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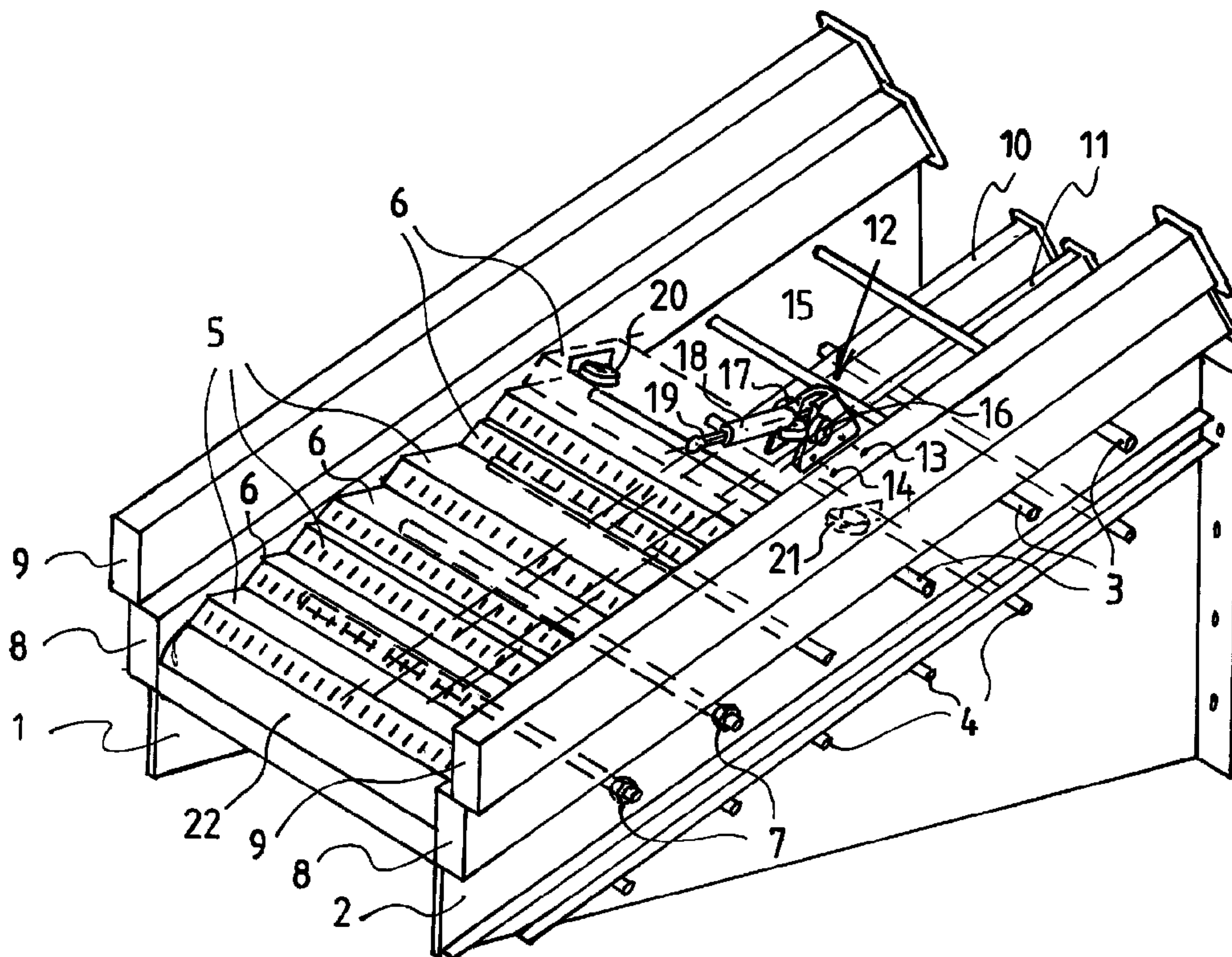
(72) Inventeur/Inventor:
STIEFEL, JAKOB, CH

(73) Propriétaire/Owner:
DOIKOS INVESTMENTS LIMITED, GB

(74) Agent: MARKS & CLERK

(54) Titre : GRILLE DE COMBUSTION A POUSSEE REFROIDIE A L'EAU

(54) Title: WATER-COOLED THRUST COMBUSTION GRATE



(57) Abrégé/Abstract:

The thrust combustion grate is designed for burning refuse. It comprises alternately stationary (5) and movable (6) hollow grate plates (5,6) in a stairway formation, that rest on each other with their front underedge. These grate plates extend across the entire width of the gateway. The movable grate plates (6) are each driven by a hydraulic cylinder-piston unit (18,19). To the sides, the gateway is limited by panels (8,9) comprising water-cooled hollow profiles (8,9), which, in the longitudinal direction, each consist of at least two sections flanged together sealingly. The panels (8,9) are rigidly screwed to each other by means of a plurality of

(57) **Abrégé(suite)/Abstract(continued):**

horizontally disposed distancing bars (3,4) running perpendicular to them. Running between the panels (8,9) there are two other hollow profiles (10,11) flanged together in the same way, for feeding in primary air and cooling water, which are fixed to certain individual distancing bars (3,4). The back sides of the stationary grate plates (5) each rest on one distancing bar (3) whilst the back sides of the movable grate plates (6) rest on at least one steel roller (16,17) with a horizontal axis, with each side of their front sides being guided along a steel roller (20,21) whose axis runs perpendicular to the grate plate (6). The front portions of the grate plates (6) are transpierced by primary air slots (25).

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WATER-COOLED THRUST COMBUSTION GRATE

The invention relates to a water-cooled thrust combustion grate for refuse combustion plants that is particularly well suited for the combustion of refuse and waste with high heating values. Such thrust combustion grates have stationary and movable grate levels comprising grate plates or a row of grate bars, with the grate plates resting on top of each other like stairs. These thrust combustion grates can be assembled so that the combustion bed is essentially horizontal, or possibly inclined, with slopes of up to 20 degrees or more being usual. The grate plates are preferably made from sheet steel and form panel-shaped hollow elements which extend across the entire width of the gateway, through which water is fed as a cooling medium. Every second grate plate is movable, allowing it to perform a stoking or transporting stroke. In the case of a forward feed grate, the leading edge of the movable grate plates can push material to be combusted forward onto the next grate plate down. In contrast, a reverse feed grate forms a back to front built-in sloped stairway, so to speak. In a reverse feed grate, the leading edges of the movable grate plates transport the material behind them backwards, which then rolls back down the slope of the grate. The movable grate plates, i.e. the grate plates in-between two stationary grate plates, are usually moved collectively to and fro in the downward direction of their inclination. This ensures that burning refuse lying on the grate for high dwelltimes of 45 to 120 minutes is constantly turned over and distributed evenly over the grate.

EP-0'621'449 discloses a water-cooled thrust combustion grate. This grate has grate plates which extend over the entire width of the gateway, i.e. which do not comprise a plurality of grate bars per grate level. The movable grate plates, like the stationary ones, are suspended by their back edge on crossbars which, when operated, move collectively forwards and backwards, thereby displacing the movable grate plates. One of the disadvantages of this means of driving the movable grate plates is that any small item that gets jammed at the side between the grate plate and the outer side panel can cause the grate plate to skew to the side, i.e. seen from the top, the plate no longer lies exactly parallel to the adjoining stationary grate plates. If it is then displaced whilst in this position, high leverage forces occur, as a result of which the plate comes into contact with

the outer side panels. The drive forces then required are correspondingly high. The wear caused by the enormous friction force is considerable, and reduces the service life of the entire grate. Furthermore, the drive means is designed in such a way that an individual drive for each movable grate plate, which would be desirable to optimize the combustion process, could only be installed at phenomenal cost.

WO 1995/018333 published July 6, 1995 discloses a thrust grate module featuring individual drives for the movable grate plates. Here, the movable grate plates roll on steel rollers, but are only guided with respect to the outer side panels by means of sliding friction. The drive is effected by hydraulic piston-cylinder units which come into contact with the approximately the centre of the grate plates. Even with this construction, skewing to the side is impossible to avoid. If a small particle gets jammed between the grate plate and an outer side panel, very high friction forces occur which, firstly, require correspondingly large hydraulic cylinders to overcome them and, secondly, cause correspondingly high wear.

Hence it is the task of this invention to create a water-cooled thrust combustion grate in which the movable grate levels are individually displaceable and cause very little wear, thereby prolonging their service life and allowing the combustion process to be optimized in a targeted manner, and in which the refuse that falls through the grate is kept to a minimum. The thrust combustion grate should also be simple to assemble and easy to service, in that in one special version, it can be accessed from underneath during the combustion process, from where the individual drives of the grate plates can be replaced separately.

The task is solved by a water-cooled thrust combustion grate for burning refuse comprising alternately stationary and movable hollow grate plates in a stairway formation that rest on each other with their front underedge, of which each one extends across the entire width of the gateway, or a plurality of adjacently assembled plates that extend across the entire width of the gateway, with each movable grate plate being driven by a hydraulic cylinder-piston unit; and which is characterized in that it is limited at the sides

by panels comprising water-cooled hollow profiles, which, in the longitudinal direction, each consist of at least two sections flanged together sealingly, these panels being rigidly screwed to each other by means of a plurality of horizontally disposed distancing bars that run perpendicular to them, and in that running between the panels, there are two other hollow profiles flanged together in the same way, for feeding in flushing air and cooling water, which are fixed to certain individual distancing bars, and in that the back side of the stationary grate plates each rests on one distancing bar whilst the back side of the movable grate plates rests on at least one steel roller with a horizontal axis, with each side of their front side being guided by a steel roller whose axis runs perpendicular to the grate plate, and in that the front portion of the grate plates is sealingly transpierced by ducts with an elongated hole-shaped cross-section for feeding in flushing air, so that these ducts project beyond the surface of the grate plates.

The drawings show different representations of an advantageous embodiment of just such a thrust combustion grate. This thrust combustion grate and its mode of operation will be described in detail and explained below with reference to these drawings, in which

Figure 1 : is a portion of the length of the thrust combustion grate in a perspective view, with partially removed grate plates;

Figure 2 : is a view of four grate plates of the thrust combustion grate in a longitudinal section seen from the side;

Figure 3 : is a cross-section through the combustion grate resp. the grate substructure, without the grate plates;

Figure 4 : is the supporting element to be assembled between the two hollow profiles along the grate, seen from the front;

Figure 5 : is a movable grate plate, seen from below.

The basic structure of this thrust combustion grate with its essential elements is seen most clearly in Figure 1. Figure 1 shows a portion of the length of such a grate in a perspective view, as it would look like during assembly, i.e. with some grate plates missing, giving a free view of the substructure. This grate is sloped downwards in the direction of conveyance. Two vertical steel walls 1,2 running parallel to each other are stably connected to each other by means of a plurality of distancing bars 3,4. These distancing rods 3,4 run crosswise to the grate and extend across the inside width between the two lateral steel walls 1,2 at two different levels. The two steel walls 1,2 left and right of the grate may consist of a plurality of steel panels or parts screwed together in a suitable manner. Distancing bars 3,4 penetrate these steel walls, have a thread on both sides, and are screwed tight with lateral steel walls 1,2 by means of tapered ends and nuts 7. The distancing bars or crossbars 3 of the top level serve at the same time as supporting rods for the stationary grate plates 5 lying on top of them. The front edge of the bottom stationary grate plate 5 abuts against a discharge lip 22 welded in place between lateral steel walls 1,2, whilst its rear section is suspended over the first top distancing bar or crossbar 3. Next comes a movable grate plate 6, whose front underedge rests on the first stationary grate plate 5 below. The front underedge of the next highest stationary grate plate 5 rests in turn on movable grate plate 6 and so on. The sloped front side of the individual grate plates is perforated by primary air slots 25, through which the primary air for the combustion is blown from below. Along the upper edge of steel walls 1,2 run two hollow profiles in the form of square pipes 8,9 disposed on top of each other in a slightly offset manner, whose lower ends are sealed by welding. These square pipes 8,9 form the side panels of the gateway and limit the sides of the combustion bed when the grate is in operation. They are water-cooled and are forcibly flooded with water from bottom to top so that their insides are always completely filled with water. The individual grate plates 5,6 are made from sheet steel and are also designed as hollow bodies that are forcibly flooded with water so that their insides are always completely filled with water, thereby preventing the formation of air bubbles. All the sheet steel parts of the grate, whether lateral panels 8,9 or grate plates 5,6, that come into contact with the material to be combusted are, therefore, continuously covered with water on the back side of the sheet steel. This means that all the parts in contact with the fire can be cooled continuously and

kept at a stable temperature so that practically no dilatation occurs. This obviates the need to provide compensatory elements of any kind to the sides of the grate plates. This means the construction of the grate can be considerably simplified. The stability of the grate construction is essentially achieved by the distancing bars or crossbars 3,4, which strut and brace the two outer steel walls 1,2 on two parallel levels as already described. Between these two levels of crossbars 3,4, running along the grate on both sides of its centre, there are two other hollow profiles in the form of square pipes 10,11, which are connected at the bottom and at the top at some points with the crossbars 3,4 running perpendicular to them. One of the square pipes, namely square pipe 10, feeds the cooling water from bottom to top for grate plates 5,6, whilst the other square pipe 11 supplies flushing and cooling air for the drives of movable grate plates 6, as will be described in detail below. Disposed between these two parallel-running square pipes 10,11, there are supporting elements 12 for movable grate plates 6. These supporting elements 12 are fixed to the square pipes by means of two bolts 13,14 that run through the two square pipes 10,11. For this purpose the square pipes or hollow profiles 10,11 have welded-in crossbars with an inside diameter designed to accommodate the retaining bolts 13,14 for the supporting elements 12. The supporting elements 12 themselves each have steel roller 15 lying parallel to the corresponding grate plate plane, as well as, to the left and right, a steel roller 16,17 acting in the vertical plane. At the same time, connected to every such supporting element 12, there is a hydraulic cylinder 18, whose piston rod 19 is in turn connected to the underside of the movable grate plate 6 which it drives. The grate plate itself, which rests on the supporting element 12 illustrated here, is only indicated here by dashed lines. On its underside it has a central guide groove, with which it rests on steel rollers 16,17, which, when the grate plate is displaced, roll along the floor of this guide groove. The inside width of the guide groove is chosen so that it is slightly larger than the diameter of the lying steel roller 15, thereby ensuring that the grate plate is sufficiently guided by roller 15 crosswise to the gateway. To guide the front side of the movable grate plate other lying steel rollers 20,21 are mounted on panels 8. The front underside of the associated movable grate plate is provided at the sides with recesses contrived so that at each side, a guiding surface is formed that runs parallel to the side surface of the grate plate but set back thereto, and on which these steel rollers 20,21 roll during the to and fro

movement. Hence every movable grate plate has a three-point bearing, so to speak. To the rear in the centre, where the drive is located, the grate plate is guided horizontally and vertically by associated steel rollers 15,16,17, and at the front it is guided on the left and right sides by steel rollers 20,21 whilst its front underedge rests on the next stationary grate plate down and slides on as it moves to and fro. For this purpose its front underedge is provided with a sliding shoe made from abrasion-resistant material which can be changed from time to time without the actual grate plate having to be replaced. An advantage of the construction described here is that the movable grate plates are guided accurately, and friction no longer occurs along the sides because the lateral guiding arrangement is adjusted so that between the side edge of movable grate plate 6 and adjacent panel 8 there is always a small gap, i.e. small enough to prevent jamming small parts from falling into the gap, and wide enough to ensure that no sliding friction occurs. Because of this accurate guide arrangement the grate plate can no longer skew to the side as it could with conventional constructions. Previously, when skewing occurred, the plate was simply moved back and forth against the enormously increased sliding friction with great force until the jamming object causing the skewing fell down or worked itself out of the gap between the grate plate and the panel. Until that occurred, however, there was time for big sliding friction forces to develop, which caused correspondingly high wear and tear. This wear and tear is eliminated by means of the arrangement shown here for mounting and guiding the movable grate plates, which increases their service life. Another advantage of the construction is that, because the grate plates are guided on steel rollers, the forces needed to operate them are considerably smaller than when pure sliding friction has to be overcome. That, in turn, allows the use of small drive units in the form of compact hydraulic cylinder-piston units, with a separate such drive unit for each individual movable grate plate. Hence each movable grate plate can be driven individually, which coincides with the requirements for maintaining as geometric a fire as possible. Depending on the progress of the combustion and the behaviour of the material being combusted, the operator can namely stoke the fire in certain specific places by small lifting movements of the grate plates, or he can transport the material being combusted along the grate with larger movements. The constructive solution with the supporting elements 12 between the two longitudinally running square pipes 10,11 even allows any

one drive unit to be replaced when the grate is in operation. This is possible because the grate plates 5,6 either stretch individually across the entire width of the gateway, or in another version, a plurality of grate plates are connected next to each other in such a way that they cover the entire width of the gateway without any gaps between them so that there is virtually nothing that can fall through the grate and onto the engineers underneath. If a plurality of grate plates is to be connected together to form one a grate level this can be done, for example, by screwing or welding together the individual grate plates that each extend across one part of the width of the gateway. In this manner two, three or more adjacently disposed grate plates can be joined up to form a single grate level. Furthermore, the water-cooling of the entire combustion bed ensures that the temperature underneath the grate is kept within a range that allows engineers to remain and work under the grate without any problems. Finally, every supporting element 12 is suspended by means of bolts 13,14 on square pipes 10,11 in such a way that the rear bolt 13 can be disengaged and the whole supporting element tilted backwards so that the hinge of the hydraulic cylinder 18 becomes accessible, allowing the cylinder to be disassembled quite easily. Figure 1 shows a portion of the length of a gateway. The entire gateway often consists of several such sections. For this purpose the ends of square pipes 10,11 and panels 8,9 are fitted with flanges 51,52 so that they can be sealingly connected to the panels and square pipes of the adjoining section. This construction makes it possible to prepare individual portions of the length of a gateway in the workshop ready for assembly, so that entire such gateway portions can then be quickly assembled on-site. This avoids both complicated special transport and lengthy on-site assembly work. The water-cooling of the grate plates is effected by connections to square pipe 10, in which cooling water flows from bottom to top. Starting from an open compensating tank located e.g. at approximately the same level as the feed-in channel or higher, it is pumped through a pipe by an electric pump at the bottom into square pipe 10, inside which it is kept at a pressure of 3-4 bar. Each set of two adjacent grate plates is connected in series to a cooling cycle since together, they always form a constant grate surface. For this purpose, water is withdrawn for each set of two grate plates from the square pipe 10 running below via a nipple or a socket and fed into the first grate plate through a temperature-resistant conduit. Inside, the warm is forcibly made to flow through a labyrinth designed so that no

air bubbles can form anywhere, and so that the entire hollow space inside the grate plate is completely filled with water. At the end of the flow channel inside the grate plate there is another connection, from which another temperature-resistant conduit leads to the second adjacent grate plate, in which the water again flows through a channel, at the end of which it is fed via a hose into a return pipe which itself feeds back into the open compensating tank. Hence, for every two neighbouring grate plates there is a water connection point on square pipe 10, and the corresponding cooling water is fed back to the compensating tank via an individual return pipe. Square pipe 11, on the other hand, does not convey water, but air at excess pressure maintained by an air pump for the following purpose: for every movable grate plate there is a separate drive unit with hydraulic cylinder. These hydraulic cylinders are each housed in a pipe jacket, so that a gap remains between the jacket and the actual hydraulic cylinder. This gap is flushed with air from square pipe 11 so that the pipe jacket forms a flushing cylinder. For this purpose, air is drawn off from inside the square pipe via a connection at every point along the square pipe 11 where there is a hydraulic cylinder, and this air is fed via a conduit into the pipe jacket which encases the hydraulic cylinder to form the flushing cylinder. The pipe jacket is open at the front so that the flushing air can flow out there again to end up in the zone below the grate where it mixes with the primary air. The volumes of this flushing air are negligible in comparison with the volume of primary air, however, and they therefore have scarcely any effect on the combustion. This flushing of the pipe jackets keeps the actual hydraulic cylinders and piston rods projecting from them free of dust and dirt, thereby helping to extend the service life of the drive units. On the other hand, this circulating air naturally has a cooling effect which contributes to ensuring that the hydraulic oil never overheats. The area underneath the grate plates is divided along the length of the gateway into several downdraught zones. Built-in underneath each stationary grate plate there is a separating wall which separates adjacent downdraught zones in a virtually airtight manner. Primary air is blown into the individual downdraught zones by means of separate ventilators, and this air then reaches the combustion air through the primary air slots. The volume of primary air can be regulated by varying the speed of the individual ventilators. This ability to vary the supply of primary air to the individual grate zones also helps to

form a geometric fire in that the fire can be fed with exactly the required volume of air in a targeted and local manner.

Figure 2 shows a section from four consecutive grate plates of the thrust combustion grate in a section along the centre of the gateway, seen from the side. At the sides, the stationary and movable grate plates 5,6 are kept at a distance from panel 8. Above panel 8 one can see panel 9. Hence these two water-cooled panels 8,9 form the lateral limit of the combustion bed. Compensating elements are, therefore, no longer required between them and grate plates 5,6. Grate plates 5,6 are made from sheet steel and are hollow. The hollow space is divided up by walls so as to form a flow channel 23, that zigzags back and forth. This flow channel 23 is generally designed to run from bottom to top so that water is forcibly made to flow through it, thereby preventing air bubbles from forming anywhere on the inside. The grate plates themselves are tilted, and so the inflowing water under pressure generally flows from the back and the bottom to the front and the top. At the same time the flow channel is arranged so that it runs along the entire surface of the grate plate so that all parts in contact with the fire are continuously in direct contact with the water on the rear side, and thereby cooled. At the front the grate plates are inclined and this slope 24 is perforated with a plurality of primary air slots 25. These slots are formed by ducts 25 with an elongated cross-section which pass through the grate plate and are welded into it, and whose edge 26 projects slightly beyond the surface of the grate plates. Primary air for the combustion is blown from below onto the grate through these slots 25 so that there is a dominant flow of air which prevents small particles from falling through. The edges 26 projecting slightly beyond the grate also effectively prevent non-ferrous metals or other small parts from falling through the slots 25. Such particles are far more likely to slip down the slope 24 and are moved around slots 25 by the projecting edge. At the bottom front edge of the grate plates can be seen the sliding shoes 27 in abrasion-resistant material. With these sliding shoes 27, each grate plate rests snugly and virtually sealingly on the next grate plate down. These sliding shoes are steel elements that are fitted onto a holding strip along the underedge of the grate plate and fixed to it with bolts, with the bolt heads being welded with the sliding shoes. To replace the sliding shoe the bolt heads are ground away, whereupon the bolts can be knocked out and the sliding shoes

removed. On their underside, both the stationary 5 and movable grate plates 6 are provided with a framework 28 made from steel sheets, which gives them the necessary form and stability. In the case of the movable grate plates 6, the framework in the middle is designed so that a recess 50 is formed to accommodate the hollow cylinder 18 resp. its pipe jacket 29. In the figure illustrated here, piston rods 19 project out of the hydraulic cylinder 18 and are connected by their ends to grate plate 6 by means of a bolt (not shown). The hydraulic cylinders resp. the pipe jackets 29 encasing them are connected at the rear to supporting elements 12. To prevent the hydraulic oil from overheating when the grate is operated, and to ensure additional cooling for the piston-cylinder unit as well, the hydraulic oil is allowed to circulate continuously through the cylinder. It flows into the cylinder 18 at one connection point and out at another. To operate the drive, i.e. to extend the piston, a stop valve is operated at the outlet so that more hydraulic oil flows into the cylinder 18 than can flow out. As soon as the piston rod 19 is completely extended, or extended as far as required, this stop valve is reopened so that as much hydraulic oil can flow out of the cylinder 18 as flows in. Hence there is a constant flow of hydraulic oil around cylinder 18, although the cylinder is not working. The hydraulic oil conveys heat away and is then recooled in an oil cooler next to the rear hydraulic pump associated with the drive. Conversely, when the piston is to be driven into the cylinder 18, a similar operation is carried out on the cylinder 18 on the opposite side of the piston. Accordingly, more hydraulic oil flows into cylinder 18 on that side of the piston than can flow away, so that the piston is driven in, and on the other side more hydraulic oil flows out of cylinder 18 during this process than flows in. By switching and controlling the hydraulic oil circuits in this manner the hydraulic cylinder-piston unit is cooled continuously. The hydraulic cylinder 18 resp. the flushing cylinder 29 for the flushing air encasing the cylinder is connected to the associated supporting element 12 in such a way that it can easily be removed. For this purpose the supporting elements 12 are fixed to both square pipes 10,11 by means of two bolts 13,14, although only square pipe 11 is visible here. If bolt 13 is removed, supporting element 12 can be folded down around bolt 14, anticlockwise in this Figure, thereby giving free access to the rear connection point of hydraulic cylinder 18 and allowing disassembly of the latter. The Figure shows the lying steel roller 15 on supporting elements 12 and the vertical steel rollers 16,17. On the rear

underside of the movable grate plates 6 there is an extension which forms a guide groove 30 whose floor 31 runs on vertical steel rollers 16,17, and whose side walls run on both sides of the lying steel roller 15 with very little play. This means that at the rear side of the movable grate plates 6, only rolling friction has to be overcome. Sliding friction occurs solely on the top side as a result of the sliding shoe 27 resting on it belonging to the next stationary grate plate 5 up, and from the plate's own sliding shoe 27 which rests on the next stationary grate plate 5 down. The stationary grate plates 5 themselves have, on their rear underside, an approximately semi-cylindrical recess 32, by means of which they rest on crossbars 3, which run between vertical steel walls 1,2. The only function of the bottom crossbars 4 is to stabilize the entire gateway construction.

Figure 3 shows a cross-section through the grate structure resp. the grate substructure, without the grate plates. The steel plates 1,2 form the side walls of the gateway. Running perpendicular to them there are, in this instance, more steel plates 33,34 with holes so that several gateway sections can be flanged together. At the top of the side walls square pipes 8,9 are recognizable, which function as water-cooled side panels for the combustion bed. The grate plates all lie exclusively between panels 8. Both side walls 1,2 are braced together on two levels by means of distancing bars or crossbars 3,4. Fitted over the ends of crossbars 3,4 there are tapered ends 37 which are pressed by nuts 7 against counter-tapered ends 38 so that a stable frame construction is formed. The nuts 7 are reinforced with locking nuts. Between the two levels of crossbars 3 and 4, run square pipes 10 and 11, of which one feeds in cooling water and the other flushing air for hydraulic cylinders 18. These square pipes 10,11 are held by connecting elements 39 to certain of the crossbars 3,4. They are themselves transpierced by ducts 35,36, through which bolts 13,14 for fixing supporting elements 12 in place can be pushed, as shown in Figures 1 and 2.

Figure 4 shows a supporting element 12 to be built in between the two hollow profiles 10,11 along the grate, seen from the front. The supporting element has two side plates 40,41 which are transpierced by ducts 42,43. These ducts 42,43 are intended to accommodate fastening bolts 13,14. The vertical steel rollers 16,17 are attached to and mounted on side plates 40,41. Both side plates 40,41 are welded together at the back by a

connecting plate 44. This connecting plate 44 carries the pillow block 45 for the steel roller 15 that is horizontally disposed and mounted on it.

Figure 5 represents a movable grate plate seen from below. The framework made from steel sheeting 28, which stabilizes the grate plate, is recognizable. Through the front sloping surface 24, seen here from below, there are a plurality of longitudinal slots 25 formed by welded-in ducts with a slit-like or elongated cross-section. On its rear side, the grate plate carries an extension 46, which, on its underside, forms a guide groove 30 for steel rollers 15,16,17 on supporting element 12. Vertical steel rollers 16,17 roll along the floor 31 of guide groove 30, whilst the horizontal steel roller 15 rolls along both side walls 47,48 of guide groove 30. On the undersides of both sides of the grate plate there is also a guide wall 49,50. The horizontal steel rollers 20,21 mounted on the side panels 8 of the gateway roll on these guide walls 49,50 and define a minimum distance between the grate plate 6 and the side panel 8.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a water-cooled thrust combustion grate for burning refuse, the grate comprising:

a plurality of stationary hollow grate plates alternating with movable hollow grate plates in a stairway formation, said hollow grate plates resting upon each other with a front underedge and extending across an entire width of a gateway, each of said hollow grate plates comprising one of a single piece and a plurality of adjacently assembled plates that extend across said entire width of the gateway, each of said movable hollow grate plates driven by a hydraulic cylinder-piston unit;

two side panels, each comprising at least two water-cooled conduits, each said water-cooled conduit comprising in a longitudinal direction, at least two sections sealingly flanged together, said panels rigidly secured to each other by a plurality of horizontally disposed distancing bars disposed perpendicular to said panels;

two air and water supply conduits comprising at least two sections sealingly flanged together, said air and water supply conduits providing flushing air and cooling water, and also fixedly secured to at least one of said horizontally disposed distancing bars;

a stationary grate plate back side of each of the stationary grate plates resting on one of said distancing bars and a moving grate plate back side of each of the movable grate plates resting on at least one back side steel roller having a horizontal axis, each end of a front side of each said movable grate plates being guided by a front side steel roller having an axis perpendicular to said movable grate plate; and

a front portion of each of the hollow grate plates sealingly forming a plurality of ducts having an elongated hole in a cross-section for feeding flushing air, said plurality of ducts protruding beyond a surface of the hollow grate plates.

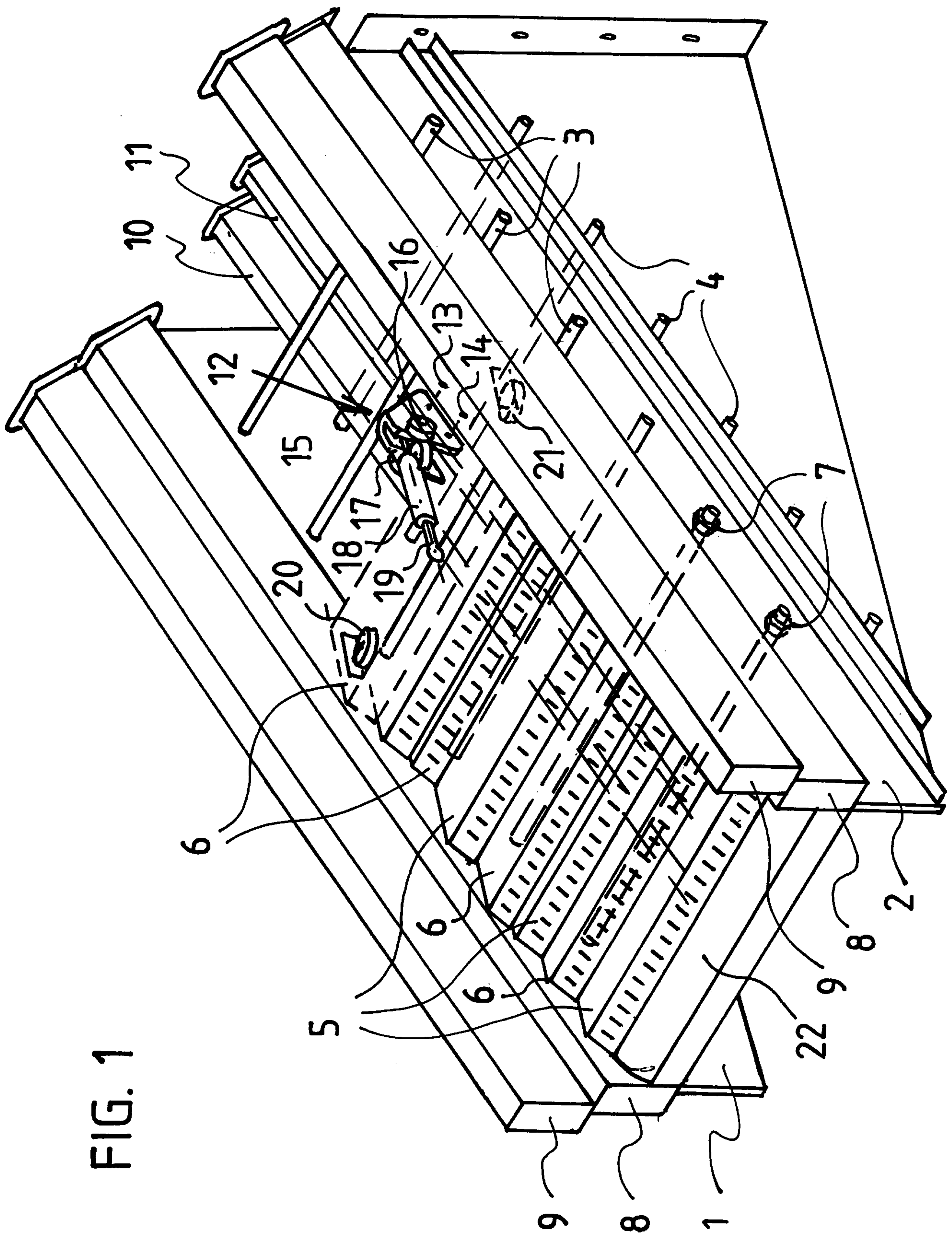
2. The water-cooled thrust combustion grate of claim 1, wherein at least one steel roller is part of a supporting element that is detachably mounted between the air and water supplying hollow profiles, and that includes the stationary connection point for the hydraulic cylinder for driving the movable grate plate.

3. The water-cooled thrust combustion grate of claim 2, wherein the supporting element has a central guiding roller whose axis when the roller is assembled, runs perpendicular to the plane of motion of movable grate plate, with grate plate having a guide groove at the bottom running in the direction of motion, which is fitted over this guide roller, and wherein the at least one adjacently disposed steel roller is mounted on the supporting element, whose axes run parallel to the plane of motion and perpendicular to the direction of motion of grate plate, and on which the movable grate plate runs.
4. The water-cooled thrust combustion grate of claim 2 or 3, wherein the supporting element is fixed to the air and water supplying hollow profiles by means of two bolts disposed parallel to each other, so that after removing one bolt, the supporting element can be swung downwards so that, in this swung down position, the hydraulic cylinder can be disassembled.
5. The water-cooled thrust combustion grate of any one of claims 1 to 4, wherein each side of the grate plates at their front side is being guided by a steel roller whose axis runs perpendicular to the grate plate, whereby these steel rollers are disposed on the insides of side panels and in that the undersides of the grate plates have guide surfaces set back with respect to the side panels, which run on the steel rollers.
6. The water-cooled thrust combustion grate of any one of claims 1 to 5, wherein the front underedges of grate plates are fitted with a replaceable sliding shoe made from abrasion-resistant material, with which they rest sealingly on top of the next grate plate down.
7. The water-cooled thrust combustion grate of any one of claims 1 to 6, wherein the side panels each comprise two square pipes running parallel to each other, disposed on top of each other and off-set in relation to each other, with the inside width between the top square pipes being wider, with these pipes forming the side limitation of the combustion bed whilst the bottom square pipes form the side limitation for grate plates.
8. The water-cooled thrust combustion grate of any one of claims 1 to 7, wherein the hydraulic cylinders are each accommodated in a flushing cylinder, inside which they are

surrounded by a jacket of air which, firstly, cools them and, secondly, prevents dust from entering via the open end at the front, and in that the hydraulic cylinder-piston units are themselves supplied and flooded with hydraulic oil on both sides of the piston by a feed-in line and an associated feed-out line, with these lines being individually blockable to control the hydraulic cylinder-piston units so that the cylinder chamber is permanently flooded even when at rest, thereby ensuring additional cooling.

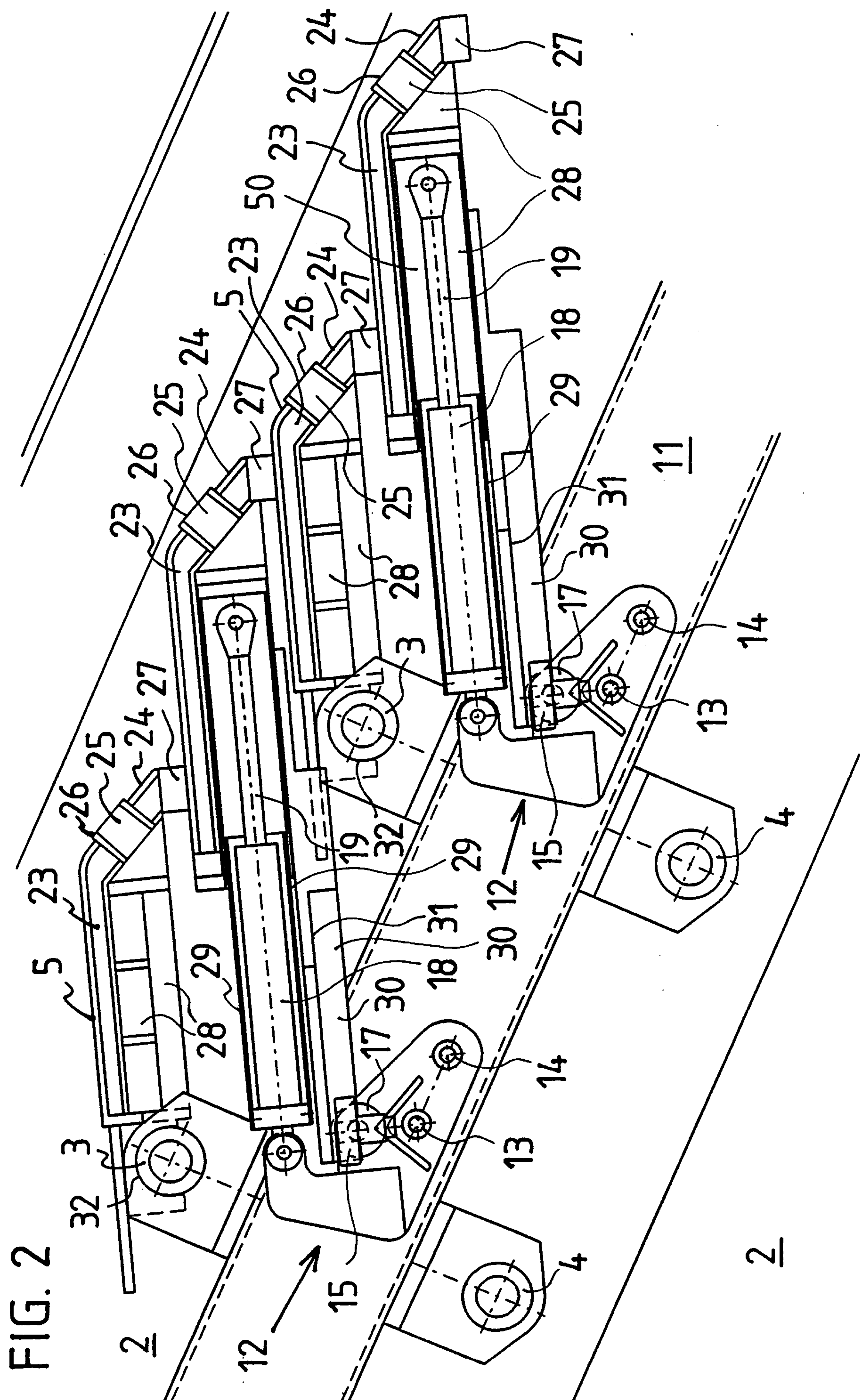
9. The water-cooled thrust combustion grate of any one of claims 1 to 8, wherein a cooling cycle for the grate plates connected in series operates for two or more adjacent grate plates.

10. The water-cooled thrust combustion grate of any one of claims 1 to 9, wherein the area underneath the grate is divided into several individual air zones separated sealingly from each other, which can each be supplied individually with air from an associated ventilator whose speed can be controlled.



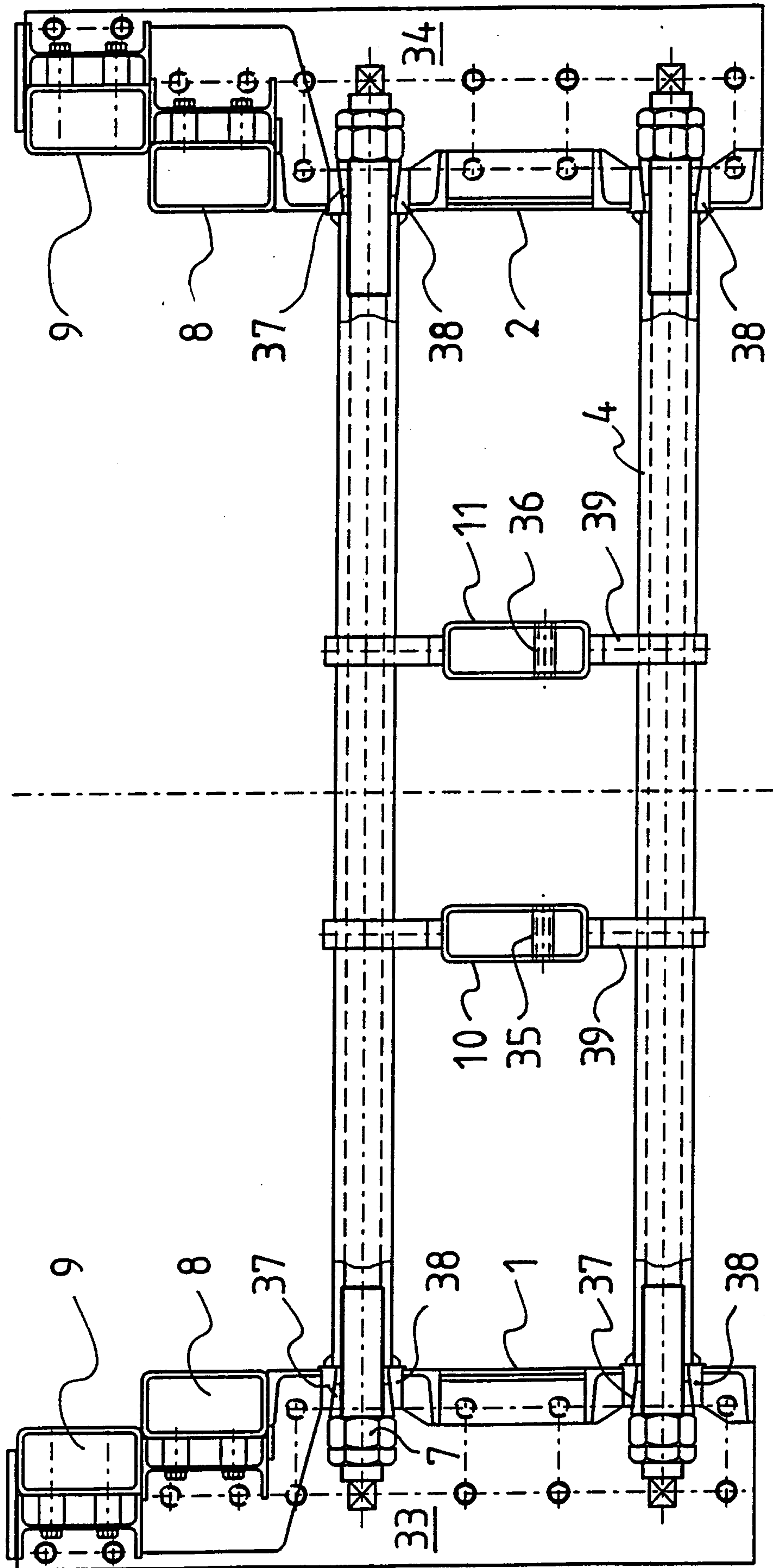
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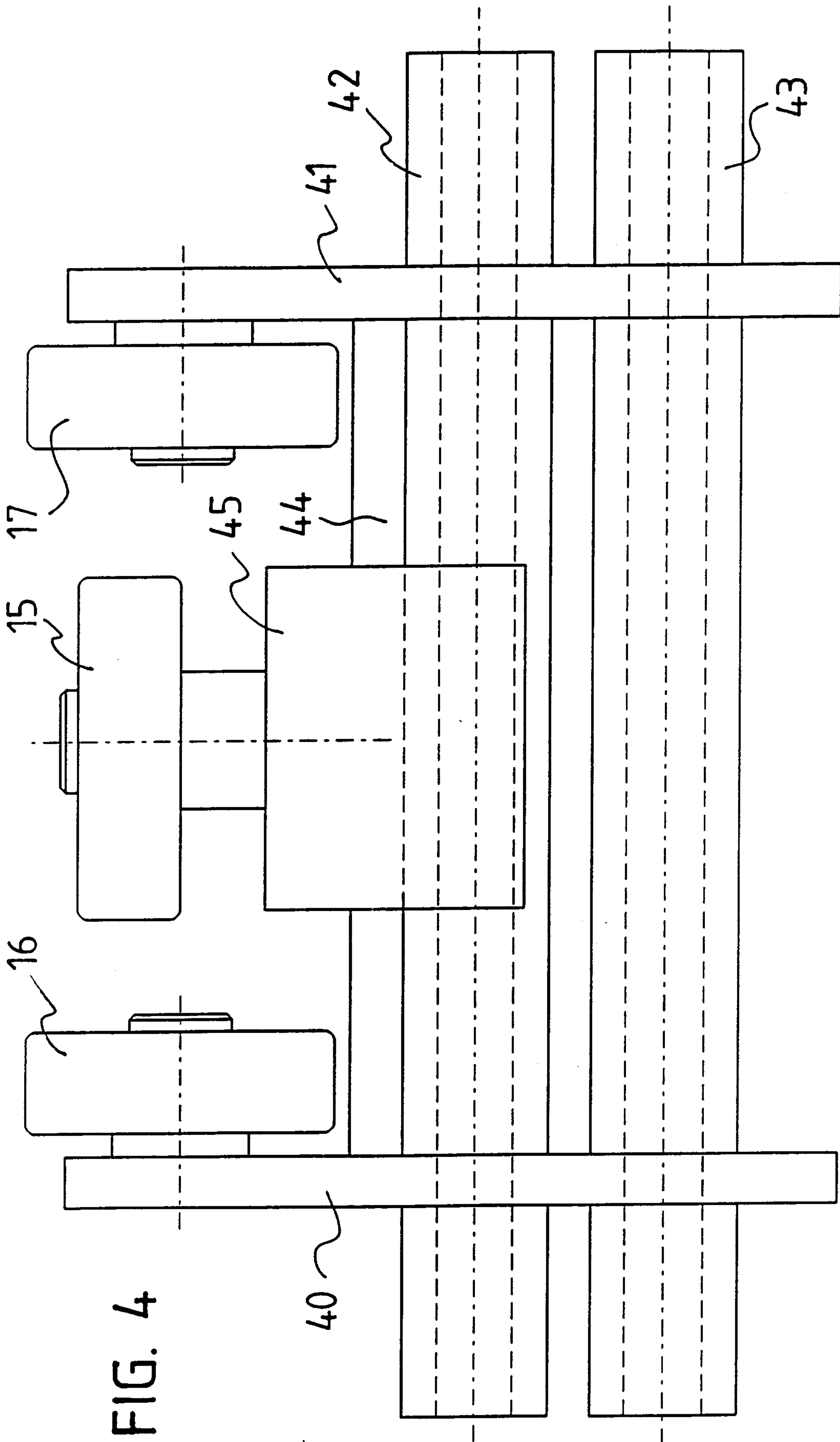


Hearts & Ovals

FIG. 3



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