

This invention relates to an apparatus for cutting stacked sheet material, having a table, the surface of which comprises a field of action, above which a cutting knife and a crosshead of a press are situated, behind which an input field is situated for receiving the material to be cut and in front of which an output field is situated for receiving the cut material, having a forward feed device for the material to be cut.

An apparatus of this type is known from DE-A-3 101 911. When trimming edges after an edge cut has been made with this apparatus the stack is usually pulled on to the output field by the operator, who remains in the region of the output field, and it is rotated there by 90°, pushed back on to the input field again and placed there under the cutting knife as defined by means of the forward feed device, so that the next edge cut can be made. This edge cut is followed by corresponding edge cuts, until finally all the edges of the stack are trimmed. A manner of working such as this necessitates strength-sapping manual operations, wherein the movement procedures are particularly unfavourable from an ergonomic point of view, since the operator has to pull the heavy material towards himself from a distance which is outside the usual reach of the arms, i.e. with his upper body bent forwards, and then has to turn the material. This applies not only to the edge cuts described above but also in general when it is necessary to rotate the material to be cut in the region of the input field.

An apparatus for cutting stacked paper which has a device for manipulating the stack of paper is known from WO-A-8 701 066. This device comprises a rotating member which can be lowered on to the stack of paper from above and which can be rotated with the stack on the table. In addition, a pair of holders is provided for grasping the stack of paper laterally in the region of opposite side faces, by means of which the stack of paper can be aligned on a forward feed unit.

The object of the present invention is to further develop an apparatus of the type cited initially so that strength-sapping, ergonomically detrimental manual operations are

avoided when rotating the material to be cut, particularly in connection with the edge trimming of the material.

5 This object is achieved for an apparatus of the type cited initially in that a gripper system is provided in the region of the input field for rotating the material to be cut in the plane of the table surface, wherein the gripper system comprises at least one pair of gripper tongs which can travel parallel to and perpendicularly to the table surface, with its gripping plane oriented parallel to the table surface.

10 The gripper system makes it possible for all the operations occurring in the region of the input field to be carried out fully automatically. Thus the material to be cut can be rotated by means of the gripper system in connection with edge trimming operations, and moreover the material to be cut can be pulled back towards the forward feed unit by means of the gripper system and can also be advanced towards the cutting knife, due to
15 which the correct placement of the stack to be cut is considerably simplified. In addition, a nozzle system can be provided in the table, particularly in the region of the input field, for reducing the displacement forces. Due to the design according to the invention, the pair of gripper tongs grasps the stack to be cut at the side; when two pairs of gripper tongs are used, these can grasp the stack on one side or on opposite sides.

20 According to a particular embodiment of the invention, provision is made for the apparatus to comprise a first support projecting above the input field, the free end of which support receives a second support which can swivel parallel to the table surface and which in turn receives the pair of grippers so that the latter can travel
25 perpendicularly to the table surface. The first support advisedly extends to about the middle of the input field, so that the second support only has to be slightly longer than half the length of the longitudinal extent of the input field. In this connection it is considered to be advantageous if the second support is constructed so that its length is adjustable, due to which the traverse times of the forward feed unit for the material to
30 be cut can be reduced, since when the stack is rotated, with a superimposed retraction movement of the support and a subsequent movement of the forward feed unit, the second support can position the stack more closely adjacent to the cutting knife.

The second support should receive a gripper carrier perpendicular thereto in the region of its free end in guides, which gripper carrier can travel parallel to the table surface, and in which a lifting element is mounted to which the gripper tongs are attached. Due to the displaceable mounting of the gripper carrier the gripper tongs can grasp the stack to be cut at different distances from the field of action, particularly in the middle of the side of the stack to be grasped. In addition to this, it is considered to be advantageous if two pairs of gripper tongs disposed at a distance from each other are attached to the gripper carrier, which gripper tongs then do not grasp the stack in the middle of the stack side, but grasp it further out. The lifting element associated with the respective pair of gripper tongs is advantageously constructed as a lifting cylinder, which is operated pneumatically or hydraulically. In addition to this, it is of course possible to displace the gripper tongs by means of a spindle or the like.

A preferred embodiment of the invention provides for the projecting support to be fixed. According to another embodiment, provision is made for the projecting support to be displaceable parallel to the longitudinal extent of the cutting knife and the crosshead of the press. For example, the projecting support may be attached to a post receiving the cutting knife and the crosshead of the press. Instead of this, however, it is also possible for the projecting support to be attached to a post disposed behind or near the input field. Particularly when the support is disposed behind the output field, the pair of gripper tongs or the pairs of grippers tongs can take over the function of the forward feed unit. Moreover, the first and the second support may form a toggle link, to the free end of which the gripper carrier with the two pairs of gripper tongs which can travel perpendicularly to the table surface is preferably attached. Thus the gripper system not only performs the function of rotating the stack, but also of advancing the latter. It is even possible to transfer the material to be cut from a peripheral device to the apparatus by means of the gripper system. When the pairs of grippers are movable in relation to each other, the gripper system can also perform the function of a swivelling feed bracket, which compensates for tolerances in the angular position of the stack.

Each pair of gripper tongs advantageously comprises a lower gripper tongue which is fixed in relation to the gripper tongs and an upper gripper tongue which can travel perpendicularly to the table surface in relation to the lower gripper tongue by means of a lifting element, particularly a lifting cylinder. In order to ensure that the material to be cut can be securely grasped by means of the gripper tongs, the table should have a trough in the input field for receiving the lower gripper tongue. Besides or in addition to this, the table may have lifting cylinders in the input field and mounted in the latter, the piston rods of which lifting cylinders can be extended from the table and can thereby raise the stack to be cut when the latter is being correspondingly positioned, so that the lower gripper tongue can be moved under the stack.

Finally, in one particular embodiment of the invention the table is provided with at least one lateral stop, which can be lowered or folded below the table surface, for aligning the material to be cut. Stacks having a diagonal larger than the width of the input field can thus be rotated on the input field of the apparatus, and consequently protrude beyond the lateral boundary of the input field when they are rotated in the region of a corner thereof.

Further forms of the invention are illustrated in the description of the Figures and in the subsidiary claims.

The invention is schematically illustrated by way of example in the Figures with reference to a plurality of embodiments, without being restricted thereto. The Figures comprise the following:

- Figure 1 is a schematic view of a first embodiment of the apparatus according to the invention, shown in plan view;
- Figure 2 is a view X according to Figure 1 of the upper region of the apparatus;
- Figure 3 is a view Y according to Figure 1 of the upper region of the apparatus;
- Figure 4 is an illustration corresponding to that of Figure 3 showing a slightly modified mounting of the gripper system;

- Figure 5 is a schematic illustration of a second embodiment of the apparatus according to the invention, shown in plan view;
- Figure 6 is a schematic illustration of a third embodiment of the apparatus according to the invention, shown in plan view; and
- 5 Figure 7 is a schematic illustration of a gripper formed from two pairs of gripper tongs.

The apparatus illustrated in the Figures relates to a paper cutting machine forming a structural unit. As is illustrated in Figures 1 to 4 relating to the first embodiment, this
10 consists in the known manner of a table 12, the surface of which comprises a field of action 12a, above which a cutting knife 2 and a crosshead 3 of a press are situated, behind which an input field 12b is situated for receiving the material to be cut 25 or 25' and in front of which an output field 12c is situated for receiving the cut material, which is not illustrated. A spindle-driven feed bracket 13, which can be displaced over the
15 input field 12b in the longitudinal direction of the table 12, serves for displacing the material to be cut. The Figures also illustrate the machine stand 11 of the paper cutting machine, the frame 11a of which, which is disposed above the table 12, receives the cutting knife 2 and the crosshead 3 of the press on its lower face. An electric motor which is flange-mounted on the machine stand 11 for operating the paper making
20 machine 1 is denoted by reference numeral 4.

As can be seen from the illustrations of Figures 1 to 3, a gripper system 29 is attached to the frame 11a. In detail, a projecting first support 14 is flange-mounted on the side of the frame 11a facing the input field 12b. This first support extends in the plane of
25 symmetry 5 of the table 12 and perpendicularly to the frame 11a almost as far as the middle of the table. The free end of the support 14 is provided with two jaws 14 disposed parallel to each other, through which a pin 6 oriented perpendicularly to the input field 12b passes. A second support 15 can swivel about the pin 6 between the jaws 14. This second support can be locked, via locking means which are not illustrated, in
30 a first position parallel to the frame 11a as shown in Figures 1 to 3 and in a second position in which it is swung from the frame 11a by a right angle in relation to the first position (double arrow A in Figure 1). The support 15 is of two-part construction; a

first tubular support element 15a is attached to the free end of support 14 and is provided with guide rollers 15b for a further support element 15c which can be displaced in the longitudinal direction of support element 15a. A pneumatically operated swivelling cylinder 7, by means of which the support element 15a can be swung out of its right-angled position with respect to the support 14 into its straight position, acts on the support 14 and on the support element 15a. A pneumatically acting cylinder 16 is disposed between support element 15a and support element 15c, and serves to advance or retract support element 15c. The constructional relationships with respect to the second support 15c are designed so that it is possible to retract the latter as far as possible but so that it is also possible to extend it sufficiently so that it protrudes beyond the side edge 12d of the table 12 or in its straight position extends as far as the forward feed bracket 13.

The support element 15 has upper and lower guides 18 in the region of its free end, which guides extend perpendicularly to its longitudinal extent and parallel to the input field 12b and in which a gripper carrier plate 17 is displaceably mounted. Movement of the gripper carrier plate 17 is effected via a further pneumatic cylinder 8, which acts firstly on the support element 15c and secondly on a support ring 9 of the gripper carrier plate 17. The length of the guides 18 is designed so that the gripper carrier plate 17 - with respect to the illustration of Figure 1 - can be moved between a position adjacent to the frame 11a and a symmetrical position in relation to the middle of the input field 12b. Two gripper receivers 10 are attached to the gripper carrier plate 17 at a distance from each other. Each of these has a receiver, extending perpendicularly to the input field 12b, through which a guide rod 21 passes which in turn receives a gripper tongue 22 at its lower end. In addition, a pneumatic lifting cylinder 19, which acts on the gripper tongs 22, is mounted in each gripper receiver 10. The gripper tongs 22 have a lower gripper tongue 22a, which is attached fixed to the lower end of the guide rod 21 and to the piston rod 19a of the lifting cylinder 19. An upper gripper tongue 22b is provided with two holes, which are not shown, through which the guide rod 21 and the piston rod 19a pass and by which they are guided. The piston rod 20a of a further pneumatic lifting cylinder 20, which is attached to the guide rod 21 above the upper gripper tongue 22b, acts on the upper gripper tongue 22b. The lifting cylinder 20 thus

makes it possible for the upper gripper tongue 22b to be moved in relation to the lower gripper tongue 22a, which is fixed in relation thereto, and thus to clamp or release the material to be cut 25.

5 It can also be seen from Figures 1 and 2 that the paper cutting machine 1 has a lowerable side guide plate 23 in the region of the left side edge 12d of the input field 12b. A plurality of lifting cylinders 24 is mounted adjacent to this side guide plate 23, each cylinder being at the same distance from the side edge 21d. The piston rods 24a of these lifting cylinders pass through through-holes, which are not shown, in the input
10 field 12b of the table 12, and when the piston rods 24a are extended, as is shown in particular in Figure 2, they protrude above the surface of the table 12.

The apparatus described above operates as follows: after edge trimming the narrow edge 25a of the material to be cut 25, the narrow edge 25a is situated in the cutting plane of
15 the knife 27 and the longitudinal edge 25b of the material to be cut 25 is seated against the side guide plate 23. The forward feed bracket 13 is moved into its moved-back end position shown in Figure 1, and the piston rods 24a of the lifting cylinders 24 are extended sufficiently so that the material to be cut 25 can be engaged from below by means of the lower gripper tongue 22a. The two grippers 22 are first moved downwards
20 to such an extent that the lower gripper tongue 22a is situated at the same level as the gap between the material to be cut 25 and the table 12. The upper gripper tongue 22b is moved away from the lower gripper tongue 22a according to the thickness of the stack. The support element 15c is then retracted into the support element 15a to such an extent that the two pairs of gripper tongs 22 completely embrace the stack to be cut
25 25. Depending on the length of the stack to be cut, it may be necessary to move the grippers along the guides 18 before introducing them into the stack, so that it is ensured that the gripper tongs 22 are positioned symmetrically with respect to the associated axis of symmetry of the stack to be cut 25. After the gripper tongs 22 have been closed by lowering the gripper tongue 22b on to the stack 25, the piston rod 24a of the lifting
30 cylinder 24 is retracted. The support element 15c is then partially retracted into the support element 15a in order to create the requisite swivelling space for the material to be cut 25 so that the stack 25 comes to rest approximately symmetrically with respect

to the longitudinal axis of the table 12. The locking means situated in the region of the pin 6 is then released and the support 15 is swung by 90°. Air nozzles, which are not illustrated but which are disposed in the table in the region of the input field, at the same time reduce the friction between the stack and the table. In this position the support 15 forms a straight line with the support 14, and the two supports 14 and 15 are locked to each other again in this position. During the swivelling movement of the support 15 the support element 15c is advantageously already being extended from the support element 15a and the gripper carrier plate 17 is moved in the guides 18, so that after completion of the swivelling movement the material to be cut is situated adjacent to the side edge 12d of the table and its longitudinal side 25c is positioned on the input field 12b at a slight distance from the cutting plane of the knife 27. The lowerable side guide plate 23 is then moved into the extended position shown in Figures 2 and 3, and the stack of material to be cut 25', which is now rotated, is placed completely on the lateral stop by a slight movement of the gripper carrier plate 17 in the guides. After being released from the stack 25', the gripper tongs 22 are moved and the support 15 is again swung into the position shown in Figure 1. The material to be cut 25' can then be advanced by means of the forward feed bracket 13 as far as the desired cutting plane under the cutting knife 2. The cut is then made after pressing down the crosshead 3 of the press. The next edge cut follows in the operating sequence described. The construction described above of the apparatus according to the invention not only enables material to be cut 25 or 25' to be rotated by means of it, particularly by a right angle, but the gripper system can also take over the function of the forward feed bracket. In particular, when the supports 14 and 15 are in their straight position the gripper tongs 22 grasp the rear edge of the material to be cut 25 or 25', and the material to be cut can thereby be advanced by retracting the support element 15c into the support element 15a or can be pulled back in an opposite movement. Moreover, a corresponding form of construction of the apparatus makes it possible, of course, not only to swing out the support 15 by an angle of 90° from the position shown in Figure 1, but also to swing it out by an angle of 180°, so that a further edge trimming operation can be effected without the gripper tongs 22 having to be released.

Figure 4 shows a slight modification of the paper cutting machine described thus far with reference to Figures 1 to 3. In this embodiment, the support 14 is mounted so that it is displaceable parallel to the longitudinal extent of the cutting knife 2 and the crosshead 3 of the press in guides 26 extending over the entire length of the frame 11a. The support 14 is displaced by means of a pneumatic cylinder, which is not visible in this view. The displaceability of the support makes it possible, for example, to take a stack from a peripheral device or to discharge it to the latter.

Figures 5 and 6 are schematic illustrations of further embodiments of a paper cutting machine 1 having a table which is correspondingly subdivided into a field of action 12a, an input field 12b and an output field 12c, and having a cutting plane of a knife 27. A guide 28, in which a similar gripper system 29 is displaceable, is provided behind the table parallel to the cutting plane of the knife 27. A base plate 30 of the gripper system, to which a first support 31 pointing towards the cutting plane of the knife 27 is rigidly attached, is displaceable in the guide 28. A second support 32 is displaceably mounted in the support 31, corresponding to the function of the supports 14 and 15 in the first embodiment. The free end of the support 32 receives a gripper carrier plate 33, which can swivel about an axis 34 oriented perpendicular to the input field 12b. The means of power for moving the base plate 30, for extending the support 32 and for swinging the gripper carrier plate 33 are not shown in the Figures. The construction and function of the gripper carrier plate 33 correspond to those of the gripper carrier plate 17 according to the embodiment described previously. Corresponding to the said embodiment, two pairs of gripper tongs are mounted in the gripper carrier plate parallel to the plane of the input field 12b so that they can be displaced perpendicularly to the latter. In the embodiment illustrated in Figure 5, the material to be cut 25 is rotated after it has been grasped by a superposition of the traverse movement of the base plate 30 on the extension or retraction movement of the support 32 and on the swivelling movement of the gripper carrier plate 33. I shows the material to be cut 25 grasped at the side with the support 32 extended and with the gripper carrier plate 33 aligned with the support 32. II shows an intermediate position with the support 32 partially retracted and with the gripper carrier plate 33 swivelled about an angle of 45° in relation to the straight starting situation. III shows the material to be cut 25' rotated about 90° with

the support 32 substantially retracted and with the gripper carrier plate 33 swivelled by 90°. A traverse movement of the base plate 30 is superimposed on the retraction movement of the support 32 and on the swivelling movement of the gripper carrier plate 33 between operating situations I and III. After reaching the rotated position, the material to be cut 25' can be placed on the associated side guide plate 23 adjacent to the cutting plane of the knife 27 by a defined movement of the base plate 30 and of the support 32. The defined advance of the material to be cut 25' to the severance position can then be effected by the gripper system 29 after the latter has moved out of the region of the forward feed bracket 13. As described for the previous embodiment, the gripper system 29 can replace the forward feed bracket 13 and can thus serve to advance the material to be cut. Due to the swivel-mounting of the gripper carrier plate 33, the latter can also take over the functions of a swivelling bracket.

Figure 6 makes it clear, with reference to a further embodiment, that the telescopic supports 31 and 32 described for the embodiment shown in Figure 5 can also be replaced by a two-part toggle lever 35. Thus one lever part 35a can swivel about an axis 36 of the movable base plate 30, which axis is oriented perpendicularly to the table 12 and is disposed behind the input field 12b. A lever part 35b can swivel with the end of the lever part 35a remote from the axis 36 about an axis 37 disposed parallel to the axis 36. The end of the lever part 35b which is remote from the axis 37 in turn receives the gripper carrier plate 33, which can swivel about an axis 34 disposed parallel to the axis 37. Corresponding to the embodiment shown in Figure 5, the gripper carrier plate 33 again receives two pairs of gripper tongs which are displaceable in the plane of the table and perpendicularly thereto. The means of power for swivelling the toggle lever 35 in total and also for swivelling the lever parts 35a and 35b and the gripper carrier plate 33 are not indicated in the drawing of Figure 6. I shows the material to be cut 25 grasped at the side with the toggle lever 35 extended. II shows the material to be cut in a partially rotated position in which the toggle lever 35 is partially folded up and the gripper carrier plate 33 has been swivelled from the starting position by an angle of 45°. II shows the toggle lever 35 folded up even more, with the gripper carrier plate 33 having been swivelled from the starting position by 90° and thus with the material to be cut 25' rotated by 90°. During the rotation of the material to be cut, a traverse

movement of the base plate 30 can be superimposed on the swivelling movement of the gripper carrier plate 33 and the toggle lever 35, in order to place the material to be cut 25' against a lateral stop again. Within the scope of this embodiment, it is possible to construct the lever parts 35a/35b so that their lengths are adjustable, the adjustment of their lengths again being effected by means of power.

Figure 7 shows a gripper system variant constructed as a clamping beam 40. The clamping beam 40 has a first beam part 40a which is fixed to the gripper carrier plates 17 or 33 described previously and in which a further beam part 40b is mounted via adjusting means, which are not shown, so that it is longitudinally displaceable. Two downwardly directed jaws 38 of the clamping beam 40 are provided with the gripper tongs 22 described previously. The two pairs of gripper tongs 22 are oriented towards each other and thus enable the material to be cut 25 to be grasped on both sides. A lifting cylinder 24 with its piston rod 24a extended is shown on the right of Figure 7. On the left, and for another variant, the input field 12b of the table 12 is provided, instead of the lifting cylinder, with a trough region 39 into which the lower gripper tongue 22a is introduced, so that it is not necessary to raise the material to be cut 25 separately in the gripper region.

List of reference numerals

	1.	paper cutting machine
	2	cutting knife
5	3	crosshead of the press
	4	electric motor
	5	plane of symmetry
	6	pin
	7	pneumatic swivelling cylinder
10	8	pneumatic cylinder
	9	support ring
	10	gripper receiver
	11	machine stand
	11a	frame
15	12	table
	12a	field of action
	12b	input field
	12c	output field
	12d	side edge
20	13	forward feed bracket
	14	first support
	14a	jaws
	15	second support
	15a	support element
25	15b	guide roller
	15c	support element
	16	pneumatic cylinder
	17	gripper carrier plate
	18	guide
30	19	pneumatic lifting cylinder
	19a	piston rod
	20	pneumatic lifting cylinder

	20a	piston rod
	21	guide rod
	22	gripper tongs
	22a	lower gripper tongue
5	22b	upper gripper tongue
	23	side guide plate
	24	lifting cylinder
	24a	piston rod
	25	material to be cut
10	25'	material to be cut
	25a	narrow edge
	25b	longitudinal edge
	25c	longitudinal edge
	26	guide
15	27	plane of cutting knife
	28	guide
	29	gripper system
	30	base plate
	31	first support
20	32	second support
	33	gripper carrier plate
	34	axis
	35	toggle lever
	35a	lever part
25	35b	lever part
	36	axis
	37	axis
	38	jaws
	39	trough
30	40	clamping beam
	40a	beam part
	40b	beam part

CLAIMS

- 5 1. An apparatus for cutting stacked sheet material, having a table, the surface of which comprises a field of action, above which a cutting knife and a crosshead of a press are situated, behind which an input field is situated for receiving the material to be cut and in front of which an output field is situated for receiving the cut material, having a forward feed device for the material to be cut, characterised in that a gripper system (29) is provided in the region of the input
10 field (12b) for rotating the material to be cut (25) in the plane of the table surface, wherein the gripper system (29) comprises at least one pair of gripper tongs (22) which can travel parallel to and perpendicularly to the table surface, with its gripping plane oriented parallel to the table surface.
- 15 2. An apparatus according to claim 1, characterised in that it comprises a first support (14) projecting above the input field (12b), the free end of which support receives a second support (15) which can swivel parallel to the table surface and which in turn receives the pair of grippers (22) so that the latter can travel
20 perpendicularly to the table surface.
3. An apparatus according to claim 2, characterised in that the second support (15) is constructed so that its length is adjustable.
- 25 4. An apparatus according to claim 2 or 3, characterised in that the second support (15) receives a gripper carrier (17, 10) perpendicular thereto in the region of its free end in guides (18), which gripper carrier can travel parallel to the table surface, and in which a lifting element (19) is mounted to which the gripper tongs (22) are attached.
- 30 5. An apparatus according to claim 4, characterised in that the lifting element (19) is constructed as a lifting cylinder.



6. An apparatus according to claim 4 or 5, characterised in that two pairs of gripper tongs (22) disposed at a distance from each other are attached to the gripper carrier (10, 17).
- 5 7. An apparatus according to any one of claims 2 to 6, characterised in that the projecting support (14) is fixed.
8. An apparatus according to any one of claims 2 to 6, characterised in that the projecting support (14) is displaceable parallel to the longitudinal extent of the cutting knife (2) and the crosshead (3) of the press.
- 10 9. An apparatus according to any one of claims 2 to 8, characterised in that the projecting support (14) is attached to a post (11) receiving the cutting knife (2) and the crosshead (3) of the press.
- 15 10. An apparatus according to any one of claims 2 to 8, characterised in that the projecting support (14) is attached to a post (28, 30) disposed behind or near the input field (12b).
- 20 11. An apparatus according to any one of claims 2 to 8, characterised in that the first and the second support (14, 15) form a toggle link (35).
12. An apparatus according to any one of claims 1 to 11, characterised in that the gripper tongs (22) comprise a lower gripper tongue (22a) which is fixed in relation to the gripper tongs and an upper gripper tongue (22b) which can travel perpendicularly to the table surface in relation to the lower gripper tongue by means of a lifting element, particularly a lifting cylinder (20).
- 25 13. An apparatus according to claim 12, characterised in that the table (12) has a trough (39) in the input field (12b) for receiving the lower gripper tongue (22a).
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14. An apparatus according to any one of claims 1 to 13, characterised in that the table (12) has lifting cylinders (24) in the input field (12b) and mounted in the latter, the piston rods (24a) of which lifting cylinders can be extended from the table (12).

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15. An apparatus according to any one of claims 1 to 14, characterised in that the table (12) is provided with at least one lateral stop (23), which can be lowered or folded below the table surface, for aligning the material to be cut (25).

