March 16, 1965 H. H. JENKINS ETAL 3,173,287

SETTING TOOL

Filed April 25, 1961

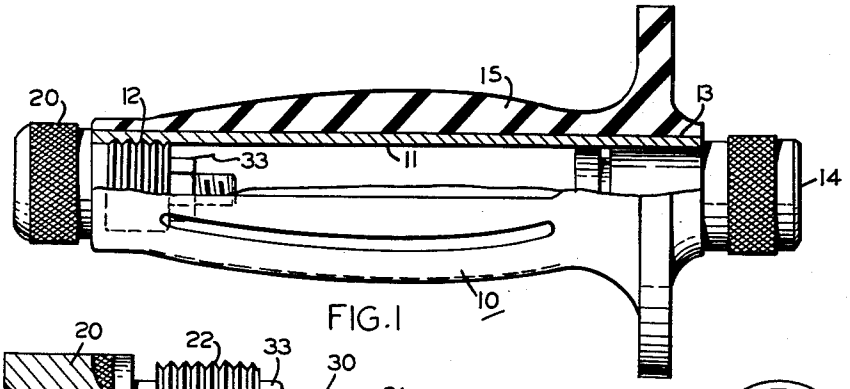


FIG.1

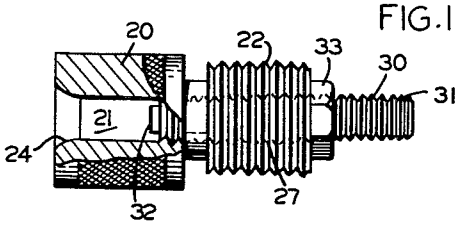


FIG.2

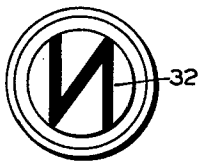
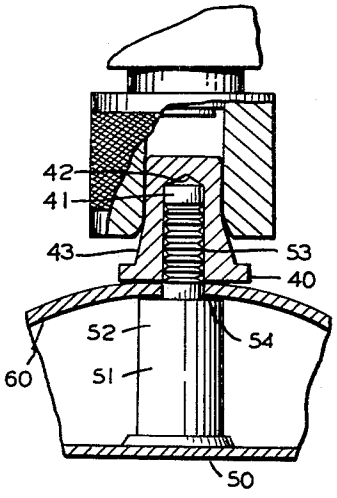


FIG.3

FIG.4



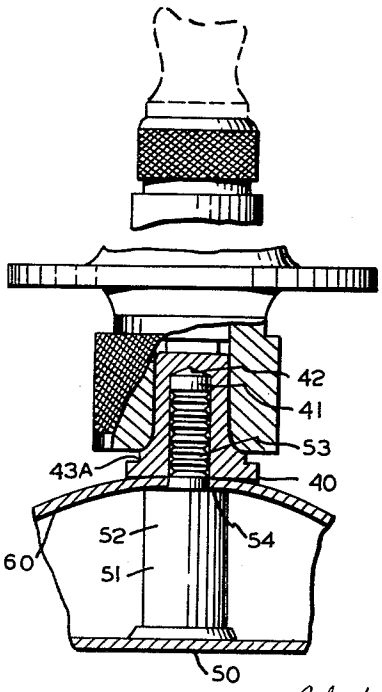


FIG.5

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SETTING TOOL

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This invention relates to hand tools, and more particularly to impact tools for swaging a fastener to a stud.

Curtain wall construction is now commonly used for commercial and industrial building. By this technique, a framework of steel is erected and then short securing studs are attached to the framework at closely spaced regular intervals. Such studs may also be applied to the roof area of the building as well as the side wall. At this stage of the construction, the building is a framework bristling with many stud pins projecting from the surface of the framework.

The next step in curtain wall construction is to hold a sheet of metal in position where it is to be secured, and then the metal is struck in the area over the studs with a rubber hammer to impale the sheet over the studs. The sheet metal is usually aluminum, or mild steel. The projecting ends of the studs are like a piercing punch, and hence the sharp upper edge of the stud is capable of cutting through the metal when so struck by a rubber hammer. It is also quite common that such sheet of metal is corrugated in form in order to give it rigidity. The building is thus provided with its exterior skin. Most usually if the building is to be heated, a sandwich wall is desired in order to provide insulation. However, many single wall buildings are employed where heat loss is not a factor. When a sandwich wall is needed, the first sheet metal is held tight against the building frame by speed clips which are slipped down over the stud and hold the first impaled sheet against the framework while additional material is impaled upon the studs. Usually the additional material consists first of an insulation material which may be tapped into place in much the same manner that the first sheet was impaled. Thereafter, an exterior sheet wall is impaled upon the studs in the same manner as used to install the first sheet. Thus, a double wall with a sandwich of insulation material is provided. The problem is to secure these sheets, whether single or sandwich construction, tightly upon the building against the forces of wind and physical impact which would quickly dislodge the sheets. Many fastening techniques are employed and one very successful method embodies the concept of a soft body of aluminum in the form of a cap swaged tight on the end of the stud. This cap has a conical form near the base and an annular flange around the base. A central bore into the cap is designed to provide a snug fit with the end of the stud by finger pressure in order to hold it in place temporarily until it can be swaged into tight contact with the stud. Preferably the stud is roughened at the outer end such as by providing encompassing grooves or threads in order to enable the cap to better lock to the stud.

Such a cap requires a base against which it can be seated while it is being deformed and swaged into contact with the stud. The preferred form of stud has a reduced end section that provides a shoulder and the small end of the stud beyond the shoulder is grooved. This shoulder

provides the resistance base to prevent the cap from going completely down upon the stud.

Then, a setting tool is employed which sets over the conical section of the cap. This tool has a shoulder which seats upon the conical section, and when the tool is struck to force it toward the shoulder on the stud, this shoulder on the tool causes the metal in the conical section of the cap to distend and swage down into the grooves on the end of the stud and lock there with a holding force sufficient to provide its share of the total holding force needed for the particular metal panel. Such caps, made of relatively soft aluminum, when properly seated, will hold in the neighborhood of 700 to 1200 pounds of force tending to pull it from the stud.

The difficulty is that the full holding force may not be developed if the cap is not struck a sufficient blow with the setting tool. It is often true that insufficient setting force is applied and that the cap has the appearance of being properly locked upon the stud, but actually fails under moderate service conditions.

A further teaching of the curtain wall construction technique and the particular aluminum cap member referred to above, may be secured by examination of Patent No. 2,983,181 issued May 9, 1961, entitled Sheet Fastener.

Therefore one of the principal objects of this invention is to provide a cap swaging tool die which will leave a visible indicia on a cap being set if, and only if, a predetermined amount of force has been applied to the tool and that force is transmitted to set the cap.

Yet another object of this invention is to provide a cap swaging tool die which will provide a visible indicia marking on a cap being swaged if the tool moves a predetermined amount.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a side elevational view partially in section with parts broken away for clarity showing a swaging tool with a swaging die in place.

FIGURE 2 is an enlarged view partially in section of the swaging die only including a longitudinally adjustable marking rod carried by the die.

FIGURE 3 is an end view of the marking rod, illustrating an example of a marking indicia on the end thereof.

FIGURE 4 is a section of a typical sandwich wall construction with a swageable cap seated on the end of the stud with a light friction grip, and with the setting tool of this invention positioned over the cap preparatory to swage seating of the cap and,

FIGURE 5 is a dynamic illustration of the tool seating a cap on a stud of the section by a hammer blow applied to the tool.

The illustrated embodiment of the invention is a preferred form having features beyond the essential minimum needs required for the invention.

The tool in general is given the reference character 10. FIGURE 1 represents a commercial embodiment of the tool 10 constructed of a tubular member 11 having one end threaded at 12 to hold the improved swaging and marking die of this invention.

At the end 13 of the tube 11 opposite the threaded end 12, an impact cap 14 provides a hammering surface to receive blows from a hand hammer. Cap 14 is merely

inserted into the end 13 of the tube 11, and held in place by frictional grip action of a rubber O-ring as illustrated.

In this particular embodiment of the tool 10 a rubber casing 15 is placed around the tube 11 in order to provide a good hand grip, and this casing 15 includes a collar located near the end 13. The collar is for the purpose of protecting the hand of the user in the event that a hammer blow directed at the cap 14 should glance or be misdirected.

This tool is a desirable environment for the particular form of the improved new swaging and marking die concept of this invention, but other suitable forms and configurations may be employed as desired. The invention resides in the combination of the die and a marking device which will impart a marked indicia upon a swaged cap if, and only if, the swaging die has been struck with a sufficient amount of force to properly set the cap.

For a better understanding of the purpose of the present tool, and the reason for the construction and operation of the tool, refer to the FIGURES 4 and 5. In FIGURE 4, for example, a plate 50 represents a base to which a stud 51 is secured. The base 50 will generally be a structural member of the building, either on the side wall or roof. Also, it is believed the preferable means of attaching the stud 51 is by the end arc weld method known as stud welding. The fillet around the base of the stud 51 indicates that the stud 51 has been so welded.

The stud 51 has a relatively large base portion 52, and a reduced end portion 53, thereby providing a shoulder 54 at the junction of these two sections. Rolled grooves have been formed in the section 53 to provide a roughened surface and thereby aid in providing a better physical grip by the swageable cap 40 shown positioned over the end 53 of the stud 51.

As outlined in the general description hereinabove, a sheet member 60 is shown impaled over the stud end 53 and resting against the shoulder 54. Thus, the illustration is limited to a single wall construction, and sandwich wall construction merely employs a longer stud with multiple layers of sheet and installation materials successively impaled over the stud. The single wall construction of the drawing will illustrate the construction sufficiently for understanding of the present invention.

The cap 40 is fully described in the above referenced U.S. patent.

The preferred material of cap 40 is swageable aluminum. This cap 40 has a bore 41 dimensioned to fit closely over the end 53 of the stud, and preferably provides a frictional grip which requires some pressure being required to push the cap into the position shown in FIGURE 4. This frictional grip temporarily holds the cap until properly seated by the tool of this invention.

The bore 41 goes to a closed end within the body of the cap as indicated by the reference character 42. The bore 41 is deeper than the length of the reduced portion 53 of the stud in order not to rupture or punch out the end of the cap. It is desired that this cap remain closed in order to seal the end of the stud against the entry of atmospheric moisture.

Cap 40 has a conical section 43 at the lower portion thereof which ends in a surrounding base flange. Therefore, by this design of cap, if a force is applied to the surface of the conical section of the direction of the shoulder 54, the mass of metal in the cap below the conical surface will be compressed and tend to flare out in both directions. By the provision of the radial flange around the base, outward distension of this metal is resisted, and hence the metal will tend to flow inwardly toward the bore 41. Thus the forged metal will fill into the roughened surface provided by the grooves in the reduced section 53 of the stud and cause a tight locking of the cap 40 to the stud 51. Furthermore, by applying a force to the conical section 43 in the direction of the stud shoulder 54, it is manifest that no distension of the metal in the section will take place until the cap meets a resistance sufficient to prevent it from moving under the applied force. Therefore, weather-tight sealing between the shoulder 54, the trapped sheet 60, and the base of the cap 40, is assured.

From this description it will be readily apparent that the mass of metal under the conical surface 43 must be compressed a certain amount in order to provide the assured full grip of the cap and seating of the material into the grooved surfaces on the stud end 53. Because the cap preferably will fit rather tightly by finger pressure, it is even possible that a cap may be inserted upon the stud by hand and then forgotten and never seated. Also, although various mechanical devices have been proposed for applying a given fixed amount of pressure, no such mechanical device has yet replaced the common hand hammer because such devices are either too heavy or require power lines leading from a power source. In either case the workman is encumbered. Therefore, since hand power is still the accepted means for applying the seating pressure, it is possible that the workman may become tired or lax as the day's work proceeds, and a blow less than the optimum force may be applied. At the present time, there is no absolute means of determining whether the cap has been fully and properly seated. It is true that the conical section 43 will deform under the impact blow from the straight conical form as shown in FIGURE 4 to the rather rounded form 43 as shown in FIGURE 5, but this form may take place to a certain degree with less than an optimum amount of deformation having taken place. Accordingly, the improved die and marking tool of this invention is employed to place an indicia mark on the top end of the cap 40 if and only if the tool is struck a sufficient blow to move the tool down into the mass of metal under the conical section 43 a prescribed distance. When the tool does move this predetermined amount, indicating that the cap has been fully deformed, then an indicia marking device will place its seal of approval on the top of the cap and the inspector can tell at a glance that the cap has been properly seated.

Referring now to the FIGURES 2 and 3, the particular arrangement of the die and marking device is set forth in some detail. The reference character 20 indicates the entire body of the die. This body 20 has a central bore 21 which is chamfered in the area indicated by the reference character 24. Note that this chamfer is a gradually rounded form suitable for performing an ironing action of the conical section 43 as opposed to a conical section which would apply a mere compressive pressure, or a square shoulder which would cut rather than deform.

Body 20 has a threaded attachment base 22 which fits into the internal threads 12 in the tubular portion 11 of the tool 10. The body may be tightened to produce a sufficient holding power to keep the body 20 from falling from the tool. There are no operative forces which tend to dislodge this die from the tool proper.

The bore 21 is threaded, as indicated by the reference character 27, throughout the area of the base 22. These threads 27 are provided to form a holding means for a longitudinally adjustable marking rod 30. This rod has external threads 31 which fit the threads 27 and has a screw slot at one end to provide a convenient means for threadably advancing or retracting rod 30 with respect to the chamfered area 24. A lock nut 33 enables the rod to be clamped in any given position. The FIGURE 3 shows a marking indicia 32 on the end of the rod 30. The illustration is a letter N but any indicia, of course, will suffice.

For further understanding of the invention, reference is again made to the FIGURES 4 and 5. As mentioned previously, the cap 40 is a device which has been developed and proven in actual practice, and is the subject matter of the reference United States Letters Patent 2,983,-181. A vast number of caps 40 have been struck varying blows in increasing increments of intensity and the holding force of these caps measured by a tensile machine.

Hence, it has been determined quite accurately the degree to which the deformation should take place for proper optimum results. Because these caps are made to precise dimension and form with tolerances held by accurate manufacturing machines, they are all substantially identical. Therefore, when the tool is seated into original contact with the cap, as shown in FIGURE 4, there is a definitely established space relationship between the tool and the cap. Whenever the tool is struck a sufficient blow to properly deform the cap, the tool must move downwardly upon the cap a precise distance with respect to the cap in this space relationship. Hence, having determined the amount of axial movement required by the tool, the rod **30** is set to position the indicia **32** to embed into the top surface of the cap whenever the tool has advanced this correct amount. Therefore, the position of the rod **30** is accurately set by suitable measuring instruments and then locked into proper position. As a safety precaution it is advisable to test each tool by seating a cap with a given proper blow sufficient to cause the indicia marking, and then to test the retention force of the cap in order to verify the correct setting of the indicia marking rod **30**.

This invention provides a means to assure accurate setting of each cap, with the added advantage of permitting inspection at a glance to determine that all caps have actually been set.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. The method of connecting a panel member to a supporting shouldered stud comprising placing an end of the stud through an aperture in the panel member, positioning the panel member against the shoulder, positioning an annular swagable cap member over said stud end and against the panel, telescoping a swedging tool with an indicia producing portion over the cap member with the portion spaced from a corresponding indicia providing portion on one of the members, fixing the cap member to the stud by impaling the tool to deform the cap member and continuing the impaling until the deformation of the cap to a locking condition is concluded and concurrently the portions coact to provide visible indicia on said one member.

2. The method of claim 1 wherein the indicia portion on said tool is a projection spaced from the axis of the tool a distance less than the maximum radius of the cap member, wherein the cap member is said one member and wherein said impaling is continued until said projection is embedded in said cap member to provide an indicia producing recess.

3. An impact tool die adapted to swage a cap on a stud by die movement axially with respect to the cap to inwardly deform the cap, said die comprising, an elongated body having a work end including a cap deforming surface and a bottomed bore extending axially from the work end, said bore having a cap-receiving opening at the work end, a rod fixed to said die and projecting into said bore from the bottom thereof, said rod having indicia imparting means within the bore and spaced from said cap deforming surface, said indicia imparting means being positioned to impart a visible indicia marking on the closed top of the cap when the die moves more than a preselected distance axially with respect to the cap.

4. An impact tool die adapted to swage a cap on a stud by die movement axially with respect to the cap to inwardly deform the cap, said die comprising, an elongated body having a swedging end and a spaced work end including a cap deforming surface and a bore extending axially from said end, said bore having a cap-receiving opening at said end, a rod fixed to said die, said rod having indicia imparting means spaced from said cap deforming surface and positioned on a side of said cap deforming surface toward said swedging end, said indicia imparting means being positioned to impart a visible indicia marking on the cap when the die moves more than such preselected distance axially with respect to the cap.

5. An impact tool die adapted for setting a cap on a stud, said die comprising, an elongated body having an axial bore and a cap deforming surface around one end of the bore, said one end of the bore being an open-cap receiving end, indicia imparting means fixed to said body and projecting into said bore, said indicia imparting means including an indicia producing portion within said bore and spaced from the cap deforming surface a predetermined distance to impart an indicia marking on a cap on a stud when the die has moved such predetermined distance relative to a cap during a setting operation.

6. The device of claim 5 wherein the indicia imparting means is adjustably fixed to the die to permit said predetermined distance to be adjusted.

7. The process of setting a cap positioned on a shouldered stud with a tool having a swaging surface and a spaced indicia marking surface comprising,

(*a*) positioning the swaging surface against the cap with the marking surface in spaced relationship therewith;

(*b*) delivering repetitive impacts to the tool thereby swedging the cap into locking engagement with the stud;

(*c*) continuing the impacting until the indicia surface is against the cap; and,

(*d*) thereafter delivering at least one more impact to the tool to mark the cap.

8. A swaging tool comprising,

(*a*) a tubular handle and die structure extending from a first to a second end,

(*b*) said handle and die structure including an annular swaging surface near the first end,

(*c*) an indicia marking member adjustably mounted within the handle and die structure and spaced from the swaging surface;

(*d*) an impaling structure removably mounted at the second end; and,

(*e*) said indicia member including means for effecting axial adjustment accessible from said second end when the impaling structure is removed.

9. The device of claim 8 wherein the handle and die structure and the impaling structure are in telescopic relationship and maintained in such relationship by friction.

10. The device of claim 8 wherein the handle and die structure comprises a tubular handle and a tubular die threaded into the handle and wherein the indicia member is threaded into the die.

11. A swaging tool comprising,

(*a*) an elongated tubular body having an impaling end and a swaging end,

(*b*) said body being internally threaded adjacent the swaging end,

(*c*) a tubular swedging die threaded into said swaging end and including a shoulder in abutment with the end of the body, said die including an annular swaging surface adjacent its outer end,

(*d*) a visual indicia producing marker threaded into the die and spaced from the annular swaging surface,

(*e*) means locking said marker on said die with the marker in predetermined spaced relationship with the swaging surface,

(*f*) an impaling member including a portion telescoped into the body adjacent its impaling end, said impaling member including a shoulder abutting the end of the body; and,

(*g*) means between the impaling member and the body to maintain the two in an assembled condition.

12. An impact tool die adapted to swage a cap on a stud by die movement axially with respect to the cap to inwardly deform the cap, said die comprising, an elongated body having a work end and a bottomed bore extending axially from the work end, said bore having a cap-receiving opening at the work end, a rod threaded into said die and projecting into said bore from the bottom thereof, said rod having indicia imparting means, said indicia imparting means being positioned to impart a visible indicia marking on the closed top of the cap when the die moves more than a preselected distance axially with respect to the cap and said rod being axially adjustable in said die.

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