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Dycke et al.

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[54] **EJECTING DEVICE FOR USE IN METAL FORGING MACHINE**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **72/345**

[51] **Int. Cl.²** **B21D 45/00**

[58] **Field of Search** 72/344, 345, 346, 427, 72/361; 83/127

[56] **References Cited**

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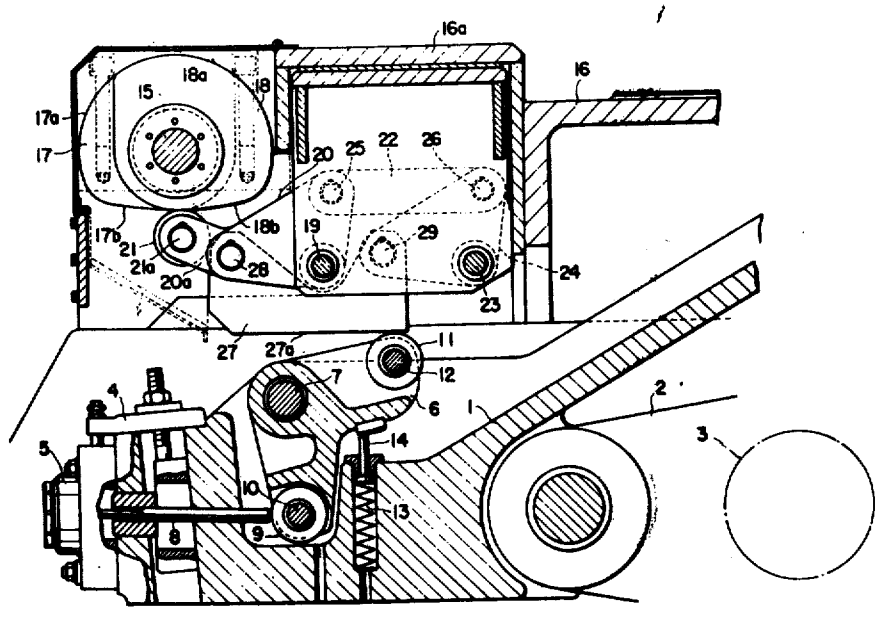
Primary Examiner—Milton S. Mehr

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[57] **ABSTRACT**

An ejecting device for use in a metal forging machine which has an ejector pin and a rocking arm exerting an ejecting motion on the ejector pin by its rocking motion. The rocking motion of the rocking arm is caused by the action of a pair of rotary cams rotated by receiving rotation of a crank shaft of the machine. The action of the pair of cams is transmitted to the rocking arm through first and second rocking members connected with each other through a link, an up and down moving element and a plurality of guide rollers.

1 Claim, 5 Drawing Figures



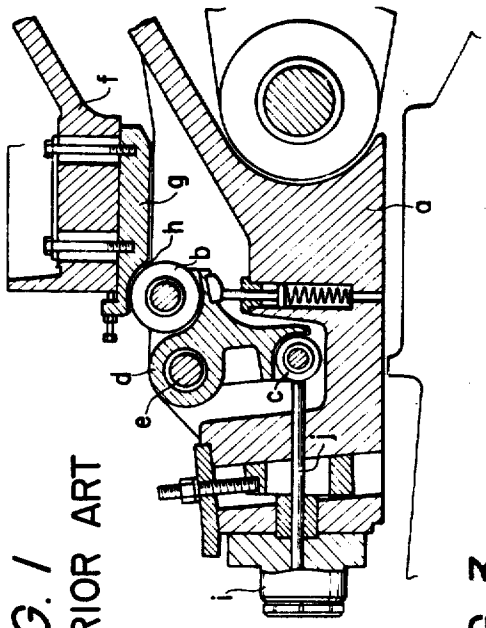


FIG. 1
PRIOR ART

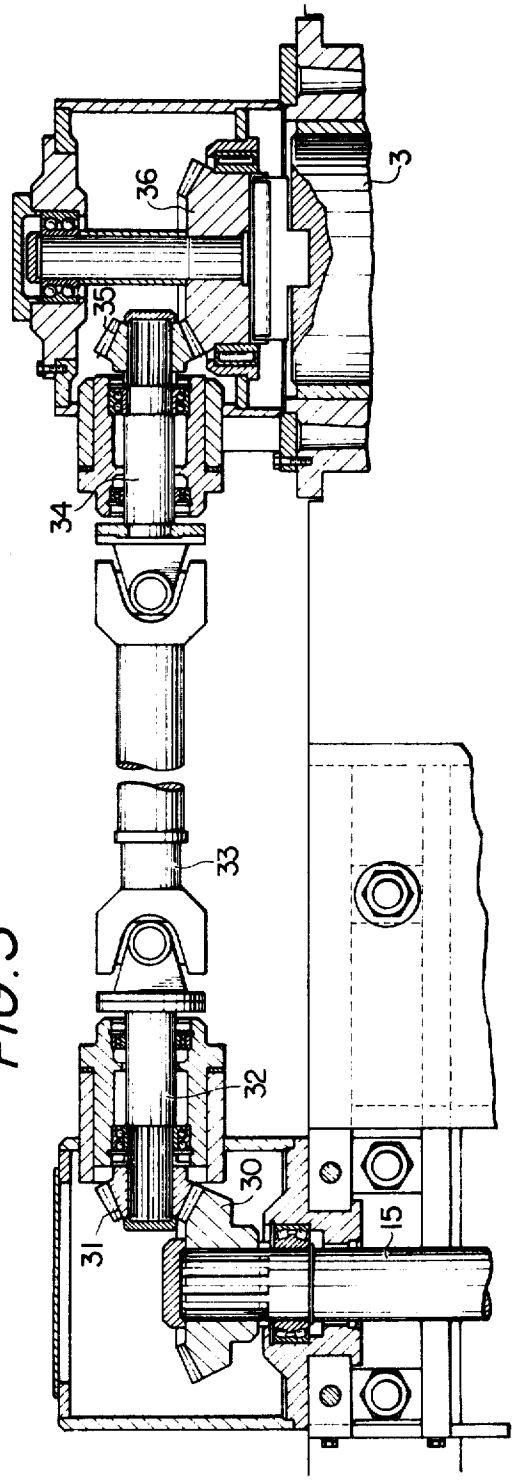
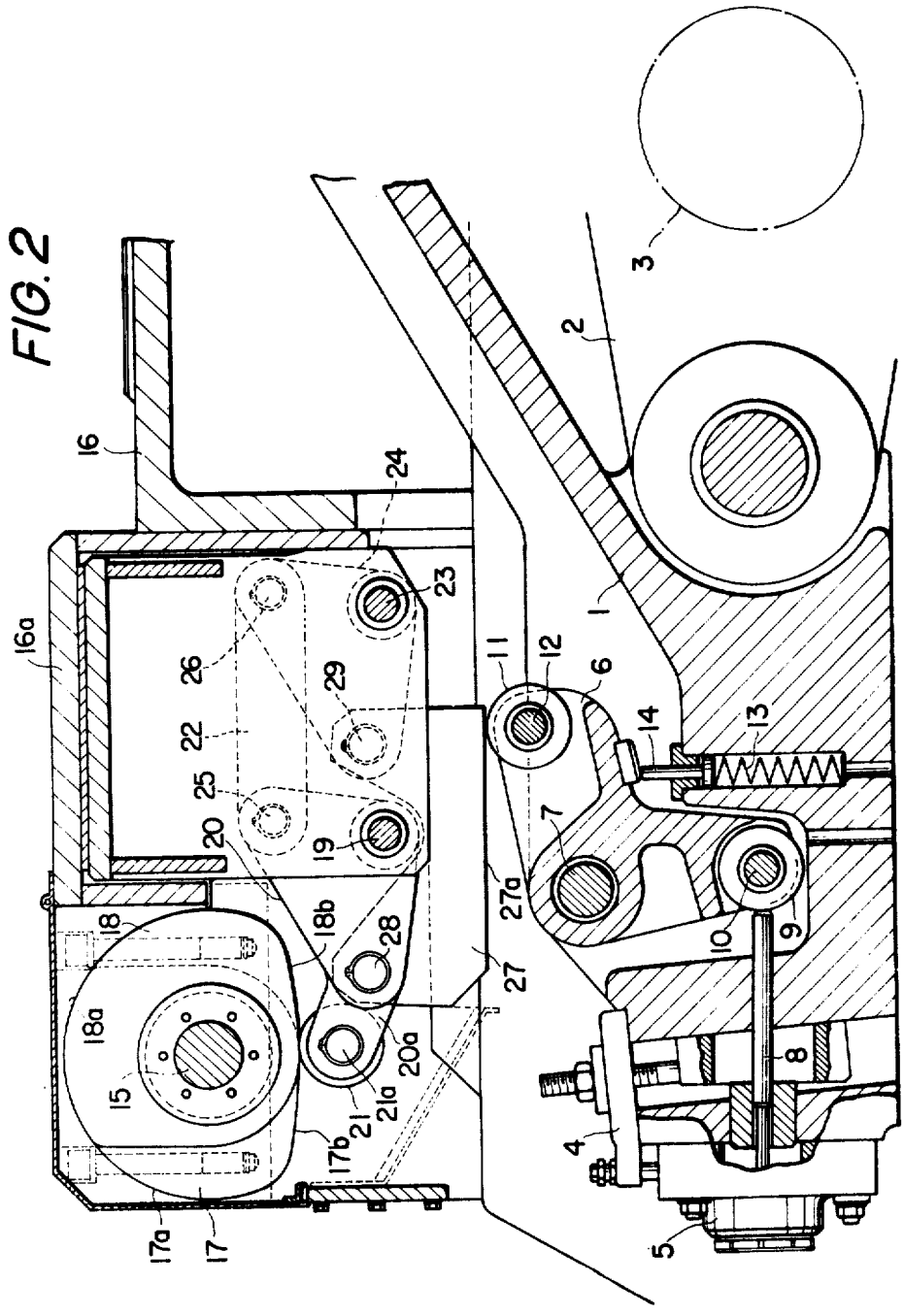


FIG. 3

FIG. 2


3
2
1
16
24
23
16a
26
29
22
25
20
19
11
12
6
14
13
7
27a
9
10
18
18b
28
27
18a
15
20a
21a
21
17b
8
4
5
17a
17

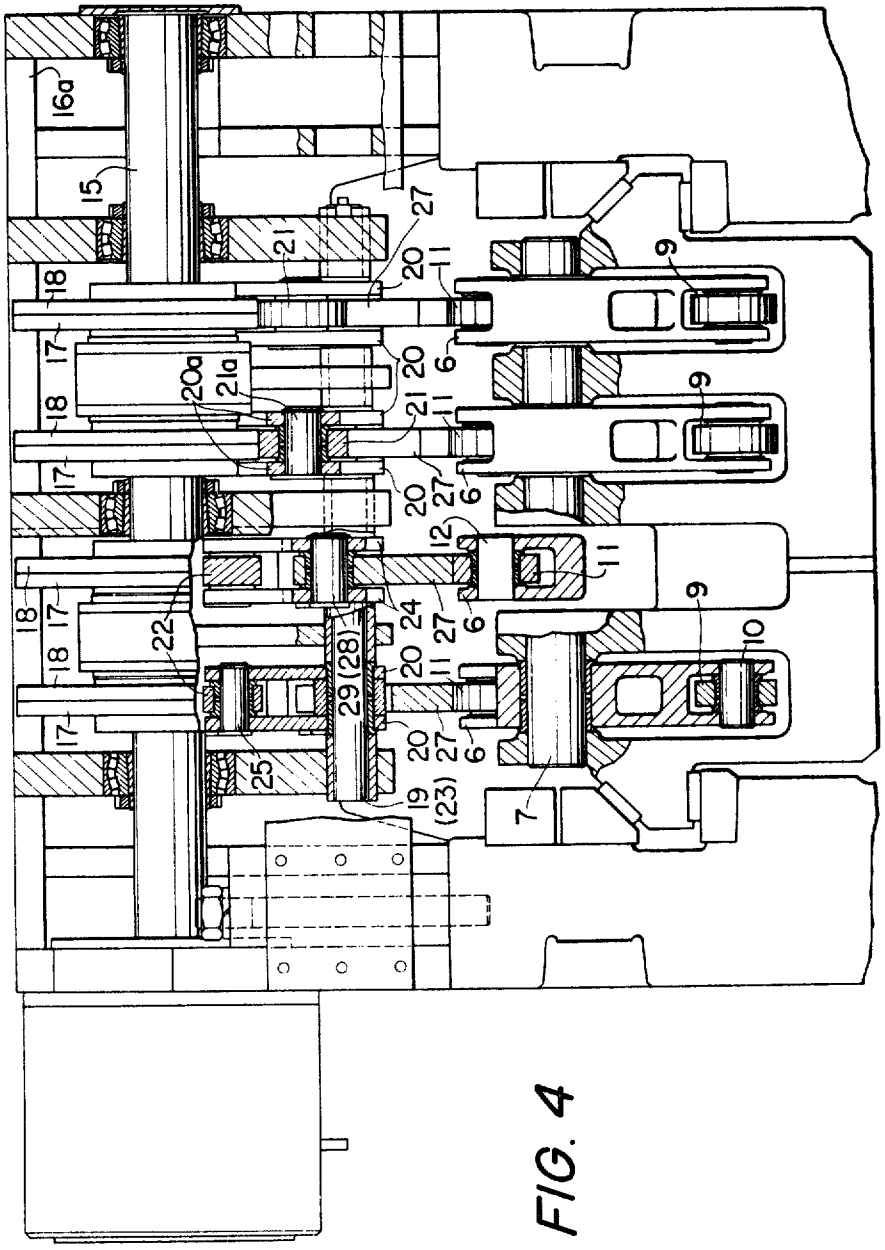

16a
15
21
27
20
11
9
18
17
20a
21a
20
6
21
11
12
22
24
(28)
29
25
19
(23)
7
10

FIG. 4

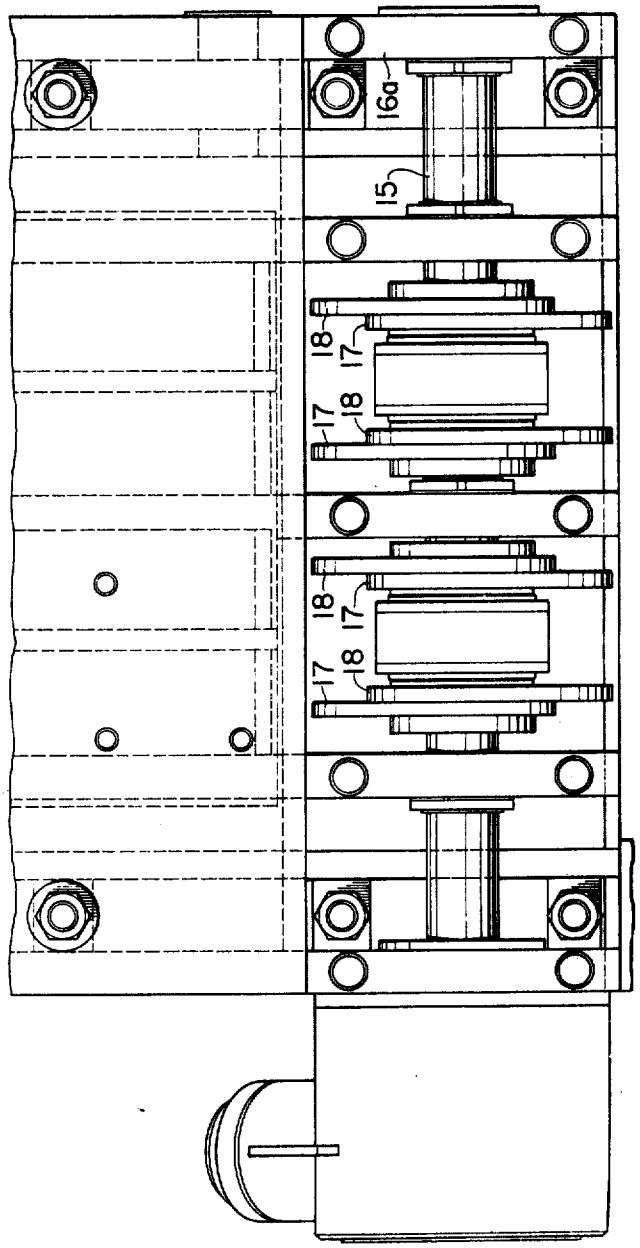


FIG. 5

EJECTING DEVICE FOR USE IN METAL FORGING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an ejecting device for use in a metal forging machine, and more particularly to an improvement of an ejecting device for use in a horizontal type of multi-stage metal forging machine, for example, for automatically manufacturing bolts from a lengthy metal rod.

2. Description of the Prior Art

A conventional ejecting device for use in a metal forging machin has such a construction that a rocking arm rockably mounted on a slide, which is reciprocated in response to rotation of a crank shaft, comes into contact with the periphery of a translation cam, which is fixed adjustably to the distal end of the machine frame, through a guide roller rotatably mounted on the upper end of the rocking arm, on the other hand, the rocking arm also comes into contact with an ejector pin slidably inserted into a punch, which is fixedly secured to the distal end of the slide, through a guide roller rotatably mounted on the lower end of the rocking arm, wherein since the upper guide roller of the rocking arm rollingly moves along the periphery of the translation cam when the slide is reciprocated in response to the rotation of the cranck shaft, the rocking arm is rocked forwards and backwards in the reciprocational direction of the slide, thus the ejector pin is ejected by the lower guide roller of the rocking arm.

In the above described conventional ejecting device, however, since the stroke timing and the amount of stroke of the ejector pin depends upon the stroke of the slide, and since the amount of stroke of the slide varies in response to a rotation angle of the crank shaft, it is very troublesome to have the stroke timing and the amount of stroke of the ejector pin. Because, these are settled by defining a shape of the translation cam depending upon the amount of stroke of the slide which is calculated from the rotation angle of the crank shaft.

In addition, since the amount of stroke of the slide becomes small at the time when the crank shaft is positioned about the lower dead point in its rotation, the amount of stroke of the ejector pin becomes also small, thereby taking a long time to knock out a product by the ejector pin.

SUMMARY OF THE INVENTION

The present invention contemplates to eliminate the above described disadvantages of the conventional ejecting device.

It is, therefore, a primary object of the present invention to provide a novel ejecting device for use in a metal forging machine which can eject a ejector pin provided therein to knock out products manufactured by the machine regardless the reciprocation of the slide of the machine, thereby saving time required to knock out products.

It is another object of the present invention to provide a novel ejecting device for use in a metal forging machine in which the stroke timing and the amount of stroke of the ejector ejector pin are selectively settled by such a simple operation as adjusting the setting position of cams with respect to the cam shaft where the cams are mounted rotatably so that the ejector pin can effectively knock out products.

According to one aspect of the present invention, there is provided an ejecting device for use in a metal forging machine including therein an ejector pin slidably inserted into the distal end of a slide reciprocated in response to rotation of a crank shaft provided within the machine and a L-shaped rocking arm having upper and lower guide rollers at each end thereof and rockably mounted on the slide through a pivotal shaft to exert an ejecting motion on the ejector pin, which comprises a pair of rotary cams rotatably mounted on a cam shaft, which is rotatably supported by a frame of the device and is rotated by receiving rotation of the crank shaft, a pair of first and second triangular rocking members, each being rockably supported by the device frame through a pivotal shaft at each apex portion thereof, which are connected with each other through a link at their respective second apex portions and are arranged in such a manner that the respective four pivotal shafts for supporting the rocking members and the link are positioned at respective four corner edges of a parallelogram, a guide roller rotatably mounted on the first rocking member through an integral bracket extending from the third apex portion of the first rocking member so that the guide roller is guided the respective outer peripheries of the pair of rotary cams when the pair of rotary cams are rotated, and up and down moving element movably suspended between the first and second triangular rocking members at their respective third apex portions and coming into contact with the rocking arm at the underside flat surface thereof through the upper guide roller of the rocking arm, wherein the rocking motion of the rocking arm exerting the ejecting motion on the ejector pin is caused by the action of the pair of rotary cams, whereby the ejecting motion of the ejector pin may be done regardless the reciprocation of the slide.

BRIEF EXPLANATION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a schematic partially cross sectional side view of a conventional ejecting device for use in a metal forging machime,

FIG. 2 is a schematic partially cross sectional side view of one embodiment of the ejecting device according to the present invention,

FIG. 3 is a schematic partially cross sectional plane view showing a drive mechanism of a cam shaft of the device of the present invention,

FIG. 4 is a fragmental partially cross sectional front view showing a main part of the device shown in FIG. 2, and

FIG. 5 is a fragmental plane view showing a main part of the device shown in FIG. 4.

DETAILED DESCRIPTION OF THE INVENTION

For better understanding of the present invention, a conventional ejecting device for use in a metal forging machine will now be described with reference to FIG. 1.

As shown in FIG. 1, a L-shaped rocking arm *d* provided with upper and lower guide rollers *b* and *c* at their respective upper and lower ends is rockably mounted on a slide *a* through a pivotal shaft *e*. The upper roller *b* comes into contact with a cam face *h* of a translation cam *g* adjustably secured to the machine frame *f*, while

the lower roller *c* comes into contact with the proximal end of an ejector pin *j* slidably inserted into the distal end of the slide *a* and a punch *i* attached to the distal end face of the slide.

In such construction, when the slide *a* is reciprocated in response to rotation of a crank shaft (not shown) provided within the machine, the upper roller *b* is rollingly moved along the cam face *h* so that the rocking arm *d* is rocked forwards or backwards in the reciprocating direction of the slide *a* about the pivotal shaft *e*. As a result, the ejector pin *j* is ejected by the lower roller *c*. Thus, in the conventional device, the ejection timing and the ejection stroke of the ejector pin depends upon the reciprocation of the slide.

Reference is now made to FIGS. **2** to **5**, one embodiment of the ejecting device of the present invention is described as follows:

A slide **1** of a metal forging machine is connected with an eccentric part of a crank shaft **3** through a connecting rod **2** so that the slide **1** is reciprocated in response to rotation of the crank shaft **3**. The slide **1** is provided through an attachment **4** with a punch **5** at the distal end thereof and a L-shaped rocking arm **6** which is mounted thereon through a pivotal shaft **7** so as to rock forwards and backwards in a reciprocating direction of the slide **1** about the shaft **7**. The rocking arm **6** is provided at the lower end thereof with a lower guide roller **9** which is rotatably mounted on a shaft **10** supported by the rocking arm **6**, while at the upper end thereof with an upper guide roller **11** which is rotatably mounted on a shaft **12** supported by the rocking arm **6** also. The lower guide roller **9** comes into contact with the proximal end of an ejector pin **8** inserted into the distal end of the slide **1** and the punch **5**. Further, the rocking arm **6** is urged counterclockwise by a biasing force of a spring **13** through an urging rod **14**. Reference numeral **15** represents a cam shaft rotatably supported by a frame **16***a* of the device. On the cam shaft **15**, a pair of first and second rotary cams **17** and **18**, which closely adhere to each other, are so mounted as to rotate together with the cam shaft **15** and to be adjustable on the position thereof with respect to the cam shaft **15**. The first and second rotary cams **17** and **18** come into contact with a first triangular rocking member **20** through a guide roller **21** which is rotatably mounted on a shaft **21***a* supported by an integral bracket **20***a* extending from one apex portion of the first triangular rocking member **20**. The first rocking member **20** is rockably mounted on the device frame **16***a* through a pivotal shaft **19** supported by the frame **16***a* and is connected by the interposition of a link **22** with a second triangular rocking member **24** which has the same shape as that of the first member **20** and is rockably mounted on the frame **16***a* through a pivotal shaft **23** supported by the frame **16***a*. The link **22** is connected between the first and second rocking members **20** and **24** through respective pivotal shafts **25** and **26** supported by the first and second rocking members, respectively, and the pivotal shafts **25** and **26** are disposed at respective upper apex portions of the first and second rocking members **20** and **24**, so that the first and second rocking members **20** and **24** carry out the same rocking motion simultaneously with each other as a pair in which the respective four pivotal shafts **19**, **23**, **25** and **26** are positioned at respective four corner edges of a parallelogram. An U-shaped up and down moving element **27** is suspended between the first and second rocking members **20** and **24** at both upper end portions thereof through pivotal shafts **28** and **29**, which are respectively supported by the first and second rocking members at their respective front apex portions, and come into contact with the upper guide roller **11** of the rocking arm **6** at the underside flat surface **27***a* thereof.

As shown in FIG. **3**, tha cam shaft **15** is connected with a transmission shaft **32** through conical gears **30** and **31** screwed on the cam shaft **15** and the transmission shaft **32**, respectively. The transmission shaft **32** is connected with another transmission shaft **34** through an universal joint **33**. The transmission shaft **34** is connected with the crank shaft **3** through conical gears **35** and **36** screwed on the transmission shaft **35** and the crank shaft **3**, respectively.

The first and second cams **17** and **18** are of plates having circular parts **17***a* and **18***a* and flat parts **17***b* and **18***b* at their respective outer peripheries.

The operation of the above constructed ejecting device of the present invention is described as follows.

When the crank shaft **3** is rotated, the slide **1** is reciprocated, at the same time, the cam shaft **15** is also rotated, and accordingly the pair of the first and second rotary cams **17** and **18** are rotated. As a result, the first rocking member **20** is rocked counterclockwise about the pivotal shaft **19** because the guide roller **21** of the first rocking member **20** is pushed down by the respective circular peripheries **17***a* and **18***a* of the first and second rotary cams, respectively, simultaneously the second rocking member **24** is rocked in the same direction as the first rocking member **20** through the link **22**, so that the up and down moving element **27** is moved downwards. In this case, since the respective pivotal shafts **19**, **23**, **25** and **26** are positioned at respective corner edges of a parallelogram, the moving element **27** is vertically moved downwards. By this movement of the up and down moving element **27**, the rocking arm **6** is rocked clockwiae through the upper guide roller **11** thereof. Thus, the ejector pin **8** is ejected forwards by the lower guide roller **9** of the rocking arm **6**, thereby knocking out a product.

In addition, the ejection timing of the ejector pin **8** is preferably adjusted with respect to the rotation angle of the crank shaft **3** by varying the correlative position between the pair of first and second rotary cams **17** and **18** and the cam shaft **15** by rotating at a certain angle the pair of cams **17** and **18** about the cam shaft **15** independently of the shaft **15**.

What is claimed is:

1. An ejecting device for use in a metal forging machine including therein an ejector pin slidably inserted into the distal end of a slide of the machine, said slide being reciprocated in response to rotation of a crank shaft provided within the machine, and a L-shaped rocking arm having upper and lower guide rollers at each end thereof and rockably mounted on the slide through a pivotal shaft so as to exert an ejecting motion on said ejector pin, which comprises a pair of rotary cams rotatably mounted on a cam shaft, which is rotatably supported by a frame of the device and is rotated by receiving rotation of said crank shaft, a pair of first and second triangular rocking members, each being rockably supported by said frame through a pivotal shaft at each first apex portion thereof, which are connected with each other through a link at their respective second apex portions and are arranged in such a manner that the respective four pivotal shafts for supporting said rocking members and said link are posi-

tioned at respective four corners of a parallelogram, a guide roller rotatably mounted on said first rocking member through an integral bracket extending from the third apex portion of said first rocking member so that said guide roller is guided by the respective outer peripheries of said pair of rotary cams when said pair of rotary cams are rotated, and an up and down moving element movably suspended between said first and second triangular rocking members at their respective third apex portions and coming into contact with the rocking arm at the underside flat surface thereof through said upper guide roller of said rocking arm, wherein the rocking motion of said rocking arm exerting the ejecting motion on said ejector pin is caused by the action of said pair of rotary cams, thereby causing ejecting motion of said ejector pin regardless of the reciprocation of said slide.

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