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LOCKOUT CAPTIVE SCREW ASSEMBLY

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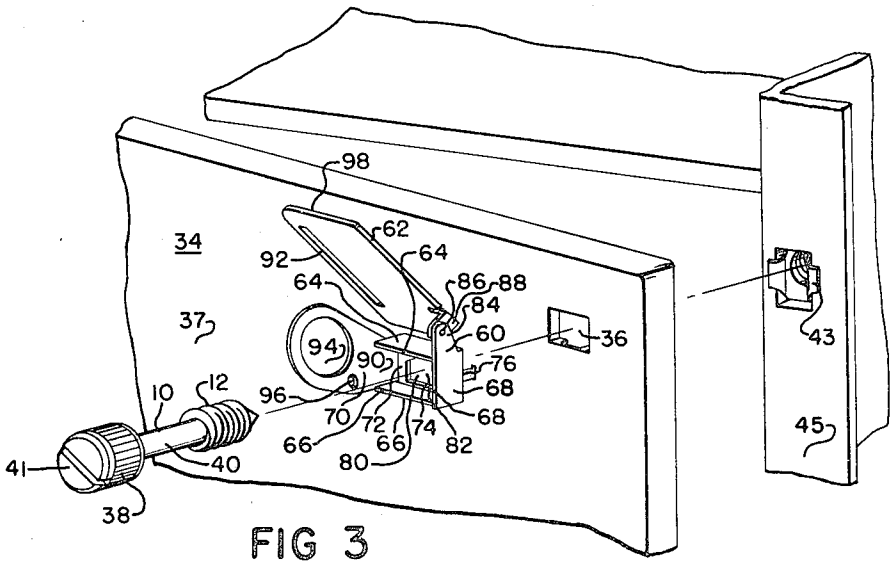


FIG 3

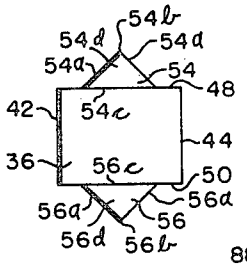


FIG 4

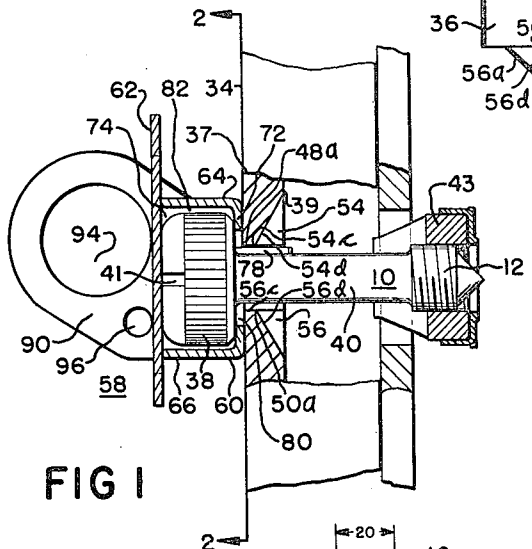


FIG 1

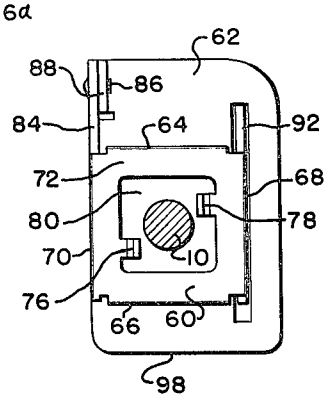


FIG 2

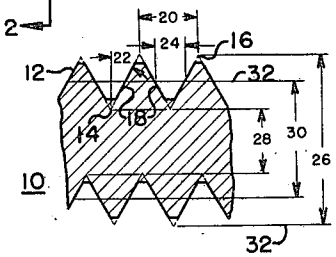


FIG 5

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LOCKOUT CAPTIVE SCREW ASSEMBLY

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U.S. Cl. 70—232 9 Claims

ABSTRACT OF THE DISCLOSURE

An inexpensive assembly for preventing access to the head of a captive screw as may be used to secure a cabinet door closed wherein access to the head of the screw is prevented by a hinged cover of an enclosure which is positioned on the door by an elongated opening which also maintains the screw captive in the door.

The present invention relates to locking devices and more particularly, to an inexpensive locking device which will prevent access to a captive screw which removably secures two members to each other.

The use of screws to retain metal covers on receptacles and doors closed in structures such as control centers is well known and frequently captive type screw arrangements are employed to prevent loss of the screws when the covers are removed or the doors are opened. In the captive screw assembly according to the present invention the screws are maintained captive in an opening in a panel having a thickness greater than the width of the threads of the screw entirely by the material of the panel without requiring special devices, such as washers or threaded openings in the panel, as are commonly employed. Additionally, for reasons of safety and to prevent mischievous tampering, the doors and covers of cabinets containing electrical control equipment are provided with arrangements for preventing removal of the covers or opening of the doors by unauthorized personnel. One form of locking arrangement frequently used includes a member which is secured to the cabinet structure and extends through an opening in the door or cover so a padlock hasp may extend through an opening in the member to prevent movement of the door or cover. While the arrangement for thus locking the door or cover has proved satisfactory, it is objectionable in that difficulties arise when the structure is initially furnished without locking arrangements and subsequent requirements make the locking devices necessary. The locking device for the captive screw according to the present invention is both inexpensive and may be readily applied or removed without special tools and thus provide advantages over the arrangements heretofore known.

It is an object of the present invention to provide an inexpensive and flexible lockout assembly which will prevent access to the head of a captive screw that is used to secure two parts together.

Another object is to provide a lockout which will selectively permit and prevent access to the head of a captive screw that is used to secure a door of a cabinet.

A further object is to prevent access to the head of a screw as may be used to secure two members together with an inexpensive structure that includes an enclosure having a hinged cover which is movable to the position to permit access to the head of the screw when the cover is in one position and prevent access to the head when the cover is in a second position and which will accept the hasp of a padlock to prevent movement of the cover from the second position.

An additional object is to prevent access to the head of a screw that is held captive in an elongated opening in a

panel with an inexpensive enclosure that is positioned on the panel by the elongated opening to conceal the head of the screw when a cover which is hinged on a base of the enclosure is moved to close an opening which provides access to the head and the cover is held against movement by a hasp of a padlock that extends through an opening in a portion of the base.

Further objects and features of the invention will be readily apparent to those skilled in the art from the specification and appended drawing illustrating certain preferred embodiments in which:

FIG. 1 is a view showing a broken-away portion of a panel and support as secured together by a captive screw lockout assembly according to the present invention wherein the captive screw lockout assembly is shown in cross section.

FIG. 2 is a rear elevational view taken along line 2—2 in FIG. 1.

FIG. 3 is an exploded view showing in perspective the components in FIG. 1.

FIG. 4 is a rear view of the elongated opening in the panel shown in FIG. 3.

FIG. 5 is a view illustrating the terms adopted by the American Society of Mechanical Engineers to define portions of screws.

For purposes of illustration, and to aid in the understanding of the present invention, the terms as hereinafter used to describe parts of a captive screw as used in accordance with the present invention are in conformity with the definitions extracted from American Standards Unified Screw Threads (ASA B1.–1960) with permission of the publisher, The American Society of Mechanical Engineers.

While the retaining means according to the present invention may be used with screws other than the type herein illustrated, referring to FIG. 5, a portion of a screw **10** having threads **12** is shown. Each thread **12** has a root **14**, a crest **16** and a flank **18**, which are defined as: The root of a thread is that surface of the thread which joins the flanks of adjacent thread forms and is identical with or immediately adjacent to the cylinder from which the thread projects. The crest of a thread is that surface of the thread which joins the flanks of the thread and is farthest from the cylinder from which the thread projects. The flank of a thread is either surface connecting the crest with the root, the intersection of which, with an axial plane, is theoretically a straight line. Additionally, the pitch of a thread is the distance measured parallel to its axis, between corresponding points on adjacent thread forms in the same axial plane and on the same side of the axis, and is designated by the dimension **20** in FIG. 5. The flank angles, shown as **22**, are the angles between the individual flanks and the perpendicular to the axis of the thread measured in an axial plane. The thickness of the threads, shown by dimension **24**, is the distance between the flanks of the thread measured at a specified position and parallel to the axis. The major diameter, illustrated by numeral **26**, is the diameter of a coaxial cylinder which would bound the crests of an external thread, and the minor diameter, shown as **28**, is the diameter of a coaxial cylinder which would bound the roots of an external thread. The pitch diameter, defined as "the diameter of a coaxial cylinder, the surface of which would pass through the thread profiles at such points as to make the width of the groove equal to one half of the basic pitch," is illustrated by the numeral **30** and is generated by the pitch line **32**, which is defined as "a generator of the cylinder specified in the definition of the pitch diameter."

While the arrangement according to the present invention has other uses, as will be readily apparent, it is

particularly suited to secure a door of a control center as disclosed in an application for U.S. patent, Ser. No. 689,538, filed Dec. 11, 1967 which is assigned by the inventors Edward J. Stark et al. to the assignee of the present invention. The means for fastening the door, a portion of which is illustrated as a panel **34**, includes a screw **10** and an elongated opening **36** extending between a front wall **37** and a rear wall **39** of the panel **34**, as will be hereinafter described.

The screw **10** has a thread portion including threads **12**, at one end and a head portion **38** at its opposite end. A shank portion **40** which is disposed between the head portion **38** and the threads **12** of the screw **10** has an external diameter not greater than the minor diameter **28** of the threads **12**. The head portion **38** has an external diameter greater than the major diameter **26** of the threads **12** and preferably includes a screw driver slot **41**.

The panel **34** has a thickness greater than the thread thickness **24** of the screw **10** is thus formed so the panel **34** may possess the required rigidity to serve as a door for a cabinet and be secured with commercially available hardware exemplified by the screw **10** and a threaded fastening element **43** carried by a structure **45** to which the panel **34** is securable. The elongated opening **36**, as most clearly illustrated in FIGS. 3 and 4, is rectangular in shape although, as will be apparent, the opening **36** may be formed as an oval, if desired. The opening **36** has end walls **42** and **44** which are spaced from each other by a distance larger than the major diameter **26** and a pair of side walls **48** and **50**. The spacing between the side walls **48** and **50**, as defined by a diameter that extends through a central portion of the opening **36** and perpendicular to the side walls **48** and **50**, is preferably equal to the pitch diameter **30** of the threads **12** although, as will be apparent, the spacing between the side walls **48** and **50** may be less or greater than the pitch diameter.

Centered and extending outwardly of the side walls **48** and **50** are indentations **54** and **56**. The indentations preferably are formed by the same tool that is used to punch the opening **36** in the panel **34** and are triangular in shape although other shaped indentations, such as semi-eclipsed indentations, may be used. The triangular shaped indentations **54** and **56** respectively have walls **54***a* and **56***a* extending vertically in the material of the panel **34** and converging at an apex **54***b* and **56***b* with the respective bases **54***c* and **56***c* of the triangularly shaped indentations **54** and **56** extending in the side walls **48** and **50**. Extending from the bases **54***c* and **56***c* to the respective apexes **54***b* and **56***b* are walls **54***d* and **56***d* which are inclined at an angle respectively designated as **54***e* and **56***e* relative to the front flat face of the panel **34**. The indentations **54** and **56** are formed in the material of the panel **34** to provide the portion of the side walls **48** and **50** wherein the bases **54***c* and **56***c* are located with a thickness respectively designated by the numerals **48***a* and **50***a* which preferably equals the thickness of the threads **24** which is preferably defined by the pitch diameter **30** and an angle of incline of the walls **54***d* and **56***d* that is less than the flank angle **22**.

An enclosure **58** which prevents access to the head **38** includes a base **60** and a cover **62**. The base **60** is formed of a single metal part to have a pair of spaced end walls **64** and **66**, a pair of spaced side walls **68** and **70**, a rear wall **72** from which the end walls **64** and **66** as well as the side walls **68** and **70** extend to provide an access opening **74**, and a pair of fingers **76** and **78** extending rearwardly on opposite sides of an opening **80** in the rear wall **72**. The rear wall **72** is preferably square shaped and has a width greater than the diameter of the head **38**. Similarly, the opening **80** is square shaped and centrally located in the rear wall **72**. The width of the opening **80** is greater than the distance between the side walls **48** and **50** and preferably equal to the distance between the end walls **42** and **44**. The fingers **76** and **78** are struck out of the material of the base **60** to extend into the opposite corners of the opening **36** to prevent rotation of the enclosure **58** on the front wall **37** and each includes a curved free end which engages surface portions of the rear wall **39** to position the base **60** against removal from the front wall **37** when the opening **80** is aligned with the opening **36**.

The end walls **64** and **66**, as well as the side wall **68**, each have free edges extending in a common plane spaced from the rear wall **72** a distance greater than the depth of the head **38**. Thus the head **38** is receivable in a space **82** defined by the walls **64**, **66**, **68** and **70** and is accessible through the opening **74**. The side wall **68** has a projection **84** extending upwardly beyond the end wall **64** to provide a support for a hinge pin **86**. The pin **86** pivotally supports a portion **88** of the cover **62** so the cover may rotate about the pin **86** from a remote or open position, as shown in FIG. 3, wherein the access opening **74** is uncovered providing access to the space **82** to a closed position, as shown in FIG. 1, wherein the access opening **74** is closed and entry to the space **82** is prevented. The movement of the cover **62** to the closed position is limited when surface portions of the cover engage the free edges of the walls **64**, **66** and **68**. The side wall **70** has a projection **90** extending forwardly of the front face of the cover **62** when the cover **62** is in the closed position. In the embodiment shown, the cover **62** is provided with an elongated opening **92** which receives the projection **90** when the cover **62** is in the closed position and permits the cover **62** to be rotated to the open position. The projection **90** has a pair of openings **94** and **96** therein each of which is located forwardly of the cover **62** when the cover is in the closed position. The opening **94** is larger in diameter than the opening **96** and is provided to receive the hasp of a suitable padlock, not shown, which may be passed through the opening **94** to prevent movement of the cover **62** from the closed to the open position. The smaller opening **96** is provided to receive the wire of a conventional seal, not shown, which is provided to prevent movement of the cover **62** to a position providing access to the head **38** of the screw **10** by unauthorized persons.

During assembly of the screw **10** and the enclosure **58** in the elongated opening **36**, the enclosure **58** is initially installed in the opening **36**. Preferably the elongated opening **36** and the fingers **76** and **78** are arranged so the cover **62**, when in the open position, will extend vertically upwardly and the hinge pin **86** is located to require that the bottom edge **98** of the cover **62** rest against the panel **34** as the cover **62** is inclined toward the panel **34**. Thus the cover **62** will be maintained in the open position. After the enclosure **58** is installed in the opening **36**, the screw **10** is installed by passing the thread portion **12** through the opening **80** into the opening **36**. During installation the screw **10** is inclined at an angle relative to a perpendicular to the panel **34** through the opening **36** so the wall portions **48***a* and **50***a* are received in the thread **12**. It will be seen that as the distance between the walls **48***a* and **50***a* is equal to or greater than the pitch diameter **30** and the thickness of the walls **48***a* and **50***a* is equal or less than the thread thickness **24**, the threading of the screw **10** into the opening **36** may be accomplished without interference as the angle of the inclined walls **54***d* and **56***d* is less than the flank angle **22**. The shank portion **40** of the screw **10** will be received in the opening **36** when all of the threads **12** have been rotated on the walls **48***a*. The diameter of the shank **40** is equal to or less than the minor diameter **28**. Thus as the distance between the walls **48***a* and **50***a* is greater than the minor diameter **28**, the shank **40** will be loosely received in the opening **36** and the screw **10** may be readily aligined and threaded into internally threaded fastener **43**, in spite of misalignments which may be present. As previously stated, the head portion **38** of the screw

10 has a diameter equal to or greater than the major diameter 26. Thus as the shank 40 is held captive in the opening 36 because the outer diameters of both the head portion 38 and the threads 12 are greater than the diameter 52, the enclosure 58 will be maintained against loss.

When the captive screw assembly as described is in the door securing position and the hasp of the lock is installed in the opening 94, or a suitable seal is secured in opening 96, unauthorized access to the head 38 of the screw or the screw driver slot 41 is prevented by the closed cover 62. When the door or panel 34 is to be opened, all that is required is that the seal passing through opening 96 or the hasp of the lock in opening 94 be removed and the cover 62 be moved upwardly about the hinge pin 86. When the cover 62 is thus positioned, access to the head 38 including the slot 41 is provided so that the screw 10 can be detached from the fastener 43 to permit the panel 34 to be opened. When the screw 10 is disengaged from the fastener 43, the assembly including the enclosure 58 and the screw 10, will be maintained captive in the elongated opening 36. Thus it is clearly apparent that if the cabinet including the panel 34 is initially furnished without a lockout assembly the cabinet may be readily converted by merely installing an enclosure 58 in a manner previously described without special tools and modifications to the cabinet structure as has been heretofore required.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto, as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation.

What is claimed is:

1. A lockout captive screw assembly comprising: a rigid panel having a front wall, a rear wall and an elongated opening extending between the front wall and the rear wall aligned with a fastening element carried by a structure to which the panel is securable, an enclosure mounted on the front wall of the panel, said enclosure including a base having a rear wall with an opening therein aligned with the elongated opening, a pair of spaced fingers extending rearwardly from the opposite sides of the opening in the rear wall into the elongated opening and engaging rear wall portions of the panel for nonrotatably positioning the enclosure on the front wall of the panel, and spaced side walls extending forwardly of the base providing an access opening to a spaced defined by the rear wall and the side walls, a cover hinged on the base and movable from an open position wherein the access opening and the space are exposed to a closed position wherein the access opening is closed and access to the space is prevented, and a projection on the base extending forwardly of the cover when the cover is in the closed position, said projection having a hasp receiving opening therein disposed forwardly of a front surface of the cover when the cover is in the closed position for preventing movement of the cover from the closed position when a hasp of a padlock is positioned in the hasp receiving opening, and a screw having a shank portion held captive in the elongated opening, a threaded portion extending rearwardly of the rear wall of the panel threadable into the fastening element for securing the panel to the structure, and a head portion within the space exposed when the cover is in the open position and concealed by the cover when the cover is in the closed position and access to the space is prevented.

2. A lockout captive screw assembly in accordance with claim 1 wherein the screw is held captive by the elongated opening in the panel.

3. The lockout captive screw assembly in accordance with claim 2 wherein the elongated opening is rectangular.

4. The lockout captive screw assembly in accordance with claim 1 wherein the projection having the hasp receiving opening therein extends through an opening in the cover.

5. The lockout captive screw assembly in accordance with claim 1 wherein the threaded portion has threads having crests and roots respectively defining a major diameter and a minor diameter of predetermined size, flanks having a predetermined angle, and a thickness defined by the distance between the flanks of the thread measured at a diameter intermediate the major and the minor diameters parallel to the axis of the screw, the shank portion has a diameter equal or less than the minor diameter and the head portion has a diameter at least equal to the major diameter, the panel has a thickness greater than the thickness of the threads and the elongated opening has a length greater than the major diameter and a width along a diameter through a central portion of the opening between a pair of opposed side walls of the opening equal to the diameter defining the thread thickness.

6. The lockout captive screw assembly in accordance with claim 5 including an indentation in each of the pair of opposed side walls, said indentations being centered on the central diameter of the opening and extending into the metal material of the panel to a depth providing clearance between the material of the panel adjacent the side walls and portions of the flank of the threads disposed between the diameter defining the thread thickness and the major diameter when the screw is threaded into the opening.

7. The lockout captive screw assembly in accordance with claim 1 wherein the spaced side walls include a pair of side walls and one of the pair of spaced side walls provides a support for the hinged cover and the other of said pair of side walls is extended to provide the projection for the hasp receiving opening.

8. The lockout captive screw assembly in accordance with claim 1 wherein the spaced side walls include four side walls defining said space with one of the four side walls providing a support for the hinged cover and a second of the four side walls providing said projection wherein the hasp receiving opening is disposed.

9. The lockout captive screw assembly in accordance with claim 8 wherein the side walls, the fingers, and the rear wall are portions of a unitary part.

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