ABSTRACT OF THE DISCLOSURE

The disclosure embraces a slug ejector arrangement for a die punch comprising an ejector pin receivable in a bore in the punch, the ejector pin being anchored or held to an end region of a biasing spring, the biasing spring having a close coiled region which may be cut to length to suit a particular die punch.

This invention relates to a die punch and slug ejector arrangement and more particularly to slug ejectors for use with punches for ejecting the slugs ensuing from punching operations.

Die punches have heretofore been equipped with slug ejector pins but in such prior constructions the ejector pins were dimensioned individually to fit each particular punch. In such prior constructions a separate spring engaged the head end of an ejector pin or an insert adjacent the pin to bias the end region of the pin beyond the punch face in order to eject the slug from the punch. In such constructions the head portion of the pin provided a means determining the extent of ejection of the pin necessitating a separate pin of correct length for each punch. Hence, punches of different lengths required individual pins of different lengths and such different length pins also required biasing springs of different lengths to secure proper ejector action.

The present invention embraces a slug ejector arrangement of a character wherein the ejector pin is fixedly secured or anchored to the biasing spring whereby the end of the spring adjacent the juncture of the pin with the spring provides a means for limiting movement of the ejector pin relative to the die punch with which it is used.

Another object of the invention resides in an ejector pin construction wherein the pin is anchored to the biasing spring, the latter engaging an adjustable abutment carried by the die punch whereby the slug ejecting pressure of the ejector pin may be adjusted and controlled.

Another object of the invention is the provision of an ejector pin and biasing spring anchored thereto which is adapted for use with punches of different dimensions by severing the pin to the proper length and severing the spring to a proper length for use with a particular die punch whereby the ejector pin and spring combination is readily conditioned for use with various punches.

Another object of the invention resides in an ejector pin and biasing spring arrangement wherein an end region of the spring is permanently anchored to an abutment provided on the ejector pin and the spring fashioned with open coiled and closed coiled regions of a character whereby the closed coil section of the spring may be cut to length to suit a particular die punch without impairing the ejecting action of the pin and open coiled region of the spring.

Another object of the invention resides in a novel arrangement for anchoring an ejector pin to a coil spring.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

FIGURE 1 is an elevational view of an ejector pin and biasing spring particularly illustrating the method of assembling the pin and spring;

FIGURE 2 illustrates the relative position of an abutment on the pin within the coil spring after assembly;

FIGURE 3 is a transverse sectional view taken substantially on the line 3—3 of FIGURE 2;

FIGURE 4 is a fragmentary longitudinal sectional view illustrating the method of permanently anchoring the pin to the spring;

FIGURE 5 is a detail view illustrating an anchoring abutment on the ejector pin;

FIGURE 6 is an elevational view illustrating the ejector pin bonded to the spring;

FIGURE 7 is a sectional view through a die punch illustrating the ejector pin construction in a position of use;

FIGURE 8 is a fragmentary view illustrating a modified form of abutment anchor on an ejector pin;

FIGURE 9 is an end view of the construction shown in FIGURE 8;

FIGURE 10 is a fragmentary view illustrating another form of abutment anchor formed on an ejector pin, and

FIGURE 11 is an end view of the construction shown in FIGURE 10.

While the anchor pin construction is illustrated in combination with a single die punch, usually referred to as a pierce punch, it is to be understood that the ejector pin construction may be used with quill punches, heeled notchting punches and as knock-out pins in compound dies.

Referring to the drawings in detail and particularly to FIGURES 1 through 6, the ejector pin 10, which is in the form of a rod preferably formed of high strength hardened steel of circular cross section but may be of other cross-sectional shape if desired, formed at one end region of the rod is a laterally extending abutment 12 fashioned by distorting a region of the rod or pin by impacting the rod with a suitable tool having a convex surface to distort the metal slightly outwardly as shown in FIGURES 1 and 5.

The biasing spring 16 for the ejector pin 10 is of the compound type wherein a first section 18 is wound with close convolutions providing for this section of the spring of a size to snugly, yet slidably, receive the rod 10. The spring 16 is fashioned with a second section 22 of spaced-apart convolutions of progressively increasing diameter upwardly from the closed convolution section 18, as shown in FIGURES 1 and 2, the section 22 of the spring being compressible lengthwise of the spring.

The spring 16 is inclusive of a third section 26 comprising a series of close convolutions, viz with adjacent convolutions in engaging relation, the diameter of convolutions of the section 26 being substantially equal to the convolution of greatest diameter of section 22 as shown in FIGURE 1. In assembly, the rod 10 is telescoped into the spring 16 until the abutment 12 is disposed at a region within the section 22 of the spring wherein the abutment 12 is frictionally gripped by the convolutions of the spring section 22 adjacent the closed convolution spring section 18, as shown in FIGURE 12.4.

The interior diameter of section 26 of the spring and the progressively reduced diameter of section 22 of the spring accommodate passage of the abutment 12 on the
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3 rod 10 until the abutment is adjacent the closed convolution section 18 which prevents further lengthwise movement of the pin as the inner diameter of the section 18 is too small to accommodate the abutment 12.

After the pin is assembled to the position shown in FIGURE 2, a bonding metal 28 such as fusible solder or other fusible bonding material is applied to the region of close convolutions 18 and flows around or embraces the abutment 12 on the rod as shown in FIGURE 4. The fusible bonding material securely anchors the pin 10 to the spring 16 to permanently secure the rod and spring together as shown in FIGURES 4 and 6.

FIGURE 7 illustrates the ejector pin and spring construction in a position of use in a tubular die punch 30. The die punch 30 has a shank or body portion 52 terminating in a hardened metal-severing or shearing region 34. The shank or body portion of the punch is provided with a first bore 36 of a diameter slightly larger than the diameter of the pin to slidably accommodate the ejector pin 10. The punch is fashioned with a second bore 38 of larger diameter to accommodate the spring 36, the juncture of the bores 36 and 38 providing a ledge or seat 40 which is engaged by the end of the bonded spring section 18 providing a movement limiting means defining the extent of the projection of the ejector pin 10 beyond the working face 35 of the die punch.

The shank of the die punch is mounted in a bore in a carrier or support plate 42 which in turn is carried by the press ram 44 in a conventional manner. The upper end of the shank 32 of the die punch is fashioned with an enlarged portion or head 46 which snugly fits into a counterbore 48 provided in the carried plate 42. The upper interior region 50 of the bore 38 is threaded to accommodate a threaded abutment member 52.

The threaded abutment 52 is engaged with the upper end of the spring section 26 and is adjustable to regulate the amount of compression in the open convolution spring section 22 to control or adjust the amount of spring pressure biasing the ejector pin 10 to its normal slug-ejecting position as shown in FIGURE 7. The die punch 30 cooperates with a female die 56 which is fashioned with an opening 58 to receive the die punch region 34 in a conventional manner in punching an opening in sheet metal 60 in the manner shown in FIGURE 7. After the punch has penetrated through the sheet metal or work blank 60 to punch a circular opening of the diameter of the region 34 of the punch, the slug 62 formed as a result of the punching operation is ejected from the end region of the punch by the spring pressure on the ejector pin 10, the ejector pin being shown in slug-ejecting position in FIGURE 7. With this arrangement, upon withdrawal of the punch 30 after a punching operation, the ejector pin 10 prevents the slug 62 from adhering to the punch.

The slug-ejector pin and spring combination is adapted for use in punches of various lengths and sizes. If the punch has a shorter shank portion below the ledge 40, the pin 10 may be cut to the proper length to accommodate the shorter punch. If the portion of the shank of the punch above the ledge 40 is of decreased length the closed convolution section 26 of the spring 16 may be severed or cut to the proper length, which operation does not impair the precision provided by the open convolution spring section 22 so that the desired compressed pressure can be exerted upon the spring by adjustment of the threaded abutment 52.

Thus, the arrangement of the invention is versatile in its application. It is easily manufactured at a low cost and is reliable in its operation as the ejector pin 10 is positively anchored by the solder or bonding metal to the section 18 of the spring 16.

FIGURES 8 and 9 illustrate a modified shape or configuration of abutment on the ejector pin. In this form the ejector pin 10' is fashioned with a flattened or planar end region 66 whereby the lateral dimension of the flattened region is slightly greater than the diameter of the body of the ejector pin 10' whereby the flattened portion 66 functions as an anchoring abutment at the region 18 of the spring 16 and then the pin is telescoped through the sections 26 and 22 of the spring 16. After assembly of the pin 10' in the spring 16, fused metal is applied to the spring section 18 and at the region of the abutment 66 whereby the pin is permanently bonded or anchored to the spring in the manner illustrated in FIGURE 4.

FIGURES 10 and 11 illustrate another configuration of anchoring abutment for the ejector pin. In this form the ejector pin 10", at a region spaced slightly from the end of the pin, has two flattened portions 70 and 72, the plane of one portion 70 being normal or at right angles to the plane of the other portion 72, the flattened portions being integrally joined as shown in FIGURE 10.

The abutment anchoring means of FIGURES 10 and 11 is employed in the same manner as the abutment 12 shown in FIGURE 1. In assembly of the pin 10" within the spring 16, the pin is telescoped through the spring until the abutment provided by the portions 70, 72 engage the interior of the spring section 22 adjacent the closed convolution spring section 18, the abutment means thereby positioning the pin 10" within the spring construction. After the pin is telescoped into the spring to its proper position, fused or molten metal, such as solder, is applied to the region of the spring at the abutment means 70, 72 to bond the pin 10" to the spring in the same manner as shown in FIGURE 4.

It is apparent that, within the scope of the invention, modifications and different arrangements may be made other than as herein disclosed, and the present disclosure is illustrative merely, the invention comprehending all variations thereof.

I claim:

1. A slug ejector construction for a die punch including, in combination, a slug ejector rod having an abutment adjacent one end thereof, a coil spring having a plurality of spaced-apart convolutions and a region of close convolutions, said rod extending through the region of close convolutions of the spring with the abutment disposed within the spaced-apart convolutions and adjacent the close convolutions, and a fused bonding material at the close convolutions anchoring the close convolutions of the spring to the adjacent portion of the rod.

2. A slug ejector for a die punch including, in combination, a coil spring having a section of spaced-apart convolutions of progressively decreasing diameter terminating at a region of least diameter in a section of close convolutions, the opposite end region of the coil spring comprising a plurality of close convolutions of larger diameter, an ejector pin extending through the section of close convolutions, said pin having an abutment at an end region thereof, said abutment being within the spaced-apart convolutions and adjacent the close convolutions of lesser diameter of the spring, and fused metal securing the spring section of close convolutions of least diameter to the adjacent portion of the pin.

3. In combination, a die punch comprising an elongated body providing a work-engaging end and having an axial bore therethrough opening at the work-engaging end and an axial counterbore extending from the opposite end of the body and joined with the bore intermediate the ends of the body providing a ledge at the juncture, an ejector pin slidable in the bore, a coil spring in the counterbore, said coil spring having end sections of close convolutions, the convolutions adjacent and surrounding an end region of the ejector pin of lesser diameter than the close convolutions of the coil spring comprising an intermediate section of the coil spring having spaced-apart convolutions progressively decreasing in diameter from the close convolutions of larger diameter to the section of close convolutions of lesser diameter, an abutment on the ejector pin disposed within the spaced-apart convolutions and adjacent the section of close convolutions of
lesser diameter, and fused metal bonding the section of
close convolutions of lesser diameter to the adjacent
region of the ejector pin, the end region of the close con-
volutions of the spring of lesser diameter being of larger
diameter than the axial bore and engageable with the
lodge to limit relative slidable movement of the ejector
pin toward the work-engaging end of the die punch.

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