



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.09.2015 Bulletin 2015/36

(51) Int Cl.:
B21D 45/00 (2006.01) B21D 28/24 (2006.01)

(21) Application number: **15155334.4**

(22) Date of filing: **17.02.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(72) Inventors:
• **Horacek, Peter**
Bingley, West Yorkshire BD162QA (GB)
• **Worsley, Robert Howard**
Bingley, West Yorkshire BD16 2HZ (GB)

(30) Priority: **28.02.2014 GB 201403537**

(74) Representative: **Barker, Rosemary Anne et al**
HGF Limited
4th Floor, Merchant Exchange
17-19 Whitworth Street West
Manchester M1 5WG (GB)

(71) Applicant: **Racks Industries Limited**
Bingley BD16 2AG (GB)

(54) **Punching machine**

(57) For punching holes simultaneously in two substantially coplanar flanges (31, 32) of a beam, such as an I beam (30), a punching machine (10) comprises a beam support (20), in which a plurality of dies (12) are mounted, and a hydraulic ram (13) with means for mounting a plurality of punches (14). The ram (13) is provided with a slot (15) to accommodate the web (33) of the beam (30) and with a cavity (16) communicating with the slot

to accommodate any other flanges (34, 35) opposing those in which the holes are to be punched. A pair of opposed stripper elements (17, 18) are formed as pivotally mounted levers and are operative in synchrony with the punches (14) to clamp a portion of the flanges (31, 32) during a punching operation. Holes are punched simultaneously in a direction outwardly from a face of the flanges (21, 32) to which the web (33) is joined.

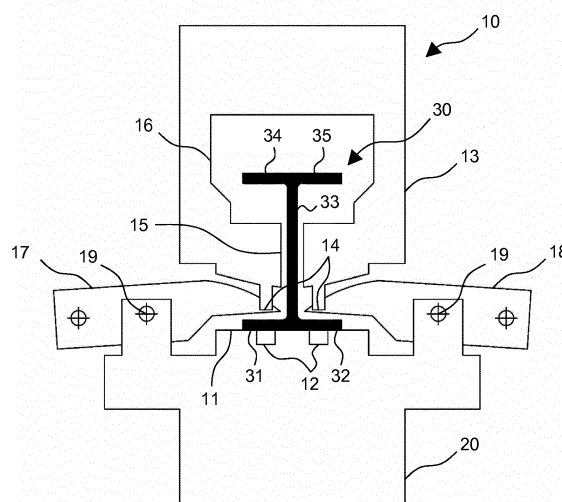


Figure 1

Description

[0001] This invention relates to a machine for punching holes in metal beams, columns, girders and the like (herein referred to as beams), particularly beams which have a web element and horizontal flange elements, such as I or H beams.

[0002] GB 1,192,769 discloses a machine that punches holes simultaneously in two flanges projecting from the web of a metal I beam. Inner faces of a pair of flanges to which the web is joined are supported by a bolster and holes are punched in the flanges in a direction inwardly from the outer faces of the flanges. A stationary stripper plate serves to release the beam from the punches as the punches are retracted. The beam is not secured during the punching operation and is liable to be lifted due to friction between the punches and the inside of the newly punched holes until contact is made with the stripper plate. This may cause two undesirable effects, namely vibration of the machine and bending of the beam as it is lifted. Bending may result in curvature of the flanges such that the punched holes may no longer be in perfect alignment with the axes of the punches, which could result in damage to the punches or to the punched holes.

[0003] US 5,063,804 also discloses a punching machine where holes are punched in a direction inwardly from the outer faces of I beam flanges. This machine provides clamping of the beam during the punch/release operation by stripper members in the form sleeves around the punches. This is a complex arrangement with multiple interdependent parts. KR 101345322 discloses a system that punches holes in the flanges and the web of an I beam. Again, holes are punched in a direction inwardly from the outer faces of the flanges. The system comprises machines arranged in series which either clamp or punch the beam. This is another complex system and one that requires a large area of floor space.

[0004] The present invention provides a punching machine for punching holes simultaneously in two substantially coplanar flanges projecting from a web of a beam, such as an I beam or H beam, said machine comprising a beam support mounting a plurality of dies, a hydraulic ram having means for mounting a plurality of punches for operating said punches simultaneously to pass through the dies and thereby punch the holes in the flanges, the ram being provided with a slot to accommodate the web of the beam and with a cavity communicating with the slot to accommodate any other flanges of the beam opposing those in which the holes are to be punched so that the holes will be punched in a direction outwardly from a face of the flange to which the web is joined, and a pair of opposed stripper elements which are formed as pivotally mounted levers and are operated in synchrony with the punches by a pair of respective hydraulic actuators to clamp a portion of the flanges of the supported beam during the punching and punch release operation.

[0005] The features of the present invention combine

an improved configuration to support and clamp a beam during a punching operation with a simplicity of design and small number of components to allow for easy and inexpensive repair and maintenance. Distortion, i.e. bending, of the flanges is prevented during a punching operation. This ensures not only the correct positioning of punched holes but also that the punches are smoothly retracted following punching. The beam remains in place and is not lifted, or moved, as the punches are retracted. As previously mentioned, if the beam is lifted then bending of the beam will result and the consequential curvature of the flanges which risks damaging the punches or the newly punched holes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic side view of a preferred practical embodiment of a punching machine in accordance with the present invention with the beam to be punched in position for the punching operation;

Figure 2 is a plan view diagram of the punching area of the punching machine of Figure 1; and

Figures 3 and 4 are further schematic side views of the punching machine of Figure 1 at a reduced scale, in use, showing subsequent stages in the punching operation.

DETAILED DESCRIPTION

[0007] With reference to Figure 1, a preferred practical embodiment of a punching machine 10 in accordance with the present invention comprises a base 20 having a substantially flat beam support surface 11 upon which a section of an I beam 30 is supported during a punching operation. Four dies 12 are mounted in the beam support surface 11 beneath lower flanges 31, 32 of the beam 30 in a symmetrical arrangement according to locations of the holes to be punched 40, as shown in Figure 2. The machine 10 further comprises a hydraulically actuated ram 13 with four punches 14 mounted on the underside of the ram 13. The punches 14 cooperate with the respective dies 12. The machine 10 can accommodate different sets of punches and corresponding dies of different sizes, shapes and spacing. The ram 13 is provided with a slot 15 and with a cavity 16 extending above the slot 15 for accommodating the web 33 and the upper flanges 34, 35 of the beam 30, respectively. In use, the beam 30 extends through the slot 15 and the cavity 16 in a longitudinal direction, as shown in Figure 1, into the plane of the paper. The size and shape of the slot 15 and the cavity 16 are chosen such that they may accommodate beams with a variety differently sized webs and flanges

and permit travel of the ram 13 during a punching operation.

[0008] A pair of hydraulically actuated strippers 17, 18 are provided on opposing sides of the support surface 11 for clamping the respective lower flanges 31, 32 of the beam 30 during a punching operation. The strippers 17, 18 are formed as levers and are pivotally mounted to the base 20 at pivot points 19. With reference to Figure 2, the strippers 17, 18 clamp respective portions 21, 22 of the lower flanges 31, 32 of the beam 30 above the support surface 11. The position of the strippers 17, 18 are such that the portions 21, 22 being clamped are midway between the locations of the two pairs of holes to be punched 40 in each flange 31, 32. This arrangement ensures symmetry of the forces subjected to the beam 30 during a punching operation.

[0009] In use, multiple punching operations are typically performed on a single beam to punch holes sequentially along its length. A first end of the beam 30 is inserted into the slot 15 and the cavity 16 on a first side of the machine 10 and is supported in position with the lower flanges 31, 32 flat upon the support surface 11. This arrangement is shown in Figures 1, 3 and 4. A first punching operation is then performed. Following this punching operation, the beam 30 is repositioned by passing the beam 30 further through the slot 15 and the cavity 16 and a subsequent punching operation is performed. This process of repositioning and punching is repeated until the desired total number of holes have been punched in the lower flanges 31, 32 of the beam 30. The beam 30 is gradually passed through the machine 10 moving in a longitudinal direction with each repositioning and is consequently removed from an opposite side of the machine 10 to which it was inserted. The exact distance the beam 30 is moved with each repositioning is determined by an indexing system (not shown) which includes graduations to define the correct distance to move the beam 30.

[0010] Each punching operation begins with the hydraulic actuation of the strippers 17, 18. As shown in Figure 3, the strippers 17, 18 rotate about the pivot points 19 until the strippers 17, 18 contact the inner faces of the lower flanges 31, 32 at the portions 21, 22 which are shown in Figure 2. The hydraulic pressure within the stripper actuators is increased until the beam 30 is sufficiently clamped in position to prevent movement during the punching operation.

[0011] The ram 13 is then hydraulically actuated to descend and force the punches 14 through the lower flanges 31, 32 of the beam 30 and into the respective dies 12, as shown in Figure 4. This action results in the punching of two pairs of holes simultaneously in both of the lower flanges 31, 32. Punching is in a direction outwards from the face of the flanges 31, 32 to which the web 33 is joined. The operation comprises a single stroke of the ram 13 after which the ram 13 returns to its starting position. The strippers 17, 18 retain the position of the beam 30 as the ram 13 ascends, thus allowing the smooth retraction of the punches 14 through the lower flanges 31,

32. Finally, once the ram 13 has returned to its starting position, the strippers 17, 18 release the beam 30 and return to the position as shown in Figure 1. The beam 30 can then be moved to another position and the punching operation repeated to punch another set of holes.

[0012] The principal advantage of this configuration and punching in an outwardly direction is that the support 11 is in contact with substantially all of the beam 30 surrounding the location of the holes to be punched 40. Therefore, the faces of the flanges 31, 32 are held firmly against the substantially flat support 11 such that they cannot be lifted or subjected to distortion at any point during the punching operation. Furthermore, this remains true even if the inside face of the flanges 31, 32 are tapered unlike in the cited prior art. A second advantage of the configuration is a minimal area of floor space required by the punching machine.

[0013] The invention is not restricted to the details of the foregoing embodiment and many variations in design detail are possible within the scope of the appended claims. For example, a number of symmetrically arranged punches and corresponding dies other than four could be provided in an alternative embodiment.

Claims

1. A punching machine (10) for punching holes simultaneously in two substantially coplanar flanges (31, 32) projecting from a web (33) of a beam (30), such as an I beam or H beam, said machine comprising a beam support (20) mounting a plurality of dies (12), a hydraulic ram (13) having means for mounting a plurality of punches (14) for operating said punches simultaneously to pass through the dies and thereby punch the holes in the flanges, the ram (13) being provided with a slot (15) to accommodate the web of the beam and with a cavity (16) communicating with the slot to accommodate any other flanges (34, 35) of the beam opposing those in which the holes are to be punched so that the holes will be punched in a direction outwardly from a face of the flange (31, 32) to which the web (33) is joined, and a pair of opposed stripper elements (17, 18) which are formed as pivotally mounted levers and are operated in synchrony with the punches (14) by a pair of respective hydraulic actuators to clamp a portion of the flanges of the supported beam during the punching and punch release operation.
2. A punching machine according to claim 1, wherein the hydraulic ram (13) has means for mounting four symmetrically arranged punches (14) which it operates simultaneously, and wherein the beam support (20) has means for mounting four corresponding dies (12).

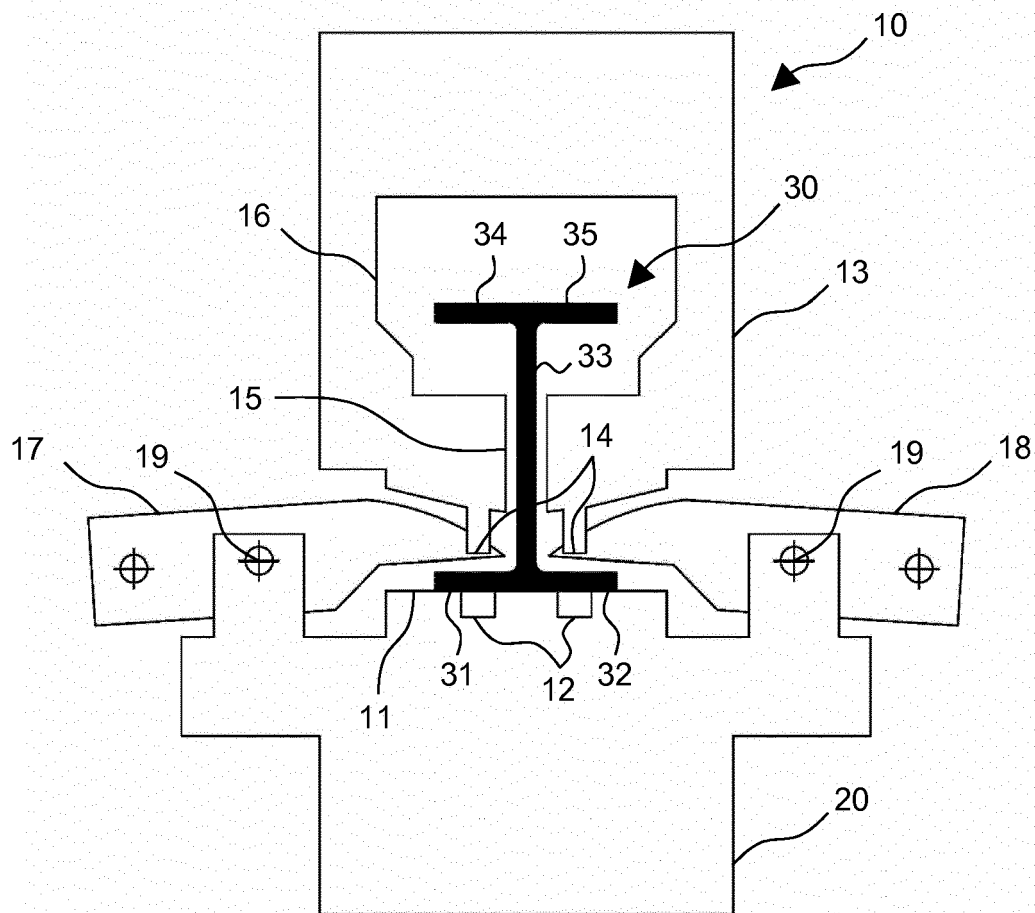


Figure 1

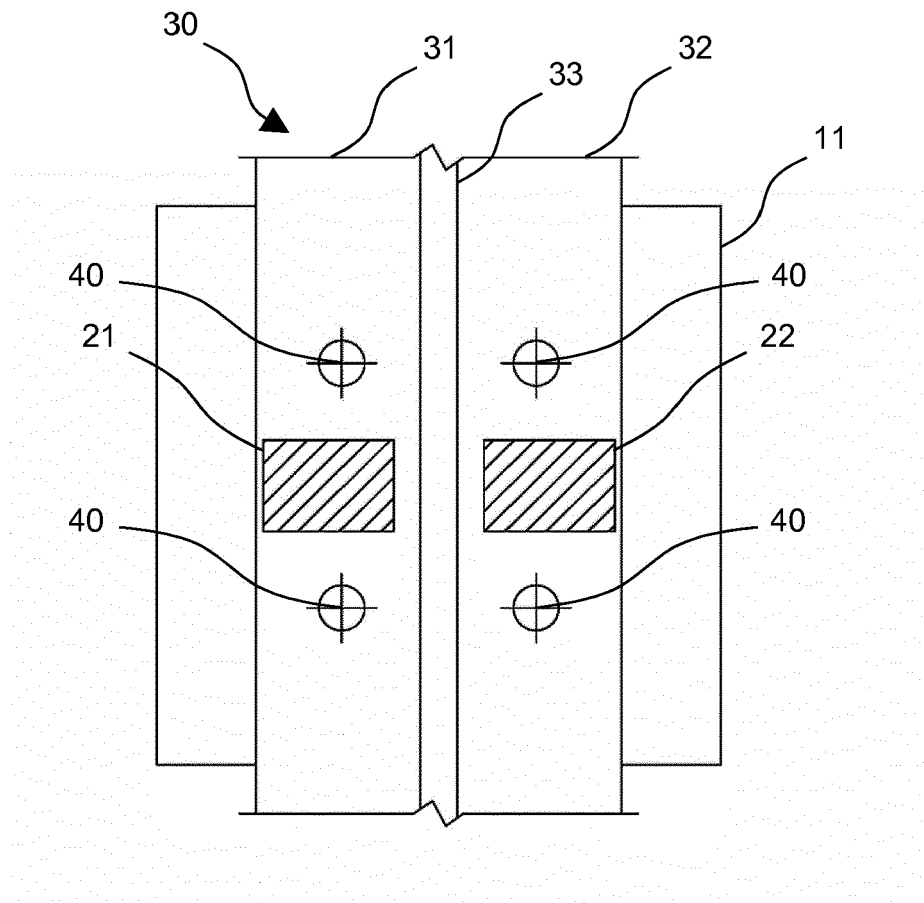


Figure 2

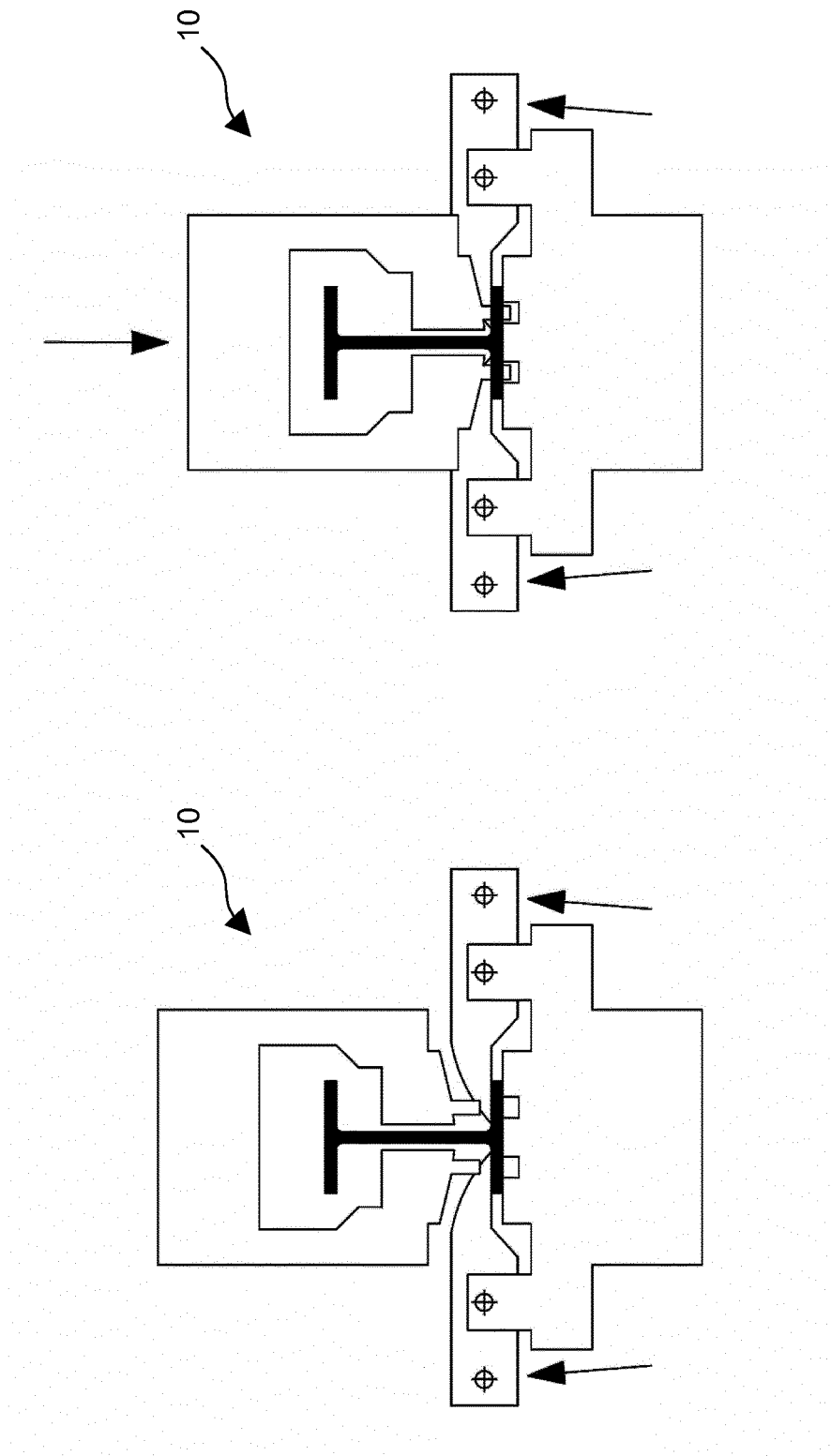


Figure 4

Figure 3



EUROPEAN SEARCH REPORT

Application Number
EP 15 15 5334

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	GB 1 192 769 A (KINGSLAND ENGINEERING COMPANY [GB]) 20 May 1970 (1970-05-20) * figure 2 *	1,2	INV. B21D45/00 B21D28/24
A,D	US 5 063 804 A (MAGNUSON JAMES M [US]) 12 November 1991 (1991-11-12) * figure 8 *	1,2	
A	FR 1 211 070 A (WINTENBERGER) 14 March 1960 (1960-03-14) * figure 1 *	1,2	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) B21D
Place of search Munich		Date of completion of the search 25 June 2015	Examiner Knecht, Frank
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 15 15 5334

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

25-06-2015

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 1192769 A	20-05-1970	NONE	
US 5063804 A	12-11-1991	DE 4107709 A1	26-09-1991
		FR 2659878 A1	27-09-1991
		IT 1246143 B	15-11-1994
		US 5063804 A	12-11-1991
FR 1211070 A	14-03-1960	NONE	

15

20

25

30

35

40

45

50

55

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- GB 1192769 A [0002]
- US 5063804 A [0003]
- KR 101345322 [0003]