

(17)

2090317

- 1 -

'CLAMPING APPARATUS'

5

This invention relates to clamping apparatus.

10

However apparatus for clamping a metallic mould is often inconvenient, because a lengthy operation is necessary to attach or detach the metallic mould.

The present invention seeks to alleviate these difficulties and to provide a convenient clamping apparatus which may be attached to or detached from inter alia a mould easily and safely in a short time.

15

According to the present invention there is provided a clamping apparatus for attachment to a mounting surface, said clamping apparatus comprising a clamp member having a stepped clamping surface providing alternative clamping levels at one end, a space block coupled at the other end to said one end by a coupling member so that when said space block is between said clamp member and said mounting surface it is rotatable in a plane substantially normal to said mounting surface,

20

thereby to provide at least two operative dispositions of said space block to provide further alternative clamping levels of said apparatus with respect to said mounting surface.

5 The invention will now be described by way of example only with reference to the several figures of the accompanying drawings in which:

 Figures 1, 2 and 3 are representations of the prior art.

10 In the drawings:-

 Figure 1 shows a plan view of the modus operandi using a conventional clamping apparatus for clamping a metallic mould;

15 Figure 2 shows a view in perspective of a clamp bar that is known,

 Figure 3 is a view in perspective of a known clamping apparatus for use in the clamping operation of Figure 1;

20 Figure 4 is a plan view of an apparatus for clamping a metallic mould in accordance with the present invention;

 Figure 5 is an elevational view of the apparatus of Figure 4;

25 Figure 6 is a sectional view taken on the section station VI-VI in Figure 5;

Figures 7A to 7E are schematics of clamping states in which an attachment plate of various thicknesses (not shown) may be clamped;

5 Figure 8 is a schematic elevation of another embodiment of this invention similar to Figure 5;

Figure 9 is a view in oblique perspective showing one way of easily attaching the clamping apparatus of the invention to a mould;

10 Figure 10 is a plan view of a further apparatus for clamping a metallic mould in accordance with the present invention (similar to Figure 2);

Figure 11 is an elevation of the apparatus shown in Figure 10;

15 Figure 12 is a sectional view taken on the section station XII-XII in Figure 11;

Figure 13 is a view in oblique perspective of the separated main parts of the apparatus shown in Figures 10, 11 and 12 with coupling plates removed.

20 Referring now to the prior art in Figures 1, 2 and 3 it can be seen that the known clamping apparatus comprises a clamp bar A, a space block B and a bolt C. Because two metallic moulds E_1, E_2 are clamped face to face on a fixed die - plate D
25 and a movable die - plate D of the moulding machine,

at upper and lower ends of both sides, eight pieces of apparatus are used to clamp the metallic moulds onto the moulding machine.

Attachment plates F_1 and F_2 are pressed toward
5 the die - plates $D.D_1$ of the moulding machine by the clamp bars A. The clamp bar A is a long block having a slot G (Figure 2). The bolt C (Figure 1) passing through the slot G, is screwed on the die - plates $D.D_1$. The space blocks B are inserted
10 between the clamp bar A and the die - plates $D.D_1$ to keep the clamp bar A parallel with the said die plates.

For safety, the bolts C must first be completely removed to detach the clamp bars A from the die -
15 plates. In this case the operation of turning the bolt must be done for the full length of its screw coupling and this is very tedious owing to the need to rotate the bolt many times.

Next, according to the different thicknesses
20 of the different attachment plates F_1 that may be used the space block B with a thickness appropriate to the attachment plate F_1 must be applied. Therefore many sizes of space blocks are essential for success.

25 Thirdly even if the bolt C is difficult to

turn, the operator must turn a spanner engaged with the bolt C by one hand, while holding the clamp bar A and the space block B with his other hand. Since, if the clamp bar and the space block were left
5 unheld, the space block B may fall injuring the operator.

Hence the conventional clamping apparatus takes a long time to attach or detach to the die - plate of the moulding machine and the operation is
10 not always achieved with total safety.

To resolve these difficulties another known clamping apparatus has been proposed (Figure 3). It has a clamp bar coupled with the function of a space block in a body.

15 In this apparatus the clamp bar shown generally at H has an adjusting bolt M at its rear end. A separable press plate J, which is fixed on the die - plate by a bolt K, presses the clamp bar H upon an attachment plate not shown.

20 If the thickness of the attachment plates F varies from operation to operation this clamping apparatus enables the operator to clamp any metallic mould by adjusting the projecting length M, of the adjusting bolt M. Therefore it needs no space blocks
25 and this clearly is a considerable advantage.

- 6 -

However another difficulty occurs as a result of the continuous adjustability of the adjusting bolt M.

5 The thickness of the attachment plate of the metallic mould is standardised in many countries providing attachment plate units in a series having individual thicknesses that vary stepwise by five millimetres.

10 When the known clamping apparatus shown in Figure 3 is used, the operator must gauge the projecting length of the adjusting bolt M by eye. Partly because the projection length of the bolt M changes continuously and partly because the visual judgement of length is notoriously difficult hence the operator wastes much time and effort to locate
15 the clamp bar H substantially parallel with the surface of the die - plate. Furthermore there appears another disadvantage. The top-end M_2 of the projection of the adjusting bolt M hinders the rotation of a spanner used to tighten the bolt K,
20 especially when a thin attachment plate is used.

Referring now to Figures 4 to 6 clamping apparatus shown generally at 10 for clamping a metallic mould said clamping apparatus comprises a clamp member shown generally at 12 to clamp
25 an attachment plate F (not shown) of a metallic mould

upon a mounting surface of a die - plate (not shown) of a mould machine (not shown), a space block 13 to keep the clamp member 12 parallel with the mounting surface of the die - plate, a pressing plate 14 to
5 press the clamp member 12 on the attachment plate (not shown), and a fixing bolt shown generally at 15 to fix the pressing plate 14 on the die - plate (not shown).

The clamp member 12 and the space block 13
10 are connected by a coupling member comprising a pair of coupling plates 16, 16₂ each having an elongate slot 16₃ and a spring 17.

The clamp member 12 is bifurcated and has two parallel front clamp arms 12, and 12₂ and a coupling
15 block 19 is welded at extremity 20 of the bifurcated clamp arms 12, 12₂ to couple the said two arms in a body. Therefore an aperture 21 opens between the clamp arms 12, and 12₂ and receives the threaded shank 15, of a fixing bolt the hexagonal head of
20 which is shown at 15₂. Lower step parts 12₃ are formed at the front ends of the two clamp arms 12, 12₂.

Clearly the clamp member 12 is easily attached to or detached from the pressing plate 14.

25 The coupling plates 16, 16₂ are loosely

suspended on both sides of the clamp member 12 by a rivet 23 penetrating through the clamp member 12 and weakly pushed on both sides of the space block 13 by screws 24 and 25 fixed on the sides of the space block 13.

The springs 17, that extend between the rivet 23 and the screws 24 and 25, pull the space block 13 toward the clamp member 12 by elastic force. The springs 17 facilitate the operation of attaching or detaching the clamp member 12 to or from a member to be clamped to a mounting surface, because the space block 13 is always in facing contact with the clamp member 12 as a result of the elastic force of the springs 17.

The side surface (seen in Figure 5) of the space block 13 is not a square, but an oblong that is to say it is rectangular with adjacent sides P and Q unequal. The longer side P is shown contacting the under surface 12₄ of the clamp member 12. If the operator rotates the space block 13 about axis W₁ W₂ (Figure 6) through a right angle from the position shown in Figure 5 the shorter side Q comes to contact with the surface 12₄ of the clamp member 12.

The lower step parts 12₃ are formed to a depth

R as shown in Figure 5. Clearly if an operator reverses the clamp member 12 from the position shown in Figure 5 one can clamp an attachment plate (not shown) that is thicker by a thickness R.

5 Because an attachment plate F (not shown) may be clamped by the front ends of the clamp arms 12, and 12₂ the height X of the bottom surface of the ends thereof from a base plane represented by the line AA₁ in Figure 5 in which the bottom
10 surface 13₁ of the space block 13 is included, must be equal to the thickness of the said attachment plate F to hold the clamping members 12 substantially parallel to the die - plate (not shown) of the moulding machine (not shown).

15 Because of the loose coupling between the clamp member 12 and the space block 13 by the coupling plates 16 16 and the springs 17, the clamp member 12 can be reversed and the space block 13 can be rotated in a plane normal to that of plane AA₁.
20 Then the height X of the end of the clamp member 12 may be made equal to any one of the following five heights,

(1) $X = R + P$ (Figure 7A)

(2) $X = R + Q$ (Figure 7B)

25 (3) $X = P$ (Figure 7C)

(4) $X = Q$ (Figure 7D)

(5) $X = R$ (Figure 7E)

For example if the values of P, Q and R are taken to be P of 25 mm, Q of 20 mm and R of 10 mm, then the clamping apparatus is able to clamp attachment plates F with a thickness of 35 mm, 30 mm, 25 mm, 20 mm, and 10 mm.

In Figure 8 the clamp member 12 has another step part 12₄ of depth S on the reverse surface of the clamp arms to step part 12₃ of depth R.

The height X for a clamping attachment plate F can then freely be changed to any of eight desired values,

- (1) $X = S + P$
- (2) $X = R + P$
- (3) $X = S + Q$
- (4) $X = R + Q$
- (5) $X = P$
- (6) $X = Q$
- (7) $X = S$
- (8) $X = R$

In practice the pressing plate 4 is attached to a die - plate of a mould machine by the fixing bolt 5. After loosening the fixing bolt 5 slightly, the operator attaches or detaches the clamp member 12

together with the space block 13. The orientations of the attaching or detaching operation are horizontal. Therefore it is better to form the pressing plate 4 asymmetrically of the bolt axis XX (Figure 11).

5 In this embodiment side members 14_1 and 14_2 of the pressing plate 4 have different thickness t_1 , t_2 . Because the weights of the side protrusions 14_1 , 14_2 are different, the pressing plate 14 is stably suspended along a vertical line XX by the action of gravity. This is a stable state of the pressing plate 4 as shown in Figure 9. It is very convenient for the operator to attach the clamp member into the pressing plate 4 by sliding it along a horizontal direction arrow B.

15 In the aforementioned embodiment the clamp member 12 is manufactured from three metal pieces by welding them in a body. Because these metal pieces are easily made by shearing a simple rectangular bar, the material cost is low in the embodiments.

20 Clearly the clamp member 12 can be made in an integral body from the beginning without welding.

In Figures 10, 11, 12 and 13 where the same integers have the same reference numbers as in Figures 4, 5 and 6 the apparatus shown generally at 100 comprises a clamp member shown generally at

- 12 -

12 which is a single metal piece which is bifurcated at 12, 12₂. This clamp member 12 has an aperture 21 between branched clamp arms 12, 12₂ for receiving the fixing bolt shown generally at 15. A pair of coupling plates 16, 16₂ and springs 17 loosely connect the clamp member 12 and a space block 13.

In this clamping apparatus 100 screws 101, 102, 103 and 104 are used to suspend the coupling plates 16, 16₂.

It will be appreciated that the spring 17 can be omitted, because the necessary condition concerning the connection between the clamp member 12 and the space block 13 is that the space block 13 cannot be separated from the clamp member 12 but can be rotated about an axis $W_3 W_4$.

The modus operandi of the clamping apparatus is as follows:-

(1) The operator need not take off the fixing bolt 15 completely but can leave it remaining on a die - plate (not shown) of a moulding machine (not shown). Then he can tighten or relax the clamp member 14 by a few turns of the fixing bolt 15. Because the operation of turning the bolt 15, which generally takes much time, is greatly reduced, the operator is able to attach or detach a metallic

mould (not shown) onto a moulding machine (not shown) in a relatively short time.

5 The space block 13, which is coupled by the clamp member 12, does not fall when the fixing bolt 15 is loosened. This arrangement assures the safety of the clamping operation.

Thus the main advantages of the above-described embodiments of the invention are facility and safety in the clamping operation.

10 (2) The thickness of attachment plates (F) are standardized and differ widely in thickness. For example the thickness of attachment plate may be 20 mm, 25 mm and 30 mm. Because the described apparatus combines the clamp member with a stepped
15 surface with the space block with an oblong side surface, it can be adjusted to accept differences of the thicknesses of various attachment plates. Because the variation of the clamp height X is not continuous but discrete, this clamping apparatus
20 enables the operator to avoid the inaccuracy resulting from the estimation of distances and thickness by eye.

(3) Furthermore, if the pressing plate 14 is asymmetric, it is stable at rest along a vertical
25 line by the action of gravity and this will

- 14 -

facilitate the operation of attaching the clamp member, because the operator need not prearrange the orientation of the pressing plate 14.

CLAIMS

5 1. A clamping apparatus for attachment to a
mounting surface, said clamping apparatus comprising
a clamp member having a stepped clamping surface
providing alternative clamping levels at one end, a
space block coupled at the other end to said one end
10 by a coupling member so that when said space block is
between said clamp member and said mounting surface
it is rotatable in a plane substantially normal to
said mounting surface, thereby to provide at least
two operative dispositions of said space block to
15 provide further alternative clamping levels of said
apparatus with respect to said mounting surface.

2. The clamping apparatus as claimed in Claim 1
wherein the clamp member at said one end is bi-
20 furcated.

32 (orb)



- 16 -

3. The clamping apparatus as claimed in Claim 1 or Claim 2 wherein the space block has an oblong side surface in said plane.

5 4. The clamping apparatus as claimed in any preceding claim wherein the coupling member is a coupling plate connecting the space block loosely with the said other end of the clamp member to permit rotation of the space block.

10

5. The clamping apparatus as claimed in any preceding claim wherein a pressing plate co-operates with a bolt to connect said apparatus to the support surface.

15

6. The clamping apparatus as claimed in Claim 5 wherein the pressing plate is asymmetric with respect to the bolt.

20

7. The clamping apparatus as claimed in Claim 5 or 6 wherein one or more springs are located between the space block and the rear ends of the clamp member for pulling the space block toward the clamp member by an elastic force.

25



- 17 -

8. Clamping apparatus as claimed in any preceding claim wherein one or more springs are located between the space block and the rear ends of the clamp member for pulling the space block toward the clamp member by an elastic force.

9. Clamping apparatus as claimed in any preceding claim wherein step parts are shaped on both surfaces of each of the bifurcated clamp arms, the step parts on each arm having different depths, and the step parts on the said bifurcated clamp arms corresponding on to the other.

10. Clamping apparatus as claimed in any preceding claim wherein the clamp member consists of two parallel clamp arms and a coupling block welded at the said other ends of the clamp arms.

11. Clamping apparatus as claimed in any one of Claims 4 to 10 wherein a rivet penetrating the other end of the clamp member and screws fixed on the side surface of the space block hold the coupling plate and the springs to permit rotation of the space block.

25

34



- 18 -

12. Clamping apparatus as claimed in any one of Claims 4 to 10 wherein screws fixed on the rear side surface of the clamp member and screws fixed on the side surface of the space block hold the coupling plate and the spring to permit rotation of the space block.

13. Clamping apparatus constructed and arranged substantially as hereinbefore described and as shown in Figures 4 to 13 of the accompanying drawings.
