



RENEWABLE ENERGY SOLUTIONS FOR THE NEXT GENERATIONS



„BIOMASS and WASTE to Energy“



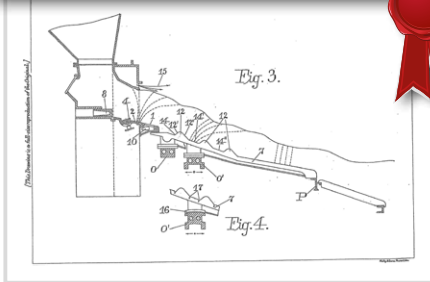
PATENT SPECIFICATION

Application Date: July 15, 1920. No. 21,872/20. **167,950**

Complete Accepted: Aug. 26, 1921.

COMPLETE SPECIFICATION.

Overfeed Stoker.



- Reciprocating grates (water-/air-cooled)
- Overthrust grates (water-/air-cooled)
- Post-combustion grates

Richard Kablitz GmbH

Kablitz stands for environmentally friendly energy production.

Active for a clean environment for tomorrow using modern energy and environmental technology.

As general contractors, we plan and construct biomass thermal power stations that use state-of-the-art firing technology and effective flue gas cleaning systems, as well as heat exchangers for gaseous media.

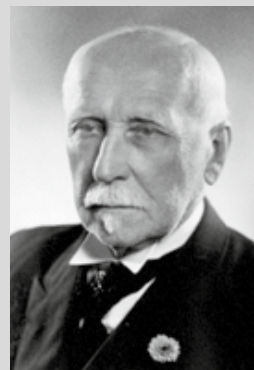
Our decades of experience in the construction of plants and power stations gives us the in-depth expertise to find a tailor-made solution even for your requirements, and one from which you will reap long-term benefit.

Boasting a history reaching back to 1901, we are a long-established medium-sized company that has been family-owned for many generations. Quality, reliability and innovativeness are the main values of our corporate philosophy, with which we will also meet market requirements in future.

By continually developing and testing new technologies, we offer our customers ground-breaking plant concepts that ensure efficient and reliable operation. In so doing, we act as an experienced partner, continually providing our customers with assistance in all project-related matters.



Richard Kablitz – Grate firing pioneers!



With the invention of the Kablitz universal high-performance overthrust firing system in 1920, Richard Kablitz laid down the foundations for our modern grate firing solutions. Since then, we have continually adapted to new challenges and have adjusted our grate systems to the demands of a wide range of fuels. Based on our many decades

of experience in the design, production and operation of grate firing systems, we are able to offer our customers decisive advantages to enable them to get the most out of their firing systems.

Your energy centre: *Everything from a single source!*

Energy technology backed by tradition

As general contractors, we provide you with turn-key services from a single source, including the specification of all interfaces.

Wherever you need us – we will be there:

An expert project manager will act as your contact point, assisting you during the entire project through to the commissioning period, during the trial operation and the warranty period and beyond.



■ **Planning**

- Plant and layout planning
- Process engineering design
- Thermodynamic design
- Electrical engineering and process control planning
- Basic and detailed engineering

■ **Delivery**

- Specification, selection and procurement of all components
- Monitoring of the planning and production services of subcontractors
- Approval inspections of subcontractor services

■ **Assembly**

- Site management and supervision of all trades
- Schedule tracking
- Interface coordination
- Quality assurance

■ **Commissioning**

- Cold and hot commissioning
- Trial operation
- Certificate of performance
- Approval
- Documentation and training
- Turnkey handover

■ **Warranty**

- Support, during the warranty period, from the project team familiar to you
- Maintenance service

More than 6,500 Kablitz plants exist throughout the world: in Europe, Asia, South and North America as well as Australia and New Zealand.

Our commitment continues even after a plant has been commissioned:

Qualified maintenance and tailor-made service ensure that our customers' plants have a high availability and operational reliability in the long term.



KABLITZ Reciprocating grates:

The flexible and low-maintenance grate firing solution.

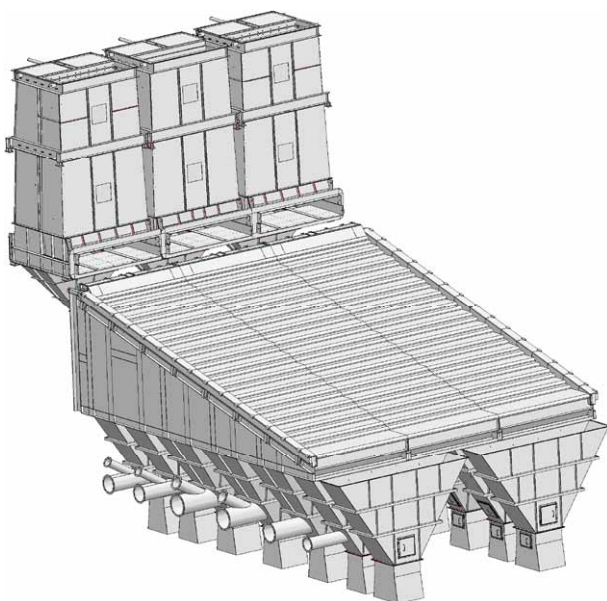
As fuel costs rise, the economic efficiency of energy production becomes increasingly important. The focus is on resource-efficient firing concepts which are not only able to adapt to the available fuels but which, at the same time, convert the fuel energy into useful heat as efficiently as possible.

KABLITZ reciprocating grates ensure excellent and versatile stoking. This is achieved with the staircase-like sectional layout and movement of the grate bars. In the special grate types both the grate bar design and the control of grate movement in the individual grate sections are adapted to the designated fuel properties.



Key technical parameters:

- Grate width: 836 – 10,032 mm
- Grate length: 4,205 – 12,460 mm
- Firing capacity: from 4.5 MW
- Fuel throughput: up to 40 t/h
- Up to 4 grid drives, which can be controlled separately
- Up to 8 primary air zones, which can be controlled separately



Advantages:

- ▶ Wide field of application for a heat value of 5,000 – 21,000 kJ/kg
- ▶ Up to 10% of the fuel can be made up of unwanted substances such as stones and bits of metal
- ▶ The primary air can be preheated up to 180°C, in special cases even more
- ▶ Fuel burn-out (energy efficiency) of $\geq 97\%$ owing to the optimised stoking motion and an individually controllable grate speed for each drive
- ▶ A load change rate of up to 1% of the firing output per minute is possible
- ▶ Minimal maintenance requirements due to the central drive unit and high-quality hydraulic cylinders
- ▶ Long service lives of the grate bars cast from high-alloy chromium steel in our own foundry



Type 415 – Sloping grate with air cooling

The universal grate system for “multiplicity fuels“. Insensitive to foreign matter and provides cost-efficient operation and maintenance.

Ideal for „multiplicity fuels“:

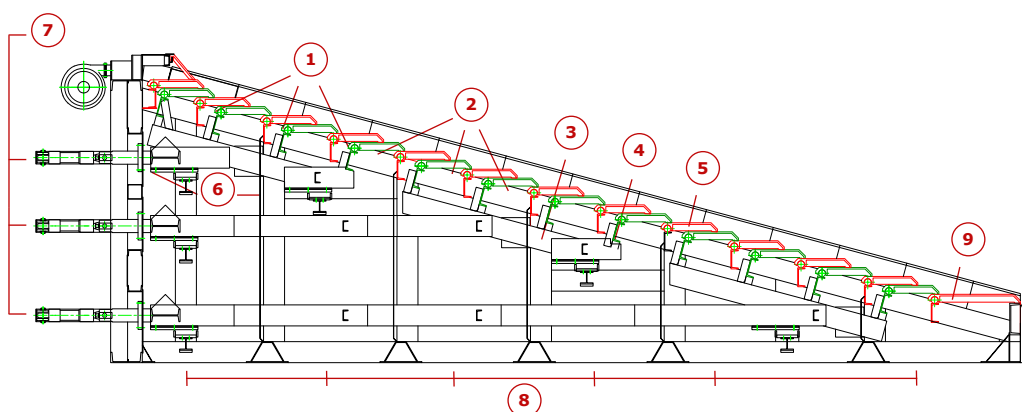
- | | | |
|-------------------------------------|---------------------------|------------------------------------|
| ✓ Wood chips | ✓ Rice husks | ✓ Fluff, RDF, Waste (sorted waste) |
| ✓ Bark | ✓ Olive pits | ✓ Substitute fuel (EBS, PEF) |
| ✓ Waste wood (MDF, OSB, chipboards) | ✓ Lignite | ✓ Brown coal |
| ✓ Used wood (A I - A IV) | ✓ Milled peat, Block peat | ✓ Wood pellets |

The Type 415 reciprocating grate is designed like a staircase with fixed and moving grate bar rows. All the grate bars in a row are closely spaced and interlocked, which results in a closed feed motion for the entire grate row. This interlocking holds the grate bars together so that the air slots in between are uniform in size. This is the only way to ensure even distribution of combustion air over the entire grate surface and thus optimum burn-out.

The lateral thermal expansion of the grate layer is accommodated by the movable side plates, which means that the individual grate rows cannot jam.

The grate bars are cooled by air only.

By not using a liquid cooling medium, major savings in terms of investment costs are possible and leaks and damage to a recirculating water cooling system are eliminated.



- 1 Row of moving grate bars
- 2 Row of fixed grate bars
- 3 Moving frame
- 4 Fixed frame
- 5 Grate bar seal
- 6 Grate carriage bearing
- 7 Hydraulic drive cylinders
- 8 Primary air zones
- 9 Dumping grate bar



Typ 715 – Inclined grate with water cooling

The Kablitz allround-grate system for high-caloric fuels:

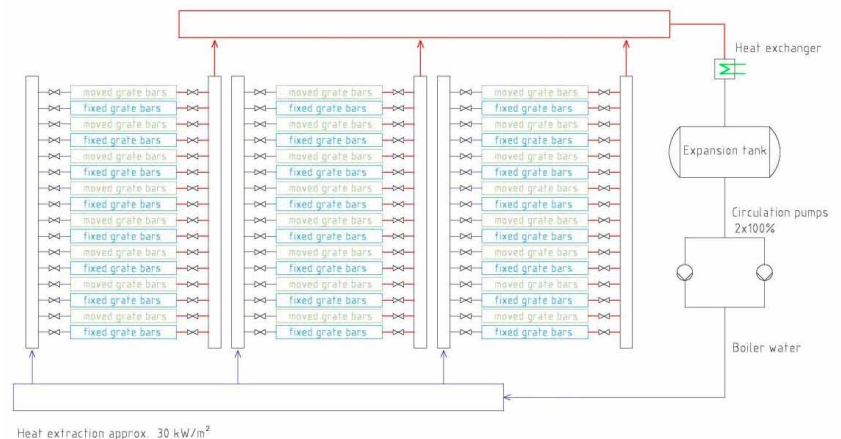
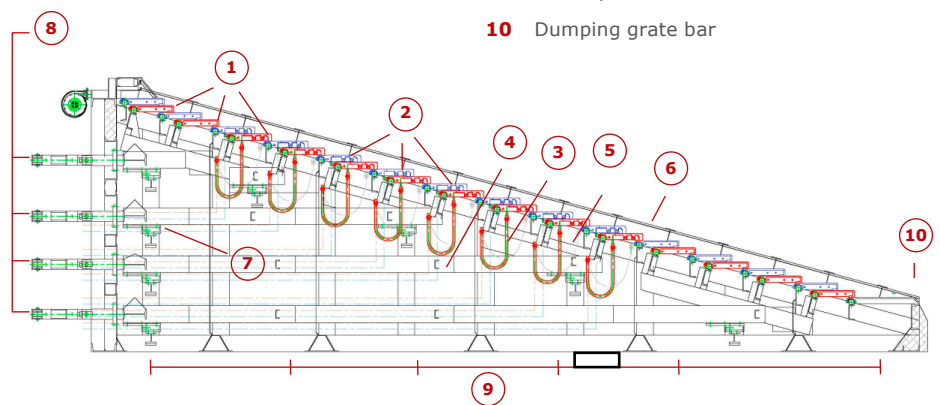
The moving as well as the fixed grate bars are water-cooled. Depending on the heat exchange principle, the customer can select the flow and return water temperatures between 50 and 150 °C. The reciprocating grate Type 715 is built out of fixed and moving grate bar like a staircase. All the grate bars lie close to each other and are interlocked with each other, so that the entire line up can unanimously execute the feed motion. Through the interlock, the grate bars are held together, so that the air gap in between can remain the same. Only so, an even distribution of combustion air via the entire grate surface, with a full burn-out is accessible.

The lateral thermal expansion of grate surface is affiliated via the movable lateral plate, which eliminates the jamming of individual grate lines. The grate bars are cooled via water cooling.

The grate system is designed in a way that the water-cooled and air-cooled grate bars are compatible and can be replaced at any time without conversion of the grate frame.

The grate can be partly water-cooled and air-cooled and be built depending on the requirements of the fuels in the future (see illustration).

- 1 Row of moving grate bars
- 2 Row of fixed grate bars
- 3 Water-cooled tubes
- 4 Moving frame
- 5 Fixed frame
- 6 Grate bar seal
- 7 Grate carriage bearing
- 8 Hydraulic drive cylinders
- 9 Primary air zones
- 10 Dumping grate bar



Heat extraction approx. 30 kW/m²

Ideal for „multiplicity fuels“:

- ✓ Wood chips
- ✓ Bark
- ✓ Waste wood (MDF, OSB, chipboards)
- ✓ Used wood (A I - A IV)
- ✓ Rice husks
- ✓ Olive pits
- ✓ Lignite
- ✓ Milled peat, Block peat
- ✓ Fluff, RDF, Waste (sorted waste)
- ✓ Substitute fuel (EBS, PEF)
- ✓ Brown coal
- ✓ Wood pellets



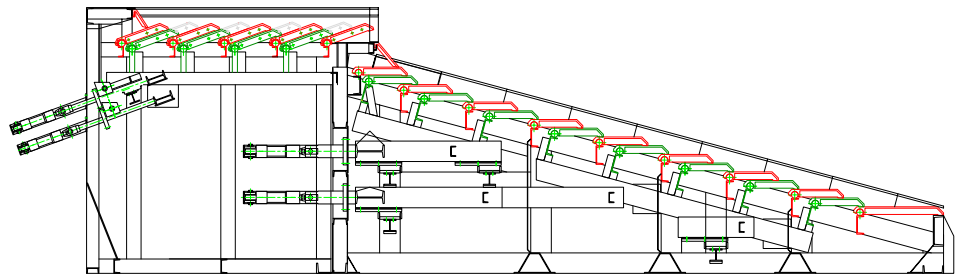
Typ 400 – Horizontal grate with air cooling

This space-saving grate system is suitable for use as a flat grate for lesser capacities of up to approx. 8 MW or as an upstream drying grate.

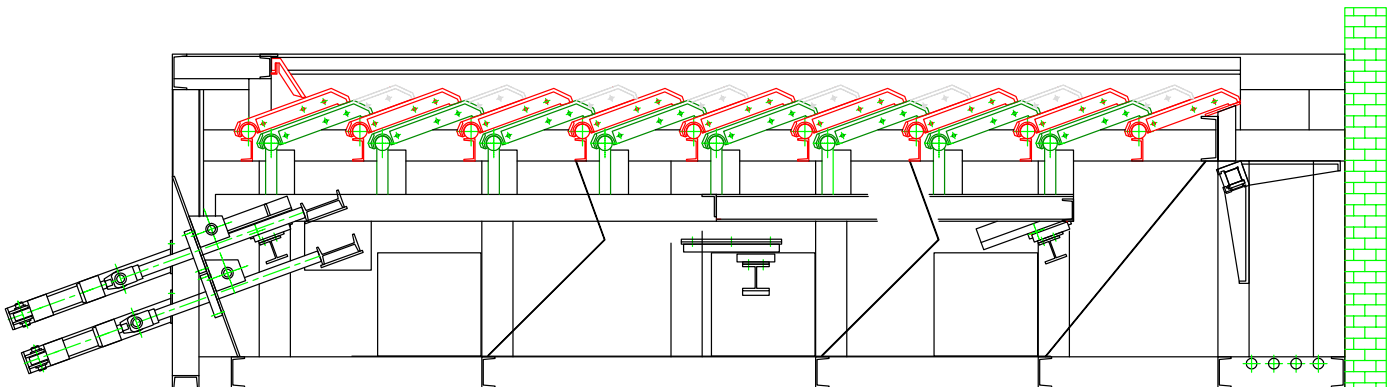
Ideal for:

- ✓ Barks
- ✓ Sawdust
- ✓ Briquettes
- ✓ Organic waste
- ✓ Lignite
- ✓ Milled peat
- ✓ Brown coal

The horizontal Type 400 grate comprises fixed and moving grate bar rows. The grate bars of the consecutive rows rise in the direction of fuel flow and are arranged like overlapping scales. The grate bars in each row are close together and are equipped with self-cleaning air nozzles. Depending on the overall length of the grate, the moving grate bar rows are driven either simultaneously or in sections. The number and the length of the strokes in each grate section can be separately controlled.



Given the high moisture level of the fuel and the spatial restrictions in the above example, the Type 400 system is used as a drying grate. Due to the horizontal alignment, the fuel spends a relatively long period of time on this flat grate, which also explains why it is dried so effectively. The additional drop edge downstream of the horizontal section turns the fuel again so that complete burn-out is achieved on the subsequent sloping grate.



Reciprocating grates

Reference project

Technical data:

- Grate area: 56.1 m²
- Grate width: 5,320 mm
- Grate length: 9,920 mm
- Firing capacity: 44.43 MW
- Fuel heat value: 13.2 MJ/kg
- Fuel throughput: 11.7 t/h
- Thermal grate load: 792 kW/m²
- Mechanical grate load: 209 kW/m²
- Regulated minimum load: 60 %



Type 422/415 – Reciprocating grate firing system for rice husks and fine-grain fuels

Biomass power station, Udon (Thailand)

In order to supply the Thai province Udon Thani with green energy in the future, our customer planned and constructed a power station to use the energy from rice husks and wood chippings.

For maximum flexibility in terms of fuel type, the top third of the robust and versatile Type 415 solution was modified by altering the angle of inclination. With this change in inclination, particularly dry and easy-to-ignite fuel can be transported faster into the main combustion zone. This effect is enhanced by the use of grate bars with a new geometrical design to improve stoking and to enable transport of the necessary volume of fuel.

By combining both firing concepts, we achieved an ideal result for the customer: moist fuel has enough time to dry, degas and burn out on the long grate. With the optimised grate geometry, dry fuels are quickly transported to the main combustion zone where they are completely combusted.

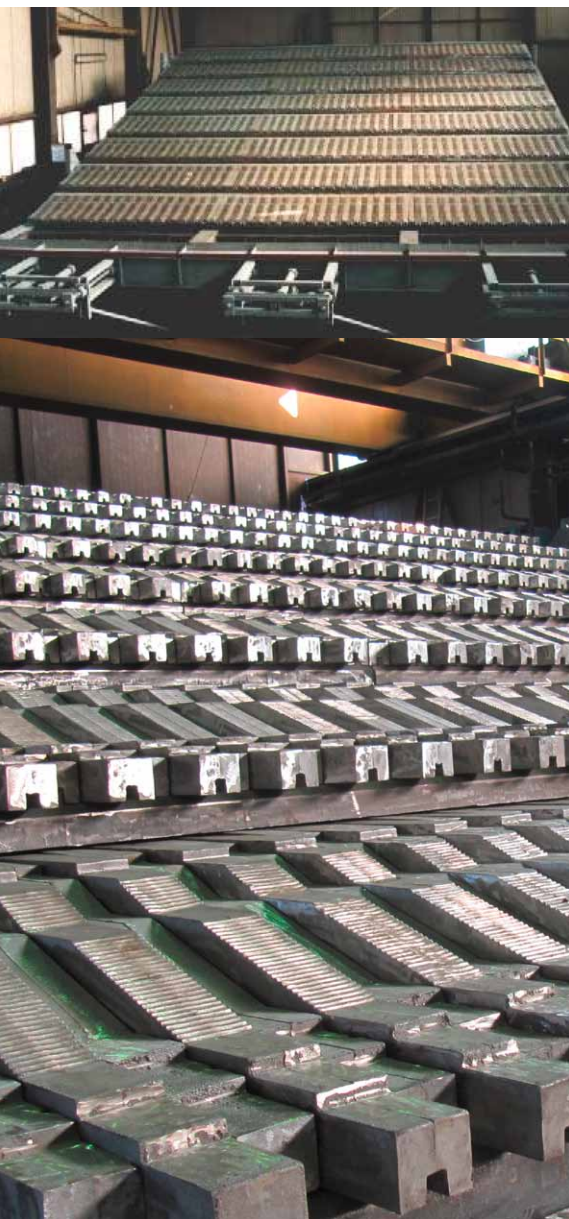


KABLITZ Overthrust grates:

The grate system for very wet fuels.

Richard Kablitz developed the first overthrust grate, the “universal high-performance furnace” back in 1921. This product, a replacement for the then common travelling grate, was designed for fuels with particularly low heat values, such as brown coal, peat and waste wood. The key advantage of this system was the mechanical stoking effect of the grate. The overthrust motion of the individual grate bars allows more air to reach the fuel bed, thus considerably improving drying, degassing and burn-out. This ensures optimum combustion of even coarse and very moist fuels, which ultimately helps to cut fuel costs in the long term.

The stoking principle differs from that of the reciprocating grate. Every parallel position of grate bars forms an approx. 1 m long grate section. In every section row, one fixed and one horizontally movable grate bar are arranged side by side in pairs. As with the reciprocating grate, the horizontal moving grate bars are driven by front-arranged hydraulic cylinders via a carrier frame system mounted on roller bearings. The first sections have a drive that is separate from the other sections. Movement of the grate can be individually controlled by altering the stroke length, stroke speed and number of strokes.



Key technical parameters:

- Grate width: from 836 mm
- Grate length: 3,467 – 10,362 mm
- Firing capacity: from 4.5 MW
- 2 grid drives per grate module, which can be controlled separately
- Up to 4 primary air zones, which can be controlled separately

Advantages:

- ▶ Wide field of application for a heat value of 5,000 – 21,000 kJ/kg
- ▶ The primary air can be preheated up to 250 °C by default
- ▶ Fuel burn-out (energy efficiency) of $\geq 97\%$ owing to the optimised stoking motion and an individually controllable grate speed for each drive
- ▶ A load change rate of up to 1 % of the firing output per minute is possible
- ▶ Minimal maintenance requirements due to the central drive unit and high-quality hydraulic cylinders
- ▶ Long service lives of the grate bars cast from high-alloy chromium steel in our own foundry
- ▶ Water-cooled grate beams available as an option
- ▶ Suitable for fuels with high moisture contents up to max. 65 %



Typ 116 SW/SL – The sloping grate with air or water cooling

The standardised grate system for fuels with low heat values unique by its stoking effect.

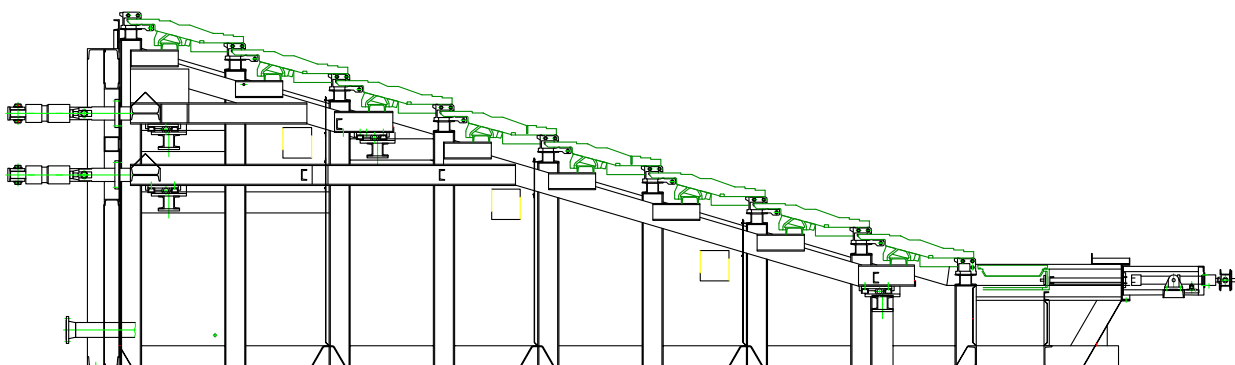
Ideal for:

- ✓ Wood, waste wood
- ✓ Barks
- ✓ Lignite
- ✓ Block peat
- ✓ Brown coal
- ✓ Pellets made from a variety of base materials
- ✓ Oil shale
- ✓ Bagasse
- ✓ Empty fruit bunches (EFB), Palm shells

This grate type is particularly suitable for very moist fuels with a water content of up to 65 %. The stroke speed can be independently set for each drive cylinder, and the primary air can be regulated in sections. In combination with the good stoking effect, this ensures optimum burn-out, even for challenging fuels. In addition, the grate can be combined with the extendable Type 200 post-combustion grate.

Depending on the nature of the fuel, the grate can be designed with either water or air cooling.

This drawing shows a cast-iron, water-cooled grate beam with teeth to support and guide the grate bars. The inserted, exchangeable sliding plates made of hard-wearing material for the moving grate bars protect the beams from wear when transporting abrasive fuels.



Overthrust grates

Reference Project

Technical data:

- Grate area: 66.2 m²
- Grate width: 7,904 mm
- Grate length: 8,392 mm
- Firing capacity: 53.01 MW
- Regulated minimum load: 31.8 MW
- Fuel heat value: 7.3 MJ/kg
- Fuel throughput: 25.4 – 60.0 t/h
- Thermal grate load: 801 kW/m²
- Mechanical grate load: 383 kW/m²



Type 116 SW-200 – Overthrust firing system for Empty Fruit Bunches from the palm oil industry (EFB)

Biomass power station, Pahang (Malaysia)

The owner of the world's largest plantation of oil palms set up a biomass power station in Pahang in Malaysia to generate an electrical output of 12.5 MW. Of this, 10.0 MW is fed into the national power grid and the rest is used to meet the operator's production requirements. Each year 210,000 t of biomass is to be converted into electrical energy. The raw material comes from the nearby palm oil factories.

In order to burn the moist EFB, the water-cooled grate uses primary air heated to 220 °C to evaporate the water in the fuel. The grate bars are prevented from overheating by water cooling. The fuel is turned over and stoked by the overthrust motion. Together with the 4 primary air zones, which can be controlled independently of each other, the air supply can be optimally adapted to the fuel properties. Depending on the moisture content, the time spent on the grate can be regulated by changing the number of strokes.

The overthrust grate together with the secondary combustion grate provides an ideal solution for the agricultural fuel, EFB. The moist fuel is pre-dried by the hot primary air and continually turned over via the stoking movement. Should extremely wet fuel fractions not burn completely on the inclined section of the grate, they remain on the secondary combustion grate until they have burnt out, too.

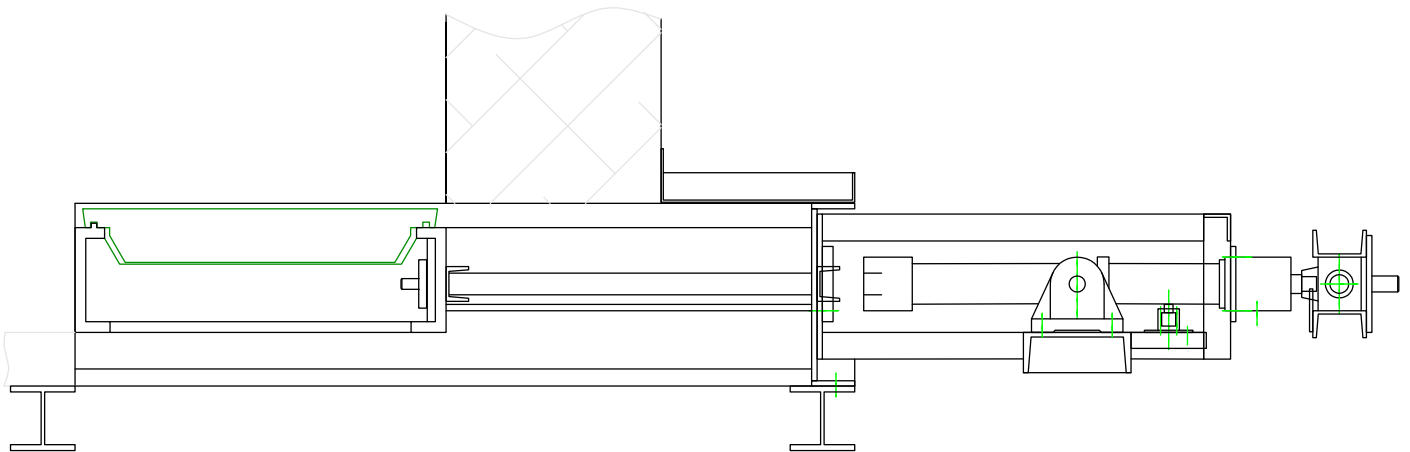
A firing efficiency of > 97 % is achieved for the entire fuel feedstock.

Type 200 – Horizontal post-combustion grate

Flat grate, which can be emptied automatically or semi-automatically, for use as a post-combustion grate for fly ash or as a slag grate in combination with Type 116, 400 and 415 grates.

This downstream grate section improves the efficiency by ensuring complete combustion of the fuels.

The flat grate bars, 560 or 660 mm in length, mounted on rollers on a cast-iron frame system, are hydraulically extended at the necessary intervals to discharge the ash. The time intervals can be regulated manually following inspection of the burn-out or set automatically in case of homogenous fuels.



Type 290 – Post-combustion grate

Tilting grate, which can be emptied automatically or semi-automatically, in combination with Type 400 and 415 grates.

The downstream tilting grate improves burn-out ($\text{TOC} < 3\%$) and the energetic coefficient, especially in cases of fuels with unequal sizes.

The grate bars, 450 mm in length, are hydraulically tilted either automatically or manually for ash discharge. With this post-combustion grate, the time intervals can also be varied depending on the fuel and burn-out. The semi-automatic mode is actuated manually following a visual inspection.



“Biomass and Waste“ as an energy source **as versatile as nature!**



Wood



Agriculture fuels



Waste / RDF

Our delivery programme at a glance

- “Biomass and Waste“ thermal power stations
- Boiler plants
- Hot gas generators
- Firing systems
 - Reciprocating grates
 - Overthrust grates
 - Injection burners
- Heat recovery
 - Cast-iron gilled heat exchangers
 - Glass tube heat exchangers
- Service
- Customized casting

Service

We provide the complete service for your plant:

- 24 h hotline / online service
- Conversions to existing plants
- Inspection, service and maintenance
- Assembly and disassembly
- Commissioning and commissioning support
- Plant optimization
- Emission measurements
- Spare and wear parts
- Process engineering consultancy

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and New Zealand.*



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