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(54) Title: **BLANKING DEVICE**

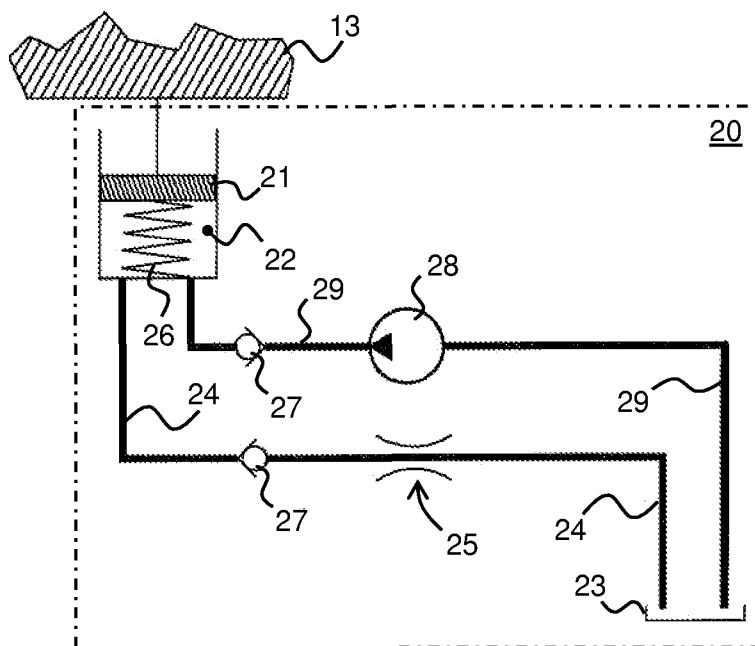


FIG. 3

(57) Abstract: The invention relates to a blanking device which is at least provided with a cutter (12) and an ejector (13) and with movement means (20) which act on the ejector (13) and which can exert a force that is oriented in the direction of the cutter (12) thereon, which movement means (20) are at least provided with a piston-cylinder assembly (21, 22), with a first oil duct (24) which connects the cylinder (22) of the piston-cylinder assembly (21, 22) to an oil reservoir (23), with means (26; 28) for displacing oil between the oil reservoir (23) and the cylinder (22), and with a second oil duct (29) which also connects said cylinder (22) to the oil reservoir (23) and in this case at least bridges said means (26; 28) for displacing oil. The second oil duct (29) is in this case connected separately from said first oil duct (24) to the cylinder (22) and/or the oil reservoir (23) of the movement means (20).

BLANKING DEVICE

The present invention relates to a blanking device, in particular a so-called fine-blanking device, more particularly intended for blanking precision-engineering products from plate material with narrow tolerances. A blanking device of this type is known, for example, from European patent application no. 1,458,992-A.

The known blanking device comprises at least one die, a guide plate or clamping plate, a cutter and an ejector. The die and guide plate are both provided with an inner recess, the periphery of which essentially corresponds to the periphery of the product to be blanked. The die and guide plate are positioned with respect to one another such that the respective inner recesses thereof are in line with one another.

The cutter and the ejector both have an outer periphery which also substantially corresponds to the periphery of the product to be blanked and are accommodated in the inner recesses of the die and the guide plate, so that the cutter and ejector are also in line with one another.

The blanking device is furthermore provided with means for moving the die and the guide plate towards one another, with the plate material being clamped inbetween, and with actuating means for moving the cutter to and fro with respect to the guide plate and the die, it being possible to move the cutter through the starting material clamped inbetween and thus blanking out the product. In addition, the blanking device is provided with movement means, which act on the ejector and which can exert a force thereon which is oriented in the direction of the cutter. The result thereof is that the product to be blanked is clamped between the cutter and the ejector, which benefits the accuracy and the controllability of the blanking process. In addition, this makes it possible to plastically deform the main surfaces of the product, as the working surfaces of the cutter and the ejector act thereon while a pressure is being exerted. A relief provided in said working surfaces is then transferred in negative form onto the respective main surface, that is it is embossed thereon.

Said movement means may comprise a piston-cylinder assembly, in which the cylinder is filled with oil, which is pressed empty via an oil duct which is provided for the purpose during, and as a result of, the movement of the ejector on account of the cutting movement which is imposed on the cutter. By means of, for example, a spring in the cylinder or a hydraulic restriction in or of the oil duct, the force of the ejector can be realised at the same time.

After the product has been blanked out, said cylinder is subsequently again

filled with oil, for example under the effect of the spring mentioned earlier or an oil pump, with the ejector returning to its starting position and the blanked-out product being ejected from the inner recess of the die.

Although the blanking device described here is in general use and works
5 satisfactorily, it has, in practice, been found that the ejector force has undesirable variations as a result of which the dimensional accuracy of in particular the main surfaces of the blanked products leaves something to be desired. Such variations in dimension have, in practice, been increasingly found to occur in particular at a relatively high striking frequency (that is the number of cutting movements/blanking
10 cycles carried out per unit time) of the blanking device and thus limit the maximum achievable efficiency of the blanking device.

It is an object of the present invention to improve the efficiency of the known blanking device by, given a desired dimensional accuracy of the blanked products, increasing the associated limit of the striking frequency. To this end, the invention
15 provides the blanking device according to the attached Claim 1.

Using the measure from the characterizing clause of Claim 1 results in the oil which has been forced out of the movement means of the ejector during the cutting movement, more particularly out of the cylinder of the piston-cylinder assembly thereof, is at least substantially circulated via the reservoir instead of being translated into said
20 oil duct. As a result thereof, the oil present in the cylinder is at least substantially replaced with each blanking stroke, which, according to the invention, reduces said undesirable variation in the ejector force.

The invention is also based on the observation that said variation of the ejector force occurs mainly during the initial blanking strokes of the blanking device following
25 a relatively short or long standstill. In practice, however, the ejector force appears to decrease significantly during the first scores of blanking strokes down to a more or less constant level. According to the invention, such an effect is the result of the viscosity of the oil decreasing due to the latter heating up by friction. Precisely because the oil is not replaced, but in each case flows back and forth between the cylinder and the oil duct, it heats up considerably and in an uncontrolled manner.
30 However, in the case of the invention, the oil in the cylinder is in each case at least substantially replaced, so that it does not heat up to such a degree and heats up relatively slowly and, in addition, it becomes possible to control the temperature of the oil in a relatively simple manner, for example by selecting the volume of the reservoir
35 to be significantly, for example 10 times or more, larger than the volume of the

cylinder. In addition, it is also possible to use a heat exchanger in the circulation circuit.

The invention will now be described in more detail by way of example with reference to the following description by means of the drawing, in which:

Fig. 1 is a diagrammatic cross section of the known blanking device;

5 Fig. 2 is a diagrammatic representation of the movement means acting on the ejector of the known blanking device; and

Fig. 3 is a diagrammatic representation of movement means according to the invention.

Fig. 1 diagrammatically shows the central parts of the known blanking device.

10 The detailed construction and operation of the blanking device are generally known and are described, for example, in patent EP-A-1,458,992 which has already been mentioned.

The known blanking device comprises a die 10, a guide plate or clamping plate 11, a cutter 12 and an ejector 13. Both the die 10 and guide plate 11 are provided with
15 an inner recess, the periphery of which substantially corresponds to the periphery of the product to be blanked 1. The cutter 12 and the ejector 13 both have an outer periphery which likewise substantially corresponds to the periphery of the product to be blanked 1 and are accommodated in said inner recesses of the die 10 and the guide plate 11. The known blanking device is furthermore provided with means (not
20 shown) for moving the die 10 and the guide plate 11 towards one another, with the plate-like starting material 2 for the product to be blanked 1 being clamped inbetween, and with actuating means (not shown either) for moving the cutter 12 to and fro with respect to the guide plate 11 and the die 10. Ultimately, it is this movement which results in the cutter 12 being moved through the plate material 2 clamped inbetween
25 in a cutting movement S and the product 1 being blanked out, as illustrated in Fig. 1.

Finally, the known blanking device is provided with movement means 20, which act on the ejector 13 and which exert a so-called ejector force F_u thereon which is oriented in the direction of the cutter 12, at least during the cutting movement S of the cutter 12. Thus, the product to be blanked 1 is clamped between the cutter 12 and
30 the ejector 13, which benefits the accuracy and the controllability of the blanking process and as a result of which the main surfaces of the product 1 can be plastically deformed and/or formed.

A known example of the movement means 20 is diagrammatically illustrated in more detail in Fig. 2 and comprises an assembly of a piston 21 and an oil-filled
35 cylinder 22, a reservoir for oil 23 and an oil duct 24 arranged inbetween. In the present

example, the oil duct 24 is provided with a so-called hydraulic restriction 25 which essentially determines the flow resistance exerted on the oil stream from the cylinder 22 to the oil reservoir 23 – and thus the ejector force F_u during the cutting movement S. A spring 26 is provided in order to return the ejector 13 and the piston 21 to the starting position after the cutting movement S, in which case the cylinder 22 is filled again with oil by drawing it in from the reservoir 23. A non-return valve 27 is in this case arranged parallel to the restriction 25 in order to ensure that the cylinder 22 is refilled quickly. In the construction of the movement means 20 illustrated here, a pump 28 is also provided, parallel to the restriction 25, which pump 28 can supplement the function of the spring 26 – that is returning the ejector 13 to the starting position, in which case the cylinder 22 is filled with oil again – or can even take over this function completely.

A problem which has occurred with the known blanking device in practice is the fact that the ejector force F_u has undesirable variations which adversely affect the accuracy and/or controllability of the blanking process. According to the invention, this problem is at least partially caused by the fact that, with the known movement means 20, the oil is moved back and forth between the cylinder 22 and the reservoir 23, i.e. is essentially translated, with a significant portion of (the volume of) the displaced oil not even reaching the reservoir 23, but rather remaining only in the cylinder 22 or the oil duct 24. It has been found that the translated oil heats up significantly as a result, so that the viscosity thereof, as well as the ejector force F_u , during the blanking movement S decrease to an undesirable degree. This heating-up process occurs in particular during the initial blanking movements, until equilibrium is reached between the heat development in and the outflow of heat from the oil.

It is an object of the invention to reduce the abovementioned heating up of the oil and the associated reduction in the viscosity thereof by means of a modified design of the movement means 20, which is illustrated in Fig. 3. The movement means 20 according to the invention are provided with a second oil duct 29 between the cylinder 22 and the reservoir 23, which serves as a supply duct 29 for the oil to the cylinder 22, with the first-mentioned oil duct 24 acting as discharge duct 24 in which said restriction 25 is accommodated. In this case, a non-return valve 27 or the like is incorporated, at least in the supply duct 29, but preferably also in the discharge duct 24, which prevents oil from streaming in the direction opposite to the desired direction. If necessary, a (non-operative) pump 28 can already prevent such an oil stream, thus making a separate non-return valve 27 redundant (cf. the variant embodiment of the

movement means 20 from Fig. 4 regarding this aspect).

In the movement means 20 according to the invention from Fig. 3, the oil from the cylinder 22 circulates through the reservoir 23 substantially via the oil ducts 24 and 29 instead of being translated inbetween. The result thereof is that the available oil
5 volume is used completely and that the oil displaced during the blanking movement is used in an optimum manner and/or can be cooled. As a consequence, the temperature of the oil in the movement means 20 according to the invention advantageously rises relatively slowly up to a relatively low degree and/or it can be controlled in a simple manner, for example by incorporating an oil cooler in the oil-
10 circulation circuit 22, 23, 24, 29.

It should be noted that it will not always be possible to provide the cylinder 22 with two hydraulic connections, that is to say to connect both said discharge duct 24 and said supply duct 29 directly to the cylinder 22. If this is the case, both ducts 23 and 29 are connected to the cylinder 22 by means of a split connecting duct 30, as is
15 illustrated in the attached Fig. 4. With such a design of the movement means 20, the volume enclosed by the connecting duct 30 has to be small in order to be able to achieve the result intended by the present invention compared to the volume of the oil displaced during the blanking movement S, that is the amount of oil displaced by the cylinder 22. According to the invention, the volume of the split connecting duct 30 is at
20 most 25% and preferably less than 10% of the amount of oil displaced.

CLAIMS

1. Blanking device provided with a die (10) and a guide plate (11), each of which is provided with a separate inner recess, the periphery of which substantially corresponds to the periphery of the product to be blanked (1), which two recesses are substantially in line with one another and in which recesses a cutter (12) and an ejector (13) of the blanking device are accommodated so as to be able to move, and with movement means (20) which act on the ejector (13) and which can exert a force that is oriented in the direction of the cutter (12) thereon, which movement means (20) are at least provided with a piston-cylinder assembly (21, 22), with a first oil duct (24) which connects the cylinder (22) of the piston-cylinder assembly (21, 22) to an oil reservoir (23), with means (26; 28) for displacing oil between the oil reservoir (23) and the cylinder (22), and with a second oil duct (29) which also connects said cylinder (22) to the oil reservoir (23) and in this case at least bridges said means (26; 28) for displacing oil, characterized in that the second oil duct (29) is connected separately from said first oil duct (24) to the cylinder (22) and/or the oil reservoir (23) of the movement means (20).
2. Blanking device according to Claim 1, characterized in that means (27; 28) are incorporated in both said oil ducts (24, 29) which block a stream of oil in the relevant oil duct (24; 29) in at least one direction, that is to say in the direction from the oil reservoir (23) to the cylinder (22) or vice versa, with both directions in which said means (27; 28) respectively block the oil stream in the separate oil ducts (24; 29) are opposite with respect to one another.
3. Blanking device according to Claim 1 or 2, characterized in that said first oil duct (24) and said second oil duct (29) are connected to the cylinder (22) or to the oil reservoir (23) of the movement means (20) by means of a common connecting duct (30).
4. Blanking device according to Claim 3, characterized in that the volumetric contents of the common connecting duct (30) is at most 25% and preferably less than 10% of the volumetric contents of the cylinder (22) or of an amount of oil forced out of the cylinder (22) during operation of the blanking device.

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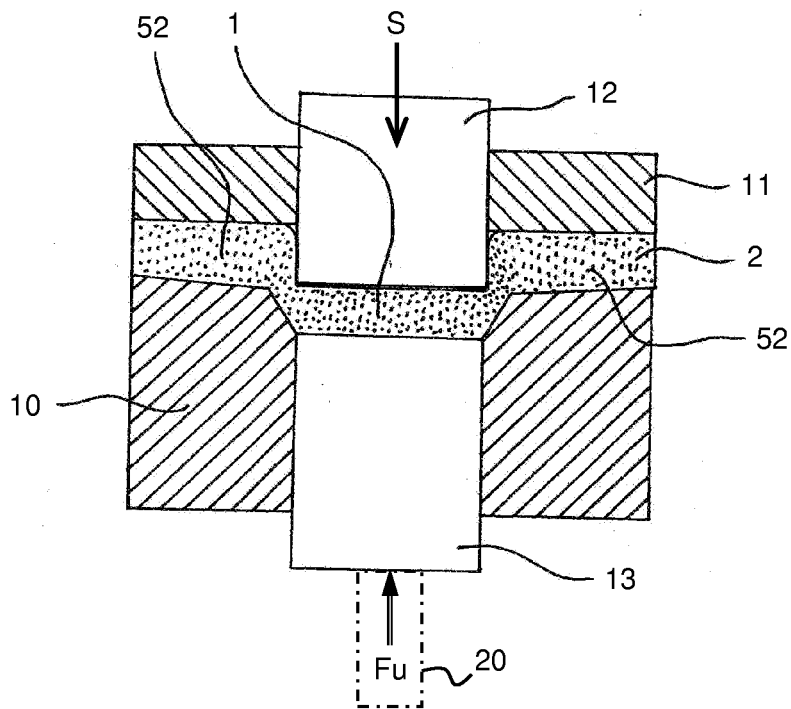


FIG. 1

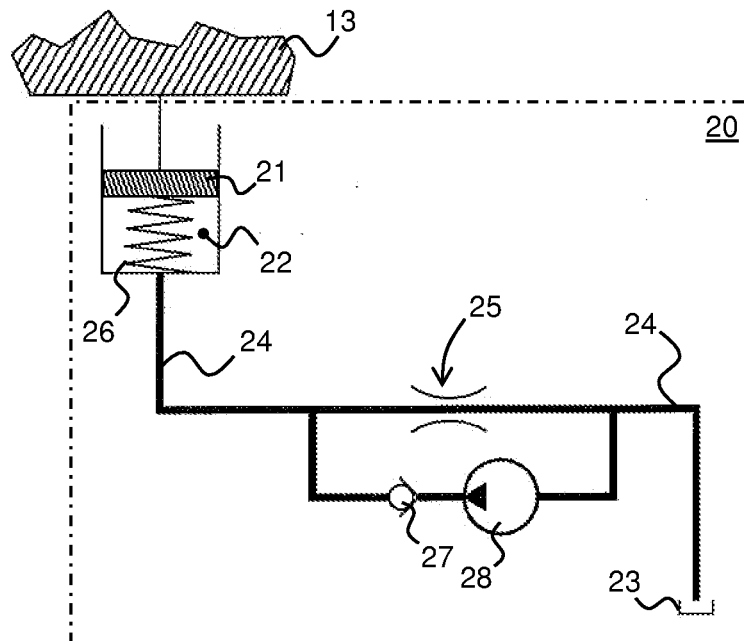


FIG. 2

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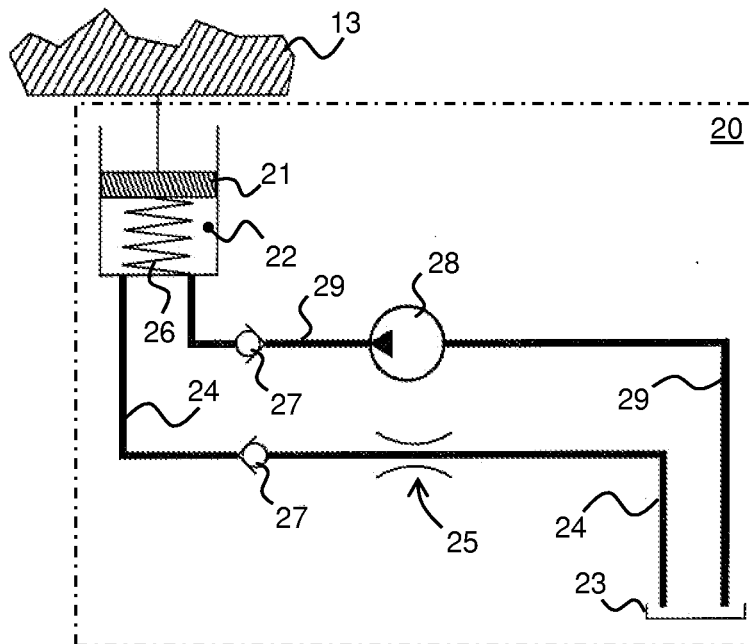


FIG. 3

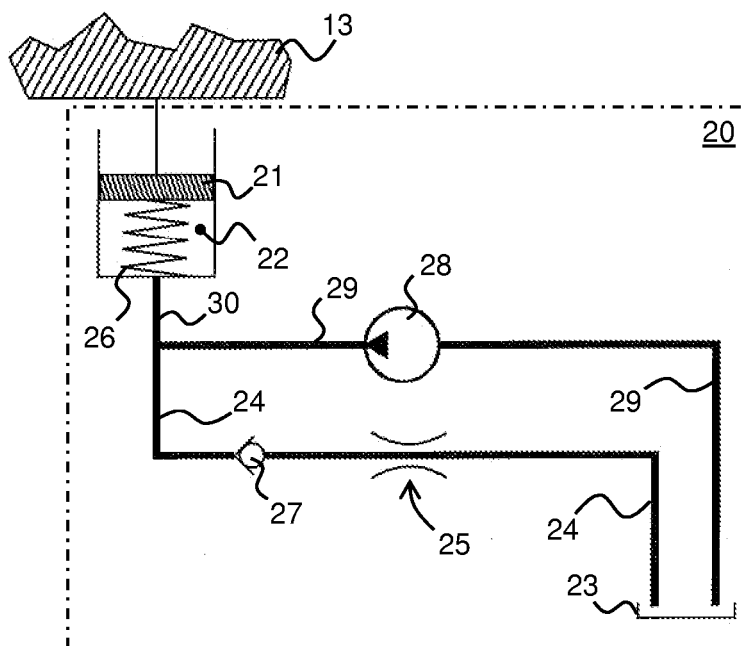


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2008/050429

A. CLASSIFICATION OF SUBJECT MATTER
INV. B21D28/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 15 52 049 A1 (PHILIPS PATENTVERWALTUNG) 18 December 1969 (1969-12-18) the whole document	1-4
X	US 3 570 343 A (WOLNOSKY ERVIN E ET AL) 16 March 1971 (1971-03-16) column 2, lines 53-66; figure 1	1-4



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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25 September 2008

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/NL2008/050429

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 1552049	A1	18-12-1969	NONE
US 3570343	A	16-03-1971	NONE