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(71) Applicant: **Pisek - Vitli Krpan, d.o.o.**
3240 Smarje pri Jelsah (SI)

(72) Inventor: **Pisek, Franc**
3240 Smarje pri Jelsah (SI)

(74) Representative: **Patentni Biro AF d.o.o.**
Kotnikova 32, p.p. 2706
1001 Ljubljana (SI)

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(54) **A SPLITTING SYSTEM FOR A LOG SPLITTER FOR STEPWISE SPLITTING OF LOGS AND A LOG SPLITTER WITH THE SAID SYSTEM**

(57) The present invention belongs to the field of log splitters, more precisely to the field of constructional details at the junction with an axe. The invention relates to an improved system including the axe for a horizontal log splitter for stepwise splitting of logs and a log splitter with the said system. The splitting system is designed as a uniform rigid assembly, which comprises:

- splitting means, which comprises:
 - a primary blade,
 - at least one secondary blade attached to the primary blade, wherein the number and the arrangement of secondary blades is arbitrary,
 - a mounting for drive means arranged to move the split-

ting means, preferably a hydraulic cylinder,

- a carrier through, which is attached, preferably welded, to the primary blade,
- preferably an additional stabilization element such as a supporting plate, a cylinder transporter or a vibrational plate below the primary blade, and
- a pair of side sliding parts, preferably a pair of longitudinal ribs for receiving a pair of longitudinal guides for simultaneous movement of the splitting means, the carrier through and the optional stabilization element initiated by the drive means.

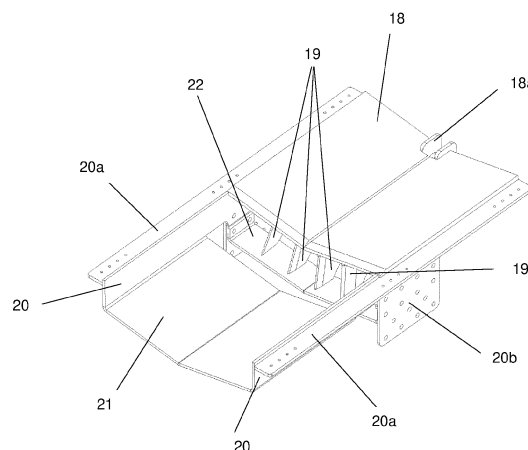


Figure 1

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Description

Field of the invention

[0001] The present invention belongs to the field of log splitters, more precisely to the field of constructional details at the junction with an axe. The invention relates to an improved system including the axe for a horizontal log splitter for stepwise splitting of logs and a log splitter with the said system.

Background of the invention and the technical problem

[0002] Wood has been used for heating for a long time, wherein processing of logs preferably includes splitting to logs having a size suitable for use in fireboxes or furnaces without any additional cutting or splitting. Several different devices for wood processing are known, among which it is important to point out devices for one-step or multistep (stepwise) log splitting. The problem of log splitting is the size of logs, as the knives of log splitters sit differently on the prepared log, thereby cutting each piece in a different manner, while splitting also depends on the nature and structure of the wood.

[0003] The technical problem, which is solved by the present invention is thus a constructional design of a splitting system for stepwise wood splitting into logs, which will ensure preparation of equally sized logs with as little waste (small cuds) as possible. The constructional design of the splitting system should be based on the shape of knives and the arrangement of primary and secondary cutting means including the supporting plate for assuring correct position of the log. The aim of the invention is to simplify and improve reliability of already known solutions of devices of multi-step, stepwise log splitting in order to prepare logs with optimal shape and minimal amount of waste splinters (chips).

State of the art

[0004] European patents EP 3 056 326 B1 and EP 3 056 327 B1 describe a device for preparation of logs, which comprises:

- A saw,
- Means for leading wood logs towards the saw,
- A support bed (plate),
- A splitting axe arranged to split a part of the log into smaller parts, wherein at least one part of the splitting axe is in the support bed,
- A supporting plate for supporting logs, and
- Means for moving the said plate and/or splitting axe one towards the other, so that the movement of these elements results in splitting of a log into smaller parts.

According to one embodiment the device comprises a vibrational plate, which is intended to remove impurities from the cut parts of wood, so that the obtained firewood

(logs) is clean. According to a second embodiment, the device is further provided with a return element for returning partly cut wood into the splitting plate for additional splitting, as well as a protective element for protection of the user.

[0005] Patent SI 25007 describes a device for processing the log section into firewood by multiphase splitting, wherein the device comprises a support frame, a support plate for supporting each log section, a splitting tool for multiphase splitting of said section logs, a drive assembly to ensure relative movement between the splitting tool and the log section. A limiting rest is provided on the frame for preventing movement of the log section during splitting. The splitting tool and the support plate are movable in the longitudinal direction of the frame. The support plate is installed in second longitudinal side guides, which are located below the guides of the splitting tool. The supporting plate is preferably movable in the longitudinal direction in a synchronized manner with regards to the movement of the splitting tool, wherein during movement of the splitting tool towards the limiter, the support plate is at the same time moving in the opposite direction.

[0006] Patent SI 25612 describes an improved device and a process for processing logs into firewood with improved splitting efficiency. The device comprises a carrier frame, a step-wise movable transport means for transporting individual logs in the longitudinal direction of the device towards a working area, a splitting tool for splitting logs into sections of pre-defined length, while in the said working area between the front and the back limiting rest a support assembly is provided, which is removed from the base and comprises two pivotable flaps, wherein at a suitable distance from the said support assembly a movable splitting tool is provided, said splitting tool being movable due to drive means, wherein the splitting tool is provided with two blades protruding in opposite directions. In the area of each of the said rests longitudinally movable supporting means is provided, which supports the non-processed part of the log section. A feature of log processing is that each movement of the splitting tool in any direction is a working movement, during which splitting of a log section is carried out, wherein the log section between the splitting tool and the support assembly is being split.

[0007] A characteristic of the above-mentioned solutions is in that the splitting tool comprises a main blade and secondary blades, which are moved along the longitudinal guides by two hydraulic cylinders. Parallely to the said guides additional guides are provided, which ensure synchronized movement of the support plate, which is mounted to the cylinder. Such synchronized movement is questionable in practice; therefore, operation of such devices is not reliable. Synchronization of movement of several elements at the same time complicates the construction, hampers maintenance of the device and increases the price of the log splitter and its maintenance.

Description of the solution to the technical problem

[0008] It is the aim of the present invention is to solve the mentioned disadvantages of known solutions, while the main aim of the invention is elimination of the need for synchronization of movement of the supporting plate (table) and the splitting axe (tool).

[0009] The technical problem is solved as described in the independent claim, while the preferred embodiments are defined in the dependent claims.

[0010] The essence of the splitting system according to the invention is in that the splitting means and the carrier through are a uniform unit and they move together in both directions, namely forwards and backwards along the X axis of the frame of the log splitter, when the splitting system is installed in the log splitter. The carrier through and the splitting means are welded into the uniform unit or are screwed or in any other way immovably joined.

[0011] The splitting system for stepwise splitting of wood logs and preparation of firewood (logs) is thus designed as an integral rigid assembly movably installed in a pair of longitudinal guides of the splitting system, wherein the said system comprises:

- splitting means comprising:
 - a primary blade,
 - at least one secondary blade attached to the primary blade, wherein the number of secondary knives is arbitrary,
 - a mounting for drive means arranged to move the splitting means, preferably a hydraulic cylinder,
- the carrier through, which is attached, preferably welded, to the primary blade for preventing a fall of a non-cut section of the log through the splitting system,
- preferably an additional stabilization element such as a supporting plate, a cylinder transporter or a vibrational plate below the primary blade, and
- a pair of side sliding parts, preferably a pair of longitudinal ribs for receiving a pair of longitudinal guides for simultaneous movement of the splitting means, the carrier through and the optional stabilization element upon movement by the drive means.

[0012] The splitting system for stepwise splitting of logs and the log splitter with the said system according to the invention will be described in continuation based on exemplary embodiments and figures, which show:

Figure 1 Splitting means with the carrier through and supporting plate

Figure 2 Plan view of the splitting means with the carrier through and supporting plate

Figure 3 Elevation view of splitting means with the carrier through and supporting plate

Figure 4 Assembly of the log splitter with the splitting system

Figure 5 The log splitter with the splitting system

[0013] The described embodiment is only one of the possible embodiments, which does not limit the essence of the invention as described above and defined in the claims.

[0014] Figure 3 shows an embodiment of the splitting system, which comprises:

- splitting means comprising:
 - a primary blade 18,
 - four secondary blade 19 attached to the primary blade 18,
 - a mounting 18 for drive means arranged to move the splitting means, the drive means preferably being a hydraulic cylinder,
- a carrier through 21, which is attached, preferably welded, to the primary blade 18,
- preferably an additional stabilization element, which is a supporting plate 22 below the primary blade, and
- a pair of side sliding parts, preferably a pair of longitudinal ribs for receiving a pair of longitudinal guides for simultaneous movement of the splitting means, the carrier through and the optional stabilization element upon movement by the drive means.

[0015] The primary blade 18 is a plate, which is in its longitudinal axis either straight, preferably curved in the shape of an open letter V or semi-circular. On the bottom part of the blade 18 an arbitrary number of secondary blades 19 are attached, said secondary blades 19 being arranged on the bottom part of the primary blade 18. The secondary blade 19 is at least one, however, more can be provided depending on the required size of final firewood (logs). Usually, four secondary blades are symmetrically arranged and attached, preferably welded, along the bottom part of the primary blade 18. Attachment of individual parts of the splitting system into a rigid unit can be achieved by welding or by screwing parts together. The parallel edges of the primary blade 19 are attached into the front part of the pair of sides 20. On both pairs of sides 20 side carriers 20b are attached for allowing attachment of the supporting plate.

[0016] The splitting system has one pair of guides provided in the log splitter, along which a pair of ribs 20a on sides 20 or any other suitably shaped sliding part and drive means 17 is moved backwards and forwards along the X axis of the log splitter. The splitting system with the pair of sides 30 connects into a rigid structure the primary blade 18 with the secondary blade 19 and the supporting plate 22 with the carrier through 21. The log splitter may have a mechanism for movement of the splitting system arranged in any suitable manner that allows movements forwards/backwards along the horizontal axis of the split-

ter. The uncut part of the log is located in the carrier through 21 during splitting, while the prepared firewood (logs) are caught by the supporting plate, which allows optimal multiphase splitting of logs or log sections.

[0017] The drive means for moving splitting systems is preferably one or more hydraulic cylinders, wherein one hydraulic cylinder is sufficient for the function. A piston of the hydraulic cylinder is mounted in the mounting 18a on the primary blade 18. Operation of the hydraulic cylinder may be controlled in any of the known ways. Control of the hydraulic cylinder operation may be manual or automatized via hydraulic or electro-hydraulic valves. Instead of one hydraulic cylinder, two hydraulic cylinders may be provided, which are installed on the primary blade in to mountings and are parallel to the sides of the splitting system. Instead of one or two hydraulic cylinders three hydraulic cylinders may be provided, so that three mountings are provided and two of the cylinders are parallel to the sides of the splitting system, while the third cylinder is in the middle of the primary blade 18. The hydraulic cylinder performs movement backwards and forwards, which ensures splitting of wood or logs, respectively. The log splitter in addition to the hydraulic circuit comprises an electronic circuit with elements such as movement sensors and electrical control, which also allow automatized operation.

[0018] The supporting plate 22 is attached in the middle part of the sides 20 below secondary blades 19. Figure 3 shows an elevation view of the splitting means with the carrier through 21 and supporting plate 22, which is lower than the bottom of the carrier through, while the carrier through is lower than the primary blade 19 and higher than the bottom part of the secondary blade 19. The size of the prepared logs depends on the distance between the supporting tin 22 and the primary blade 18 as well as on the number and individual secondary knives 19 and the distance between them. In the process of splitting the supporting plate 22 enables holding of split logs, as it prevents the log from turning downwards too fast and thus jamming the secondary blades. The supporting plate thus enables good guiding and optimal positioning of the log sections. Instead of the supporting plate a vibrational or a cylindrical separator could be installed below the secondary blades.

[0019] At the sides the splitting system with the primary blade and the supporting through inserted into a guide on the frame of a log splitter for multi-step log splitting. The guide may have any suitable shape and embodiments known to the person skilled in the art, preferably the guide is made from a tin with a groove, which has a cross-section of a capital letter U and has a sliding surface attached in the inner part. The sliding surface may be plastic, graphite, brass or other suitable materials. The guides may be achieved with bearings or as linear guides.

[0020] The described splitting system may be installed in any log splitter for splitting wood or wood logs into logs or fire wood, which are suitable for use in furnaces, ovens, fireplaces and similar. The log splitter may be equipped

with one of known drive means, which are controlled by electronic circuit including sensors and computer programs for automatized operation of the log splitter. Control of the hydraulic drive may also be mechanical. The log splitter for multiphase splitting of a log or its section comprises a frame provided with a bottom and two sides as well as two pairs of supporting legs. The log splitter may be without the legs, if it is a part of a combined machine for processing logs. Transversely to the bottom are two, parallel sides, which form a space for receiving a section of the log A before splitting beings. In the splitting process the parallel sides function as a support, which allows the splitting means comprising the primary and secondary blade to split the log for the first time. Into the bottom of the log splitter a rigidly attached pair of guides is provided, into which the pair of ribs of the splitting system is inserted. In the front part of the frame an attachment elements is provided for attaching the drive means, which are on the other side mounted into the primary blade. The supporting plate of the splitting system allows guiding of the remaining log section into such position that the splitting means upon the following movement of the hydraulic cylinder from the initial position into the final position can split the remaining piece of the log once the splitting means are returned into the initial position and are thus prepared for a new movement.

[0021] The splitting system according to a possible embodiment may be installed in the frame of the horizontal log splitter shown in figures 4 and 5. The log splitter has a frame 1 provided with a bottom 11 with sides 12 and two pairs of supporting legs. Transversely to the bottom 11 is a first side 13 and a second side 14 which is parallel to the first side 13. Sides 13 and 14 form a space for receiving a section of a log A, which is cut into firewood with the splitting system. In the splitting process the sides 13 and 14 are a support, which enables the splitting means comprising the primary and secondary blades, to split the said log section. Into the bottom 11 of the log splitter a rigidly fixed pair of guides 15 is provided, which can receive a sliding part, preferably the pair of ribs 20a of the splitting system. In the front part of the frame 1 an attachment element 16 is provided for attaching drive means 17, which are on the other side mounted in the mounting 18a on the primary blade 18 of the splitting means.

[0022] A process for stepwise splitting of wood logs is carried out in the following way: drive means for movement of the splitting means, preferably one or more hydraulic cylinders move the splitting system along the X axis of the log splitter, wherein the primary blade together with the secondary blade, the supporting plate and the carrier through is movable in the X axis forwards and backwards, wherein movement forwards is a working movement (splitting occurs) and movement backwards is a vain movement (no splitting). In the splitting process the carrier through prevents fall of a non-split part of the wood through the splitting system, while the support plate below the primary blade enables stabilization of the re-

maining part of the log after first or second splitting.

[0023] The process of multi-step, stepwise splitting of wood into logs with the log splitter is carried out so that into the space between the side 13 and second side 14 of the frame a part of a wood log A is inserted and its lower part is cut with the primary blade and simultaneously by the secondary blade upon movement of the splitting system from left to right, wherein the number of thus created firewood pieces is one more than the number of the secondary blades. Upon return of the splitting system into its initial position the remaining piece of the log section A in the carrier through is put back into a horizontal position. A further movement of the splitting system from left to right cuts the remaining log section A with the primary and secondary blades; movement of the splitting system from left to right and back to the initial position is repeated until the log section A is completely cut. Upon placement of a new log section A the said steps are repeated.

[0024] With the splitting system according to the invention enables manufacturing of log splitters for stepwise log splitting with which a part of a wood log having a larger diameter is stepwise split into logs or fire wood, wherein little number of cuds is produced and the prepared fire wood logs have a desired size.

Claims

1. A splitting system for a log splitter for stepwise splitting of wood logs, **characterized in that** splitting means and a carrier through are an integral piece and are arranged to move together as a whole in both directions, i.e., forwards and backwards along an X axis of the log splitter housing with installed splitting system.
2. The splitting system for a log splitter for stepwise splitting of wood logs according to claim 1, **characterized in that** the carrier through and the splitting means are joined into the integral piece by welding or by screwing or joined in any other immovable manner.
3. The splitting system for a log splitter for stepwise splitting of wood logs according to claim 1 or 2, **characterized in that** the system is designed as a uniform rigid assembly, which comprises:
 - splitting means, which comprises:
 - a primary blade,
 - at least one secondary blade attached to the primary blade, wherein the number and the arrangement of secondary blades is arbitrary,
 - a mounting for drive means arranged to move the splitting means, preferably a hy-

draulic cylinder,

- the carrier through, which is attached, preferably welded, to the primary blade,
- preferably an additional stabilization element such as a supporting plate, a cylinder transporter or a vibrational plate below the primary blade, and
- a pair of side sliding parts, preferably a pair of longitudinal ribs for receiving a pair of longitudinal guides for simultaneous movement of the splitting means, the carrier through and the optional stabilization element upon movement by the drive means.

4. The splitting system for a log splitter for stepwise splitting of wood logs according to any of the preceding claims, **characterized in that** the splitting means have a parallel edges of the primary blade (18) attached into a front part of the pair of sides (20); that along the pair of sides (20) ribs (20a) are horizontally mounted and vertical side carriers (20b) are approximately mounted in the middle; that on the bottom part of the primary blade (18) preferably four secondary blades (19) are attached; that the supporting plate (22) is mounted in the side carriers (20b) approximately in the middle of the sides (20) under the secondary blades (19); that the carrier through (21) is attached in a back part of the pair of sides (20), wherein the carrier through (21) is located higher than the supporting plate (22); that the supporting plate (22) is located lower than the primary blade (18) and higher than the bottom part of the secondary blade (19); that the pair of ribs (20a) on the sides (20) enables movement forwards and backwards along the X axis of a log splitter; that the pair of sides (20) of the splitting means connects the primary blade (18) and the secondary blade (19) as well as supporting plate (22) with the carrier through (21) into a rigid structure; that the mounting (18a) on the primary blade (18) enables attachment of drive means.
5. The splitting system for a log splitter for stepwise splitting of wood logs according to any of the preceding claims, **characterized in that** the primary blade (18) is a plate, which is in its longitudinal axis straight, preferably curved in the shape of open letter V or semi-circular.
6. The splitting system for a log splitter for stepwise splitting of wood logs according to any of the preceding claims, **characterized in that** on the bottom part of the primary blade preferably four secondary knives are provided, said four secondary knives being uniformly arranged on the bottom part of the primary blade.

7. A log splitter with the splitting system according to any of the preceding claims.
8. The log splitter according to claim 7, **characterized in that** the splitting system is installed in a frame (1), provided with a bottom (11) with sides (12), wherein transversely to the bottom (11) a first side (13) and to it parallel second side (14) are installed; that sides (13 and 14) form a space for receiving a log section (A), which is split by the splitting system in several phases into firewood; that in the bottom (11) a pair of guides (15) is rigidly attached, the pair of ribs (20a) of the sides (20) of the splitting system being received by the pair of guides (15); in the front part of the frame (1) an attachment element (16) is provided for attaching drive means (17), which are on the other side attached into the mounting (18a) on the primary blade (18); that the assembly of the splitting system is movably installed with the pair of ribs (20a) of the sides (20) into the pair of longitudinal guides (15) of the log splitter, wherein the said system is driven preferably by one hydraulic cylinder (17) so that the piston of the cylinder, which is attached to the mounting (18a) of the primary blade (18) moves the whole assembly from left to right and vice-versa.
9. A process for stepwise log splitting into logs with the log splitter according to claim 7, **characterized in that** drive means for movement of the splitting means, preferably one or more hydraulic cylinders move the splitting system along the X axis of the log splitter, wherein the primary blade together with the secondary blade, the supporting plate and the carrier through is movable in the X axis forwards and backwards, wherein movement forwards is a working movement and movement backwards is a vain movement; and **in that** the carrier through prevents fall of a non-split part of the wood through the splitting system, while the support plate below the primary blade enables stabilization of the remaining part of the log after first or second splitting.
10. The process according to the preceding claims, **characterized in that** in the space of the log splitter between the first side (13) and the second side (14) of the frame (1) a section of the log (A) is placed, the bottom part of the said section is cut by the primary blade and simultaneously by the secondary blade upon movement of the splitting system from left to right, wherein the number of thus created firewood pieces is one more than the number of the secondary blades; upon return of the splitting system into its initial position the remaining piece of the log section (A) in the carrier through is put back into a horizontal position; a further movement of the splitting system from left to right cuts the remaining log section (A) with the primary and secondary blades; movement of the splitting system from left to right and back to the initial position is repeated until the log section (A) is completely cut; upon placement of a new log section (A) the said steps are repeated.

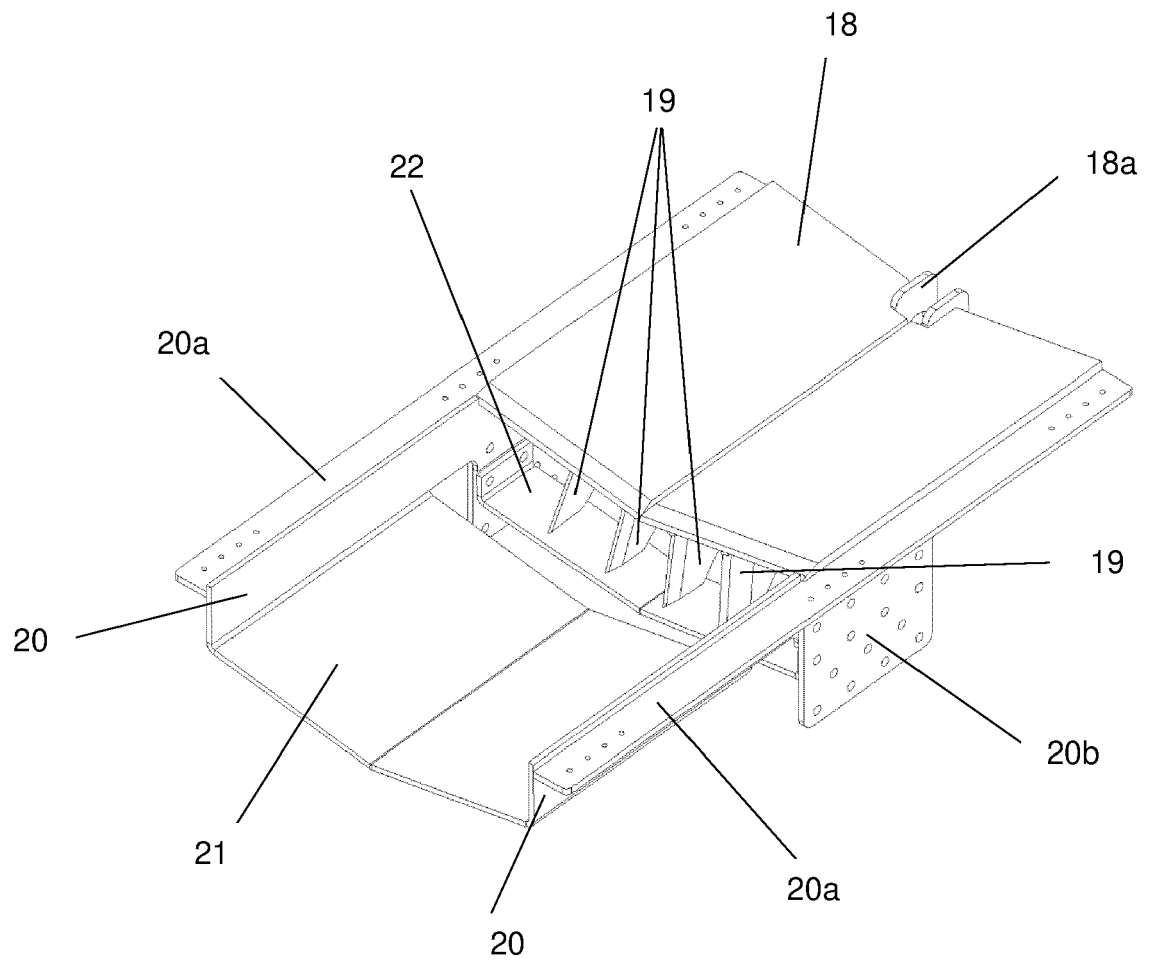


Figure 1

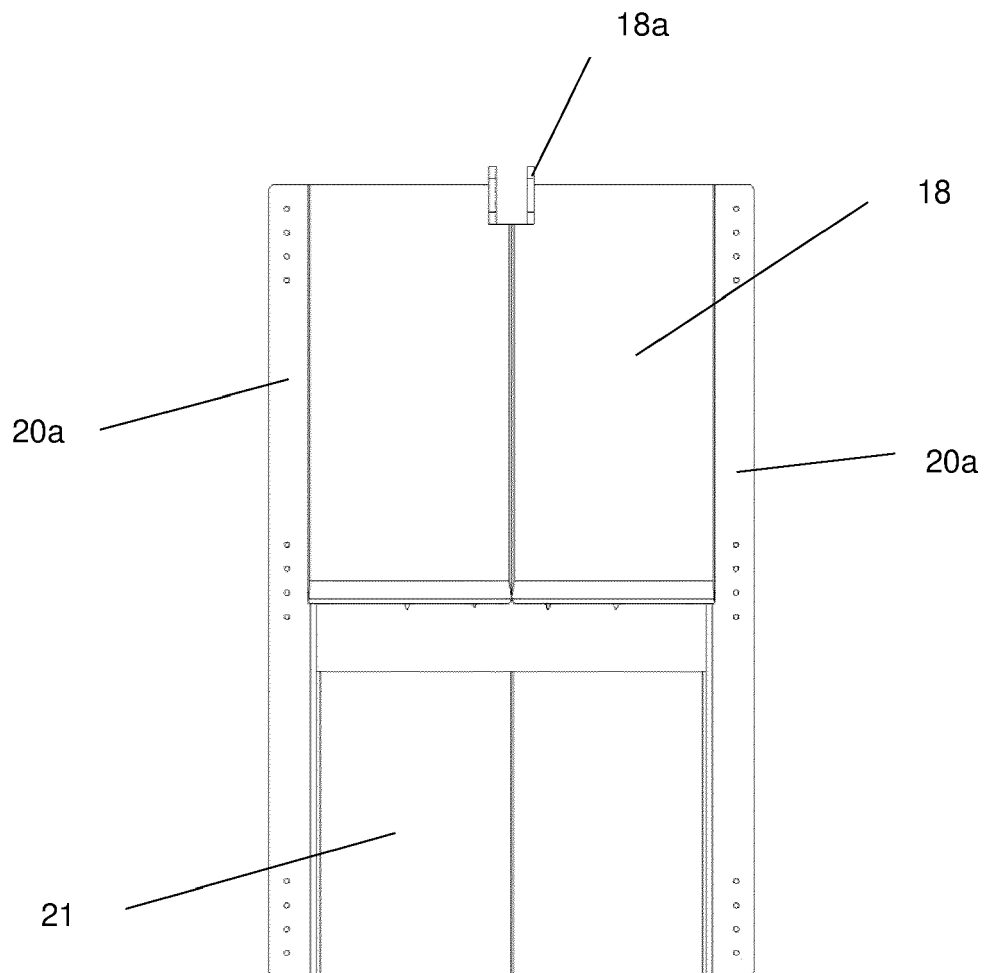


Figure 2

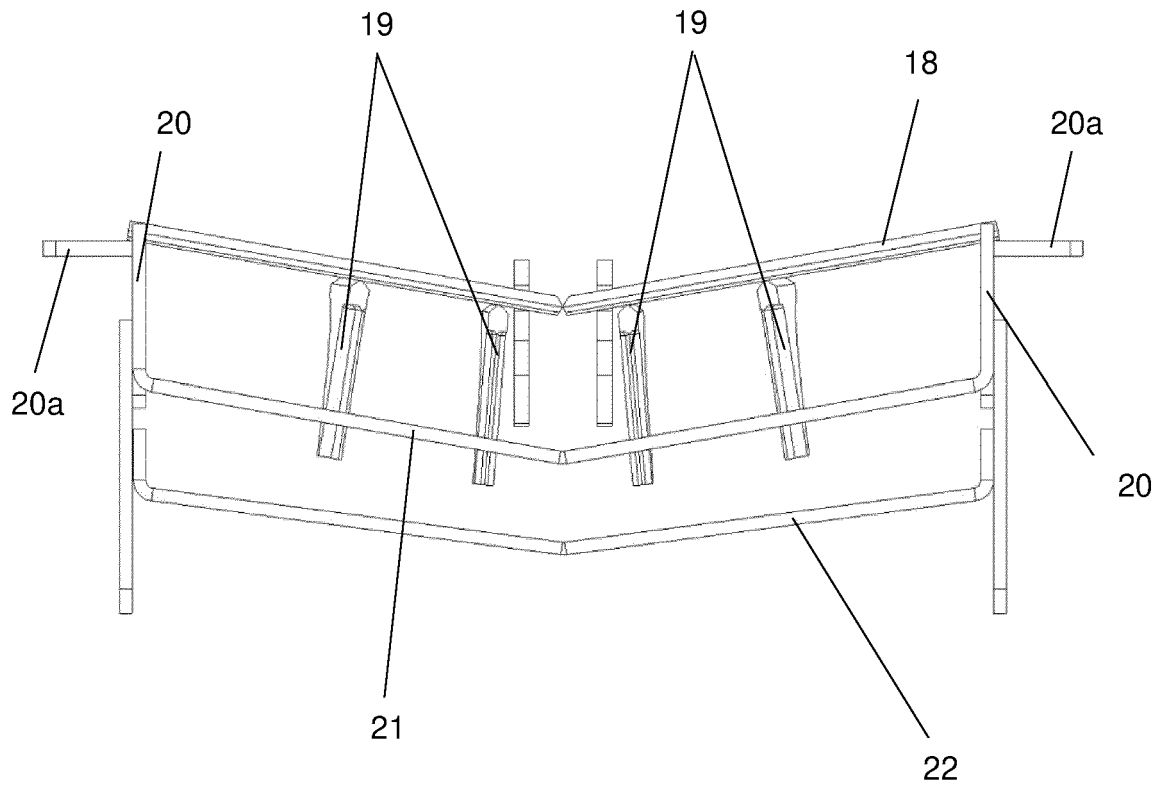


Figure 3

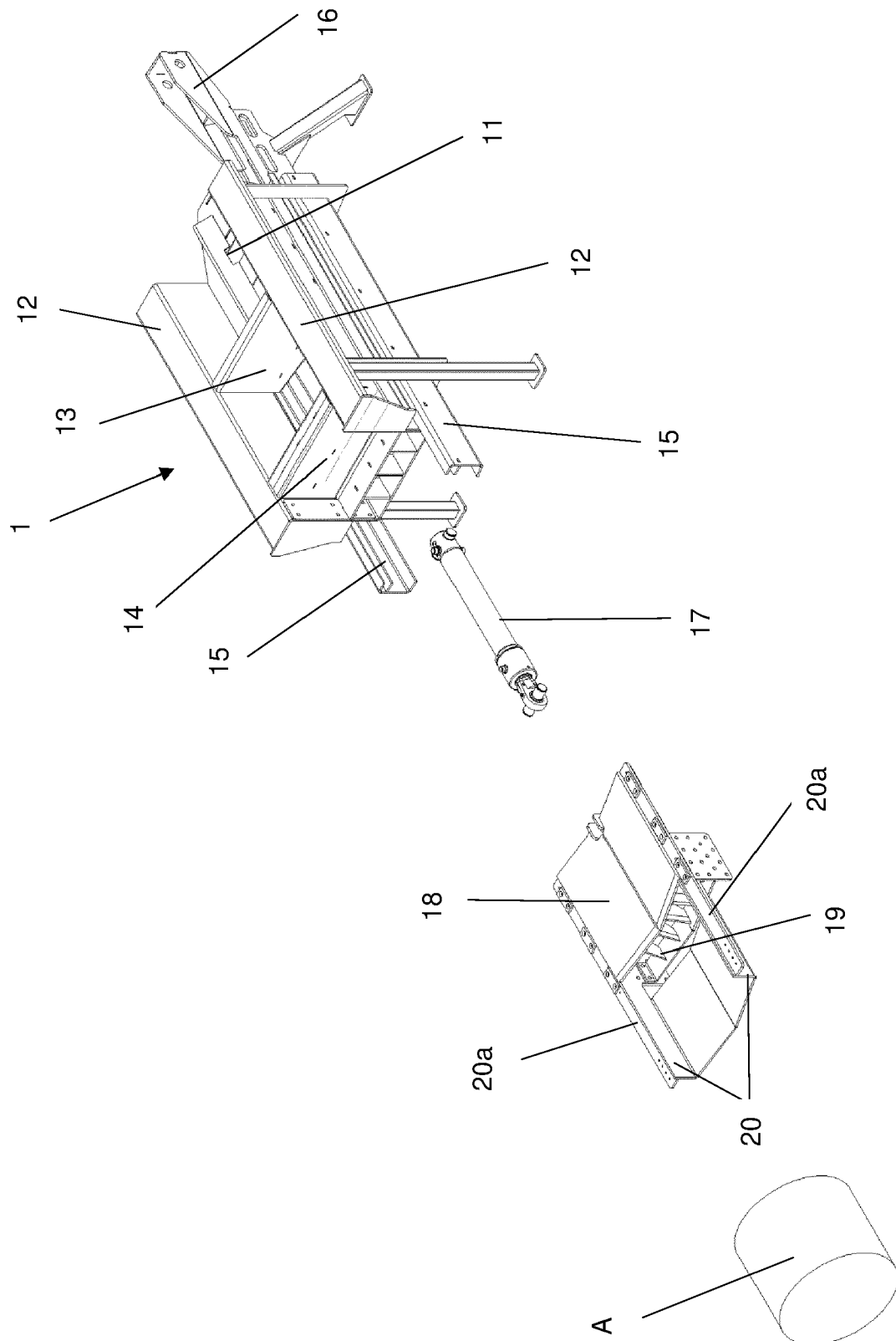


Figure 4

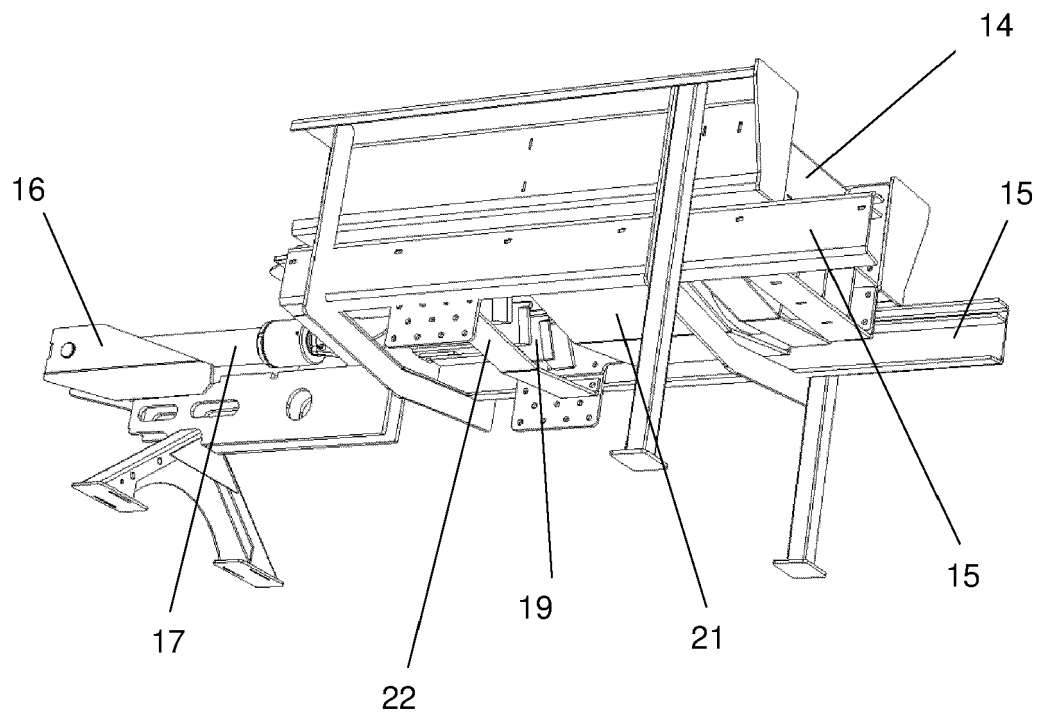


Figure 5



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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29 October 2021	Examiner Hamel, Pascal
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