puzzle comprising a plurality of interfitting pieces which are interlocked together with pins. In the puzzle a pin is attached at one end to one of the interfitting pieces. The pin has a portion formed with a notch which extends through a hole in a second one of the interfitting pieces. Locking means positioned within the second piece of the puzzle fits within the notch to lock the pin and prevent its removal from the second puzzle piece.

The means, locking the puzzle pieces together, takes several forms. One means comprises a second pin fixed at one end to a third one of the puzzle pieces and extending through a second hole in the second puzzle piece. The second pin intersects the first pin within the notch and thus prevents removal of the first pin. The locking portion of the second pin can be removed from the notch by a withdrawal of the second pin from the notch by either a longitudinal or rotational movement of the second pin, or by a combination of these movements. Another locking device for the first pin is a weighted piece, which is positioned by gravity within the notch and can be removed by turning the puzzle over.

FIG. 1 is a plan view, partially in section of a puzzle in accordance to several embodiments of the invention.

FIGS. 2–5 are partial sectional views taken on corresponding section lines **1—1**, **2—2**, **3—3**, and **5—5** of FIG. 1.

FIG. 6 is a plan view, partially in section of another puzzle, in accordance with other embodiments of the invention.

FIG. 1 schematically discloses a puzzle having several embodiments of the invention. The puzzle, having an outline of a seal, comprises a plurality of interfitting pieces identified by even reference numbers **12** through **32**. The interfitting pieces are locked together by a plurality of pins **12***p*, **14***p*, **18***p*, **26***p*, **28***p*, **30***p*, and **32***p*. In accordance with a feature of the invention, most of the pins in turn are locked and cannot readily be removed until the locking means are removed.

Pin **12***p* is fixed at one end in puzzle piece **12** and slidably extends through aligned holes in pieces **14**, **16**, **18**, **20** and **22**. In a similar manner pin **14***p* is fixed at one end to piece **14** and slidably extends through other aligned holes in puzzle pieces **16**, **18** and **20**. Another pin **26***p* is fixed at one end to piece **26** and extends successively through aligned holes in pieces **24**, **22** and **20**. Pin **26***p* intersects pins **12***p* and **14***p* in respective notches. **12***n* and **14***n*. As viewed in FIG. 2, pin **26***p* is offset below the axes of pins **12***p* and **14***p*, which are substantially in a common plane.

Notch **14***n* of pin **14***p* fits around and over the end of pin **26***p* only sufficiently loose to permit withdrawal of pin **26** from the notch **14**n. Otherwise the fit of notch **14***n* around pin **26** snugly locks pin **14***p* to pin **26***p*, and thus locks pieces **14**, **16**, **18** and **20** together. Notch **12***n* is elongated, as indicated in FIG. 1 which permits only partial withdrawal of pin **12***p* from piece **22** while pin **26***p* remains within the notch **12***n*. The presence of pin **26***p* within notch **12***n* locks pin **12***p* within piece **22**, except for the limited withdrawal movement.

Pin **26***p* in turn is locked in its position, shown in FIGS. 1, 2 and 3 by a weighted metal piece in the shape of a disc **34** positioned in a recess **36** formed in piece **22** and within a notch **26***n* in pin **26***p*. FIG. 1 indicates the greater width of disc **34** than the diameter of the hole in piece **22**, through which pin **26***p* extends. FIGS. 2 and 3 disclose the locking position of disc **34**, which prevents the withdrawal of pin **26***p* from puzzle piece **22**. When the puzzle is turned over and as illustrated in FIG. 4, gravity causes the disc **34** to fall out of the notch **26***m* into the recess **36** to thus release pin **26***p* for withdrawal from piece **22**.

Pin **30***p* is fixed at one end within puzzle piece **30** and extends successively through aligned holes respectively formed in pieces **28**, **26**, **24**, **22** and **20**. Pin **30***p* is offset from and extends below pin **12***p*, as viewed in FIG. 1. Pin **30***n* forms an intersection with pin **12***p*. A notch **30***n* is formed in pin **30***p* at this intersection with pin **12***p* and fits around pin **12***p*, whereby pin **30***p* is is locked against withdrawal. Removal of pin **12***p* from notch **30***n*, as described below, unlocks pin **30***p* at this intersection with pin **12***p*.

Pin **32***p* is fixed at one end to piece **32** and movably extends through a hole in piece **20** above pin **30***p*, as viewed in FIG. 1, to an intersection with pin **30***p*. A second notch **30***m* is formed in a pin **30***p* at this intersection with pin **32***p* (FIG. 5). Pin **32***p* has a portion positioned within slot **30***m* (FIG. 5), which locks pin **30***p* within piece **20** and prevents its withdrawal. Pin **32***p* has a notch **32***m* formed in its upper surface as seen in FIGS. 1 and 5. This notch **32***m* is part of a cylindrical surface formed with its axis at an angle with the axis of pin **32***p*, which is the supplement of the angle that the axes of pins **30***p* and **32***p* make with each other. Thus, when pins **32***p* is rotated 180° from its position, as viewed in FIGS. 1 and 5, notch **32***m* is aligned with pin **30***p* and pin **30***p* can be withdrawn from piece **20**, when it is unlocked by pin **12***p*.

Pin **18***p* is fixed at one end to piece **18** and extends through a hole in piece **20** and below pin **32***p* into an intersection with pin **32***p*, as viewed in FIG. 1. At this intersection, an annular notch **32***n* is formed in pin **32***p*. Extension of pin **18***p* into notch **32***n* locks pin **32***p* in piece **20** until pin **18***p* is removed from the notch to permit withdrawal of the pin **32***p*. Notch **32***n* is annular to permit the 180° rotation of pin **32***p* to unlock pin **30***p*.

Pin **28***p* is fixed in its central portion in piece **28** and its two ends extend movably through aligned holes respectively in pieces **26** and **30**. This pin **28***p* serves to hold the three pieces **30**, **28** and **26** together and prevents the rotation of pieces **28** and **30** about pin **30***p*.

An inspection of FIG. 1 indicates that each one of the interlocking pieces of the puzzle, except for piece **12**, has at least two pins fixed to or passing through the piece. This arrangement prevents the pieces from pivoting relative to each other around one of the pins and retains all the pieces fixed relative to each other, except for a sliding movement along one or more pins. Furthermore, two or more pins extending into or through most of the pieces, except for pieces **12**, **28** and **30**, are not parallel with each other, so that no piece can be slid away from

an adjacent piece unless one or more of the pins is removed from the piece. Also, except for pins **28***p* and **18***p*, each of the other pins is locked at one or more intersections by another pin.

To take apart the puzzle of FIG. 1, the following procedure may be followed. Piece **32** is rotated 180° to remove the locking portion of pin **32***p* from the notch **30***m* and unlock pin **30***p* at this intersection. Pin **12***p* is partially withdrawn by moving piece **12** outwardly along the axis of pin **12***p*. This movement, as permitted by the elongated notch **12***n*, is only sufficient to place a notch **12***m*, formed in pin **12***p*, at the intersection of pins **12***p* and **30***p* and to permit **30***p* to now be withdrawn by sliding piece **30** away from piece **28**. Removal of pin **30***p* and piece **30** frees piece **28**, which can be removed. To unlock pin **26***p*, the puzzle is turned upside down and locking disc **34** falls into the recess **36** in piece **22**. In this position of the puzzle, pin **26***p* is freed and the piece **26** is slid away from piece **24** until pin **26***p* is fully withdrawn. This unlocks pins **12***p* and **14***p*. Piece **12** can then be removed and pin **12***p* is withdrawn from pieces **14**, **16**, **18**, **20** and **22**. With the removal of pins **30***p*, **26***p*, and **12***p* from piece **22**, it falls away. Piece **14** can now be removed as pin **14***p* is free to be withdrawn by the removal of piece **12**. Piece **16** falls away and permits the withdrawal of pin **18***p* and the removal of piece **18**. The withdrawal of pin **18***p* from notch **32***n* unlocks pin **32***p*, which was also previously unlocked by the withdrawal of pin **30***p*. Pin **32***p* can now be withdrawn and piece **32** separated from piece **20**. The puzzle is reassembled in the reverse order.

In accordance with a feature of the invention there is provided a three-pin system comprising a first pin locked to one of the interfitting puzzle pieces; a second locking pin for locking the first pin into the puzzle; and a third limiting pin which permits movement of the second pin to an unlocking position to release the first pin. However, the limiting pin limits the movement of the second pin to or beyond its unlocking position and prevents withdrawal of the locking pin from the puzzle.

One example of the three-pin system in FIG. 1 is illustrated by the three pins **30***p*, **12***p*, and **26***p*. The first pin **20***p* is locked to interfitting piece **22** by the second, locking pin **12***p* extending through notch **30***n*. As described, pin **30***p* is unlocked from piece **22** by withdrawing pin **12***p* until the unlocking notch **12***m* is positioned at the intersection of pins **12***p* and **30***p*. This unlocking movement of pin **12***p* is limited by the third pin **26***p* and the elongated notch **12***n*, which prevents withdrawal of the unlocking pin **12***p* from the puzzle. Another example of the three-pin system is illustrated in FIG. 1 by the three pins **30***p*, **32***p* and **18***p*. Pin **30***p* is locked in the interfitting piece **20** by the second, locking pin **32***p* extending through notch **30***m*. As described, pin **30***p* is unlocked from piece **20** by rotating pin **32***p* about its longitudinal axis until the unlocking notch **32***m* is positioned at the intersection of pins **30***p* and **32***p*. The pin **32***p* is limited to only a rotational movement by the third limiting pin **18***p*, which also prevents the withdrawal of pin **32** from the puzzle. The rotation of pin **32***p* moves the unlocking notch **32***m* through the unlocking position so that pin **30***p* is locked again unless notch **32***m* is aligned with pin **20***p*.

The two three-pin systems operate independently of each other, and only one of the systems is needed to lock pin **30***p* into the puzzle. The limiting pins require more skill to take the puzzle apart, as the locking pins **12***p* and **32***p* cannot be completely withdrawn to provide the unlocking of pin **30***p*, but must be moved to an exact position to unlock pin **30***p*. Any other position of pins **12***p* and **32***p*, to which they are limited by pins **26***p* and **18***p*, respectively, will retain pin **30***p* locked into the puzzle.

Several types of interlocks at the intersections of the pins are described, but are not limiting. Thus, it is within the scope of this invention to modify or utilize the locking means in other arrangements. For example, notch **32***m* could be angularly displaced a small amount from its unlocking position instead of its 180° angular displacement, as described. Thus, piece **32** need only be turned through the same angle to bring notch **32***m* into position to permit withdrawal of pin **30***p*. Annular notch **32***n* need only to extend around pin **32***p* a sufficient distance to permit pin **32***p* to be turned through this angle. Also, notch **12***m* could be angularly displaced about the axis of pin **12***p*, so that, to bring notch **12***m* into an unlocking position at the intersection with pin **30***p*, pin **12***p* needs both to be partially withdrawn to bring notch **12***m* to the intersection with pin **30***p* and then rotated about its axis to remove the locking portion of pin **12***p* from the intersection and free pin **30***p* for withdrawal. Alternatively, notch **12***m* could be formed at the intersection of pin **12***p* with pin **30***p* and only angularly displaced around the axis of pin **12***p*. Thus, pin **12***p* need only be rotated to free pin **30***p*. In this latter case, the interfitting surfaces of pieces **12** and **14** must be of a nature to permit such rotation.

As shown in FIG. 1, the free other end of pin **12***p* is within the notch **30***n* of pin **30***p* and prevents its withdrawal until notch **12***m* is positioned at the intersection of pin **12***p* and **30***p*. However, this end of pin **12***p* need only to extend within the notch **30***n* to lock pin **30***p*, and thus pin **12***p* need only be long enough that the partial withdrawal of pin **12***p*, allowed for by the elongated notch **12***n*, unolcks pin **30***p*. As described above, at the intersection of pins **12***p* and **30***p*, pin **12***p* locks pin **30***p*. Alternatively, notch **12***m* could be elongated to include this intersection of the pins and notch **30***n* could be eliminated, so that pin **30***p* locks pin **12***p* except for the partial withdrawal of pin **12***p*, permitted by the elongated notches **12***n* and **12***m*.

Although the outline configuration of the puzzle is a seal, any desired shape or configuration lends itself to the locking embodiments of the invention. Other configurations could be a map, a vase of flowers, or a type of modern art or sculpture. The pieces need not be planar, nor form a flat configuration when assembled, as they can be block-like, with a thickness near the other two dimensions. The configuration could be a statue of a human figure, for example. The parts and pieces of the puzzle also can be of any material, molded or shaped, or cast, as may lend itself to the design desired.

As shown, the puzzle is of an animal. The pieces are locked together so that the puzzle can be free standing or even hung from a support. The interfitting surfaces can be formed along natural lines of the figure, as shown. The interlocking surfaces may be formed along the stripes of a zebra or tiger, for example, giving a more natural appearance to the design.

The pins are shown as straight pins. It is also within the scope of the invention to use curved pins which can be removed by withdrawing the piece to which the curved pin is attached by an arcuate withdrawal movement.

FIG. 6 schematically shows a similar puzzle in the configuration of an alligator. The puzzle comprises flat interlocking pieces numbered consecutively from **52** through **67**. Pieces **67**, **52**, **53**, **54** and **55** are resiliently held together by a resilient assembly including a pin **67***p*, which is attached at one end to a coil spring **68**, the other end of which is connected by a flexible line **69** to a nail **70**, driven into piece **67**. As shown, the one end of spring **68** is pivotally hooked to the adjacent end of pin **67***p*. The flexible line **69** may be fire or a plastic fish line. The free end of line **69** is formed with a loop, which is removably passed over the head of nail **70** and held thereby.

Pin **67***p* slidably extends into a hole in puzzle piece **55** and is locked into this position by a pin **66***p*, which is schematically shown as a single line. Pin **66***p* is fixedly attached at one end to piece **66** and passes successively through aligned holes in pieces **65**, **54**, **55** and **56**. Pin **66***p* also passes through a notch **67***n* at its intersection with pin **67***p*. As viewed in FIG. 6, the axis of pin **66***p* is offset below the axis of pin **67***p*, and passes under pin **67***p*

through the notch 67*n* and locks pin 67*p* in piece 55. Spring 68 is tensioned between the locked pin 67*p* and line 69 and the assembly of line 69, tensioned spring 68 and locked pin 67*p*, resiliently holds puzzle pieces 67, 52, 53, 54 and 55 together.

Pin 66*p* also passes under pin 64*p*, which is also schematically shown as a solid line in FIG. 6. Pin 64*p* is fixedly attached at one end to piece 64 and slidably extends through an aligned hole in puzzle piece 55 and through a notch 66*n* in the upper surface of pin 66*p*, at the intersection of pin 64*p* with pin 66*p*. Notch 66*n* is indicated as a downwardly extending loop in FIG. 6. Pin 64*p* extending through notch 66*n*, locks pin 66*p* within piece 55 and prevents its removal from piece 55. Pin 64*p* has a notch 64*n* formed in its under surface, as indicated by the upwardly extending loop in FIG. 6. Notch 64*n* is formed between the intersection of pin 64*p* with pin 66*p* and the free end of pin 64*p*. The partial withdrawl of pin 64*p* positions notch 64*n* at the intersection of pins 64*p* and 66*p* and unlocks pin 66*p* from piece 55.

The free end of pin 66*p* extends slidably through an aligned hole in piece 56 and into an intersection with pin 63*p*, which is fixedly attached at one end, as indicated, to puzzle piece 63 and extends above pin 66*p* at their intersection, as viewed in FIG. 6. At this intersection, pin 63*p*, is formed in its under surface with a notch 63*n*, as indicated by the upwardly extending loop, through which pin 66*p* passes to lock pin 63*p* within piece 56. Pin 63*p* also passes through a notch 55*n* formed in the under surface of a pin 55*p*, as indicated by the upwardly extending loop, Pin 55*p* is fixedly attached at one end to piece 55 and slidably extends through an aligned hole in piece 56 into its intersection with pin 63*p*. Pin 63*p* thus locks pin 55*p* within the piece 56.

Puzzle pieces 56, 57, 58, 59, 60, 61 and 62 are also resiliently held together by a pin and spring arrangement, in which a pin 62*p* is attached through a coil spring 72 to the piece 62. As indicated in FIG. 6, one end of pin 62*p* is attached to one end of spring 72. The other end of spring 72 is pinned to piece 62. Pin 62*p* is locked within piece 56 by the pin 63*p*, schematically represented by a line. Pin 63*p* extends through a notch 62*n* in the upper surface of pin 62*p* at the intersection of pins 62*p* and 63*p*. The axes of pins 62*p* and 63*p* are offset from each other at the intersection of the pins, and pin 63*p* passes over pin 62*p*, as viewed in FIG. 6 and locks pin 62*p* within piece 56.

With pin 62*p* locked within piece 56, spring 72 is tensioned so that the interfitting pieces 56, 57, 58, 59, 60, 61 and 62 are resiliently held together. This permits the tail of the alligator to flex. Pin 54*p* is fixed attached as indicated, to piece 54 and extends into an aligned hole in piece 53 to hold pieces 53 and 54 together.

To take the puzzle apart, piece 64 is slid away from piece 55 only enough to move notch 64*n* into the intersection with pin 66*p*. This unlocks pin 66*p* from piece 55 and permits pin 66*p* to be fully withdrawn to unlock pins 63*p*, 64*p* and 67*p* at their intersections respectively with pin 66*p*. Partial withdrawal of pin 63*p* removes pin 63*p* from notch 55*n* and unlocks pin 55*p*. This also moves piece 63 from blocking piece 64 so that it can be withdrawn by pulling pin out of piece 55. The puzzle can then be separated by sliding pieces 55 and 56 apart along the pin 55*p*.

Because of the tension of spring 72, pin 63*p* is not readily withdrawn through notch 62*n*, because the resiliently loaded pin 62*p* binds pin 63*p* as notch 63*n* slides into the intersection with pin 62*p*. Pin 63*p* can readily be released by returning the pin 63*p* to its position shown in FIG. 6 and then binding pin 62*p* in position by forcing pieces 56 and 57 in opposite directions against pin 62*p*. This prevents pin 62*p* from slipping into notch 63*n* as pin 63*p* is withdrawn. Pin 63*p* can then be withdrawn to unlock pin 62*p* from piece 56. Pieces 57, 58, 59, 60, 61 and 62 can then be separated.

With the withdrawal of pin 66*p*, piece 65 can be withdrawn and pin 67*p* can be slipped out of piece 55. Pieces 54, 53, 52, and 67 can then be separated from the assembly of pin 67*p*, spring 68 and line 69.

A realistic touch to the alligator is the movable jaw piece 67. One end of the jaw piece 67 has a cylindrical hinge surface 74 fitting within a matching surface of piece 52. With the puzzle together, spring 68 acting through the line 69 on nail 70 holds jaw piece 67 resiliently against head piece 52. Jaw piece 67 can be manually pulled downwardly against the action of spring 68, viewed in FIG. 6, to open the alligator's mounth. Release of jaw piece 67 will allow it to snap back into a closed position. A threaded screw 76 extends from piece 53 through piece 52 and locks these pieces together. The end of screw 76 extends into a notch 78 in the cylindrical surface 74 of piece 67 and limits the opening movement of jaw piece 67 and keeps jaw piece 67 in plane with piece 52.

A weighted lever 80 is pivoted in piece 53 and has one end extending into the mouth cavity 82 of the head piece 52. As the jaw piece 67 is opened a bent down lock portion 84 of lever 80 rides down behind the head of nail 70 and holds the jaw piece open, when it is released. The other end of lever 80 pivots upwardly and moves an operating pin 86 into position above the surface of piece 53. Manual pressure on pin 86 rotates lever clockwise, as viewed in FIG. 6, and lock portion 84 releases the head of nail 70 and allows the jaw piece 67 to snap into the closed position under the action of spring 68.

I claim:

1. A puzzle comprising a plurality of interfitting pieces, a first pin attached at one end to a first one of said interfitting pieces and having a portion removably extending through a hole in a second one of said pieces, said pin having a first notch formed in said portion, a second locking pin fixed at one end to a third one of said interfitting pieces and removably extending through a second hole in said second piece, said locking pin having a locking portion extending into a first intersection with said first pin within said first notch, said locking pin having a second notch of a size to permit passage therethrough of said first pin when said second notch is positioned at said intersection, said second notch being displaced from said locking portion of said second pin wherein said second pin is moved to position said second notch at said intersection to unlock said first pin, said second pin being formed with a third notch positioned within one of said interfitting pieces, and a third limiting pin fixed at one end to a fourth one of said interfitting pieces and removably extending through said one of said interfitting pieces into said third notch, said limiting pin and said third notch being constructed and arranged to limit the movement of said locking pin and second notch through said intersection of said first and second pins.

2. A puzzle in accordance with claim 1, wherein said second notch is displaced along the longitudinal axis of said second pin from said locking portion of said second pin whereby said second pin is moved along its longitudinal axis to position said second notch at said intersection, said third notch being elongated and spaced along the axis of said second pin from said second notch, said third pin extending into said elongated third notch to prevent complete withdrawal of said second pin, said elongated notch being of a length to permit the positioning of said second notch at said first intersection by moving said second pin along its longitudinal axis.

3. A puzzle in accordance with claim 2, wherein said second notch is displaced angularly around the longitudinal axis of said second pin from said locking portion of said second pin whereby said second pin is rotated about its longitudinal axis to position said second notch at said intersection, said third notch being formed as an annular notch coaxial with the axis of said second pin,

said third pin extending into said annular third third notch to prevent withdrawal of said second pin.

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ANTON O. OECHSLE, Primary Examiner

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