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(54) **PUNCH PRESS FOR CRUSHING ASBESTOS CONTAINING PLATE MATERIAL**

(57) The invention relates to a punch press for crushing asbestos containing plate material, such as corrugated, flat and tubular asbestos containing plate material, which punch press comprises:
- a press frame;
- a stationary tool holder arranged fixedly to the press frame;
- a ram with a movable tool holder;
- hydraulic driving means arranged between the press frame and the ram for driving the movable tool holder towards the stationary tool holder;
- a first tool arranged in the stationary tool holder, which first tool is a grating-like die with parallel rows arranged at a first pitch, wherein each row has a plurality of through holes arranged at a second pitch;
- a second tool arranged in the movable tool holder, wherein the second tool comprises a base plate with parallel rows arranged at the first pitch, wherein each row has a plurality of pins extending from the base plate and being arranged at the second pitch;
wherein the cross-section of the pins is configured for the pins to be inserted into the through holes, when the movable tool holder is driven by the ram towards the stationary tool holder.

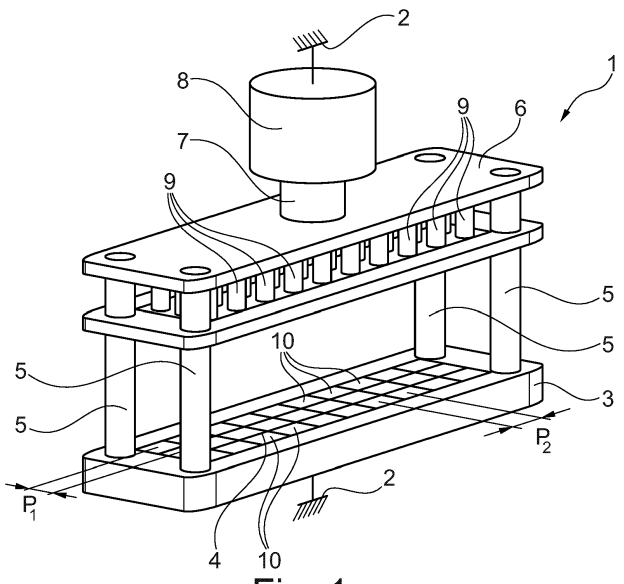

Fig. 1

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Description

[0001] The invention relates to a punch press for crushing asbestos containing plate material, such as corrugated, flat and tubular asbestos containing plate material, which punch press comprises:

- a press frame;
- a stationary tool holder arranged fixedly to the press frame;
- a ram with a movable tool holder;
- hydraulic driving means arranged between the press frame and the ram for driving the movable tool holder towards the stationary tool holder.

[0002] Hydraulic punch presses are known in the prior art and used to punch out a part from for example a metal sheet. To this end, the hydraulic punch press is provided with a first tool arranged in the stationary tool holder having a hole corresponding to the part, which is to be punched out of the metal sheet. The movable tool holder is provided with a second tool, which matches the first tool and can slide into the hole of the first tool, such that the desired part is cut out of the metal sheet.

[0003] It is known that hydraulic punch presses can be used with sheet material, which is easily cut, such as metal sheet or plastic sheet. However, a brittle material is typically not considered suitable to be cut as it does not provide predictable results.

[0004] In the field of asbestos containing plate material, which was typically used as roofing material, it is desired to discard said material in a safe way, as the asbestos fibers can cause severe illness, such as lung cancer.

[0005] A known method is developed in which small particles of asbestos containing plate material are mixed with acid, such that the asbestos fibers are isolated and can no longer cause any health issues. This method requires that asbestos containing plates are crushed into small particles. Up to now, the asbestos containing plates are shredded, but this generates a substantial amount of asbestos containing dust, which is far more dangerous for people than the asbestos containing plates.

[0006] It is an object of the invention to reduce or even remove the above mentioned disadvantages.

[0007] This object is achieved according to the invention with a punch press according to the preamble, which is characterized by

- a first tool arranged in the stationary tool holder, which first tool is a grating-like die with parallel rows arranged at a first pitch, wherein each row has a plurality of through holes arranged at a second pitch;
- a second tool arranged in the movable tool holder, wherein the second tool comprises a base plate with parallel rows arranged at the first pitch, wherein each row has a plurality of pins extending from the base plate and being arranged at the second pitch;

wherein the cross-section of the pins is configured for the pins to be inserted into the through holes, when the movable tool holder is driven by the ram towards the stationary tool holder.

[0008] With the punch press according to the invention, an asbestos containing plate can be crushed into small particles without the generation of a substantial amount of dust as known in the prior art. Due to the grating-like die and the second tool with corresponding pins, which can be pushed through the holes in the grating-like die, it is possible to break an asbestos containing plate into a large number of particles, which are pressed through the openings in the first tool.

[0009] In a preferred embodiment of the punch press according to the invention the plurality of through holes have each a square cross-section and wherein the pins have a circular cross-section.

[0010] As asbestos containing plate material is typically brittle and cannot be cut as metal sheet or plastic sheet, the asbestos containing plate material will break into small particles when the first and second tool of the punch press according to the invention are pressed together. By having square through holes and cylindrical pins, there will be some space between the through holes and the pins, such that the broken parts of the plate material can easily be pushed through the through holes, without jamming the punch press.

[0011] Preferably, the width of the square cross-section is at least 10% larger than the diameter of the circular cross-section. This ensures substantial play between the through holes and the pins, allowing for the asbestos containing particles to be pushed through the through holes.

[0012] In yet another embodiment of the punch press according to the invention the dividing walls between the through holes taper towards the movable tool holder.

[0013] These tapering ends of the dividing walls provide cutting edges which improve the breaking of the asbestos containing plate material into small particles. The tapering ends also improve the breaking of debris material remaining at the stationary tool holder at a next stroke of the movable tool holder.

[0014] A further preferred embodiment of the punch press according to the invention further comprises a scraper plate arranged parallel to the base plate of the second tool, wherein the pins of the second tool extend through the scraper plate and wherein spring means are arranged between the scraper plate and the base plate, such that the scraper plate is movable along the pins.

[0015] The scraper plate will be urged on the asbestos containing plate, when the first and second tool are brought together. This fixates the plate, when the pins are forced through the plate. In case for example corrugated, flat or tubular asbestos containing plate material is used, the scraper plate will also flatten and/or break the plate material, after which the plate material is crushed.

[0016] Upon return of the movable tool away from the

stationary tool, the scraper plate will scrape along the pins and clean the pins from any debris of the crushing of the plate.

[0017] In still a further embodiment of the punch press according to the invention, a funnel is arranged underneath the through holes of the first tool to collect particles of asbestos containing plate material crushed by the interaction of the first tool and the second tool.

[0018] The invention further relates to a method for crushing asbestos containing plate material, such as corrugated, flat and tubular asbestos containing plate material, which method comprises the steps of:

- providing a punch press according to the invention;
- inserting an asbestos containing plate material between the first and second tool of the punch press;
- operating the hydraulic driving means to move the first and second tool towards each other, such that the asbestos containing plate material is crushed and particles of the plate material are discharged via the through holes of the first tool.

[0019] Typically, the device according to the invention will be used and the method according to the invention will be performed in a controlled environment to reduce any health risks for operators. This controlled environment can be provided by a housing in which the device is arranged or the method is performed. This housing is subjected to a pressure lower than the environmental pressure, such that any asbestos particles will be kept within the housing.

[0020] Preferably, the device is arranged in a shipping container, like a 20 foot container, together with a power unit, feed and discharge stations, to provide a mobile unit to crush asbestos containing plate material at building sites and to be able to fill the material in a closed means of transport.

[0021] These and other features of the invention will be elucidated in conjunction with the accompanying drawings.

Figure 1 shows a perspective view of a punch press according to the invention.
Figure 2 shows a cross-section of the punch press according to figure 1.
Figure 3 shows a cross-section of an asbestos containing plate material arranged in the punch press according to figure 1.
Figure 4 shows a cross-section of an asbestos containing plate material crushed by the punch press according to figure 1.

[0022] Figure 1 shows an embodiment of a punch press 1 according to the invention. The punch press has press frame 2, which is schematically shown in figure 1. At the bottom, a stationary tool holder 3 holding a grating-like die 4 is provided. From the top surface of the stationary tool holder 3, four guides 5 extend, along which a movable tool holder 6 can move toward the stationary tool holder 3.

[0023] The movable tool holder 6 is urged by a ram 7 driven by hydraulic means 8. The movable tool holder 6 has a plate from which pins 9 extend. These pins 9 can be inserted in through holes 10 arranged in the grating-like die 4. These through holes 10 are arranged in parallel rows arranged at a pitch p_1. The through holes 10 within a row are arranged at a pitch p_2.

[0024] Figure 2 shows a cross-section of the punch press 1 of figure 1. The movable tool holder 6 is movable along the guides 5. A scraper plate 11 is also provided at the guides 5 and springs 12 are positioned between the movable tool holder 6 and the scraper plate 11. The pins 9 of the movable tool holder 6 extend through the scraper plate 11.

[0025] When the movable tool holder 6 is moved downwards against the stationary tool holder 3, the scraper plate 11 will be pushed against the spring force of the springs 12. This ensures that on the upward movement the scraper plate 11 will scrape the pins 9 clean from any debris.

[0026] A funnel 13 is arranged underneath the stationary tool holder 3 such that particles pushed through the through holes 10 by the pins 9 will be collected.

[0027] Figure 3 shows a detailed view of the punch press 1 according to figure 1. The dividing walls 14 of the grating-like die 4 and defining the through holes 10 are provided at the top with a tapering end, which contribute in crushing an asbestos containing plate 15. As the width w of the square through holes 10 is substantially larger than the diameter D of the cylindrical pins 9, the plate can easily be broken and particles P will not be jammed between the pins 9 and the dividing walls 14, as shown in figure 4.

Claims

1. Punch press for crushing asbestos containing plate material, such as corrugated, flat and tubular asbestos containing plate material, which punch press comprises:

   - a press frame;
   - a stationary tool holder arranged fixedly to the press frame;
   - a ram with a movable tool holder;
   - hydraulic driving means arranged between the press frame and the ram for driving the movable tool holder towards the stationary tool holder;

   characterized by

   - a first tool arranged in the stationary tool holder, which first tool is a grating-like die with parallel rows arranged at a first pitch, wherein each row has a plurality of through holes arranged at a

second pitch;

- a second tool arranged in the movable tool holder, wherein the second tool comprises a base plate with parallel rows arranged at the first pitch, wherein each row has a plurality of pins extending from the base plate and being arranged at the second pitch;

wherein the cross-section of the pins is configured for the pins to be inserted into the through holes, when the movable tool holder is driven by the ram towards the stationary tool holder.

2. Punch press according to claim 1, wherein the plurality of through holes have each a square cross-section and wherein the pins have a circular cross-section.

3. Punch press according to claim 2, wherein the width of the square cross-section is at least 10% larger than the diameter of the circular cross-section.

4. Punch press according to any of the preceding claims, wherein the dividing walls between the through holes taper towards the movable tool holder.

5. Punch press according to any of the preceding claims, further comprising a scraper plate arranged parallel to the base plate of the second tool, wherein the pins of the second tool extend through the scraper plate and wherein spring means are arranged between the scraper plate and the base plate, such that the scraper plate is movable along the pins.

6. Punch press according to any of the preceding claims, wherein a funnel is arranged underneath the through holes of the first tool to collect particles of asbestos containing plate material crushed by the interaction of the first tool and the second tool.

7. Method for crushing asbestos containing plate material, such as corrugated, flat and tubular asbestos containing plate material, which method comprises the steps of:

- providing a punch press according to any of the preceding claims;
- inserting an asbestos containing plate material between the first and second tool of the punch press;
- operating the hydraulic driving means to move the first and second tool towards each other, such that the asbestos containing plate material is crushed and particles of the plate material are discharged via the through holes of the first tool.

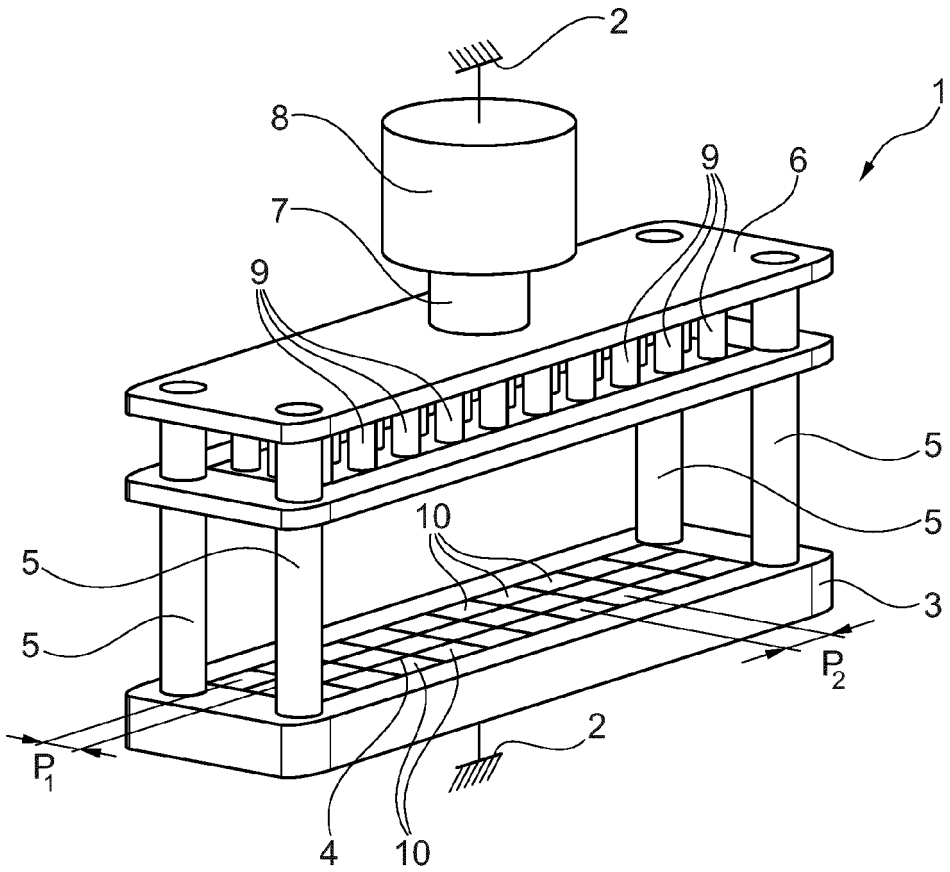

Fig. 1

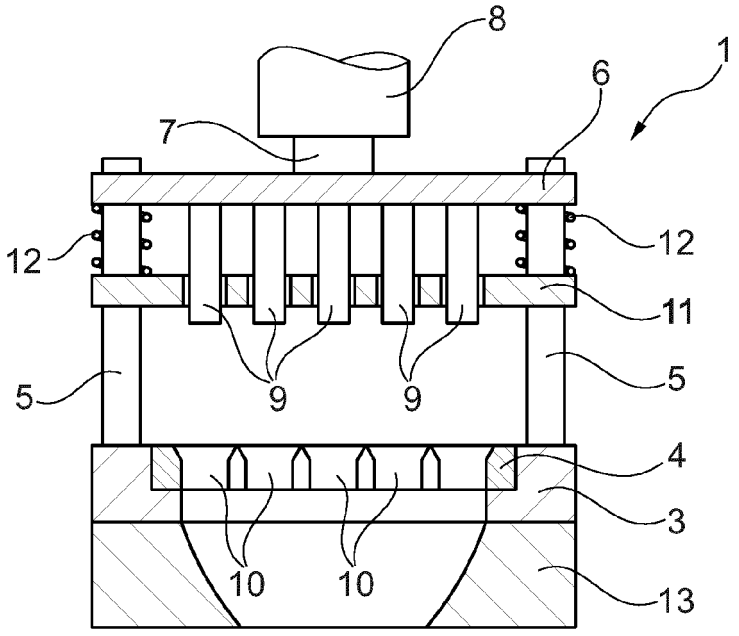

Fig. 2

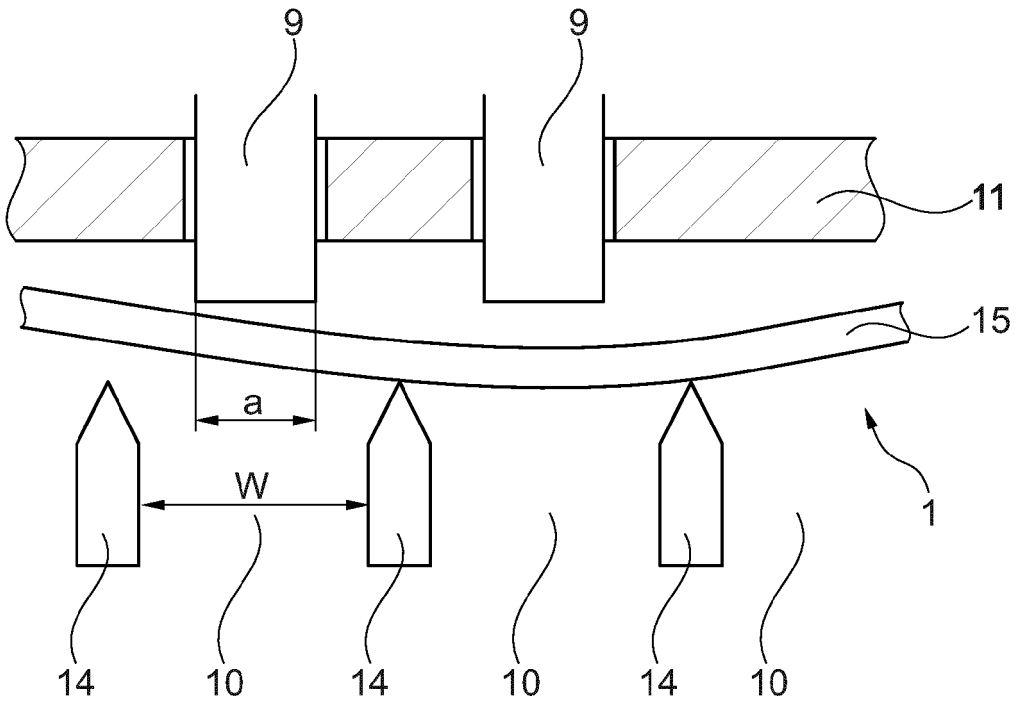

Fig. 3

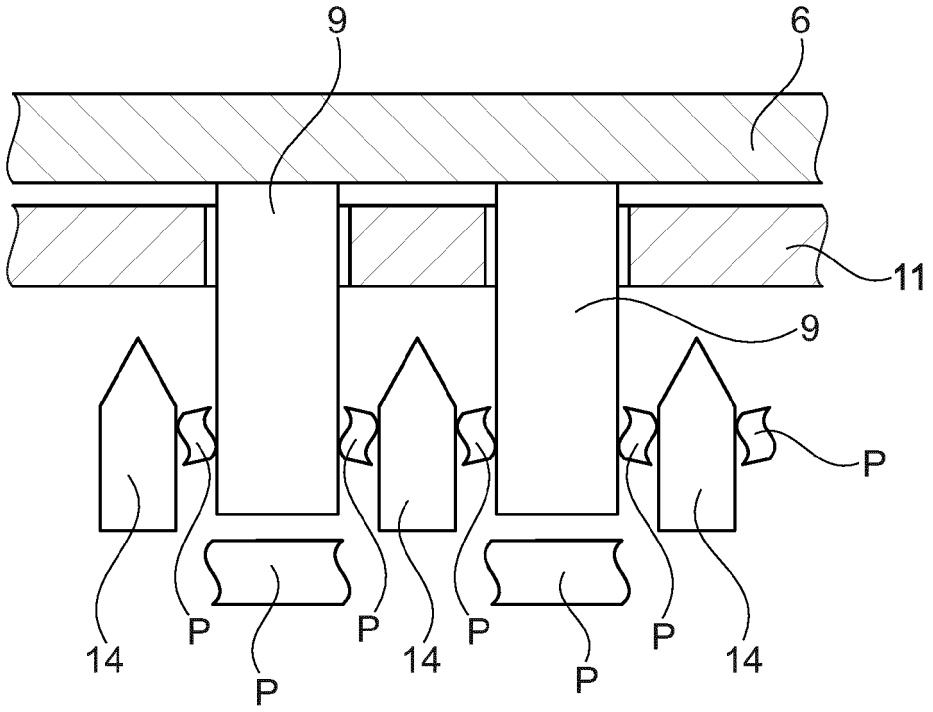

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 19 17 3022

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 452 790 A1 (HEIDELBERGER DRUCKMASCH AG [DE]) 16 May 2012 (2012-05-16)	1,7	INV. B02C1/14 B02C19/00
Y	* paragraphs [0024] - [0033]; figures	2,3,5,6	
A	1,2a,2b,3a,3b *	4	

Y	US 2009/025519 A1 (NANNEY DOUGLAS T [US] ET AL) 29 January 2009 (2009-01-29)	2,3,6	
A	* paragraphs [0029] - [0039]; figures 1,3,6 *	4	

Y	GB 1 086 220 A (ICI LTD) 4 October 1967 (1967-10-04)	5	
A	* page 2, column 2, line 13 - page 3, column 2, line 64; figures 1,3 *	3,4	

TECHNICAL FIELDS SEARCHED (IPC)

B26F
B02C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 November 2019	Iuliano, Emanuela

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 17 3022

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