

[54] INSTALLATION FOR CUTTING ROLLED SHEETS

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- [51] Int. Cl. B23d 15/08, B23d 33/02
- [58] Field of Search 83/81, 71, 91, 94, 104, 83/106, 165, 167, 206, 207, 208, 221, 281, 367, 415, 417

[56]

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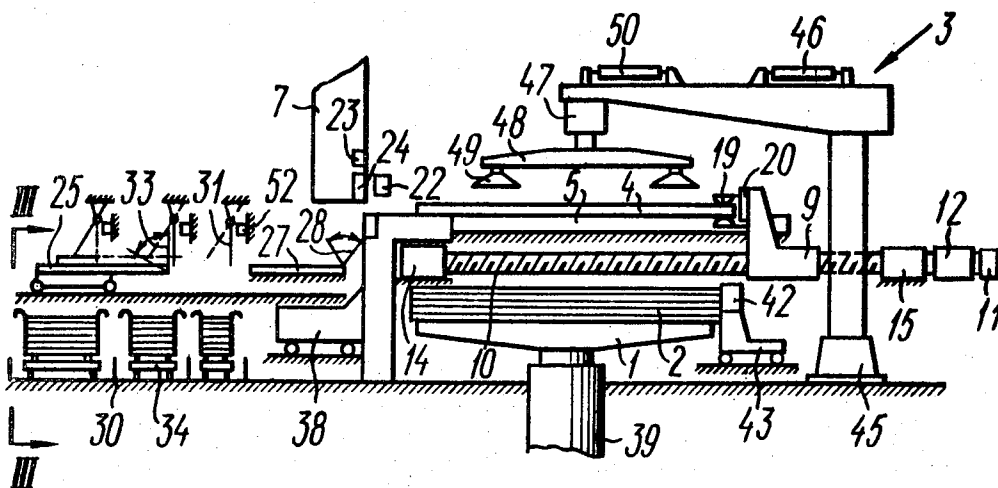
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[57]

ABSTRACT

An installation comprises a device to sort and pile the pieces of a sheet being cut while a sheet-feeding device comprises a slide-block on which a front limit stop for a sheet is mounted and a sheet gripper which is capable of moving in a longitudinal direction. The slide-block is also provided with a pick-up which signalling of a moment of the sheet entrance into the gripper and so produces a signal to make the gripper operative and movable to orient the sheet relative to the knives of guillotine shears in accordance with the limit stop. Installed in front of the knives is a pick-up for computing origin of the size of a sheet part to be cut which controls the passage of the front edge of the sheet and produces a signal to put a movable knife of the shears into operation to cut the sheet in accordance with the pre-set program.

6 Claims, 4 Drawing Figures



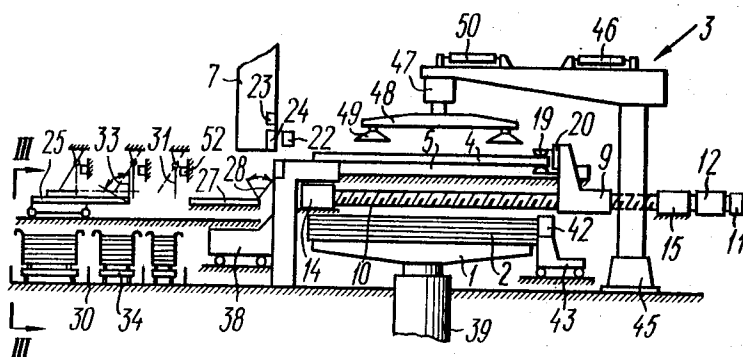


FIG.1

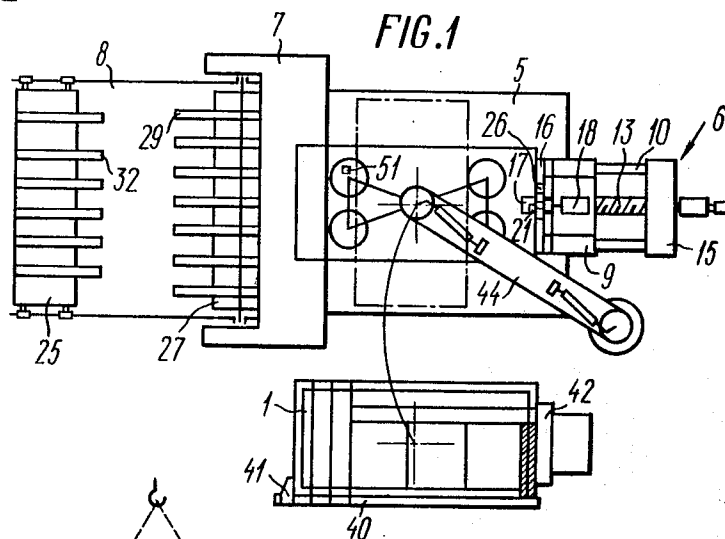


FIG. 2

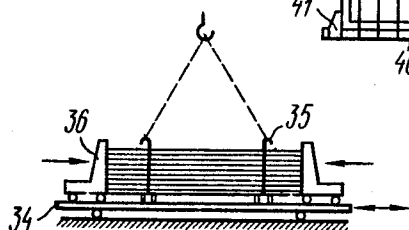


FIG. 3

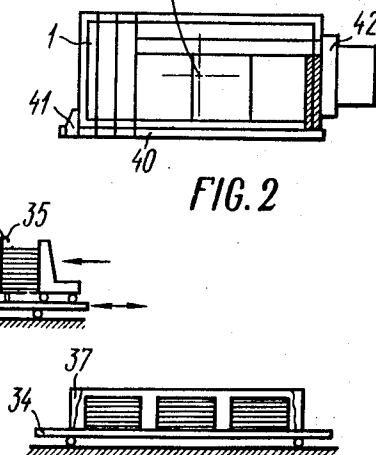


FIG.4

INSTALLATION FOR CUTTING ROLLED SHEETS

The present invention relates to the metal pressure shaping equipment and in particular to the installations for cutting rolled sheets.

The invention is utilized most effectively in cutting rolled sheets in accordance with a combined low-waste cutting chart, yet, it is equally applicable for cutting a sheet into the equal-sized blanks.

Known today are installations for a combined rolled sheet cutting which comprise a mechanism to place a sheet taken from the pile on the table with the aid of a gripping device, and a device to feed the sheet to the guillotine shears (see, for example, FRG Pat. No. 1147825, class 49 c, 10/02). In such installations the device to feed a sheet to the knives represents a car with sheet retaining facilities which moves along the table in the direction of sheet feeding while the table is provided with a turning grid with retaining appliances which is designated for turning the sheet in a horizontal plane.

Since an accurate placement of a pile relative to the knives is difficult because of its considerable weight and because of the fact that the sheets of the pile are displaced as regards one another the car will place them on the table with a warping towards the knives. So the sheets will be fed to the knives in such a warp position since the car cannot orient a sheet accurately towards the line of cutting. This will result in cutting oblique-angled blanks and in reducing the accuracy of the pre-set sizes of blanks to be cut.

A shuttle-like nature of the movement of the car reduces the efficiency of cutting since extra time is required to return the car back, to lock a sheet anew and to feed it to the knife again to cut a blank next in turn.

Since the sheet is gripped in its upper plane at a certain distance from the edge sufficient for its movement this area of the sheet cannot be cut by the knives which results in the increase of the technological end remnants and involve some difficulties in removing them from the table. Such a method of gripping makes it necessary to enlarge the sizes and the mass of the car and to increase the distance between the guides along which it moves and that will affect the accuracy of blank cutting.

When combined charts are applied a sheet can be effectively cut into blanks of several types and sizes if there is a separate storage of blanks provided by a device to sort and pile the blanks and to remove the technological waste; but the known installations are lacking of such a device.

The object of the present invention is to overcome the said disadvantages.

The main task of the invention is to create an installation for cutting rolled sheets which could provide for a fully automated, accurate and highly efficient cutting of sheets into blanks in accordance with the combined charts of cutting by way of improving a sheet-feeding device and introducing both a device to sort and pile the blanks and a system of programmed control to be provided with pick-ups to control the passage of a sheet in the installation.

The said object is achieved by the provision of an installation for cutting rolled sheets, comprising a mechanism to place the sheets from a pile on the table with the aid of a gripping device and a device to feed the

sheet to the knives of the guillotine shears, according to the invention includes a device to sort and pile the pieces of the sheet being cut, while the sheet-feeding device contains a slide-block on which a sheet gripper is installed and which is capable of moving longitudinally, a front limit stop located in parallel to the knives, and a pick-up which registers the entrance of the sheet into the gripper and produces a signal to make the gripper operative and movable in order to orient the sheet in accordance with the limit stop relative to the knives in front of which there is a pick-up for computing origin of the size of a sheet part to be cut installed in the direction of sheet movement to control the passage of the front edge of the sheet and to produce a signal to put a movable knife of the guillotine shears into operation to cut the sheet in accordance with the pre-set program of cutting, the upper position of the movable knife being determined by a pick-up connected with a movable car of the device which sorts and piles the pieces of the sheet being cut and which is located outside the knives in the direction of sheet movement.

The slide-block together with the front limit stop and the movable gripper mounted on it as well as the said pick-ups make it possible to provide for the automatic feeding of sheets to the knives, to secure the feeding of portions of a sheet of the pre-set sizes with the required accuracy, to reduce the quantity of technological end remnants and to offer possibilities of removing them to outside the knives in an easy way. The device to sort and pile the pieces of a sheet being cut connected with the sheet-feeding device provides for a separate storage of the cut blanks, whose position is suitable for a further re-treatment, and for the removal of technological waste as well. As a whole, all the facilities make it possible to secure an automatic, highly efficient process of cutting the sheet into blanks in accordance with the combined charts.

In order to simplify the control of operation of the sheet-placing mechanism and the sheet-feeding device and in order to prevent the sheets from being cut into rejectable blanks, if for some reason or other the sheets are not oriented properly relative to the knives in accordance with the limit stop, the drive of the slide-block is electrically connected with a sheet availability pick-up mounted on the sheet-gripping device of the sheet-placing mechanism, with the pick-up for computing origin of the size of a sheet part to be cut, and with a pick-up mounted on the front limit stop of the slide-block, and intended to control the contact between the back edge of the sheet and the limit stop.

In order to simplify the control of operation of the device which feeds the knives with portions of a sheet of the pre-set sizes with the required accuracy the drive of the slide-block is provided with a step electric motor equipped with a hydraulic booster connected to the slide-block through a lead screw.

According to the invention the device to sort the pieces of a sheet being cut contains a table, provided with a slipway, on the surface where there are longitudinal ribs to receive the blanks being cut, both of them being designed to prevent the deflection of a sheet outside the knives; and a blank storage compartment with pushers installed above it in a consecutive order along the way of the car and capable of turning in the direction of blanks movement and throwing them into the storage compartment from the car when the latter moves towards the knives, the movable car being in the

shape of a fork the prongs of which enter the space between the ribs of the table when it approaches the knives and carry spring-loaded catches to remove the blanks from the receiving table which sink under the weight of the blanks lying on the table and return with the aid of the springs to their initial position under the slipway of the receiving table.

The availability of the table for receiving the cut blanks makes it possible to raise the efficiency of cutting since the said table, performing the function of an intermediate storage, enables it to proceed with the cutting of incoming sheets at the time when the blanks which have already been cut are being transported.

Described above table, the movable car and the pushers simplify the design of both the device which sorts the blanks and the system which controls the movement of the car.

In order to provide for a separate storage of blanks of various types and sizes and for the removal of waste the storage compartment is made multisectional, with the number of sections being equal to that of the pushers, every section of which is provided with a platform capable of moving in the direction parallel to the knives and having a device to pile the blanks up mounted on it.

The movable platform provides for a better filling of the sections since it is capable of storing several piles of blanks if their sizes permit.

In order to remove the technological waste more efficiently without putting the movable car into operation the slipway of the receiving table is made turnable to let the cut edges and technological end waste pass into a bin under the receiving table.

The present invention will be better understood from the consideration of a specific example of its embodiment given below with reference to the drawings enclosed herewith in which:

FIG. 1 shows a general view of the installation proposed;

FIG. 2 — ditto, a top view;

FIG. 3 — section III—III given in FIG. 1;

FIG. 4 — another alternative of the storage compartment.

An installation for cutting rolled sheets comprises a lifting plate 1 (FIGS. 1 and 2) for an initial pile 2 of sheets, a mechanism 3 to place a sheet 4 from the pile 2 on a table 5, a device 6 to feed the sheet 4 to knives of guillotine shears 7, and a device 8 to sort and pile the pieces of a sheet being cut.

The device 6 to feed a sheet to the knives, according to the invention, contains a slide-block 9 which moves along cylindrical guides 10 with the aid of a step electric motor 11, a hydraulic booster 12 and a lead screw 13. The lead screw and the guides 10 are mounted on a front 14 and back 15 block bearings. A front limit stop 16 for the sheet 4 is mounted parallel to the knives on the slide-block 9. In accordance with the limit stop the sheet 4 is oriented relative to the knives. Mounted on the same slide-block is a sheet gripper 17 made in shape of clamp cheeks and capable of moving in a longitudinal direction relative to the slide-block, for example, with the aid of an electromagnet 18, in order to orient a sheet in accordance with the limit stop 16. The upper cheek 19 is made movable to be pressed to the lower cheek, for example, with the aid of an electromagnet 20. Also mounted on the slide-block 9 is a pick-up 21 of the program control system which registers the

entrance of a sheet into the cheeks and produces a signal to make the electromagnets 18 and 20 operate. Installed in front of the knives of the guillotine shears 7 is a pick-up 22 for computing origin of the size of a sheet part to be cut which reacts to the passage of the front edge of the sheet 4. The guillotine shears 7 are also provided with a pick-up 23 which determines the upper position of a movable knife 24 and which is electrically connected to the step electric motor 11 and a movable car 25 of the device which sorts and piles the pieces of a sheet being cut.

Mounted on the limit stop 16 is a pick-up 26 which is to control the contact between the back edge of the sheet 4 and the limit stop.

The device 8 to sort and pile the pieces of a sheet being cut contains a receiving table 27 with a slipway 28. On the table there are longitudinal ribs on which the cut pieces of a sheet are placed. The ribs are also designed to prevent the deflection of a sheet outside the knives. Outside the receiving table there is a multisectional storage compartment 30 above which, in the direction of blanks movement, turning pushers 31 are installed to throw the blanks from the car 25 into the storage section.

The car 25 has the shape of a fork prongs 32 of which may enter the space between the ribs 29 of the table 27 when the car approaches the guillotine shears. The prongs 32 carry spring-loaded catches 33 designed for removing the blanks from the receiving table. The catches are made in such a way as to be capable of sinking under the weight of the blanks lying on the receiving table 27 and of returning to their initial position under the slipway 28.

Every section of the storage compartment 30 is provided with a platform 34 capable of moving parallel to the knives. The platform has a device to pile up the blanks. The device is provided with clamps 35 (FIG. 3) adjusted to the size of a blank and movable walls 36 which are used in case accurate piles of blanks are required. The walls are capable of moving towards each other, for example, with the aid of pneumatic cylinders, in order to straighten the faces of the blanks in a pile. The upper ends of the clamps 35 are unbent to facilitate the unloading of them from a storage section together with a ready pile. If there are no special requirements to pile the blanks the piling device may be represented by a conventional container in the shape of a bin 37 (FIG. 4). Since the platform 34 is made movable there are possibilities of placing several piles of blanks into the box which increases the rate of container filling.

The container installed on the platform 34 of the first section of the storage section counting from the knives may be utilized to receive the technological waste (the cut edges and end remnants). Yet, it seems appropriate to throw the waste into a bin 38 located under the receiving table 27 directly outside the knives in order to raise the efficiency of cutting. For such a case the slipway 28 of the receiving table 27 is made turnable.

The plate 1 (FIGS. 1, 2) is lifted by a hydraulic cylinder 39 of the piston type. The plate has a rule 40 with a limit stop 41 designed for orienting a pile to be placed on the plate. To facilitate the separation of the upper sheet from a pile a magnetic separator 42 is mounted on a carriage 43.

The mechanism 3 to place a sheet on the table contains a jib 44 turning on a column 45 with the aid of a

hydraulic cylinder 46. At the end of the jib there is a pneumatic cylinder 47 to lift and lower a cross-bar 48 with pneumatic suckers 49 which are used to grip a sheet. The cross-bar is turned by a hydraulic cylinder 50. Mounted on the cross-bar is a sheet availability pick-up, for example, a pick-up measuring the pressure under a pneumatic suction cup. The pick-up is electrically connected to the actuating cylinders 46, 47, 50 and to the step electric motor 11.

The installation operates as follows:

Prior to putting the installation into operation the following adjusting operations are to be made. The clamps 35 adjusted to the size of a blank or to the container 37 are mounted on the platforms 34. The rule 40 and the limit stop 41 are installed in accordance with the sizes of the initial pile. Then the pile of the sheets 2 is placed on the plate 1 lowered to its extreme position. The magnetic separator 42 is wheeled to the pile and the plate is lifted to introduce the upper part of the pile into the active zone of the magnetic separator.

After the said operations the facilities of the installation being in the adjusting regime are set into the initial position: the jib 44 is turned to the initial pile, the cross-bar 48 is lifted to its upper position to be located along the pile.

The slide-block 9 is moved to its extreme position counting from the knives, with its gripper being released and moved forward towards the knives, while the car 25 is driven to the knives. The program control system is supplied with the data required to cut a sheet in accordance with the pre-set chart of cutting (the provisional chart is not conditionally shown in the upper sheet of the pile, see FIG. 2), viz. the sizes of blanks, the number of them, the address of a section of the storage compartment to which they are to be directed after cutting, the sizes of the edges to be cut if such a cutting is provided by the technological requirements, the address for end remnants if they are not to be thrown to the bin 37, the data on the location of a sheet on the table when it is being fed to the knives (whether it is placed along or across the table 5).

That is the end of the preparatory work and the installation is ready to be set into the automatic regime.

The cross-bar 48 is lowered to the upper sheet of the pile 2 by the pneumatic cylinder 47. At the same time the magnetic separator starts operating. After the suckers develop the rated lifting force (which can be registered by the pick-up 51) the actuating cylinders 47, 46 and 50 are put into operation in accordance with a signal produced by the pick-up 51. The cross-bar is lifted and a sheet is transferred to be placed on the table 5. When the movements of jib 44 are combined with those of the cross-bar 48 the sheet is placed along the table, when only the jib turns the sheet is placed across the table.

After the sheet 4 is placed on the table 5 the pick-up 51 will produce a signal to make the step electric motor 11 operate. The slide-block 9 starts moving to the guillotine shears. As soon as the sheet is between the cheeks of the gripper 17 the pick-up 21 produces a signal for a consecutive operation of the magnets 20 and 18: the sheet is clamped and drawn to the limit stop 16 to be oriented relative to the knives. The clamping and orientation of the sheet are made on the move without the stoppage of the slide-block 9. If for some reason or other the sheet is not oriented the pick-up 27 reverses

the step electric motor 11, viz. the slide-block 9 returns to its initial position, the gripper is released and moved forward, and the slide-block again starts moving to the sheet.

After the front edge of the sheet enters the origin computing pick-up 22 (made on the basis of a photocell) the sizing of the first blank starts (or that of an edge to be cut), viz. computing and comparing the number of impulses sent to the step electric motor 11 and those pre-set by the program. When the size is set the control system produces a signal to stop the step electric motor 11 and to lower the knife 24. The sheet starts being cut. After the knife 24 reaches its upper position the pick-up 23 produces a signal to size the second blank, the third blank, etc.

A cut blank falls to the receiving table 27. By a signal from the pick-up 23 the car 25 starts moving from the knives to remove a blank from the table 27 with the aid of the clamps 33 and to transport it to the pre-set section of the storage compartment. (At that time a blank next in turn is being fed and cut). If several, similar blanks are cut in succession the car 25 transports the piles of such blanks.

When the car moves from the guillotine shears the pushers 31 are freely turned by the blanks and when it goes back they clear the blanks into the storage compartment since the turn of the pushers to the opposite direction is limited by the stops 52.

If it is necessary to throw the blanks, for example, into the last section of the storage compartment 30 counting from the knives the car 25 will receive a signal to reverse (from a route-changing switch) only after it will be above the said section and will pass the corresponding pushers.

When the car 25 moves towards the knives the catches 33 are freely turned (sunk) by a blank lying on the table and under the slipway 28 they return to the initial position and approach the face of a blank. The blanks cleared by the pushers 31 fall into the clamps 35. The faces of the blanks are periodically straightened in a pile by the walls 36.

If there are no special requirements to piling the blanks they may be stored in the container 37. After the pile in the container reaches its maximum height the platform 34 can be shifted to give room to another pile (in the same container) without the stoppage of the installation for unloading.

The cut edges and remnants (i.e. waste) can be taken by the car 25 to be immediately directed to the bin 38. For this purpose the slipway 28 is opened prior to cutting and the car 25 moves away from the knives to let the waste pass into the bin.

In order to turn a sheet in the process of cutting (if it is provided by the cutting chart) it is driven by the slide-block 9 to under the cross-bar 48 to be turned by the said cross-bar and then fed to the knives and cut the way it has been described above.

After the first sheet has been cut the next one starts being cut immediately. The process continues uninterruptedly until the pre-set number of sheets has been cut.

In the process of sheet cutting the initial pile is periodically lifted by the hydraulic cylinder 39 in order to maintain the upper part of the pile in the active zone of the magnetic separator.

What we claim is:

1. An installation for cutting rolled sheets comprising: a mechanism to place the sheets from a pile on a table equipped with a sheet-gripping device; knives of guillotine shears which cut a sheet into blanks; a slide-block; a drive of the slide-block; a front limit stop for a sheet installed on the slide-block and located parallel to the knives; a sheet gripper installed on the same slide-block and capable of moving longitudinally with regard to the slide-block to orient a sheet relative to the knives in accordance with the limit stop; a pick-up which registers the entrance of a sheet into the gripper and which is installed on the slide-block to produce a signal to make the gripper cooperate and move relative to the slide-block; the said slide-block, gripper and pick-up which provide for the feed of a sheet to the knives; a pick-up for computing origin of the size of a sheet part to be cut which is installed in front of the knives in the direction of sheet movement and which controls the passage of the front edge of a sheet and produces a signal to put a movable knife of the guillotine shears into operation to cut a sheet in accordance with the pre-set program of cutting; another pick-up installed on the shears and determining the upper position of the movable knife; a device to sort and pile the pieces of a sheet being cut which is located outside the knives in the direction of sheet movement; a movable car mounted on the sorting device and connected with the pick-up which determines the upper position of the movable knife.

2. An installation as of claim 1 in which the sheet-gripping device of the sheet-placing mechanism is equipped with a sheet availability pick-up; the front limit stop — with a pick-up controlling the contact between the back edge of a sheet and the limit stop; and the drive of the slide-block is electrically connected with the said pick-ups as well as with the pick-up for

computing origin of the size of a sheet part to be cut.

3. An installation as of claim 2 in which the drive of the slide-block contains a step electric motor with a hydraulic booster connected with the slide-block through a lead screw.

4. An installation as of claim 1 in which the device to sort the pieces of a sheet being cut contains a table, provided with a slipway, on the surface of which there are longitudinal ribs to receive the blanks being cut, both of them being designed to prevent the deflection of a sheet outside the knives; and a blank storage compartment with pushers installed above it in a consecutive order along the way of the car and capable of turning in the direction of blanks movement and throwing them into the storage compartment from the car when the latter moves towards the knives, the movable car being in the shape of a fork the prongs of which enter the space between the ribs of the table when it approaches the knives and carry spring-loaded catches to remove the blanks from the receiving table which sink under the weight of the blanks lying on the table and return with the aid of the springs to their initial position under the slipway of the receiving table.

5. An installation as of claim 4 in which the storage compartment is made multisectional, with the number of sections being equal to that of the pushers, every section of which is provided with a platform capable of moving in the direction parallel to the knives and having a device to pile the blanks up mounted on it.

6. An installation as of claim 1 in which the slipway of the receiving table is made turnable to let the cut edges and technological end waste pass into a bin located under the receiving table.

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