Nov. 19, 1968 AKIRA ASARI 3,411,340

KNOCK-OUT DEVICE OF IMPACT FORMING MACHINE

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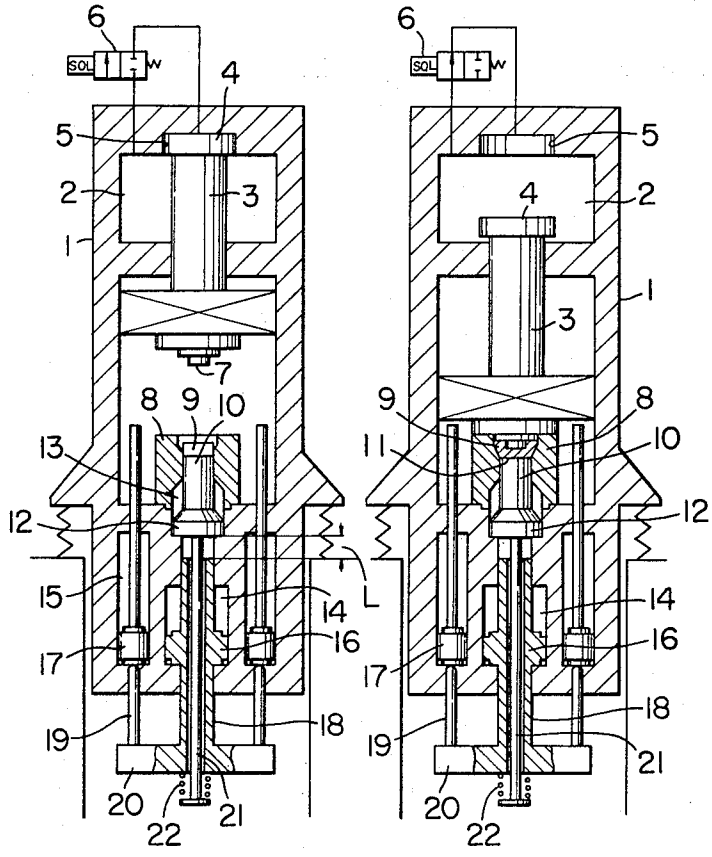
Fig. 1 Fig. 2



Akira Asari,

INVENTOR.

BY Wenderoth, Lind and Ponack, Attorneys

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Fig. 3

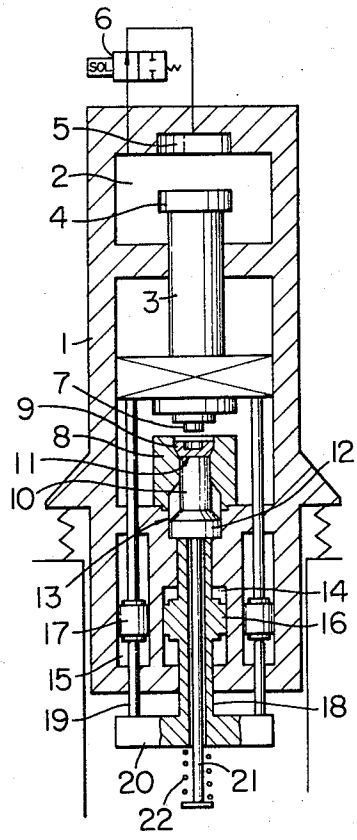
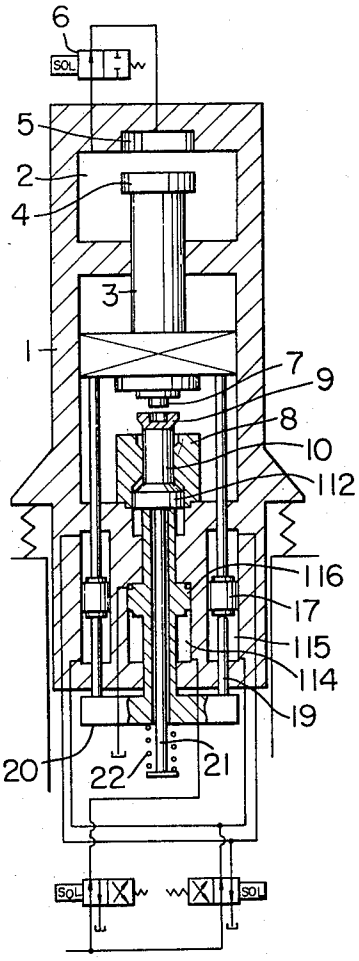


Fig. 4



Akira Asari,
INVENTOR.

BY Wenderoth, Lind
And Brack, Attorneys

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Fig. 5

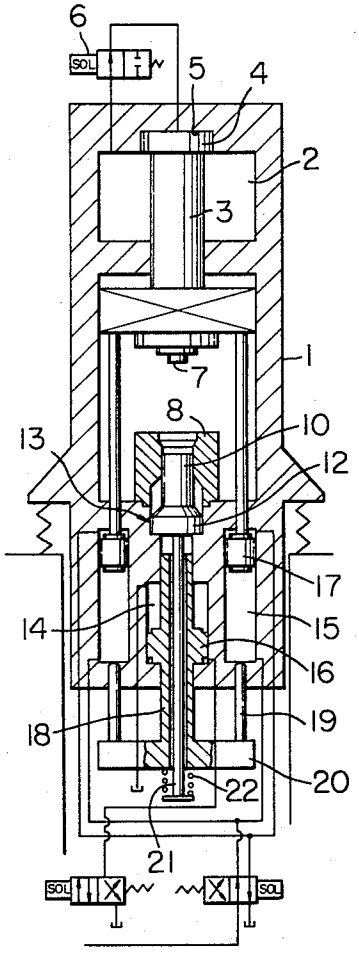
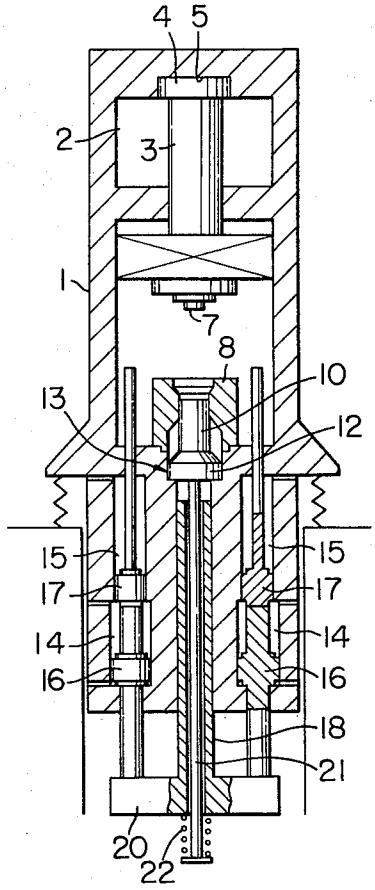


Fig. 6



Akira Asari,

INVENTOR.

BY Wenderoth, Lind and Ponack, Attorneys

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3,411,340

KNOCK-OUT DEVICE OF IMPACT FORMING MACHINE

Akira Asari, Osaka-shi, Japan, assignor to Kobe Steel Ltd., Kobe, Japan

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10 Claims. (Cl. 72—453)

The present invention relates to a product knock-out device of impact forming machine, more particularly, relates to a knock-out device for carrying out the operation of removing formed products from the mold immediately after forming in an impact forming machine which forms materials placed between the upper mold and a lower mold which faces this by driving a ram rapidly with hydraulic pressure.

As is well known, an impact forming machine forms materials by utilizing the velocity energy due to high speed of ram and a very large force can be obtained by this and furthermore, it has the feature of having a very high fabrication speed. However, it is not possible to remove the product rationally after it has been formed and consequently, the feature of this machine cannot be utilized sufficiently unless the ejection of the product can be speeded up.

The object of the present invention is to speed up the ejection of the formed products in order to improve the efficiency of the impact forming machine. To attain this object, this invention is characterized by carrying out the removal of the product from the upper mold by the return action of the ram utilizing a jack mechanism and immediately before this action or when it has been completed, the knock-out action is carried out to knock-out the product from the lower mold. More particularly, the jack mechanism for the return action of the ram and the knock-out mechanism are interlocked so that they act in sequence, by which knock-out is carried out after the stroke has moved to a certain extent after the jack mechanism has begun to act, during which time, the jack mechanism removes the product from the upper mold and then the knock-out mechanism carries out the actual knock-out operation to eject the product from the lower mold.

The invention will be better understood from the following description taken in connection with the accompanying drawings and its scope will be pointed out in the appended claims.

FIGS. 1, 2, 3, 4 and 5 are longitudinal sectional views showing in sequence the operation of an embodiment of a knock-out device of the present invention,

FIG. 6 is a longitudinal sectional view of another embodiment of the knock-out device of the present invention.

An embodiment of the knock-out device of this invention is explained for a device in which hydraulic force is utilized with a pair of piston and cylinder as the jack mechanism and knock-out mechanism.

In FIGS. 1, 2, 3, 4 and 5, in the drawing component of the impact forming machine, an upper half of ram **3** extends into a gas cylinder **2** which comprises the upper, interior part of frame **1** and a large piston **4** at its upper end fits into a cavity **5** formed in the ceiling of the cylinder **2**. As high pressure gas is sealed into the gas cylinder **2**, the ram **3** is maintained at the upper dead point as shown in FIG. 1 by the pressure of gas acting on the lower surface of the piston **4**. Now, when a part of the high pressure gas in the gas cylinder **2** is introduced into the upper part of the cavity **5** by an opening valve **6**, this pressure pushes the piston **4** downward and when the upper surface leaves the cavity **5**, the entire pressure of the gas cylinder **2** acts on the upper surface of the piston **4** to push the ram **3** down at a high speed (FIG. 2).

Now, when an upper mold **7** is attached to the lower surface of ram **3** and a lower mold **8** to the bottom of frame **1**, a material **9** which has been placed between the upper and lower molds **7** and **8** is impact-formed by the rapid lowering of the ram **3**.

As the knock-out device for removing the product after it has been formed, the lower mold is made hollow and a knock-out member **10** is pushed in from the lower side and its top surface **11** forms the bottom of the mold of lower mold **8**. The bottom of knock-out member **10** is in the form of a base **12** and fits into a cavity **13** which is formed at the bottom of frame **1**. A cylinder **14** for knock-out is provided at the center and cylinders **15** for jack at both sides of the bottom of frame **1**. In the former cylinder **14** is fitted a knock-out piston **16** whose upper end faces the lower surface of aforementioned knock-out member **10** and in the latter cylinders **15** are fitted jack pistons **17** whose upper ends face the lower surface of the aforementioned ram **3**. The knock-out piston **16** has a stem **18** which passes through the frame **1** and extends downward, and an arm **20** having pushing rods **19** whose upper ends face the lower surface of aforementioned jack piston as an integral part of it.

When impact forming is completed, both the knock-out piston **16** and jack pistons **17** are at the lower dead points (FIGS. 1 and 2) and also, a sufficient clearance corresponding to L is provided between the upper end of the knock-out piston and lower surface of the knock-out member **10**. When ram **3** comes down and impact forming is finished, hydraulic pressure is introduced as soon as possible into the lower part of cylinder **14** for knock-out and the cylinders **15** for jack to raise the piston **16** for knock-out and jack pistons simultaneously, by which the jacks **17** are pushed upward to the height of the ram in FIG. 3 while the piston for knock-out **16** is rising a distance of L, by which the upper mold **7** separates from the product **9**. At this time, the upper surface of piston **16** for knock-out is contacting the lower surface of knock-out member **10** and as it continues to raise, the knock-out member **10** moves upward in the lower mold **8** and carries out the knock-out action by pushing the product upward from the lower mold **8** (FIG. 4). At this time, there is no further rise of the knock-out member **10** as the piston **16** for knock-out has already reached the upper dead point in the cylinder **14** and subsequently, only the jack piston **17** rises to push up the ram **3** to the upper dead point to return it to its original position (FIG. 5). When knock-out of product is completed, the product is taken out from above the knock-out member **10**, then only the piston **16** for knock-out comes down at first and next the jack pistons **17** come down to complete one cycle.

Also, the aforementioned knock-out member **10** has a rod **21** extending downward, this passes through the center of piston **16** for knock-out and this is supported on the arm **20** by way of a spring **22** so that the knock-out member **10** is pushed down by force from its upper position.

As is clear from the above description, in this invention the upper mold **7** is pulled out from the product **9** immediately after it has been formed; next the removal of the product from the lower mold is carried out by the two-stage operation of the combination of jack pistons **17** for returning the ram **3** and the piston **16** for knock-out which pushes up the knock-out member **10** and furthermore, the upper mold **7** is taken out from the product **9** by the jack pistons **17**, the piston **16** for knock-out is made to approach or contact the knock-out member **10** so that the product **9** is removed from the lower mold **8** by the knock-out action immediately before or simultaneously with the removal of the upper mold **7** from the product **9**, the ram **3** rises further by the independent

action of the jack pistons **17** even after the knock-out action has been completed, by which the separation of the product from the upper and lower molds **7**, **8** is carried out immediately and also instantaneously after forming. This removes the load and the effect of heat from the mold as quickly as possible to prevent shortening of the life of the mold. On the other hand, the impact forming cycle becomes shorter and production efficiency is increased as the knock-out operation is carried out instantaneously. Also, operation is simple as this is composed only of driving the various pistons and at the same time, high precision can be maintained due to simple construction, which makes it a very practical impact forming machine.

The knock-out device of FIG. 6 shows another embodiment. This differs from the first embodiment in which the piston for knock-out and jack pistons are provided in separate cylinders as the piston for knock-out and jack piston are provided one above the other in the same cylinder. In the drawing, the cylinder **14** for the knock-out piston **16** and the cylinder **15** for the jack piston **17** are arranged in a straight line one above the other, the upper surface of the piston **16** for knock-out contact the lower surface of the jack piston **17** and also, the diameter of this cylinder **14** is made large in order to prevent excess rise of the piston **16** for knock-out. The actions of these are the same as those explained above.

While the invention has been described in conjunction with certain embodiment thereof, it is to be understood that various modifications and changes may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A knock-out device of impact forming machine comprising, an upper mold and a lower mold disposed at a corresponding position to said upper mold for providing a material disposed on said lower mold with impact forming, a ram supporting said upper mold, a jack mechanism for providing said ram with return motion by which said upper mold is taken from a formed material after impact forming, a knock-out mechanism for knocking-out said formed material from said lower mold at a time between a time of just before and just on time of taking-off said upper mold from said formed material according to said return motion of ram by said jack mechanism, said jack mechanism working with said knock-out mechanism in a combined relation while said taking-off motion of said ram from said formed material and knocking-out motion of said formed material from said lower mold.

2. A knock-out device of impact forming machine comprising, an upper mold and a lower mold disposed at a corresponding position to said upper mold for providing a material disposed on said lower mold with impact forming, a ram supporting said upper mold, a jack mechanism for providing said ram with return motion by which said upper mold is taken from a formed material after impact forming, a knock-out mechanism for knocking-out said formed material from said lower mold at a time between a time of just before and just on time of taking-off said upper mold from said formed material according to said return motion of ram by said jack mechanism, said jack mechanism working with said knock-out mechanism in a combined relation while said taking-off motion of said ram from said formed material and knocking-out motion of said formed material from said lower mold, after said knock-out motion, further providing said ram with upward shifting motion by an individual motion of said jack mechanism.

3. A knock-out device of impact forming machine according to claim **1**, further characterized by said jack-mechanism and knock-out mechanism having respective pairs of piston and cylinder working by hydraulic pressure.

4. A knock-out device of impact forming machine according to claim **2**, further characterized by said jack-mechanism and knock-out mechanism having respective pairs of piston and cylinder working by hydraulic pressure.

5. A knock-out device of impact forming machine according to claim **1**, wherein said knock-out mechanism comprises, said lower mold having hollow portion, a knock-out member slidably engaging an upper portion of it with said hollow portion of said lower mold so as to form a base surface of said lower mold by a top end of said knock-out member, a cavity disposed at a central position of a base portion of a frame of said impacting machine, a knock-out cylinder having a piston vertically disposed at the central position of said base of said frame, a base portion forming a main body of said knock-out member slidably engaged with said cavity of said frame, an upper end of said piston of knock-out cylinder facing lower end surface of said knock-out member, said piston of said knock-out cylinder provided with a downward extending rod, said rod passing vertically through said base of frame, and an arm secured at a lower end of said rod, in a condition of one-body, thereby, before completion of said impact forming the top end of said knock-out piston is positioned under the bottom surface of said knock-out member with sufficient interval, after completion of said impact forming said knock-out piston is shifted upward by a hydraulic pressure provided into said knock-out cylinder by which said knock-out member is pushed up, therefore, said knock-out member is shifted upward inside the hollow portion of said lower mold, said formed material is knocked-out from said lower mold, after said knocking-out said formed material, said knock-out piston is moved downward so as to complete one stroke of said knock-out motion.

6. A knock-out device of impact forming machine according to claim **2**, wherein said knock-out mechanism comprises, said lower mold having hollow portion, a knock-out member slidably engaging an upper portion of it with said hollow portion of said lower mold so as to form a base surface of said lower mold by a top end of said knock-out member, a cavity disposed at a central position of a base portion of a frame of said impacting machine, a knock-out cylinder having a piston vertically disposed at the central position of said base of said frame, a base portion forming a main body of said knock-out member slidably engaged with said cavity of said frame, an upper end of said piston of knock-out cylinder facing lower end surface of said knock-out member, said piston of said knock-out cylinder provided with a downward extending rod, said rod passing vertically through said base of frame, and an arm secured at a lower end of said rod in a condition of one-body, thereby, before completion of said impact forming the top end of said knock-out piston is positioned under the bottom surface of said knock-out member with sufficient interval, after completion of said impact forming said knock-out piston is shifted upward by a hydraulic pressure provided into said knock-out cylinder by which said knockout member is pushed up, therefore, said knock-out member is shifted upward inside the hollow portion of said lower mold, said formed material is knocked-out from said lower mold, after said knocking-out said formed material, said knock-out piston is moved downward so as to complete one stroke of said knock-out motion.

7. A knock-out device of impact forming machine according to claim **5**, further characterized by said jack-mechanism comprising a pair of cylinder for jack motion disposed symmetrically at both sides of said knock-out cylinder of knock-out mechanism, each jack piston slidably engaged with said cylinder for jack motion respectively in such a way that an upper end of each jack piston faces the lower surface of said ram respectively, a pair of pushing rods vertically disposed on an arm rigidly secured to said rod of said knock-out mechanism, top ends of said pushing rods facing corresponding lower surface of said jack pistons respectively, thereby, before completion of

said impact forming, said jack pistons are positioned at lower dead points, after completion of said impact forming, said cylinders for jack motion are provided with hydraulic pressure, said jack pistons are subjected to shift upward at the same time as the upward lifting of said knock-out piston, after said knock-out member reaches at the utmost upper position, said jack pistons are continued to shift upward and therefore said ram is shifted to an upper dead position by said jack piston, said jack pistons are subjected to shift downward after said downward motion of said knock-out piston and then the one stroke of said jack piston is completed.

8. A knock-out device of impact forming machine according to claim **6**, further characterized by said jack-mechanism comprising a pair of cylinder for jack motion disposed symmetrically at both sides of said knock-out cylinder of knock-out mechanism, each jack piston slidably engaged with said cylinder for jack motion respectively in such a way that an upper end of each jack piston faces the lower surface of said ram respectively, a pair of pushing rods vertically disposed on an arm rigidly secured to said rod of said knock-out mechanism, top ends of said pushing rods facing corresponding lower surface of said jack pistons respectively, thereby, before completion of said impact forming, said jack pistons are positioned at lower dead points, after completion of said impact forming, said cylinders for jack motion are provided with hydraulic pressure, said jack pistons are subjected to shift

upward at the same time as the upward lifting of said knock-out piston, after said knock-out member reaches at the utmost positions, said jack pistons are continued to shift upward and therefore said ram is shifted to an upper dead position by said jack piston, said jack pistons are subjected to shift downward after said downward motion of said knock-out piston and then the one stroke of said jack piston is completed.

9. A knock-out device of impact forming machine according to claim **3**, further characterized by disposing both pistons of said jack mechanism and knock-out mechanism one above the other in the same cylinder.

10. A knock-out device of impact forming machine according to claim **4**, further characterized by disposing both pistons of said jack mechanism and knock-out mechanism one above the other in the same cylinder.

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J. HOWARD FLINT, JR., *Primary Examiner.*