

The invention relates to a single shaft punch press, with a machine frame; an eccentric shaft supported for rotation in the machine frame; a tool carrier which
5 is guided for a rectilinear reciprocating movement in the machine frame; an arrangement of connecting rods with connecting rod members which are drivingly mounted to the eccentric shaft; a lever means with individual lever units, whereby each lever unit is pivotally mounted at a
10 first point to connecting rod members of the arrangement of connecting rods and is pivotally supported at a second point at the machine frame, and has a respective further pivotal point located remote from these two points, an arrangement of rams with rams which are pivotally mounted
15 to the respective further pivotal points and to the tool carrier.

The off-centre loading of the tools, specifically of the upper tool in such punch presses, causes a variety of difficulties and drawbacks. For a given machine size, the allowable loading of the tools decreases
20 considerably towards the edge areas and reaches in certain cases even the value zero. Among others, the bearings, e.g. between ram and tool carrier and also between ram and driving members pivotally mounted thereto which
25 are subjected in case of off-centre loadings of the tools to a considerable wear and increased friction. Furthermore, an increased wear occurs also at the guiding structures of the rams and of the tools and in the tool. Off-centre loadings cause additionally cantings and elastic
30 deformations such as for instance a deflecting of elongate structural members of the punch press, and accordingly inaccurate products are produced.

Here, the invention intends to provide a remedy. The invention such as characterized in the claims
35 solves the object to provide a single shaft punch press of which the arrangement of connecting rods is pivotally mounted to a lever means which includes single lever

units arranged separate from each other, which are pivotally mounted independently from one another to the individual ram members of the arrangement of rams and the machine frame, whereby four rams extending parallel to each other are present which are pivotally mounted to a
5 respective lever unit such that the tool carrier of the single shaft punch press is suspended at four rams.

The advantages gained by the invention are mainly to be seen in that the rams can be arranged at the
10 tool carrier in a square arrangement in such a manner that considerable off-centre loadings can be taken up. This leads to a smaller wear at bearing and connecting points of the press and a decrease of frictional forces. Because the transfer of forces from the tool carrier to
15 the eccentric shaft occurs along four paths which are independent from one another, the punch press can be designed with considerably smaller dimensions.

In the following, the invention will be described based on drawings illustrating one single embodiment.
20

Figure 1 is a vertical section through a single shaft punch press,

Figure 2 is a section along line II-II of figure 1,

25 Figure 2A is a variant of the design of the connecting rod, and

Figure 3 is a section along line III-III of figure 1.

The eccentric shaft 2 of the single shaft
30 punch press is supported for rotation in the machine frame 1 via roller bearings 22 and 23. The eccentric shaft 2 is coupled via a coupling/braking apparatus to a fly wheel which is drivingly connected via a belt drive to an electric motor. These mentioned structures are generally known and commonly used in punch presses such that
35 a detailed description thereof is not needed.

The eccentric shaft 2 includes a centre eccentric section 18, and at both sides of the centre eccentric section 18 one respective further eccentric section 19 and 20, respectively, (see figure 2). A yoke-shaped balancing weight 24 is supported via roller bearings 25 on the centre eccentric section 18. This balancing weight 24 serves for a balancing of the rotating mass forces occurring in operation of the punch press. Linkage rods 26 and 27, respectively, are pivotally mounted by pivot pins 28 and 29, respectively, to the two lateral ends of the mass balancing weight 24, which linkage rods 26 and 27 are in turn pivotally mounted via further pivot pins 30 and 31, respectively, to the mass balancing weight 32, which in operation of the punch press balances the oscillating mass forces. This design is described in the US-PS 4,757,734 of the same applicant and for reasons of disclosure, reference is made to the mentioned patent specification.

The further eccentric sections 19 and 20, respectively, located at both sides of the centre eccentric section 18 support each a connecting rod member 4 and 5, respectively, mounted thereon via roller bearings 33 and 34, respectively. The lower end of the connecting rod members 4 and 5, respectively, is designed according to the embodiment of figure 2 in the shape of a fork having three prongs. A bolt 21 projects through the walls of the connecting rod members 4 and 5, formed by the prongs of the fork. Figure 2A illustrates a further embodiment which will be described in detail further below.

Now, the four lever units 6, 6A, and 7, 7A, and 8, 8A and 9, 9A, respectively, of the lever means of the punch press are pivotally mounted at one of their ends to this bolt 21. These one ends are identified in the figures generally by the reference numeral 35.

At their opposite ends, which are generally identified by the reference numeral 36, the lever units are supported according to the illustrated embodiment via

threaded spindles 37 on the machine frame 1. The adjustment of the height level of the ends 36 of these lever units and accordingly of the upper tool carrier 3 of the punch press proceeds by a rotating of these threaded
5 spindles. The details of this design for the adjustment of the height level of the tool carrier are disclosed in the US-PS 5,052,257, whereby reference is made here specifically to this disclosure.

Now, the lever means of the punch press will
10 be explained below. To this end, attention is specifically drawn to figure 3. Two single-arm lever units are allocated to each connecting rod member 4 and 5, respectively, which are supported at one of their ends on the bolt 21.

15 The lever units are structured due to design reasons as having two lever portions located adjacent to each other.

The lever unit with the lever portions 8, 8A and the lever unit with the lever portions 9, 9A are
20 thereby allocated to the connecting rod member 4. Accordingly, these lever units are arranged in a pair-wise fashion.

In other words, the lever units form together with the lever portions 8, 8A and 9, 9A a lever pair
25 driven by the connecting rod member 4.

The lever unit with the lever portions 6, 6A and the lever unit with the lever portions 7, 7A are allocated to the connecting rod member 5. Also these lever units form a lever pair and are composed due to design
30 reasons of the mentioned lever portions.

All lever portions 6, 6A, 7, 7A, 8, 8A, 9, 9A forming the entire lever means are single-arm levers which are supported at one end on a bolt 21 common to all, and at the other end on the threaded spindle 37 and
35 thus indirectly on the machine frame 1.

As specifically can be seen in figure 3 and also in figure 2, these lever units penetrate into each

other at their ends at the bolt 21 in a fork-like manner. The lever portion 9A includes a forked end and the lever portion 8A projects in the interstice encased by the prongs of the fork. The lever portion 8 is forked and receives in the fork the lever portion 9. Furthermore, the lever portion 7A and 6 are forked and receive in the fork the lever portions 6A and 7, respectively.

Each lever unit includes a further pivotal point with pivot pins 10, 11, 12, 13 between its ends 35, 36.

The lever unit with the lever portions 6, 6A includes the pivot pin 10, the lever unit with the lever portions 8, 8A includes the pivot pin 12, the lever unit with the lever portions 7, 7A includes the pivot pin 11 and the lever unit with the lever portions 9, 9A includes the pivot pin 13.

The ram 14 is linked at the pivot pin 10, the ram 15 is linked at the pivot pin 11, the ram 16 is linked at the pivot pin 12, and the ram 17 is linked at the pivot pin 13. Accordingly, this single shaft punch press comprises four rams. At their lower ends, the rams 14, 15, 16, 17 are finally pivotally mounted to the tool carrier 3. The tool carrier 3 includes four guiding columns 38, by means of which it is guided in the machine frame 1.

Figure 2A illustrates a variant in which both connecting rod members 4, 5 are separated, such that totally four single connecting rods 4A, 4B, and 5A, 5B are present. Accordingly, each ram is allocated to one pair of levers, e.g. to levers 6 and 7 of figure 3.

It is evident from the above description that the four rams 14, 15, 16, 17 determine the corners of a rectangular square. Accordingly, off-centre loadings can be absorbed in the punch press without suffering the initially mentioned drawbacks. And, furthermore, because the path of the transmitting of the forces through the various structural members of the punch press up to the ec-

centric shaft 2 or connecting rod members 4, 5, respectively, proceeds along four independent paths, the punch press can be designed in comparison with earlier punch presses for a given punch press size, which is determined
5 by the force to be exerted by the punch press with considerably smaller dimensions.



Patent Claims

1. Single shaft punch press, with
5. - a machine frame (1)
- an eccentric shaft (2) supported for rotation in the machine frame (1),
- a tool carrier (3) which is guided for a rectilinear reciprocating movement in the machine frame
- 10 (1),
- an arrangement of connecting rods with connecting rod members (4,5; 4A,4B; 5A,5B) which are driv-
ingly mounted to the eccentric shaft (2),
- a lever means with lever units (6,6A; 7,7A,
- 15 8,8A; 9,9A) whereby each lever unit (6,6A; 7,7A; 8,8A; 9,9A) is pivotally mounted at a first point to connecting rod members (4,5; 4A,4B; 5A,5B) of the arrangement of connecting rods and is pivotally supported at a second point of the machine frame (1) and has a respective fur-
- 20 ther pivotal point (10,11,12,13) located remote from these points,
- an arrangement of rams with rams (14,15, 16,17) which are pivotally mounted at one end to the re-
spective further pivotal points (10,11,12,13) and at the
- 25 other end to the tool carrier (3),
- characterized in that the lever means comprises four single lever units (6,6A; 7,7A; 8,8A; 9,9A) arranged separate from each other and every single lever unit is pivotally mounted to the connecting rod members
- 30 (4,5; 4A,4B; 5A,5B) of the arrangement of connecting rods and to the machine frame (1), resp. independently from the other lever units, and in that the arrangement of rams comprises four parallel rams (14,15,16,17), of which every respective ram is pivotally mounted at one end to
- 35 the respective further pivotal point to a respective lever unit (6,6A; 7,7A; 8,8A, 9,9A) and at the other end to the tool carrier (3), such that the tool carrier (3)



of the single shaft punch press is suspended at four rams (14,15,16,17).

2. Single shaft punch press according to claim 1, characterized in

5 - that the eccentric shaft (2) comprises a center eccentric portion (18) and at both sides thereof are further eccentric portion (19,20),

- that a means (24-32) for balancing mass forces occurring during the operation of the punch press
10 is present, which means is drivingly connected to the center eccentric portion (18),

- that the connecting rod members (4,5; 4A, 4B; 5A,5B) of the arrangement of connecting rods are respectively supported on one of the further eccentric portions (19,20),
15

- that the lever units (6,6A; 7,7A; 8,8A; 9,9A) of the lever means form single arm lever pairs (6,6A; 7,7A and 8,8A; 9,9A) with a respective first end (35) and a second, opposite end (36), whereby the lever
20 portions (6,6A; 7,7A and 8,8A; 9,9A) are pivotally mounted at the first end (35) via a bolt (21) common to all to one respective connecting rod member (4,5; 4A,4B; 5A,5B) and at the second end (36) to the machine frame (1), and the further pivotal point (10,11,12,13) is lo-
25 cated respectively between the two ends (35;36),

- that the rams (14,15,16,17) are pivotally mounted at one end to the respective further pivotal point (10,11,12,13) of the single arm lever pairs (6,6A; 7,7A and 8,8A; 9,9A) and at the other end to the tool
30 carrier (3), such that every connecting rod member (4,5; 4A,4B; 5A,5B) is pivotally mounted simultaneously to two single arm lever pairs (6,6A; 7,7A and 8,8A; 9,9A), of which each in turn is mounted to one of the rams (14,15, 16,17).

35 3. Punch press according to claim 1 or 2, characterized in that respective two of the single arm lever pairs (6,6A and 8,8A; 7,7A and 9,9A, resp.) are ar-



ranged adjacent each other and the two further pivotal points (10,11,12,13) thereof have the same distance from the bolt (21) common to all, such that the rams (14,15, 16,17) determine the corners of a rectangular square.

5 4. Punch press according to one of the preceding claims, characterized in that each connecting rod member (4,5) has the shape of a fork with three prongs,, that each lever unit (6,6A; 7,7A; 8,8A; 9,9A) consists of two adjacent lever unit portions (6;6A;7,7A;8,8A;9,9A)
10 with a respective first and a respective second end, whereby the first ends of the respective lever portions (6;6A;7,7A;8,8A;9,9A) are supported in the respective interstice between the sidewalls formed by the prongs on the bolt (21) common to all.

15 5. Punch press according to the claims 1-3, characterized in that each connecting rod member comprises two adjacent connecting rods (4A,4B; 5A;5B) each having a forked head, that each lever unit (6,6A, 7,7A, 8,8A, 9,9A) consists of two adjacent lever portions (6,6;
20 7,7A, 8,8A, 9,9A) with a respective first and second end, whereby the first ends of the respective lever portions (6,6A, 7,7A, 8,8A, 9,9A) are supported at the sidewalls formed by the prongs of the fork on the bolt (21) common to all, such that the arrangement of connecting rods in-
25 cludes four connecting rods.