# United States Patent [19]

**Prince**

[11] **3,842,476**

[45] **Oct. 22, 1974**


[54] **MULTI-OPERATIONAL PUNCH**


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[21] Appl. No.: **369,267**

[52] **U.S. Cl.** ..... **29/200 B,** 72/347, 72/356
[51] **Int. Cl.** ..... **B21d 53/36,** B23p 11/00
[58] **Field of Search** ..... 72/384, 389, 381–383, 72/404, 347, 348, 356; 29/200 B, 467



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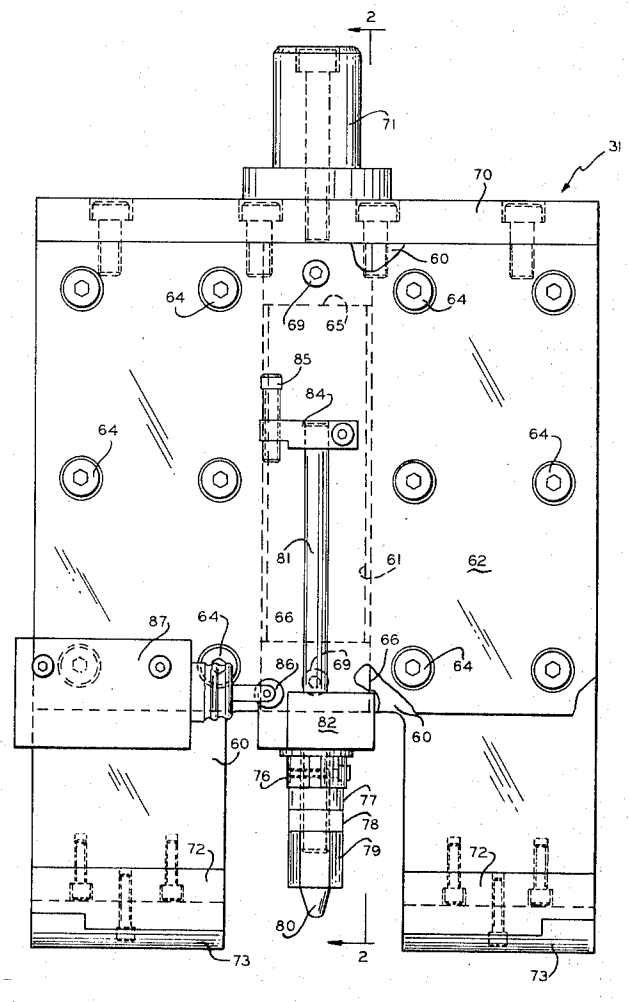
*Primary Examiner*—Richard J. Herbst
*Attorney, Agent, or Firm*—Bruns & Jenney



[57] **ABSTRACT**

A certain type of mine bolt expansion shell has shell halves secured to either end of a metal strap and a wedging nut, the strap being bent on either side of the nut to hold the assembly together. Assembly requires bending over tongues projecting from the shell halves, trueing the shell halves, and bending the strap. A punch and die for performing these operations at a single station has die recesses in which all the parts can be assembled and arranged and a punch which can be advanced and withdrawn by means of a press for bending the tongues and trueing the halves in a first operation, the punch including ram means for performing the bending operation after the first operation is complete. Withdrawal of the die after the first operation automatically initiates operation of the ram means.


**1 Claim, 14 Drawing Figures**



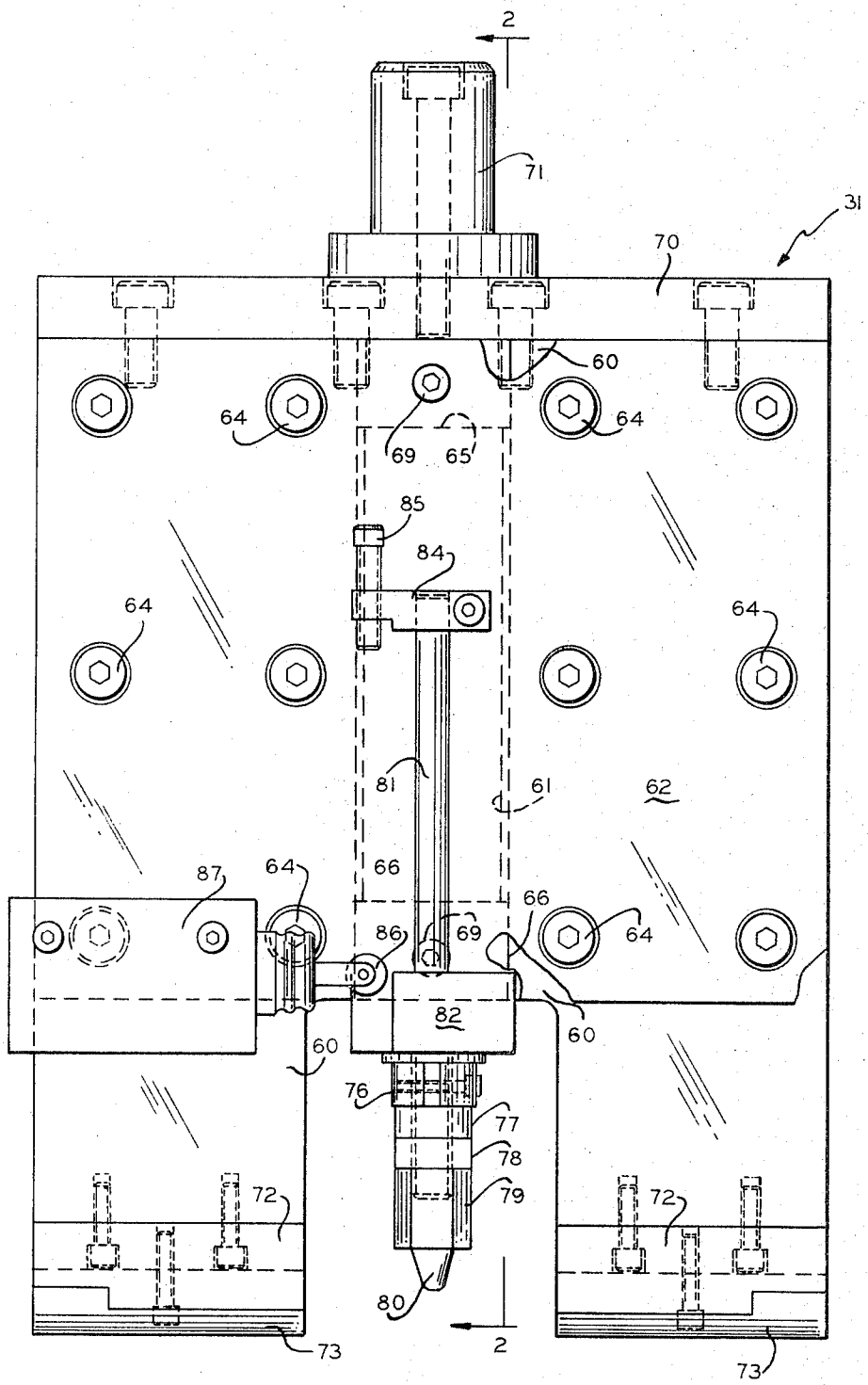

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Fig. 1

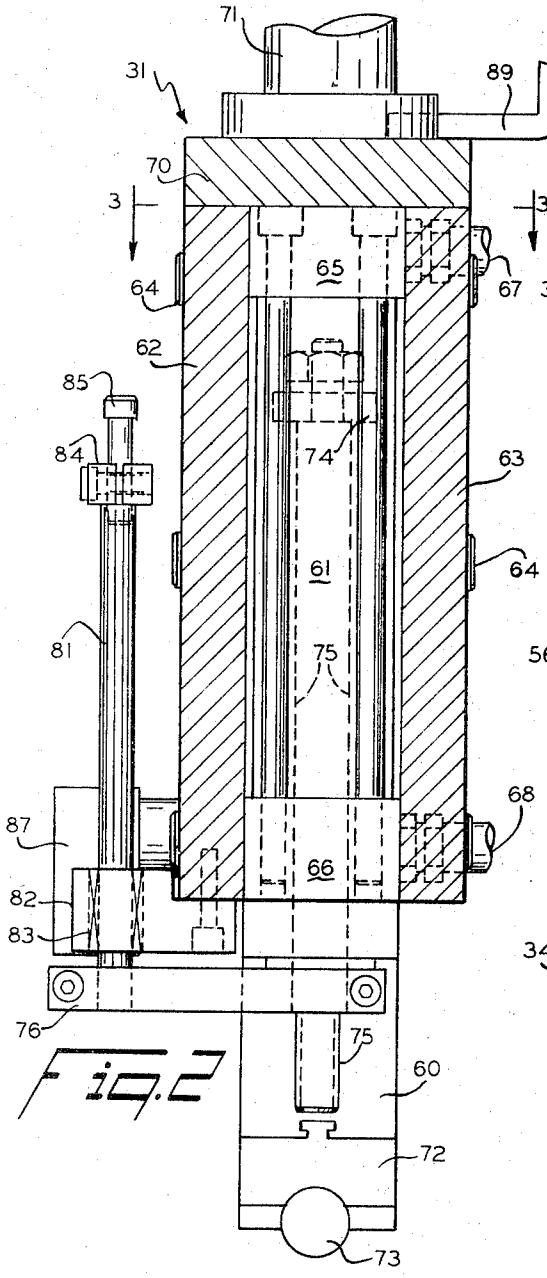



Fig. 2

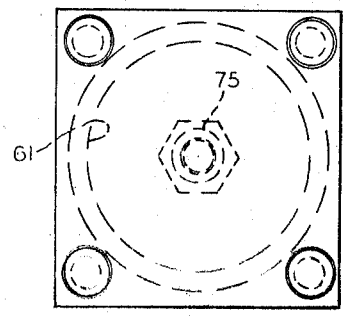



Fig. 3

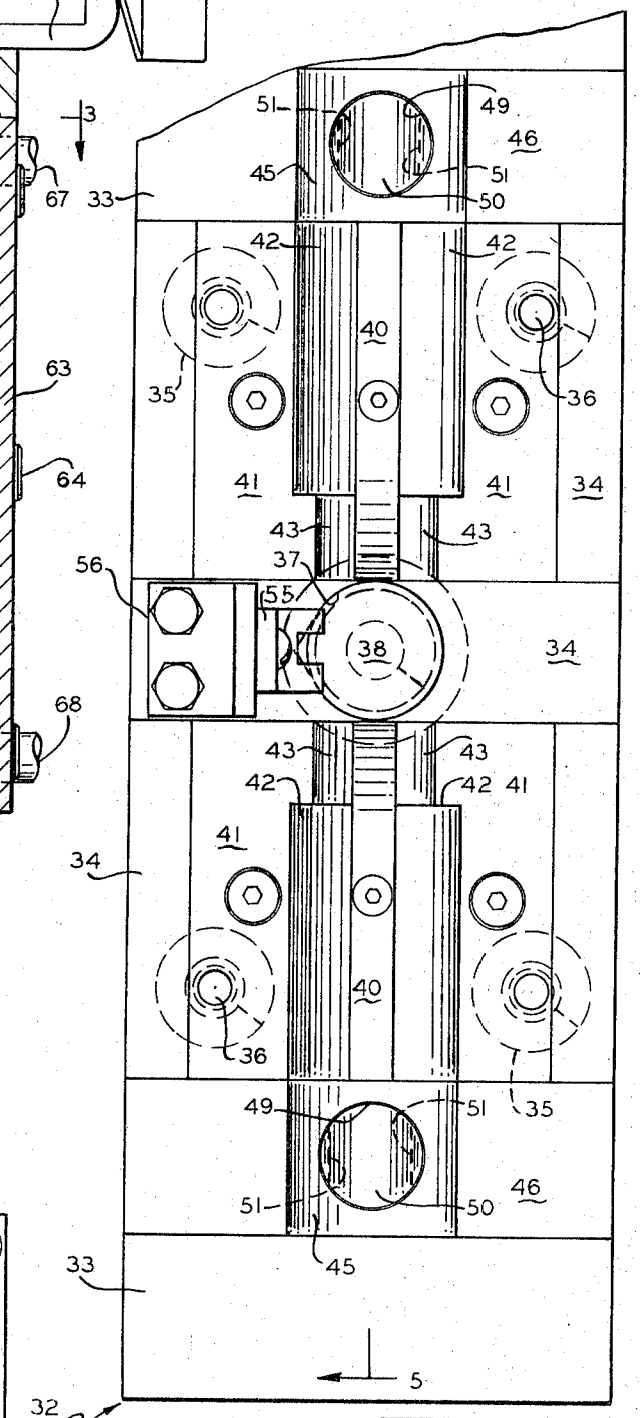



Fig. 4

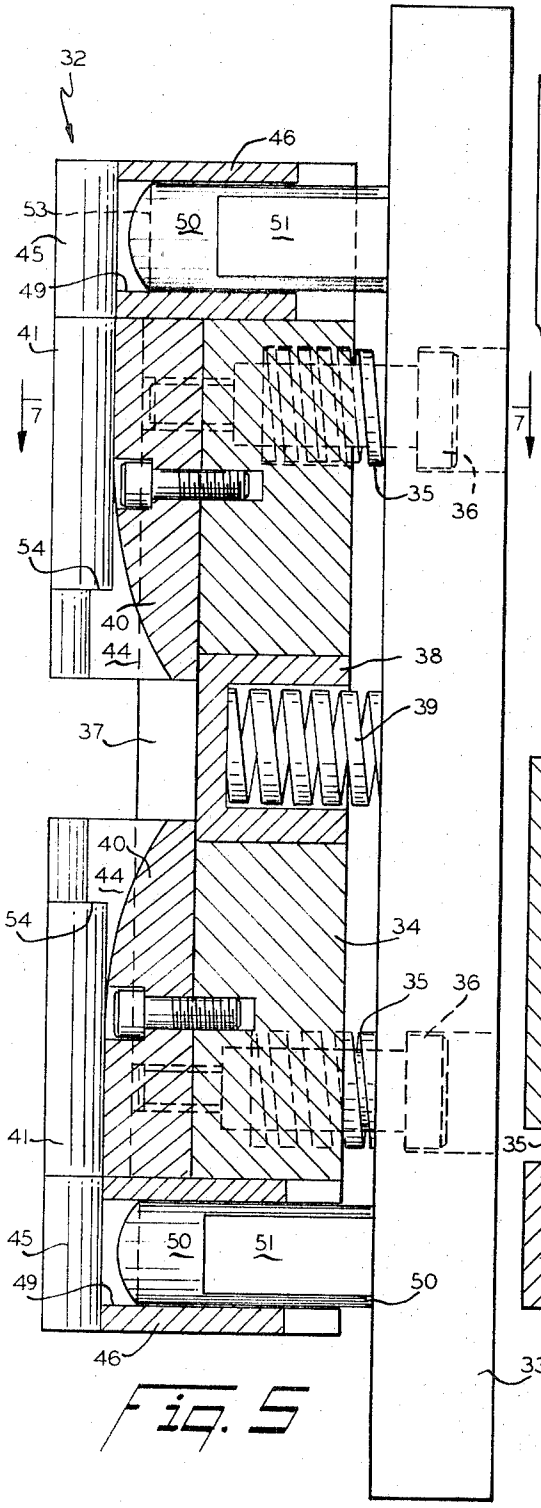



Fig. 5

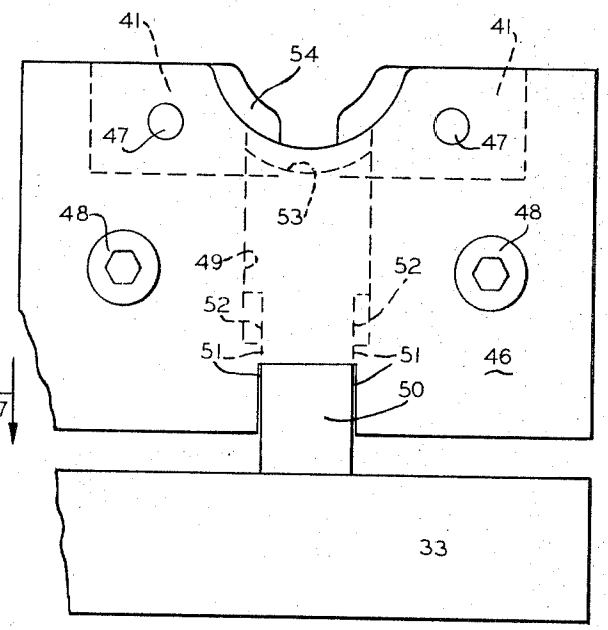



Fig. 6

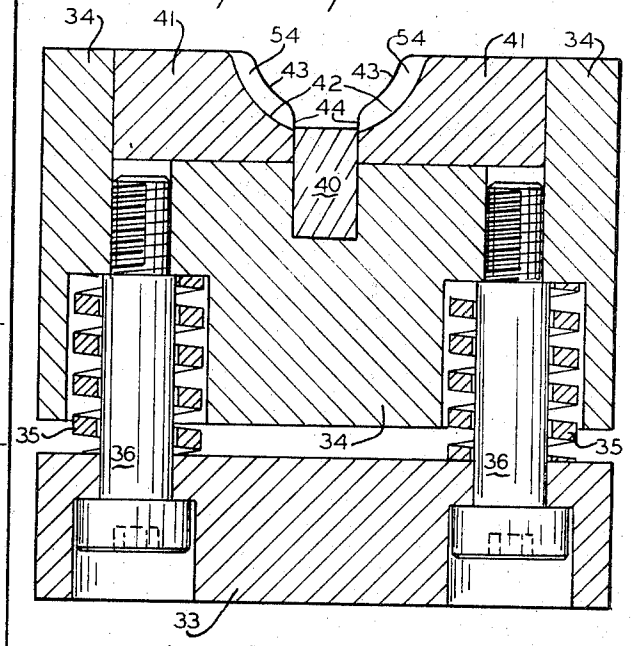



Fig. 7

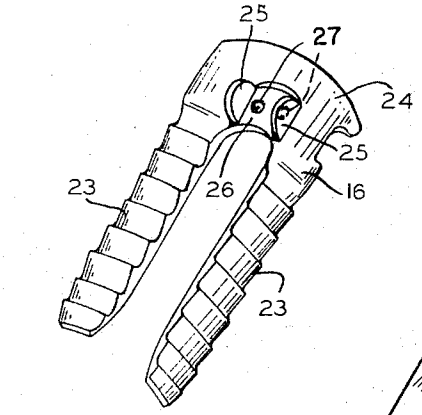



Fig. 8




Fig. 9

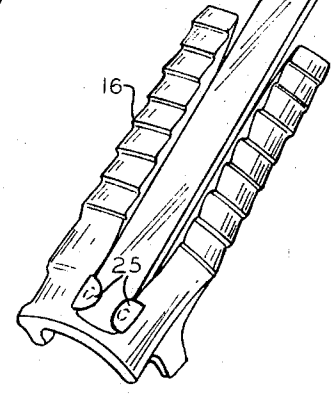



Fig. 10

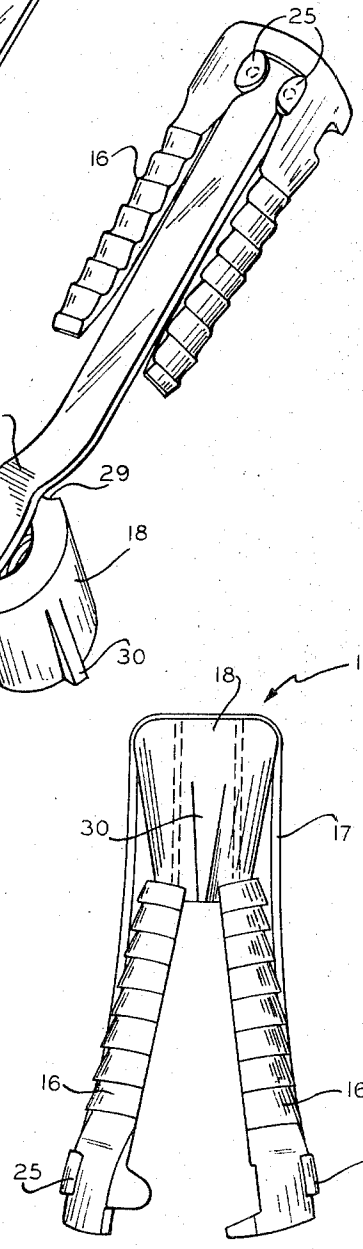



Fig. 11

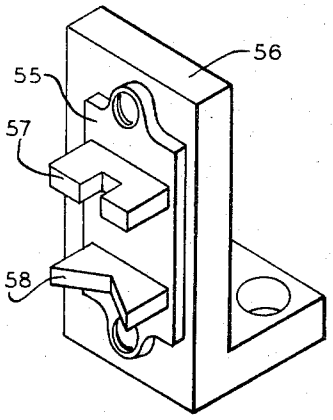



Fig. 13

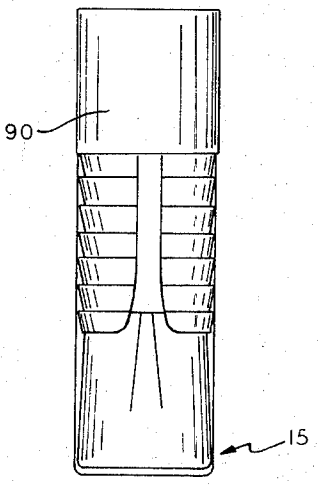



Fig. 14




Fig. 12

# MULTI-OPERATIONAL PUNCH

## BACKGROUND OF THE INVENTION

This invention relates to a double acting punch adapted to be moved against a die for shaping and forming the work, the punch being provided with ram means for performing a successive bending operation on the work, the operation of the ram being initiated automatically by the withdrawal of the punch from the work.

Punches have been provided for successive strokes to contact different portions of the work but it is required that the work be moved between strokes. This requires additional time and means for securing the work in relative position while being moved.

Moreover, bending operations have been performed by use of a punch or ram. However, the bending of an elongated member to a U-shaped configuration is traditionally performed by supporting the elongated member at its center and bending both ends of the member by pushing them in the same direction.

## SUMMARY OF THE INVENTION

This invention contemplates assembling the parts of an expansion shell for mine bolts on a die having recesses for the portions and then, at a single station, joining certain of the parts together by a press-carried punch and then bending another portion of the shell by pushing a part of the shell assembly between two spaced portions of the die. The pushing is done, without moving the work, by a ram carried as an integral portion of the punch and whose operation is automatically initiated at the completion of the press-operated joining operation.

It will be understood that the particular structure of the parts of the work, the mine bolt expansion shell, require that the parts of the shell assembly be brought to the die in which they are arranged with a particular side up if they are to be automatically arranged on the die. This requires that tongues on the shell halves project downward into recesses in the die and, since the tongues must be bent over, anvil portions of the die are supported below a spring supported platform so that the shell halves on the platform may be carried on the platform and forced downward by portions of the punch so that the tongues are bent over.

The expansion shell to be assembled includes a wedging nut to be held in place by a metal strap bent U-shaped. The ends of the strap are secured to shell halves and, as these halves are carried in recesses in the die precluding their being bent upward, the strap is bent U-shaped by forcing the center down between a spaced pair of die members by means of the ram after the punch, on which the ram is carried, is withdrawn by the press away from the strap ends.

It will be understood that the pressing operation and succeeding ram operation is particularly appropriate as carried out as the last station in an automated arrangement where the prior stations comprise conveyer means for successively positioning the component parts of the expansion shell on the die.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of a punch according to the invention, certain parts of the front side plate being broken away to show structure therebeyond;



FIG. **2** is a sectional view on the line **2—2** of FIG. **1**, certain parts being omitted;

FIG. **3** is a plan view of the hydraulic cylinder shown in FIG. **2** as viewed on the line **3—3** of FIG. **2**;

FIG. **4** is a plan view of a die for use with the ram of FIG. **1**;

FIG. **5** is a sectional view on the line **5—5** of FIG. **4**;

FIG. **6** is an end elevational view of the die of FIG. **4**;

FIG. **7** is a sectional view on the line **7—7** of FIG. **5**;

FIGS. **8** and **9** are perspective views respectively of a shell half and a strap of the expansion shell to be assembled;

FIG. **10** is a bottom plan view of the shell partially assembled;

FIG. **11** is an assembled shell;

FIG. **12** is a fragmentary diagrammatical side elevational view of the expansion shell, die and ram during the final step of assembling;

FIG. **13** is an enlarged perspective view of the wedging nut holder shown in FIG. **4**; and

FIG. **14** is an assembled expansion shell and its constraining tube ready for shipment.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to sheet **4** of the drawings and particularly to FIG. **11**, an assembled expansion shell **15** comprises two identical shell halves **16**, shown in perspective in FIG. **8**, a strap **17**, shown in perspective in FIG. **9**, and a wedging nut **18**, also shown in FIG. **10**. As seen in FIGS. **9** and **10**, strap **17** has two curved centering portions **20**, whose purpose will hereinafter become evident, the portion **21** between curved portions **20** is reversely curved. At each end strap **17** is provided with a pair of grooves **22** in the opposite edges.

As seen in FIG. **8**, each shell half **16** has a spaced pair of curved and toothed legs **23** connected together at one end by a substantially semicircular portion **24**. The portion **24** has a spaced pair of ears **25**, one on each side of a recess **26** and in the recess a spaced pair of round lugs **27** project. The lugs **27** are adapted to be engaged in the grooves **22—22** at each end of strap **17**, as shown in FIG. **10**, and the ears **25** are adapted to be bent over, as shown, to secure a shell half at each end of strap **17**.

The wedging nut **18** is frusto-conical as best seen in FIG. **11** and has an axially extending threaded hole **28** (FIG. **10**) adapted to receive the threaded end of the mine bolt, as well known in the art. Nut **18** has a pair of diametrically opposite slots **29** adapted to receive strap **17**, as shown in FIGS. **10** and **11**, and has a pair of diametrically opposite projecting locator ribs **30**, as shown.

Turning now to the punch **31** of the present invention, shown in FIGS. **1** and **2**, and the die **32**, shown in FIGS. **4–7**, it will be hereinafter described how die **32** is adapted to receive the component parts of the expansion shell **15** as they are assembled thereon and punch **31** is adapted to "stake" or bend over the tongues **25**, "coin" or true up the shape of the shell halves **16** and assemble the component parts into expansion shell **15** by bending strap **17**.

It will be understood that when the assembling of the component parts on die **32** is hereinafter referred to the

assembling may be done manually or, preferably, by means of vibrating conveyers at successive stations as the die is moved from station to station by indexing means.

Referring to FIGS. 4–7, the die **32** has a base **33** and a platform or die body **34** supported on four springs **35.** As best seen in FIGS. **5** and **7,** the springs **35** are coiled around shoulder bolts **36** which secure the body **34** to base **33.** Bolts **36** are recessed in base **33,** as shown, and hence are free to move with respect to the base. When springs **35** are compressed they each exert over 500 lbs. pressure.

As best seen in FIG. **5,** there is a hole **37** at the center of body **34** and under this hole a plunger **38** is free to move downward with respect to body **34.** Plunger **38** is recessed for a spring **39,** which is similar to springs **35,** so that plunger **38** is normally supported in raised position by spring **39.**

On either side of hole **37** one of a spaced pair of shaping members **40—40** extends longitudinally and is secured, as shown in FIG. **5,** in a slot in body **34.** On either side of each member **40** a contour member **41** is secured as shown in FIG. **4.** Each member **41** has a hollow **42** in which a shell half leg **23** is adapted to lie and be shaped therein. On either side of the hole **37** smaller hollows **43** provide a vertical wall **44** (see FIG. 7) on either side of contour member **40** for locating strap **17** at the center of die **32.**

The curves **20** seek the hole **37** in the body by contact with the curved portions of the members **40—40** when strap **17** is placed on top of members **40,** the walls **44** aligning the strap on top of the members **40.** The strap, inverted from the disposition shown in FIGS. **9** and **10** extends at either end beyond the hollows **42** and the shell half semicircular portion **24** of each half is adapted to lie in another hollow **45** formed in each end of body **34** or, as shown in the drawings, in an end piece **46** secured to body **34** by dowels **47** and screws **48** as shown in FIG. **6.**

At the center of each hollow **45** a hole **49** houses a substantially cylindrical anvil member **50** as shown in FIGS. **4, 5** and **6.** The anvil has at least one side flatted at **51** to cooperate with a flatted side of hole **49** at **52** to keep the anvil **50** from turning and plainly shown in FIG. **6.**

The top of anvil **50** is concavely curved from side to side, as best seen at **53** in FIG. **6,** for bending over the pendant ears **25** of the shell halves when the punch is operated as will appear. The anvils **50** are supported on base **33,** as shown in FIGS. **5** and **6** so that the ears are bent after the shell halves and base are carried downward by compressing springs **35.**

It will also be noted that at the point where hollows **42** and **43** meet a vertical shoulder **54** is formed which is useful in accurately locating the shell halves (FIGS. **5** and **7**).

Referring now to FIG. **4** a magnet **55** is carried on an L-shaped support **56** secured to body **34** adjacent the hole **37.** As shown in FIG. **13** the magnet **55** has a projecting portion **57** with a square notch in it and another projecting portion **58** with a V-shaped notch in it. After the strap and shell halves are arranged on the die **32,** the wedging nut **18** is brought to the die and placed upon the center of strap **17** inverted from the disposition shown in FIG. **10.** The magnet serves as a nut holder with one of the ribs **30** located in the square notch in projection **57** and the V-notch in projection **58** embracing the rounded lower portion of nut **18.**

Referring now to FIGS. **1, 2** and **3,** the punch **31** has two press plates **60** secured together on either side of a hydraulic cylinder **61,** best seen in FIG. **2** by a front plate **62** and a back plate **63.** Plates **62** and **63** are secured to the upper portions of plates **60** by a plurality of partially recessed bolts **64.**

Cylinder **61** has a square upper head **65** and a square lower head **66** bolted together as is usual in such cylinders and, as shown in FIG. **2,** flexible hydraulic lines **67** and **68,** respectively, are connected to the heads through appropriate holes in the back plate **63.** Appropriate bolts **69** secure the heads to the front plate **62.** A top plate **70** is bolted to plates **62** and **63** and a shank **71** is secured to the top plate adapting the punch to be secured in a press.

The lower ends of plates **60** have hardened support members **72** bolted thereto for securing in place hardened rounded press and shaping members **73** bolted to the support members as shown in FIG. **1.**

Cylinder **61** has the usual piston **74** secured to piston rod **75** for forming a ram as indicated in FIG. **2.** The lower end of rod **75** is threaded as shown in FIG. **2** for carrying thereon a clamp member **76,** spacing collars **77** and **78,** a hexagonal ram cap **79** with a bullet nosed point **80,** all shown in FIG. **1.**

The clamp member **76** has a vertically disposed and upwardly projecting ram control rod **81** secured to its forward end and a rod guide **82** having linear bearing means **83** for the rod is bolted to plate **62** as shown in FIG. **2.** As best seen in FIG. **1,** rod **81** has another clamp member **84** secured to its upper end for carrying an adjusting screw **85.**

The screw **85** is adapted to operate the switch arm **86** of a reversing switch **87** secured to plate **62** of the punch for returning the ram cap **79** on rod **75** after the ram has completed its stroke.

Referring to FIG. **2,** another switch **88** is mounted on the support or frame of the press, not shown, and is adapted to be operated by an arm **89** secured to top plate **70** for initiating the operation of the ram.

In operation, after the component parts of the expansion shell **15** have been assembled on the die **32** either by hand or automatically, the press in which punch **31** is mounted is operated manually or by operation of suitable indexing mechanism to lower the punch against the work assembled on die **32.**

The shaping members **73** at each side of the punch contact the shell halves and force them into the hollows **42** and **45** of the die, "coining" or trueing the shape of legs **23.** The tongues **25** on the shell halves are carried down with the platform or body **34** until the tongues strike anvils **50** which "stake" or bend over the tongues to lock the shell halves to the ends of strap **17.** The bullet nose **80** of the ram enters the threaded hole **28** of the wedging nut **18** and centers the nut over hole **37** of the die if it is not correctly aligned.

When sufficient pressure is attained the punch is raised by the operator or by automatic means and arm **89** operates switch **88.** Hydraulic fluid introduced into cylinder **61** through the hose **67** and the ram is carried down until the ram cap **79** contacts the wedging nut **18** and forces it and the middle portion of strap **17** down against plunger **38** compressing its spring **39.** The strap is thus bent, as shown in FIG. **12,** by the spaced members **40.**

As the nut **18** is carried down by the ram the center portion of the strap contacts plunger **38** backed by its spring **39** and the counter-curved center portion **21** of the strap is flattened by the pressure of the plunger and by the bending of the strap at the curves **20—20.**

As the ram bottoms, the screw **85** contacts switch arm **86** operating switch **87** which diverts hydraulic fluid from the pump, not shown, from hose **67** to hose **68** to raise piston **74** and the ram to the position shown in FIGS. **1** and **2.** Operation of the punch is thus completed and the operator removes the assembled expansion shell **15,** squeezing legs **23** together and slipping a plastic tube **90** over the ends of the legs as shown in FIG. **14.** The shell is then ready for shipment.

I claim:

**1.** A punch and die combination for performing a plurality of operations assembling a mine bolt expansion shell, the shell having a half secured at either end of a connecting strap and a wedge nut, the strap being bent substantially U-shaped on either side of the nut for holding the shell together, the shell halves having tongues bent over by a staking operation to secure them to the straps and requiring trueing by a coining operation, the bending into U-shape of the strap constituting the assembly operation; the die having a platform with an elongated recess for receiving a partially bent strap and recesses for receiving the shell halves at either end of the strap, the platform being supported on springs, each shell half recess having a base supported portion for staking the tongues, the elongated recess having a spaced pair of members at its center; the punch having press portions for forcing the shell halves against the die and a ram portion for forcing a wedging nut at the center portion of the strap down between the spaced members for bending the strap U-shaped, the punch being adapted to be carried by a press for forcing the shell halves against the die and then for withdrawing the press portions, independent motor means for advancing the ram portion against the wedge nut for forcing it down and then withdrawing the ram portion, the independent motor means being secured to the press portion of the punch, and means for automatically initiating operation and withdrawal of the second motor means upon withdrawal of the press portion of the punch.

* * * * *