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## CHAPTER 1

### PLATE DATA

**PRODUCTION:** 130 tons/h (at 3% of umidity) with finished product temperature of 150° at sea level, at following standard conditions:

- Aggregates moisture content ≤ 5%
- External temperature: ≥ 10°C
- Altitude reference sea level
- Average feed aggregates density 1650 Kg/ m<sup>3</sup>
- Fuel caloric value fuel < 100-1000 cSt at 50°C) ≥ 9.600 Kcal/Kg.
- Discharged aggregates temperature ≤ 150°C
- Mixture residual moisture content ≤ 0,3%
- Max aggregates size: 40mm
- Material passing screen 3mm ≤ 40%
- Material passing screen ASTM 2000 0 74 microns ≤ 7%
- Formula Binder standard
- Aggregate specific heat: less than 0.21 Kcal/Kg °C
- Filler specific weight 1.0 t/m<sup>3</sup>
- Production tolerance rate according to ambient and parameter conditions ±10%
- Production rate is inclusive of all recovered filler and average value of 5% in weight added bitumen
- Material not porous, not hygroscopic with normal shape and with good preselection

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## CHAPTER 2

### GENERAL INFORMATION

#### 2.1 GENERAL

The **CB/140S QUICK** plant is designed for discontinuous production of bituminous conglomerates (asphalt) designed and manufactured by SIM in Verona, Italy.

A conglomerate is a hot mix of mineral aggregates, fillers and bitumen.

The types of conglomerate can be organized into three classes depending on the intended applications:

- Conglomerates for base or foundation course;
- Conglomerates for binder or intermediate course;
- Conglomerates for wearing course or surface course.

These types differ for the size of the aggregates used and weight percentage of the components included in the mix. Starting from the largest size, we have the base course, the binder and the various types of surface course which usually does not exceed 10-12mm. The maximum size of the aggregates is also limited by the course thickness: the wearing course can sometimes be kept down to 20-30mm, whilst the base course can reach 200-300mm.

The **MINERAL AGGREGATES** make up the basic portion of the conglomerate in a percentage ranging from 80% to 90% of total weight; they have to meet specific characteristics, such as hardness, porosity, non-friability, resistance to vertical and horizontal stress, and grading.


In particular, grading is the most critical feature in the production process since it is partially associated with the conglomerate mixing plant. The variety of the aggregate sizes is to optimize the compactness of the final product with the smaller stones interpenetrating the larger ones and conglomerate porosity being within acceptable values.

Depending on the sizes, the aggregates are classed into the following types:

- Sand 0-4mm
- Aggregates 4-12mm
  - Average 12-20mm
  - Large 20-32mm
  - Extra >32mm

The **FILLER** is also a very fine aggregate (0 to 200 micron) and its amount is calculated separately because of its importance as a filling agent. The percentage of filler ranges from 3 to 12-13% and tends to increase for finer conglomerates (wearing courses).

The mix binder, the **BITUMEN** is used in the 3 to 8% range.

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## 2.2 FUNCTIONAL DESCRIPTION

The **CB/140S QUICK** plant is designed for:

- Store the aggregates (sand, stone etc.) into dedicated prefeeders;
- Carry the selected aggregates to a drying/heating treatment section and a further sorting according to size;
- Store the aggregates so selected and treated in hot bins;
- Withdraw, weigh and convey the aggregates to the mixer;
- Withdraw, weigh and convey the recycle to the mixer;
- Withdraw, weigh and send the filler to the mixer;
- Withdraw, weigh and send the bitumen to the mixer;
- Produce the bituminous conglomerate and send it on the truck or on the finished product silos.

The plant consists of the following units:

1. Prefeeders;
2. Three main separate feed lines (aggregates, filler, bitumen);
3. A tower for sorting, weighing and mixing the components;
4. Finished product silos;
5. Auxiliary systems as required for operation of the production process.

The auxiliary systems consist of:

- A thermal system for production of heated diathermic oil;
- A system for generation of compressed air for feeding the pneumatic control mechanisms.

The entire production sequence is controlled by a SIMTHESIS computerized system which is operated by an operator in the control room.

The plant is discontinuous operation type, that is, after every mixing the mixer discharges the finished product. With this method the flow of the finished product is not constant and product discharge occurs after every mix.

All the equipment except the prefeeders and winch are fitted inside a shield.

## 2.3 PLANT COMPONENTS

The plant consists of prefeeders, three feed lines (aggregates, filler, bitumen and additive), a mixer, finished product storage bins, auxiliary systems and a control cabin for process management.

Reference to TABLE 1 the components are as follows:

### 2.3.1 Prefeeders


#### 2.3.1.1 Aggregates Prefeeders

The preselected materials (sand, gravel, average stones etc.) coming from the quarries are discharged into the prefeeders, from where they are collected and conveyed, via collector belt, to the production process section.

The NE650 type prefeeders consist of:

- a. N. 4 hoppers (key 1) (capacity 12m<sup>3</sup> each), arranged in line for storage of the preselected aggregates each equipped with:
  - Opening for extraction;
  - Adjustable-speed extractor belt (MOTORVARIOR) with remote control (max output 150tph each), instrumentation for volumetric read-out of output (encoder) for dosing regulation;
  - No flow indicator;
  - Electro-pneumatic anti-bridging vibrator (only for one hopper);
  - Electric plant.
- b. N. 1 collector belt (key 2) with discharge hopper arranged below the prefeeders for collection and carriage of the selected aggregates. The belt is equipped with an emergency shutdown system.




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### 2.3.2 The feed lines

The three feed lines consists of the following units:

1. The **AGGREGATE LINE** conveys the aggregates collected from the prefeeders to the mixing tower.  
This line consists of:
  - a) 1 aggregate heating and drying system consisting of:
    - Drying cylinder (key 3) ( $\varnothing$  1.700/2.000mm; L=8.300mm) complete with frame, soft start motor reduction gears, pre-chamber, outlet channel and smokes ducting; including: preheated fuel feed systems, high pressure pump, diesel oil high pressure burner type (key 4) with air and fuel adjustment systems; burner blower (key 5).
  - b) 1 bucket elevator (key 6) for transfer of hot aggregates to the mixing tower top (Key 7).
2. The **FILLER LINE** is designed to transfer the filler from the filter baghouse and filler-holding silos to the mixing tower. This line consists of:
  - a. N. 1 storage silos (key 8) for the recovered fillers: capacity  $30\text{m}^3$ . Silo is equipped with: butterfly valves with pneumatic control, discharge duct with pneumatic control valve, max level indicator, discharge pipe with pneumatic valve. The silo fillers is equipped, in addition with an anti bridging system.
  - b. 1 smoke exhaust fan (key 10) with associated motorized flow adjusting circuit installed on the suction line, which depressurises the smoke extraction line and discharges into the chimney (key 11);
  - c. 1 scrubber (key 12) to make the larger particles fall onto the hopper underneath (pre-filtration);
  - d. A set of filter baghouses (DM-IF 294 type; filtering surface  $426\text{ m}^2$ ) (Key 13) for removal of finer suspended particles (natural filler) with associated system for cleaning of filters; hopper underneath with worm conveyor; ducting from drying cylinder and to smoke exhauster; deprimometric valve complete with automatic electronic control system for drying cylinder best efficiency;
  - e. Tubular screw conveyors (key 14) for transfer of the filler collected inside the hopper of the filter baghouses and from recovered silo filler to the filler bucket elevator; automatic starting; tubular screws conveyor from auxiliary silo filler to the filler weighing hopper and fro the filler weighing hopper to the mixer;
  - f. 1 filler bucket elevator (key 15) for transfer of the filler from the scrubber and filter baghouse and from the recovered silos fillers to the auxiliary filler silos (key 10) arranged inside the mixing tower.
  - g. 1 chimney (key 11).
3. The **BITUMEN** is designed to transfer the bitumen from the bitumen storage tanks to the mixing tower.



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### 2.3.3 Mixing tower

The mixing tower is designed to store the hot aggregates coming from the aggregates line, measure and weigh the components coming from the 3 feed lines, and send them to the mixer for mixing.

The mixing tower consists of:

- a. Vibrating screen VA 1840 (key 16) located on top for resorting the hot and dry aggregates coming from the aggregates line; n. 4 selections + by-pass and oversize.
- b. 1 hot bin subdivided into 5 (4 +1) compartments (key 18) for storage of the hot aggregates corresponding to the various screen sortings, with extraction openings and hatches (partialised for better precision), 4 continuous level indicators in the 4 size hot bins and 1 max level indicator for by-pass size, pneumatic and electric plant. Capacity: 17m<sup>3</sup>. The silo is insulated and coated with aluminium sheet.
- c. N. 1 auxiliary filler silos (Key 10) for to storage of the recovered filler used for the conglomerate. Auxiliary silo is equipped with high and low level switches for control (start/stop) of the silo filler tubular screw conveyors and filler bucket elevator.
- d. 3 electronic weighing hoppers (key 18) with presetting and weight reading in the cabin, one for fillers, one for aggregates and one for bitumen. The filler and aggregate weighing hoppers are fitted with extraction openings whilst the bitumen hopper is fitted with a spraying system;
- e. 1 mixer (key 19) designed to amalgamate the aggregates, the fillers and the bitumen, located under the weighing hoppers, with an extraction opening, pneumatic and electric plant. Mixer is electrically heated.
- f. Antidust system.
- g. Cleaning system.

### 2.3.4 Finished product storage bin


The finished product storage silos is intended for stocking the product coming from the mixing tower and delivering it to the trucks for use. The system consists of:

- a. 1 storage bin (key 20) fitted with 2 compartments and with 2 extraction openings and hatches for the discharge of the material. Total capacity 28m<sup>3</sup> (14 + 14 m<sup>3</sup>). The storage silo is insulated and coated with aluminium sheet in the lower part. Inside the silo there is a deviator with electro-pneumatic control for silo selection, 2 high level indicators (one for each). Discharge gates are heated. Hatches are opened/closed by means the pneumatic pistons. The silo is positioned on load cells with weight indication on screen computer. An central channel allow the mixer discharge. The silo is weighing type (key 23).

### 2.3.5 Auxiliary systems

The plant is equipped with the following auxiliary systems:

- 1 heater for DIATHERMIC OIL system (NO SIM SUPPLIED), with thermostat, pressure switch, thermometer, electric motor pump for circulation of heating oil, expansion tank
- 1 COMPRESSED AIR system made up of an electrically-driven compressor (key 21) and a compressed air tank and a circuit to supply the compressed air to the pneumatic pistons for opening the silo output hatches, hoppers and filter baghouse and anti-bridging devices of the filler silo and sand prefeeders.

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### 2.3.6 Control & monitoring system

The **CB/140S QUICK** plant is controlled by a switchboards with associated SIMTHESIS system for plant monitoring and control complete with modem, video, printer and peripherals interbuses.

The switchboards and the microprocessor are installed inside the control cabin (key 22). The cabin is equipped with heatless glasses, rubber floor, air conditione hot and cold, microphone system with external loudspeaker.

The operator will start, stop and check the production by means of the mouse. The commands are shown on the screen display.


The following voltages are used:

- 380V 50Hz power supply voltage from switchboard for feeding the electric motors.
- 220V single-phase for the burner and the control circuits (prefeeder regulator, servo controls, SIMTHESIS system via UPS)
- 110V 50Hz supply voltage obtained through a transformer placed inside the supply board feeding the electric motor controls, the alarm circuits, the mixer automation system, the EE/valves etc
- 24V for BUS supply

To access the top of tower and plant assemblies, suitable ladders are provided. In addition duty shelters are provided on top of the vibrating screen, finished product bins, weighing hoppers, mixer and hot bins. Shelters and ladders are fitted with rails in compliance with the regulations for accident prevention at work. The vibrating screen, the hot bins, the weighing hoppers and the mixer top are arranged inside tight & depressurised casings to avoid dust dispersion into the environment.

Depressurisation occurs through an exhaust fan that conveys the dust to the filter baghouse.



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## 2.4 DESCRIPTION OF MACHINERY

### 2.4.1 Aggregates Prefeeders

Each prefeeder (Fig. 2.1) is made up of one hopper and one extractor belt.

#### Hopper

The hopper (capacity 12 m<sup>3</sup> each) is a container for presorted aggregates. It is sheet steel container supported by a frame made of steel sections.

The upper part of the bin (boards) has adequately-high vertical walls.

The wall on the loading side is inclinable in order to ease the loading operations by the mechanical equipment (loading shovel or haulage truck) and to increase the bin capacity. In addition the boards prevent the material from falling into the contiguous hoppers.

The lower portion is a reversed pyramid and ends with a dose gate.

The slope of the truncated pyramid walls is such as to allow for an easy sliding of the material towards the flow opening.

#### COMPONENTS OF THE HOPPER:

- Electro-anti-bridging system (hopper N. 1 only) to facilitate the sliding of material.

#### Extractor Belt

The hopper is fitted with an extractor belt (key 1), placed just under the flow adjustment gate (Max Delivery max: 150t/h each).

The extractor belt, made of rubber-covered fabric, is arranged over a frame that mounts the supporting rollers (key 4).

The belt motion is provided by a driving cylinder (key 2) actuated by a drive variator e/motor (key 10) coupled to a reduction gear (key 7) and a transmission drum (key 2) with a tensioning system and belt guide wheels (key 5). The motor drum is placed on the left handside and the transmission of the motion from the drum to the belt occurs by friction. Product flowrate is defined by adjusting the belt revolving speed.

As a matter of fact, the motor drum is operated through motorvariator (key 10) through which the belt revolving speed can be accurately adjusted via a control system.

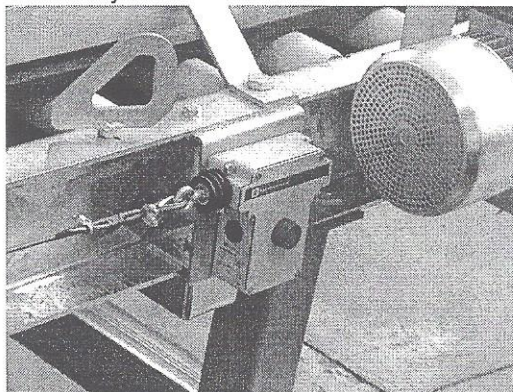
The rollers are fitted with bearings.

The transmission drum revolves on two ball bearings.


The extractor belts are started and stopped in sequence in order to allow for the collector belt to reach exactly when the mixture is completed. In addition a device allows for increasing/reducing the total flowrate without changing the percentage of every type of aggregates in the mixture.

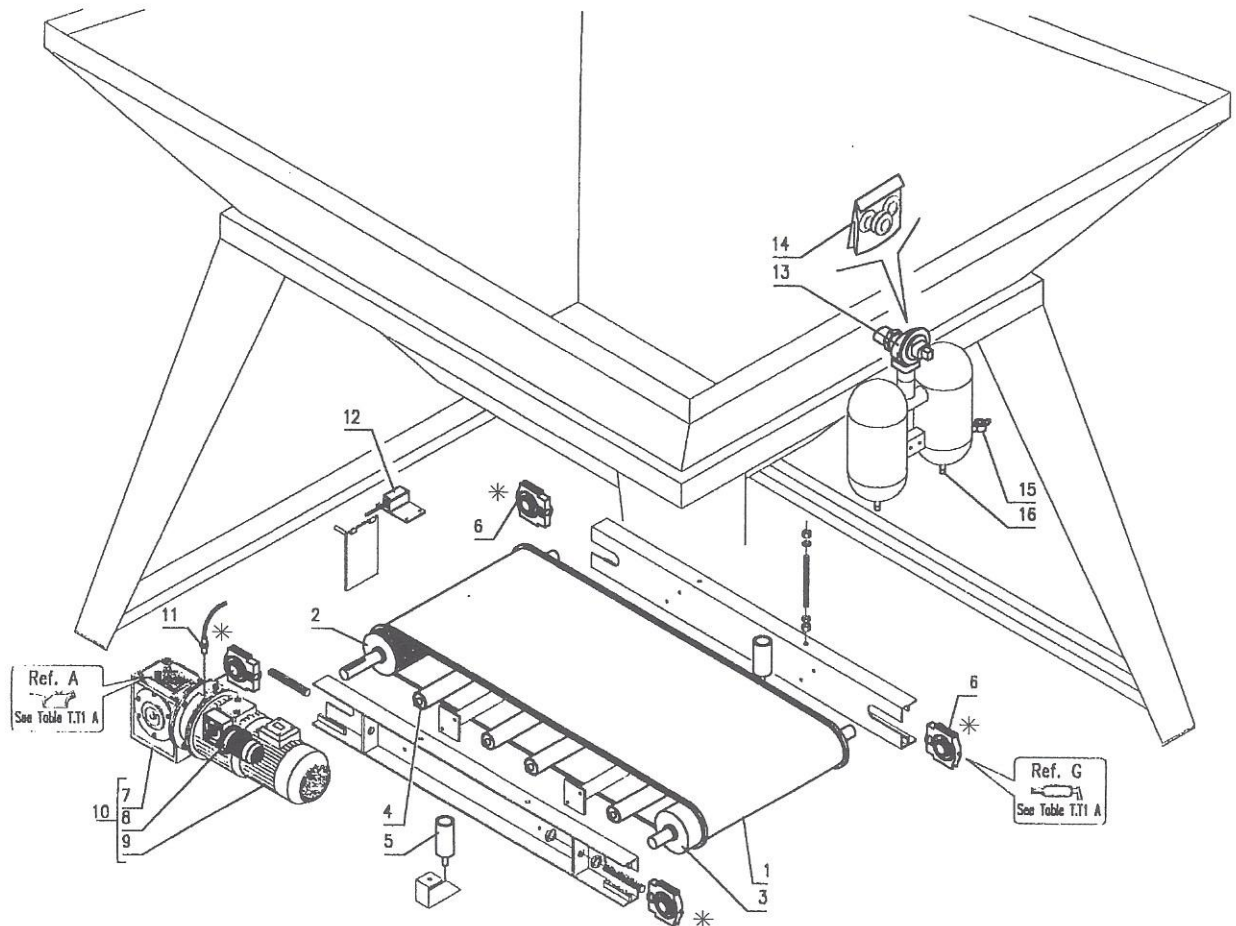
#### COMPONENTS OF THE EXTRACTOR BELT:

- N. 4 no-flow indicators. Microswitches (key 12) and blades absence of material detectors placed above the belt in correspondence with the motor drum.
- Emergency stop system controlled by a cable






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1. RUBBER BELT
2. DRIVE TIRED DRUM
3. IDLER DRIVEN DRUM
4. STRAIGHT ROLLERS
5. GUIDE BELT TROLLER
6. SUPPORT
7. REDUCTION GEAR
8. REDUCTION GEAR + ELECTRIC MOTOR
9. VARIABLE SPEED DRIVES
10. VARIABLE + REDUCTOR ASSEMBLY
11. SENSOR
12. LIMIT SWITCH
13. CONTROL SOLENOID VALVE
14. RUBBER DIAPHRAGM KIT
15. SINGLE ACTIN VALVE
16. DRAIN COCK

(\*) LUBRICATION POINTS

FIG. 2.1: PREFEEDER NE/650

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## 2.4.2 Collector belt

The collector belt is fitted underneath the extractor belt of the prefeeders, load and transfer the aggregate on the relevant feed belt.

The collector belt (FIG. 2.2) revolves around a structure consisting of a steel longitudinal beam, at the ends of which there is mounted a rubberised driving drum and an driven drum.

Dedicated rollers for belt support are arranged at a suitable interval in the upper portion (bearing) and lower portion (return) of the beam. In the upper portion the rollers are sloped and mounted in double V position, whilst in the lower portion the roller is individual and mounted linearly. The sloped rollers bear the load side of belt and force the belt to take the shape of a channel, thus increasing the loading capacity and avoiding escape of aggregates. Other belt guiding rollers are arranged sideways laterally and prevent the belt from displacing laterally.

The rollers revolve on bearings.

The driven cylinder revolves on two ball bearings.

Rubber belt scrapers are provided to remove any aggregates stuck to the belt.


The driven belt is fitted with a tensioning system, which gives the belt the required tension.

The belt motion occurs by friction through a driving cylinder driven by an electric motor through a reduction gear.

### COMPONENTS OF THE COLLECTOR BELT:

- Rubber belt scrapers fitted to remove any aggregates stuck to the belt
- Emergency stop system controlled by a cables
- Hopper placed on the driving head, which conveys the aggregates on the feed belt
- Hoisting points

The rotation of the belts are fully controlled from the SIMTHESIS system.

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### 2.4.3 Drying cylinder

The drying cylinder (FIG. 2.3) consists of a rotary drum (key 1) and two stationary ends, respectively on the aggregates inlet side and on the hot aggregates outlet side. The drying cylinder is installed on a steel frame (key 4), with a 5° slope horizontally. The support structure is bolted at shore foundation plinth. (key 5). Longitudinal supports are slopings and equipped with adjustments shims.

On the aggregates inlet side (key 2) there are two openings, respectively provided on the lower portion to allow the aggregates belt to deposit the presorted aggregates inside the drum, the other for suction of smoke and dust generated towards the filtering system.

Three openings are provided in the aggregates discharge side (key 3): one in way with the drum shaft, where the burner is fitted (key 6); the other fitted with a discharge duct (key 7) for outlet and transfer of the dried/heated aggregates towards the bucket elevator.

A third opening allows for access inside the cylinder for checking purposes. The hatch is equipped with safety key. When open de-energize the drying cylinder.

On forefurnace (burner side) there is an connection for a pipe, small diameter, allow to check the inside cylinder vacuum. Pipe is connected with P-sensor fitted in cabin (see Para 2.4.5).

Sealing between the rotary part and the stationary parts is provided by labyrinth seals.

The rotary drum is made of heat-proof & abrasion-proof steel and is stiffened in the areas most submitted to thermal and mechanical stress.

On the inside face there are suitably fitted vanes and pockets that are used to raise, hold, mix and cause the aggregates to fall - in order to optimize the heat exchange with the burnt gases and avoid their fall into the naked flame generated by the burner.

In addition to the drum slope, the vanes are so arranged as to allow for feeding the material at the desired speed.

Heat exchange occurs by convection, conduction and irradiation.

At the outlet, the aggregates reach a temperature of 150 °C; the exhaust smokes reach a temperature lower than 120 °C.

The drum outer surface is covered with aluminum sheets.

On the outside the drum is fitted with 2 rolling rings (key 8) for support and rotation.

The rings are welded to the drum and are of a thickness and surface adequate to bear the significant stress borne by the drum.

In correspondence with the rolling rings, on the frame there are fitted 4 sliding rollers (key 10)(two for each ring) and two thrust rollers.

The rollers are mounted on micrometrically adjustable brackets in order to enable a proper rotation of the cylinder under operation.

The bearing rollers enable the drum rotation whilst the thrust bearings are used to prevent the drum from traversing.


For regulation of the rollers see para 5.3.4.

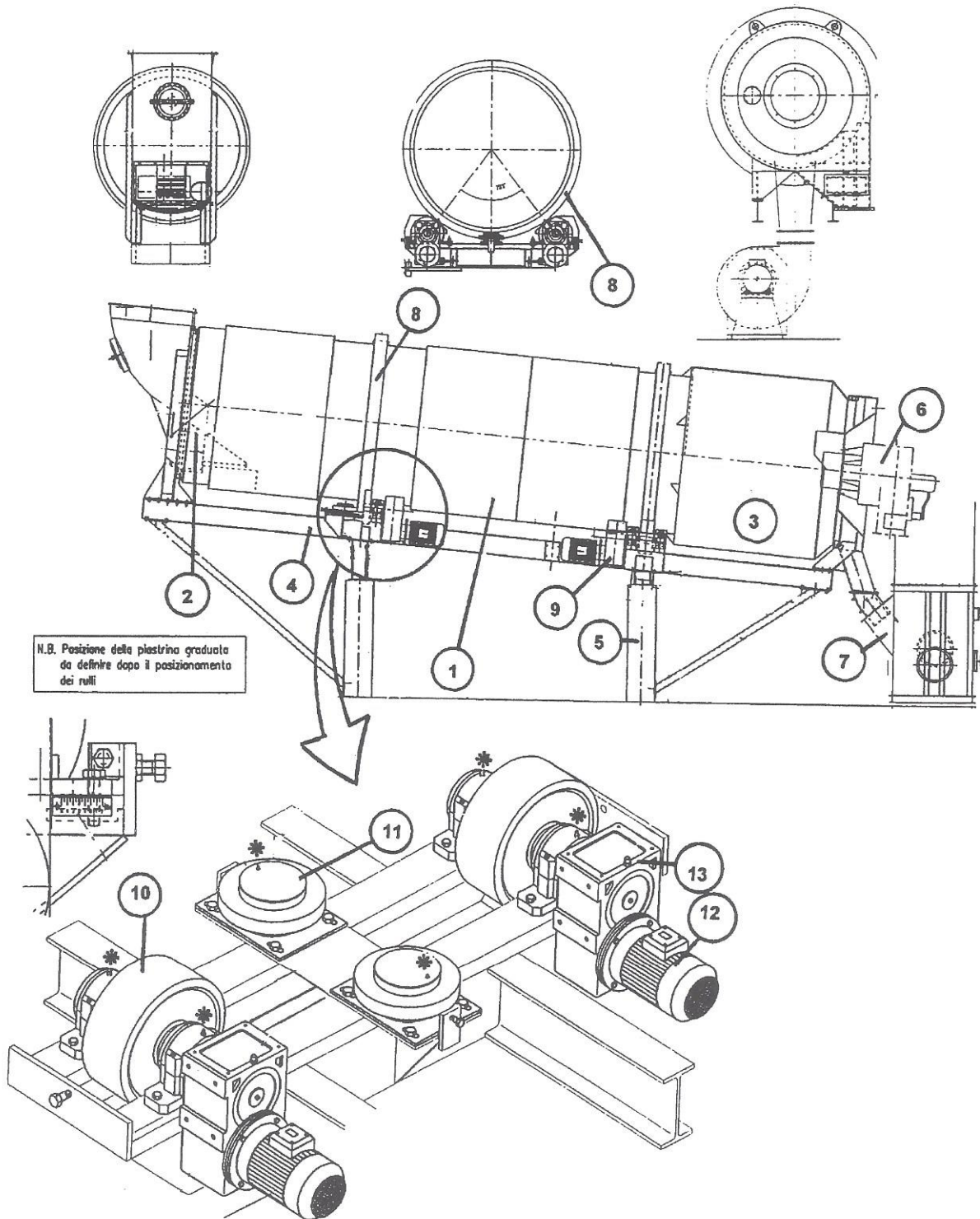
#### COMPONENTS OF THE DRYING DRUM

- 4 sliding rollers (key 10) (2 for each ring)
- 2 thrust rollers (aggregates inlet side) (key 11)
- 4 drum drives (key 9). Each drum drive is made up of an electric motor (key 12) (Soft start) that transmits the motion directly to a reduction gear (key 13)
- Depression meter
- Thermostat
- Thermocouple (on the aggregates discharge)
- Emergency stop pushbutton

The movements of the drum is fully controlled (soft start) from the SIMTHESIS system.




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(\*) LUBRICATION POINTS

FIG. 2.3: DRYING CYLINDER

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## 2.4.4 Burner and blower automatic regulator

The SIM PYR 6GNR burner (FIG. 2.4) it is liquid fuel spray high-pressure mechanical type. The liquid fuel delivered from the fuel booster system at a 30 Bar pressure is conveyed into the nozzle of the burner, which sprays it into the cylinder (Fig. 2.07).

Coaxially with the fuel diffuser cone there is a combustion air diffuser, which diffuses it inside the drying cylinder.

The combustion air (See FIG. 2.5) is supplied by a blower (key 6) at a pressure of 50 mbar through an automatic flow rate control placed on the body at an angle of 90° to the burner's shaft.

The automatic flow rate-adjusting device (FIG. 2.7 key 19) is made up of an air lock, whose opening/closing is controlled by an actuator as a function of the flow rate of the fuel to the burner and preset temperature.

The blower is fitted on the ground.

The flow of air between the ventilator and the burner is by means of a pipe.

The burner is ignited (FIG. 2.7) through an electric ignitor feeded by a dedicated system (key 13, 20). The pilot flame is remotely ignited by an electrode from the control cabin and controlled by an automatic cycle.

The burner flame intensity is adjusted manually from the SIMTHESIS SYSTEM or automatically through a thermocouple installed on the hot aggregate discharge duct. This thermocouple detects the aggregate temperature and sends a signal to the plant control and monitoring system, which compares the received value with the preset value.

The temperature difference generates a signal that acts onto the actuators that adjust the fuel discharge to the burner and to the combustion air inside the cylinder. The combustion air is proportioned during the plant testing in order to achieve an optimal combustion and efficiency under all working conditions.

The safety systems fitted to the burner consist of the following devices:

- A flame-sensing RAR 8, photocell located near the burner;
- A solenoid valve to intercept and deviate the fuel;
- A fuel pressure switch set at max 30 Bar;
- An air pressure switch set at 160 mBar;

When coming into operation, the safety systems shut off the fuel discharge to the burner nozzle and send it back to the tank.

The burner is ignited according to an automatic sequence, which lasts about 3 minutes, controlled by a LAL 1.25 system that sequentially develops the following actions:

1. Combustion air fan is started with opening of the gate (fuel/air) until 50% opening is attained; it keeps opened for 25 secs. During this period the sensor circuit is diagnosed (flame detector, pressure switches etc.). The supply air cleans the burner from any carbon deposits. During this phase, the air pressure switch detects the air pressure. After 25 secs, the gate is closed to the minimum supply.
2. Ignited through an electric discharge and fuel starts to be admitted,
3. Combustion occurs at minimum capacity; the air-adjusting gate is positioned at the optimal position for minimum capacity.

If flame is lacking within 2 secs, then the flame detector sensor locks the burner.

To re-start the plant it is necessary to reset.

The burner does not start if the drum is not in rotation.

The flame is controlled by RAR-8 system, made up of a circuit with a photocell, which detects the presence of the flame.

FOR FURTHER CHARACTERISTICS SEE THE SPECIFIC MANUAL



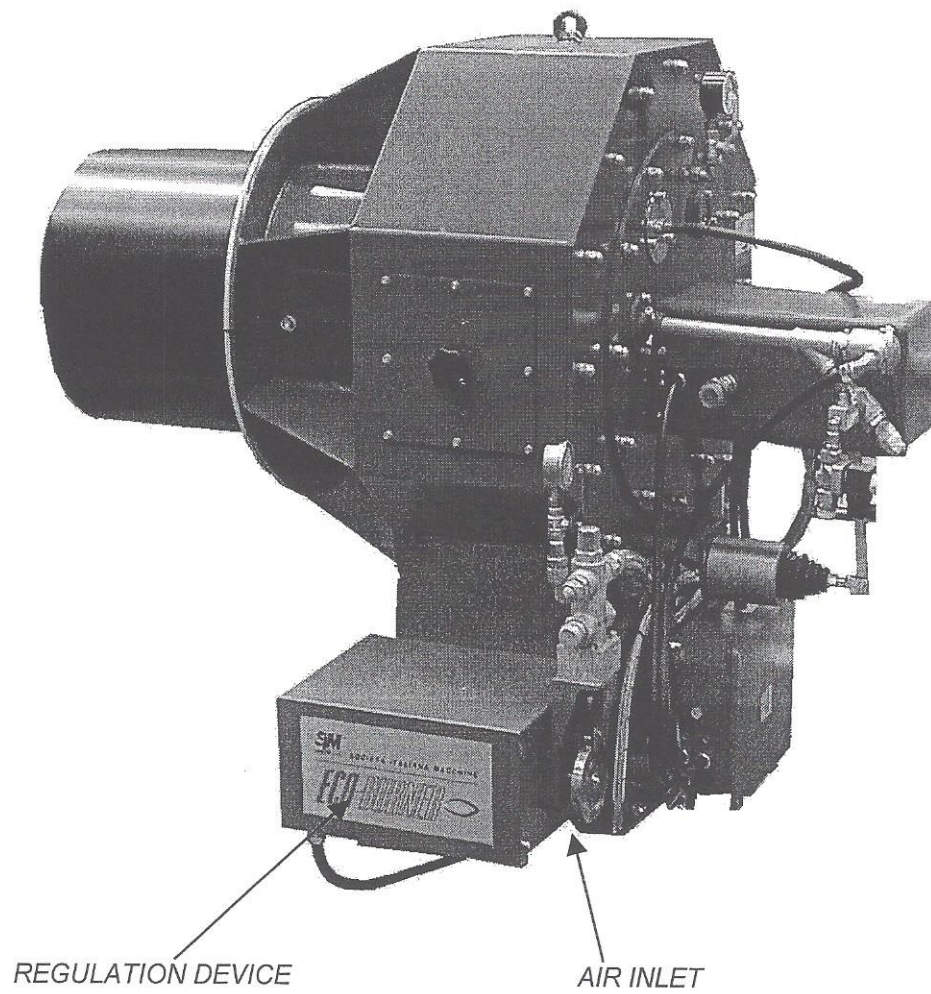



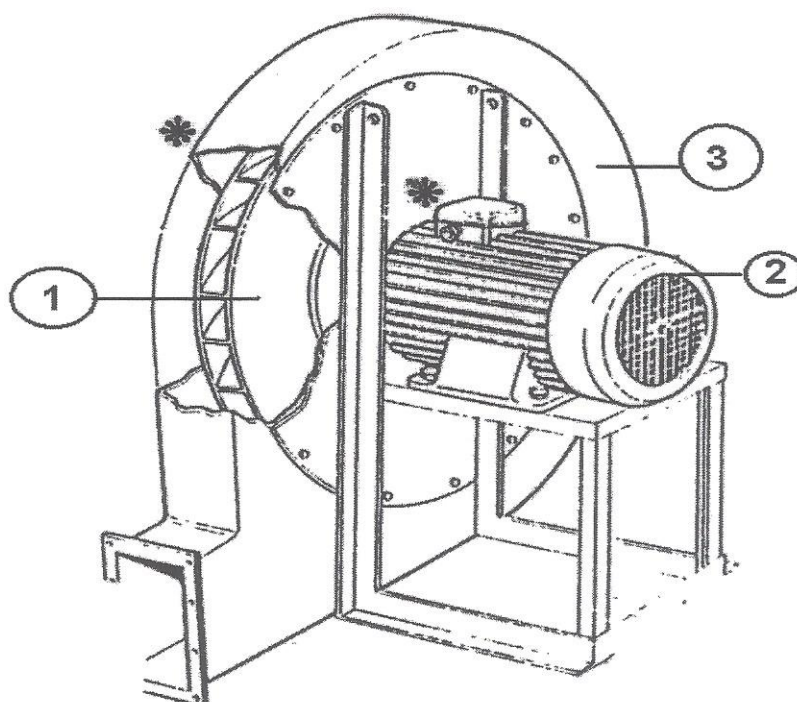
FIG. 2.4: BURNER & AUTOMATIC FLOWRATE CONTROL



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### 2.4.5 Combustion air blower

The air taken in by the fan flows to the burner through an automatic flowrate adjusting device. The blower (Fig. 2.5) is made up of a fan (key 1), a drive shaft and an electric motor (key 2). The fan is located inside the metal screw (key 3) fitted with an air suction and delivery nozzle. The drive shaft is integral with the impeller and is sustained by supports. The motion transmission between the electric motor (key 1) and the axel is through direct coupling. The fan is fitted with a soft starting system. The air taken in by the fan flows, via a duct equipped with a vibration-proof coupling, to the burner through an automatic flowrate adjusting device.



(\*) LUBRICATION POINTS

FIG. 2.5: BLOWER FAN

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## 2.4.6 Smoke exhaust system and automatic air flowrate control

The smoke extraction system withdraws the smoke generated during combustion and automatically adjusts the flow inside the drying cylinder.

The system consists of:

- 1 electrically-driven smoke exhauster;
- 1 control radial segment valve.

The smoke exhaust (FIG. 2.6) is used to withdraw the smoke generated inside the drying cylinder and to convey it as follows: first, in a dedusting circuit, then into the chimney for discharge to the open air. The smoke exhaust consists of an impeller (key 6), a drive shaft (key 5) and an electric motor (key 1). The extractor is average pressure axial type and is located on ground level on a dedicated baseplate. The impeller (key 6) is arranged inside a screw (key 7) equipped with air suction and delivery nozzle. The drive shaft is integral with the impeller and supported by a shelf. Motion transmission between the electric motor (key 1) and the shaft (key 5) occurs through the V-belts (key 3) and pulleys (key 2, 4).

The extractor is fitted with a soft start-up system.

The automatic air flowrate control (key 8) is coupled with the smoke exhaust system, suction side by means a coupling (key 9) and is controlled by means an actuator (key 10).

The automatic air flowrate control (FIG. 2.6A) is designed to keep the drying cylinder under a vacuum in the range of 3 to 8 mmH<sub>2</sub>O.

The automatic air flowrate control (key 1) is mounted on the suction nozzle of the smoke extractor and is linked to the smoke exhaust circuit by a vibration-proof collar. The adjusting device consists of a radial segment valve (7) which is opened/closed by an actuator (key 4) according to the vacuum inside the drying cylinder. The adjusting device is fitted with three limit switches for opening the gate in three positions (0%, 30%, 100%) with 0% opening indicator on the computer. In the pre-oven section there is a vacuum sensing element, which sends a signal to the plant control and monitoring system.

Vacuum inside the cylinder is checked by means P-sensor and GEFTRAN 3400.


On forefurnace (burner side) there is a pipe connected with P-sensor (DRP 64). The P-sensor detect the effective vacuum and compare the effective value with value pre-setted. In case of difference sensor send a signal at plant control system GEFTRAN 3400.

GEFRAN control the radial segmented valve driver that change the opening for to eliminate the difference.

Therefore, after setting the vacuum value, the plant is capable, through its instruments, of adjusting the smoke exhaust in such a way as to optimize the heat exchange inside the cylinder and cause the flame to take on an ideal shape to develop correctly in an environment of dusty and humid aggregates.

This automated circuit cuts fuel consumption and, therefore, reduces air-borne dust and wear of filters.



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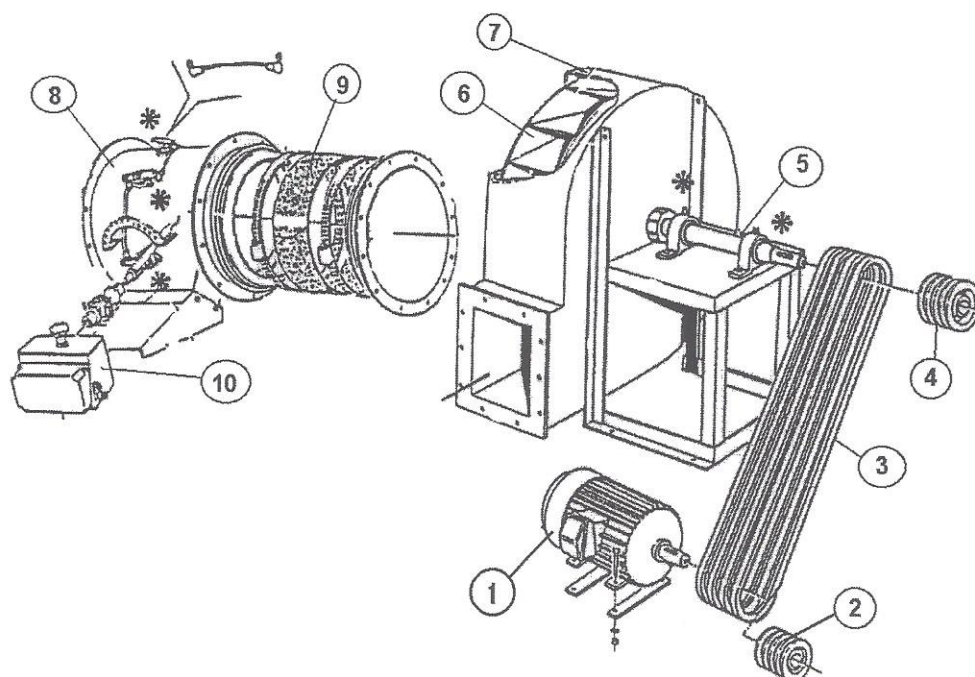


FIG. 2.6: SMOKE EXTRACTOR AND RADIAL SEGMENT VALVE

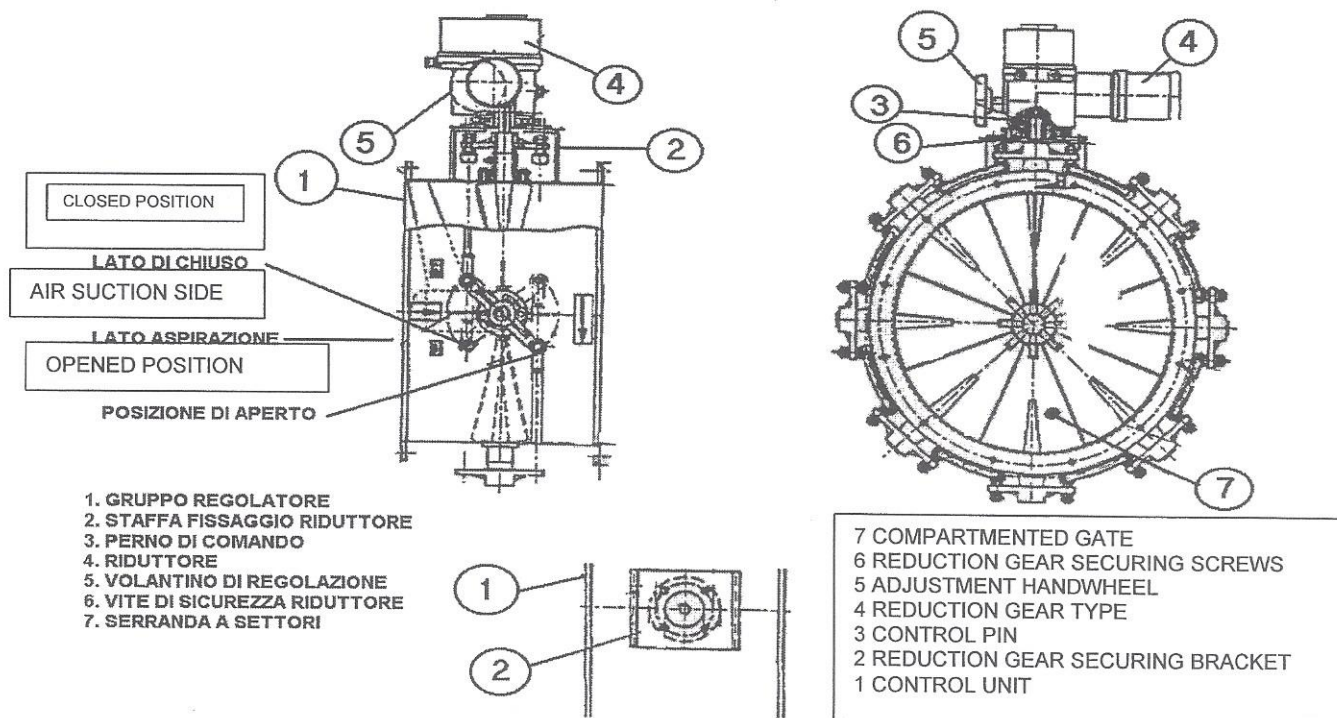



FIG. 2.6A: COMPARTMENTED GATE



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## 2.4.7 Fuel feeding system

The drier is equipped with a separate fuel feeding system (Fig. 2.7) consisting of:

- N. 1 fuel storage tank with valves.
- One heat exchanger, tube bundle type, (key 1) with temperature switch (key 3), safety valve (key 15) and temperature indicator (key 24);
- One electrically-driven pump (key 23) for circulating of the diathermic oil inside the exchanger (key 1) with manually valves (key 16) and no return valve (key 9);
- One electrically driven pump (key 25) for circulating of the fuel oil inside the air separator (key 4C) with filter (key 26) and manually valves (key 28, 29). Air separator is electrically heated.
- One fuel booster system consisting of one electrically-driven pump (key 4A) and filter (key 4B) for fuel feed the burner nozzle and heat exchanger (key 1). Pump and filter are electrically heated.
- One electrically driven pump (key 10) for circulating the diathermic oil on the ramps with valves (key 11), with diathermic oil cylinder (key 17) and thermostat (key 6) (setted 70-80°C). The thermostat control pump (key 10) according the temperature of the diathermic oil circulation inside the double-walled coaxial pipes of the ramps.
- Double-walled coaxial pipes with cavity heated with diathermic oil.
- Valves, regulating valve, no return valve etc.. (key 7, 8, 9, 11, 15, 16, 21, 27, 28, 29).

The fuel collected inside the storage tank is kept at a temperature of approx 80 °C by the diathermic oil, which is supplied by one oleothermic heater.

The fuel temperature is controlled by a thermocouple (set at 80°C), that provides to control the pump. (Diathermic oil temperature is 180 - 200 °C.)

The fuel taken in from the tank and filtered (key 26) is circulated inside the air separator (key 4C), through an electrically driven pump (key 25), and then conveyed to the tank return circuit at 2-3Bar pressures.

The fuel needed from the burner is taken by the burner feed-booster system (key 4A) from the air separator, heated inside the heat exchanger and delivered to the burner at a pressure of 25Bar.

Excessive fuel return inside the air separator.

The electric/pneumatic valve (key 27) allows the recycle of the fuel (fuel tank and air separator) when the burner is not in operation (fuel booster system not in operation). When the burner is in operation (fuel feed pump (key 4A) in operation) the electric/pneumatic valve (key 27) allow stop the recycle of the fuel oil with the tank and active the fuel circulation burner and air separator. The valve (key 8) allows the automatic discharge of the air during the burner operation. The valve (key 8) must be setted at first start of the plant y SIM technician.

A thermostat set at 80 °C prevents the burner fuel thrust pump to operate when the fuel temperature does not meet the expected values.


From the tube side, the diathermic oil is circulated by the electrically driven pump (key 23) that withdraws the hot oil from the oleothermic heater.

The filter and the pipings, which carry the fuel from the tank to the preheater and there from to the fuel thrust pump, are double walled.

The fuel circulates inside the inner chamber whilst the diathermic oil circulates within the outer chamber (void) by means one electrically driven pump (key 10).

This circuit keeps the piping that carries the fuel to the burner at a temperature of 70 - 80 °C.

This pump (key 10), controlled by the thermostat (key 6) fitted on the diathermic oil cylinder (key 17), must be activated before burner start and stopped when burner is in operation.

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### 2.4.8 Chimney

The plant is fitted with a cylindrical shaped chimney to discharge the combustion gases, after an adequate treatment into the air, at a certain height above.

The chimney consists of overlapped flues and is arranged vertically above the smoke extractor by means of interbolted flanges.

### 2.4.9 Aggregates elevator

The elevator (FIG.2.08) consists of a pair of chains (key 1) forming a closed loop on two pairs of main pulleys (key 2). Each buckets (key 3), arranged to the chains and located at even distance, load:

- The hot aggregates coming from the drier and discharge them onto the screen;
- The recycle material coming from the recycle line and discharge them inside the dosing system.

The chains move inside the main flues, at whose ends the following items are installed:


- In the lower part the elevator base, the loading hatch, the pulleys driven with the counterweight tensioning system and an inspection hatch;
- In the upper part the driving pulleys and the delivery slide. Bolted to the slide are wear-proof plates and a deviator, pneumatically controlled by a piston with incorporated magnetic limit switches that enable the aggregates to be conveyed to the below mentioned silo "tout venant" or onto the screen for selection.

The motion of the driving pulleys is transmitted by a reduction gear (key 4) coupled to an electric motor (key 5), arranged outside the flues on a dedicated support in the upper part of the elevator. The reduction gear is equipped with a system preventing rotation in the reverse direction.

The rotation shafts are integral with the pulleys and arranged on tight supports, placed outside the flues and fitted with bearings.

The buckets are made of abrasion-proof steel.



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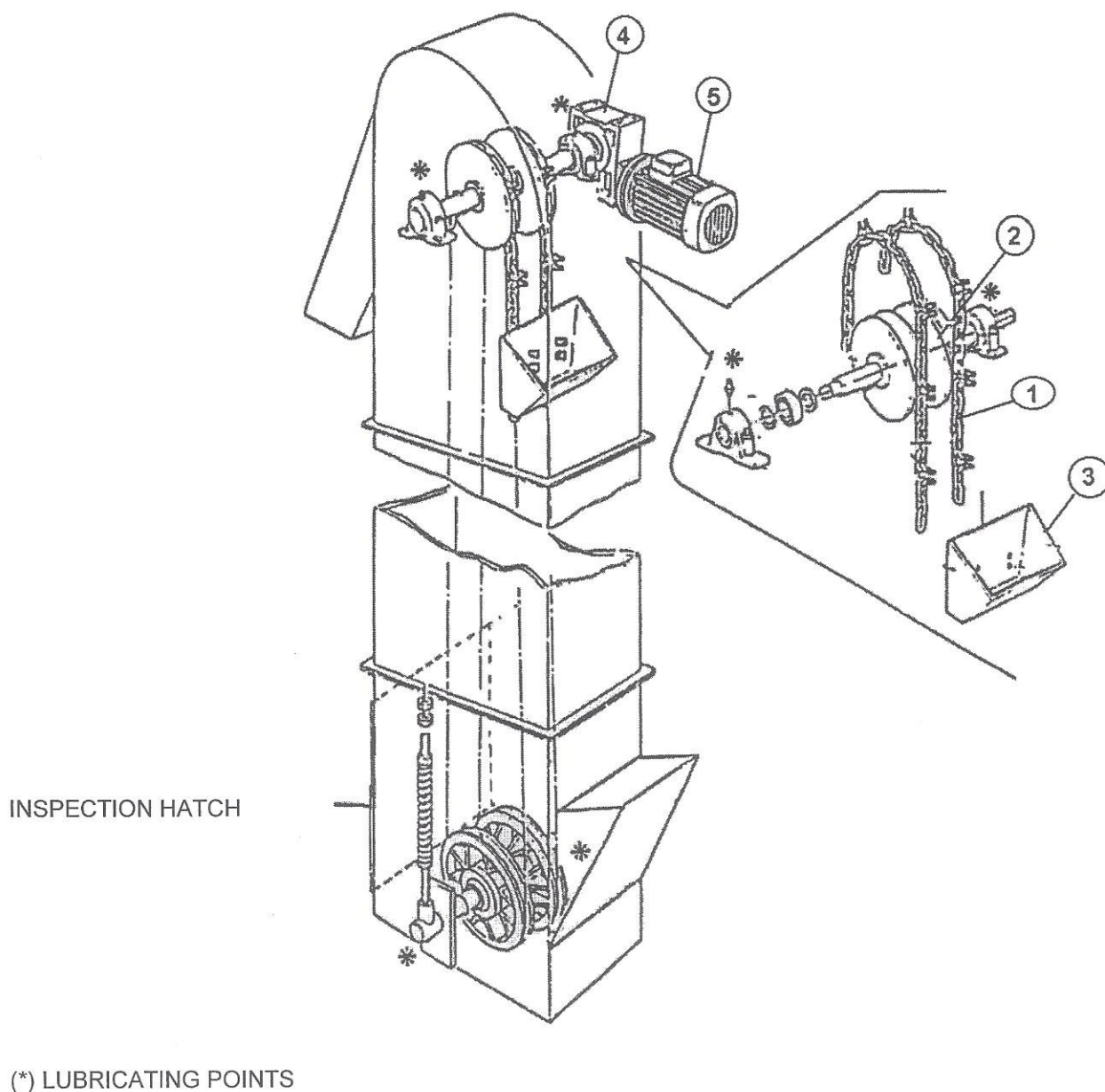



FIG.2.08: BUCKET ELEVATOR

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## 2.4.10 FILLER LINE

### 2.4.10.1 Filler holding silos

The plant is equipped with:

- 1 large silos arranged near the tower (capacity 30m<sup>3</sup>).
- 1 small silos arranged inside the tower, bolted to the hot aggregates silo above the weighing hopper.

The large silos are designed for recovery and storage of mineral and recovered filler to be used for the production.

The filler recovered from the dedusting plant (filter) are conveyed to the small silo filler inside the tower. The storage fillers are conveyed from the storage silo fillers, via worm conveyors and elevators, to the small silos arranged inside the tower for immediate use.

The mineral and recovered filler are conveyed from the relevant small silos to the filler weighing hopper via worm conveyors.

If product is in excess, the material is discharged, from the holding silo, into trucks and carried elsewhere, by discharge pipe fitted with a manual valve.

The silo (FIG. 2.10) is a cylindrical vessel (key 1) built of sheet steel and supported by frames in steel sections secured onto 4 supports (key 2).

The upper part of the silo has cylindrical walls whilst the lower part has an overturned truncated cone shape in order to ease the discharging of the product. At the end of the cone of the holding silo there is a discharge opening and a flow shut-off system with butterfly valve.

At the end of the cone of the small tank inside the tower there is a worm (FIG. 2.12) that allows for the transfer of the product into the weighing hopper.

The small silo is equipped with:

- An inspection hatch;
- Minimum/max level indicators, rotary shaft type. The minimum level causes the worm conveyor to start automatically for transfer of the filler from the holding silo to the relevant small silo when the preset minimum level is exceed. The maximum level stops automatically the worm conveyor for filler transfer from the holding silo to the small silo when the preset maximum level is attained.

The holding silo is equipped with:


- Air valve
- An continuous level indicator
- A pneumatic fluidification system arranged in the truncated cone portion of the silos, to ease the sliding of the materials. The system consists of a manifold linked to the compressed air system with 6 nozzles arranged in groups of three on two different levels. The nozzles are staggered by 60° to each other. Each nozzle is equipped with a diffusion plate that when actuated by diffuses compressed air inside the silo. The system arranged upstream the manifold is made up of a filter, a pressure regulator that reduces the pressure to 1 Bar and a pressure gauge. The system starts to operate automatically when the worms start.
- External chute pipe with pneumatic valve for discharging extra filler.
- Inspection hatch on the top.
- Butterfly valve with pneumatic control on the extraction duct

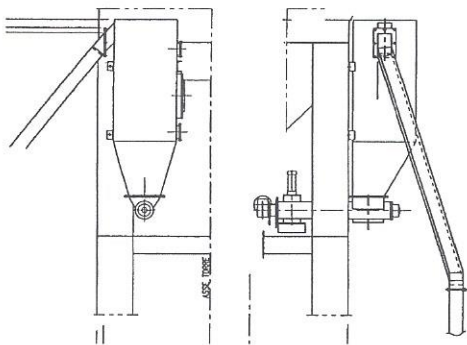
The inspection hatch is accessible by vertical ladders.

The silo top is fitted with handrails according to the applicable rules and regulations for preventing accidents at works.

The movements of the materials are fully controlled from the SIMTHESIS system.



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(SMALL SILO FILLER INSIDE THE TOWER)

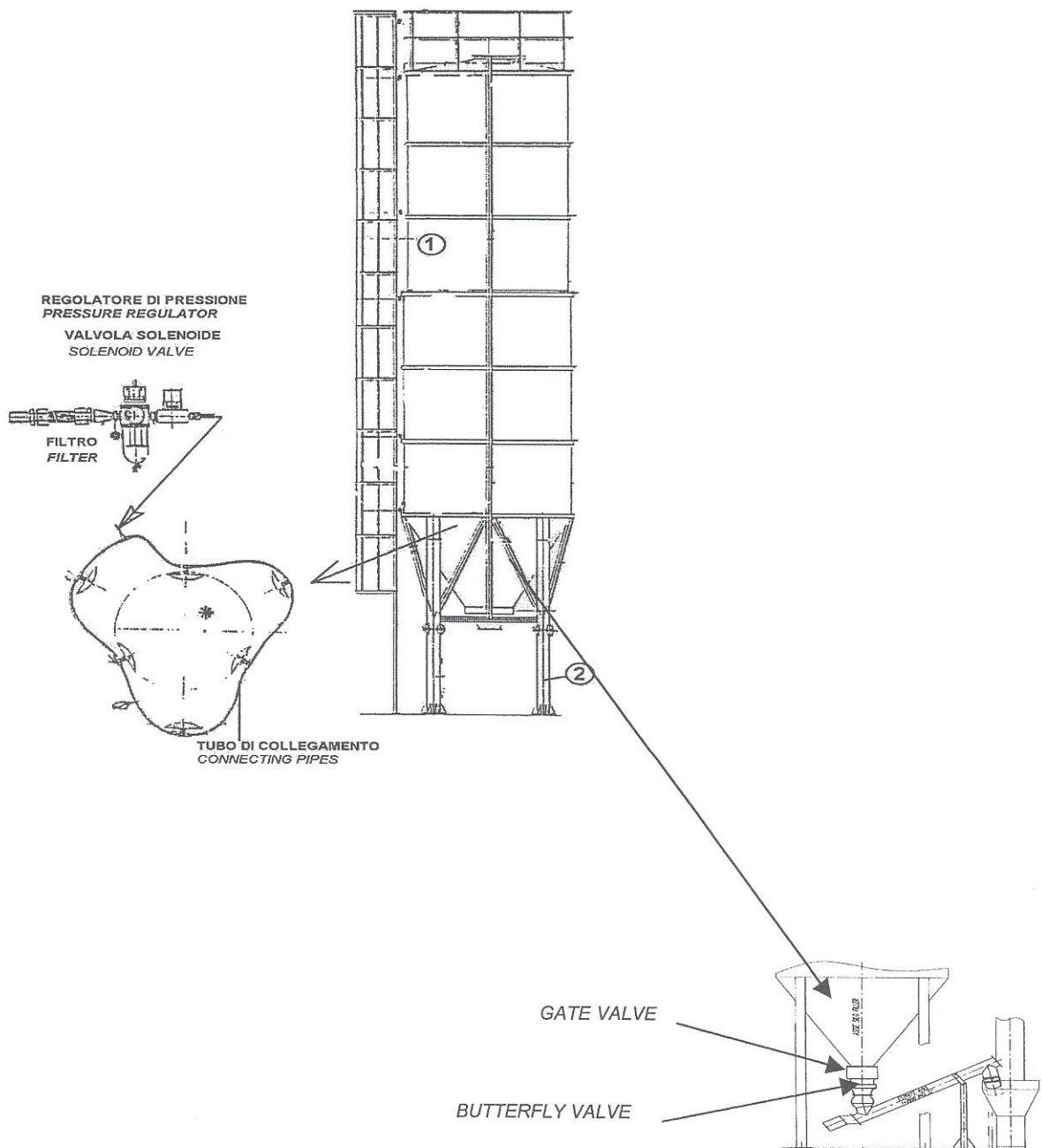



FIG. 2.9: FILLER STORAGE SILOS

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#### 2.4.10.2 Smoke feed line

The hot smoke exiting the drying/reheating cylinder carry beside the combustion products (vapour, CO<sub>2</sub>, SO, SO<sub>2</sub> etc.) a large amount of dust freed from the aggregates. This dust, the so-called "recovered filler" is re-utilized for the bituminous conglomerates.

The smoke, before being discharged to the atmosphere, needs to be purified. The purification aims both at reducing the air pollution to minimum levels according to the applicable EEC rules and regulations and at allowing this dust to be re-utilized in the conglomerate production cycle. To this purpose a conveyor is fitted in the stationary section of the drying cylinder that extracts the smoke and conveys it to a dedusting system, dry type where the dust is separated from the vapour and from the combustion products. The dust is recovered, while the volatile combustion products are discharged into the atmosphere through the chimney.

The gases to be purified extracted from the drying cylinder are conveyed into:

- A scrubber to make the greater dust particles (sand) fall onto the hopper underneath;
- A set of filter baghouses to make the finest dust (recovered filler) fall onto the hopper underneath.

The recovered dust at a temperature of 110-120°C is then transferred by means of worm conveyors to the filler elevator.

##### 2.4.10.2.1 Scrubber

Inside the I 4M scrubber the first smoke filtering takes place, whereby most of the particles with a size greater than 0,10 mm (sand) are removed.


The scrubber consists of a closed vessel, directly arranged with the filter-baghouse, placed on a same filter container-support. The top section has vertical walls and houses a set of labyrinth diaphragms; the bottom section is of truncated pyramid shape. The truncated pyramid wall slope facilitates the material flow to the output. On one of the walls a watertight inspection hatch is fitted.

The smoke is fed into the scrubber through a side opening and is forced along a tortuous pathway among the diaphragms, whereby the coarse grains (sand) are separated from the smoke and the finest ones (recovered filler).

The separated sand precipitate to the bottom, leave the scrubber and are fed, through the single worm conveyor in the container lower part fitted. The sand and recovered filler (from the scrubber a from the filter) are conveyed by means external worm conveyors to the filler elevator base, to be then sent to the tower.

The smoke carrying the finest dust is conveyed, through a dedicated output, to a deeper filtering system, consisting of filter baghouse (Para 2.4.10.2.2).



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#### 2.4.10.2.2 Filter baghouse

The DM-IF 294 filter baghouse (FIG. 2.10) has the function of retaining the filler still suspended in the exhaust gases after the scrubber.

The filter baghouse is made up of an airtight container (key 1) located on a metallic framework made up of 6 supports. The vessel's upper part is a vertical wall chamber, the lower part (key 2) a reverse truncated pyramid chamber at whose end a worm conveyor (key 3) is fitted.

The upper chamber is subdivided into 14 cells (key 4), each of them fitted with 21 baskets that support 21 cloth bags (key 5). On one chamber wall there is a flanged connection (key 6) for the smoke manifold coming from the scrubber, on the other side wall there is a flanged connection (key 7) for the manifold connected to the smoke extractor.

The void inside the chamber is created from bottom to the top (the extraction is toward the cell top). Inside the chamber the smoke ducting is of longitudinally-variable section so as to allow for the smoke to reach all the filtering elements evenly (by reducing the section, the velocity at which the smoke crosses the filter bags increases).

Above the air ducting 14 airtight hatches are located (key 8), one for each cell, which can be opened by pneumatic pistons (key 9).

The upper chamber walls are insulated by 50 mm rockwool to prevent the heat dissipation that could give raise to unwanted condensate. The heat insulation layer is covered by aluminum panels.

On the chamber top there are 7 airtight inspection hatches (key 10), one every two contiguous cells.

The access is through a vertical metal ladder.

The chamber top is fitted with handrails according to the applicable rules and regulations for preventing accidents at works.

The truncated pyramid chamber underneath is hollow to convey the dust into the worm conveyor. The chamber is fitted with a hatch for emergency filler discharge and with inspection hatches.

The gases partially dedusted at the scrubber exit are sucked in the collector through a variable section side ducting (key 6) and are spread all along the chamber.

Inside the collector the gases undergo a notable expansion due to the volume increase, with a consequent velocity loss. In these conditions the heavier dusts that have been not retained by the scrubber tend to deposit and precipitate to the collector bottom.


The void in the bags causes the gases to raise. The gases cross the bags all along the bag surface and the finest particles, still suspended, are retained by the bag surface.

The removal of the dusts from the bags is obtained by inverting the flow inside each filtering cell according to a cyclic sequence controlled by timer or differential pressure switch, so as to dedust all the filtering bags. For some instants the hatch located above the smoke ducting is opened pneumatically. The relevant filtering cells suddenly pass from the vacuum status to the atmospheric pressure. This pressure change causes a sudden expansion of the bag and, therefore, the separation of settled fillers.

The separated fillers fall to the bottom and are fed, through worm conveyors, to the filler elevator base, whereupon they are sent to the relevant small tank for recovered fillers inside the tower.

#### COMPONENTS OF THE FILTER HOUSE

- Differential pressure switch for filter cleaning system automatic operation;
- Load loss and clogging detector (U pipe). The detector indicates the static pressure drop between the dirty chamber (smoke emission side) and the clean chamber (purified smoke exit side) of the filter house. It consists of a glass U pipe containing distilled water, located on a plate above two graduated scales. The detector is connected, via rubber tubes, to two outlets, one on the clean air chamber and one on the dirty air chamber, located in the upper part of the filter. The difference in pressure of the two chambers is shown by the water level inside the tube. The graduated scales are identical and are constructed so as to enable the reading of the total pressure drop in one of the two scales. In the middle of the two scales is a level marker which, when the plant is off, must be placed according to the water level reached inside the U pipe;


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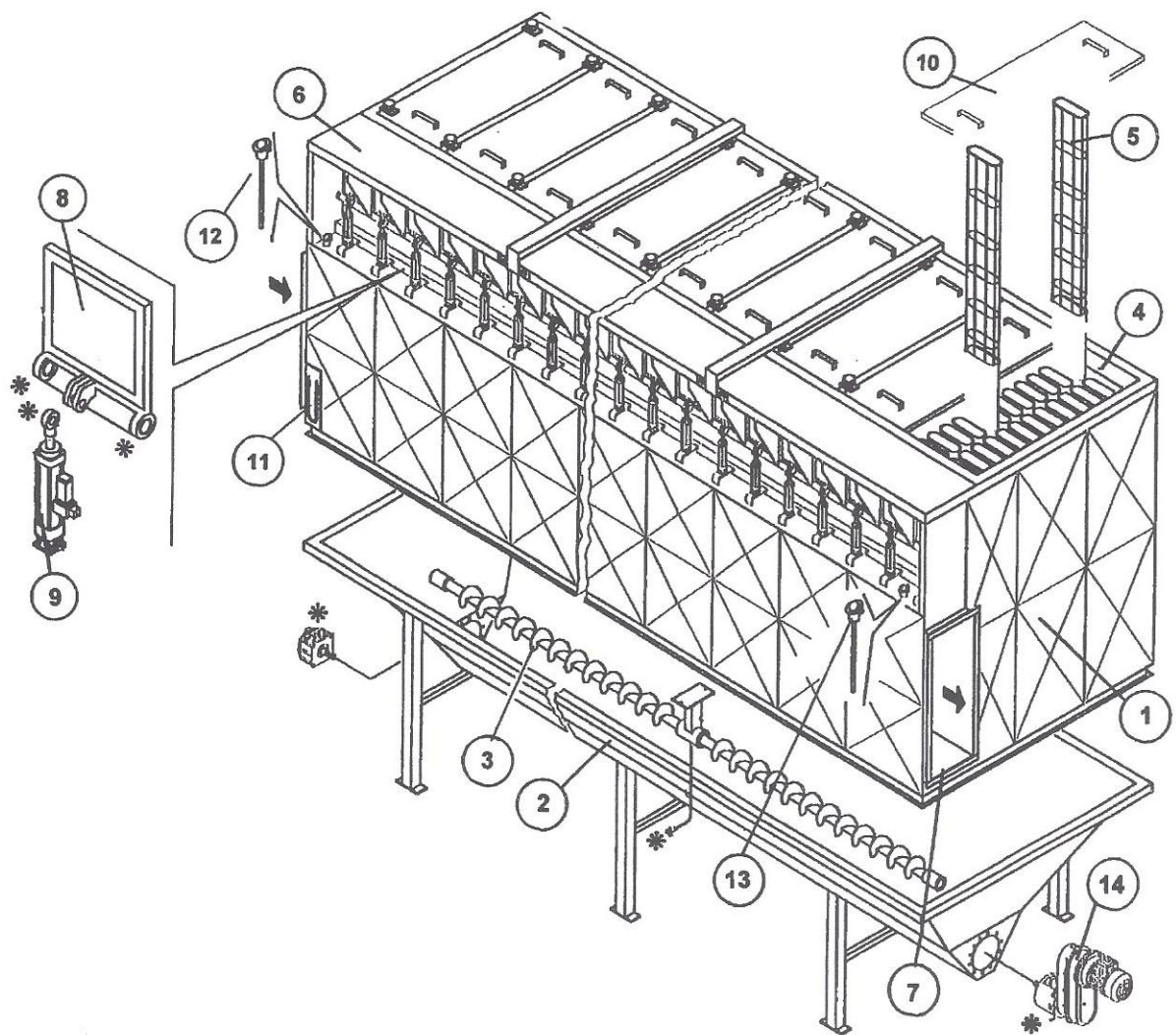
#### NOTE

**IF U-PIPE IS FITTED CAREFULLY ADJUST THE DEPRESSION INSIDE THE FILTER.  
ECCESSIVE EXHAUST, FROM SMOKE EXHAUST FAN, SUCKS THE WATER FROM THE U-PIPE  
AND SEND THEM INSIDE THE MAGNEHELIC SENSOR.  
IN THIS CASE THE DETECTOR COMING OUT OF ORDER**

- Thermocouples that detect the filter inlet/outlet gas temperature. (OPEN AIRTIGHT HATCHES IF THE TEMPERATURE IS UPPER OF THE PRESETTED VALUES)
- Porthole for emergency discharge
- N. 1 internal worm for the extraction of the fillers




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FIG. 2.10: FILTER BAGHOUSE

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### 2.4.10.3 Tubular Screw conveyors

Tubular screw conveyors are used to transfer:

- Sand and recovered filler, recovered respectively from the scrubber and the filter, to the fillers elevator;
- The filler from the recovered filler holding silos to the filler elevator;
- The filler from the auxiliary silos filler to the weighing hopper;
- The filler from the filler weighing hopper to the mixer.

In particular the plant is equipped with the following worms:

- N. 1 screw placed in the filter scrubber/baghouse;
- N. 1 tubular screw (FIG. 2.11) for transfer sand and filler from the filter baghouse to the filler bucket elevator (key 2);
- N. 1 tubular screw (FIG. 11A) for transfer the filler from the recovered silos to the filler bucket elevator (key 7);
- N. 1 tubular screw conveyor fitted with quick-closing valve for transfer the filler from the auxiliary silo filler inside the tower to the filler weighing hopper (FIG. 2.13);
- N. 1 tubular screw conveyor from the filler weighing hopper to the mixer.

The tubular screw conveyor installed under the filter baghouses has no closed channel.

Tubular screw conveyors (FIG. 2.12) are made up of an archimedean screw (key 1) enclosed inside a duct (key 2) with a detachable inspection cover. Near the duct ends there are two inlet/outlet openings for the filler impelled by the archimedean screw.


The screw rotation is controlled by a reduction gear (key 3) driven by an electric motor (key 4).

The tubular screw conveyor for transferring the filler from the small silos to the weighing hopper (FIG. 2.12) is also fitted with a pneumatically-controlled quick-closing valve (key 1), with mechanical end stops showing the status of the valve, thus allowing for a more accurate dosing.

The tubular screw conveyor that transfers the fillers from the small silos to the weighing hopper is fitted with a safety system disabling the worm conveyor operation if the output hatch is non opened.

FIG. 2.11, 2.11A shows the tubular screw conveyor arrangement in details.



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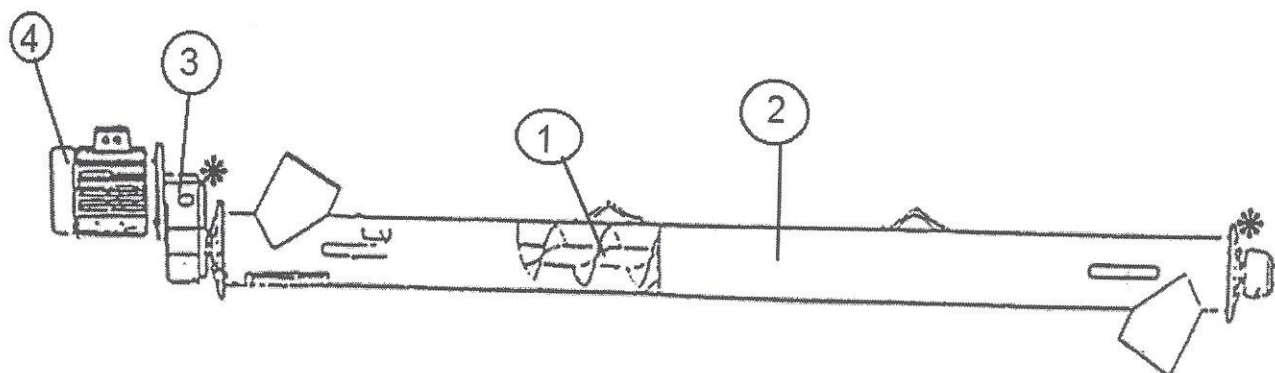
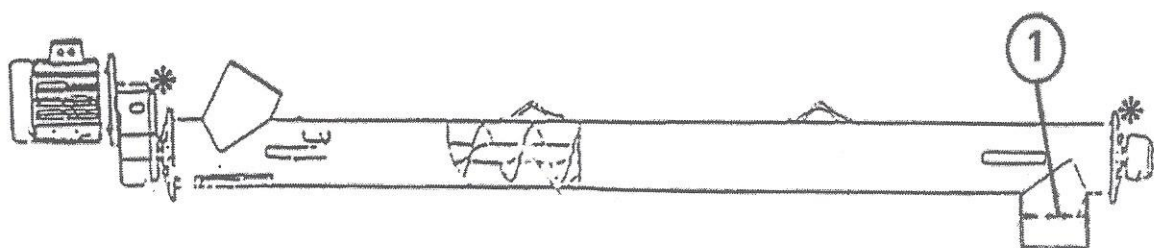



FIG.2.12: WORM CONVEYOR



(\*) LUBRICATION POINTS

FIG.2.13 : WORM CONVEYOR WITH PNEUMATICALLY-CONTROLLED QUICK-CLOSING VALVE

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#### 2.4.10.4 Filler elevator

The elevator (FIG. 2.14) is made up of a couple of chains (key 1) wound at closed ring on two pairs of bearing pulleys (key 2). Buckets (key 3), connected to the chains and located at even distance, load from the bottom the fillers and discharge them inside the small silos inside the tower.

The chains move inside the main flues, at the ends of which the following items are fitted:


- In the bottom section, the elevator base, the loading hatch, the driven pulleys with the relevant tensioning system and an inspection hatch;
- In the top section, the driving pulleys the delivery slide for the discharge of filler into the small tank.

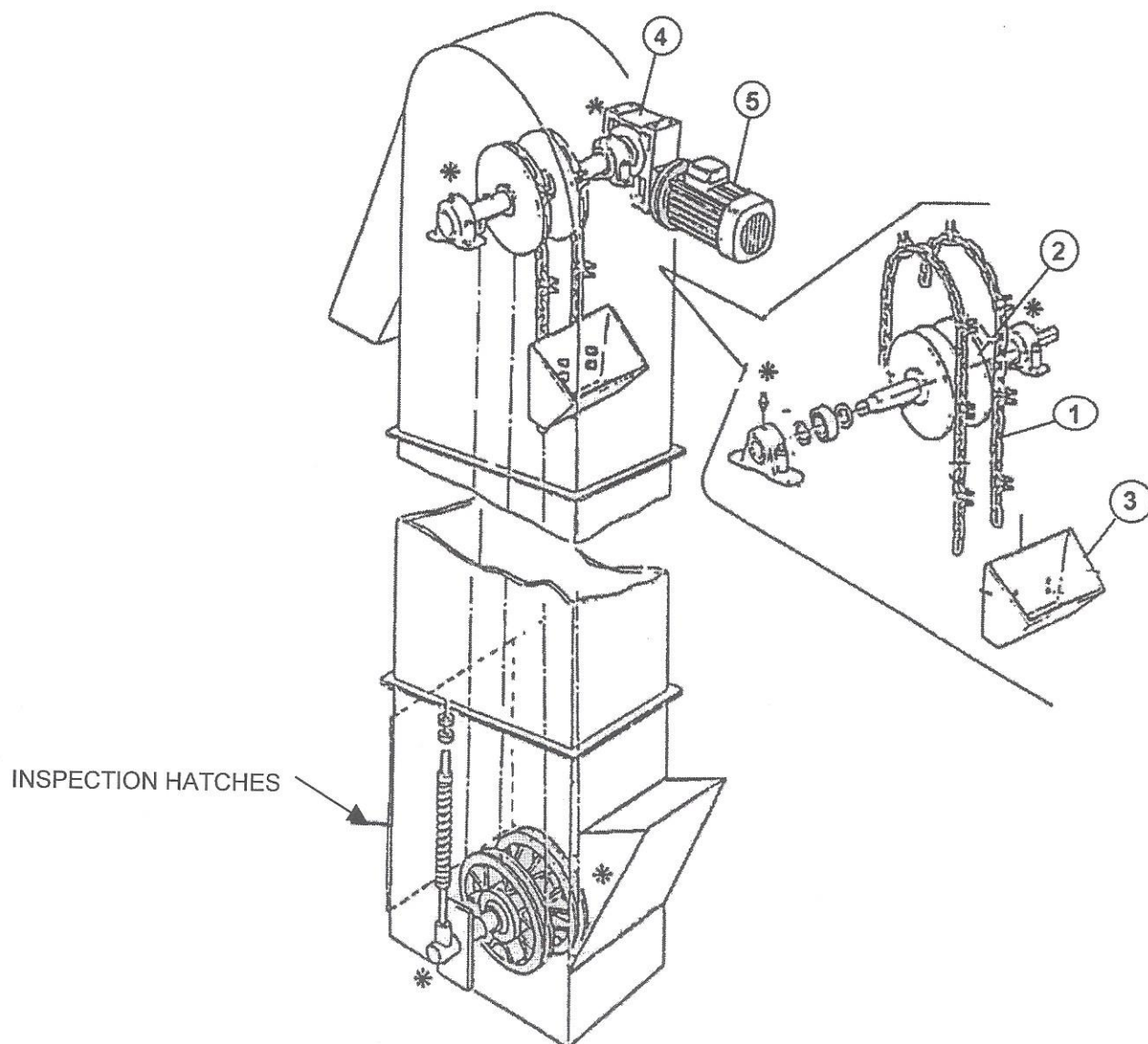
The driving pulley motion is transmitted by a reduction gear (key 4) fitted with an anti-reverse rotation system coupled to an E/motor (key 5), arranged outside the flues on a dedicated support on the elevator top.

The rotation shafts are integral with the pulleys and are fitted on tight supports located outside the elevator and fitted with bearings.

The buckets are made of abrasion-resistant steel.




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(\*) LUBRICATION POINTS

FIG. 2.14: BUCKET ELEVATOR FOR FILLER

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#### 2.4.11 Bitumen circulation system

During the plant operation the bitumen stored into the tanks is kept in circulation by means of a circulation system that sends the bitumen to the bitumen weighing hopper. The continuous circulation helps to keep all the bitumen at the liquid status inside the tank. Thermostat controls the bitumen temperature tumen inside the tanks.

##### COMPONENTS OF THE SYSTEM (FIG. 2.15):

- Suction and filling pipes from/to each storage tanks, fitted with manually and remotely controlled shut-off valves.
- N. 1 off electric drive gear pump (key 3) for bitumen circulation;
- N. 1 off three-way valve (key 6) for deviating the flow into the weighing hopper. The valve is remotely controlled.
- Termocouple (key 9) for control bitumen temperature on the system.

The delivery pipes are of insulated double-walled type.


The bitumen is displaced by a pump directly coupled to an electric motor by a coupling joint.

The pump is of the gear type with a chamber heated by the diathermic oil. Valves and filter are heated by the diathermic oil.

The system is equipped with a temperature detector on the SIMTHESIS system.

The three-way motorized valve sends the bitumen from the manifold to the bitumen weighing hopper by means of the electric pump (see para 2.4.12.6).



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## 2.4.12 MIXING TOWER

The materials coming from the three feeding lines (aggregates, fillers and bitumen) are conveyed through the elevators to the mixing tower in order to complete the production process.

In particular:

- The hot aggregates, to determine the mix composition according to the specifications (grain size and weight), are finally selected by a vibrating screen, placed on top of the mixing tower, which provides to accurately re-sort the hot aggregates according to their sizes and to collect them in separate compartments, each fitted (in the lower part) with a hatch, activated by pneumatic pistons, for discharging the material into the hot aggregates weighing hopper;
- The filler is collected into the filler holding silo arranged inside the mixing tower. At the end of the cone of every small silos there is a worm conveyor that conveys the material into the filler weighing hopper;
- The heated bitumen is withdrawn from the manifold by a motorized valve located on the circuit which enables it to enter the bitumen weighing hopper.

From the three weighing hoppers the different materials are sent to the mixer, where mixing occurs according to the following sequence: first, the aggregates; soon after the bitumen is added by means of sprayers, and finally the filler. The mix lasts about 45 seconds.

Dust produced inside the mixing tower is recovered through a dedicated system.

The following units are installed inside the mixing tower:

- 2.4.12.1 Vibrating screen;
- 2.4.12.2 Hot bins;
- 2.4.12.3 Hot aggregates scale;
- 2.4.12.4 Filler weighing hopper;
- 2.4.12.5 Bitumen weighing hopper;
- 2.4.12.6 Pump for spraying the bitumen into the mixer;
- 2.4.12.7 Mixer
- 2.4.12.8 Tower anti-dust system

### 2.4.12.1 Vibrating screen

The aggregates coming from the bucket elevator are distributed, through a fan-shaped slide, over the entire surface of the screen that re-sorts the aggregates according to size and conveys them into separate compartments for further withdrawal.

On the slide there is fitted a deviator for conveying the aggregates into the "tout venant" silo underneath or to the screen for sorting. In addition the screen is fitted with a further deviator, located at the end of the meshes to discharge the out-of size stones separately. The deviators are pneumatically controlled by a piston with built-in magnetic end stop.


For sorting and storage of hot aggregates, the CB/140S QUICK plant is equipped with the following parts (FIG. 2.16):

- N. 1 screen located at the tower top for re-sorting the hot and dried aggregates;
- N. 1 bin partitioned in 5 compartments (4 selection + by-pass) with extraction opening and inspection hatches, for storage of the hot aggregates according to the screened sizes. A tube collects all material discarded by the screen and conveys it into a separate bin.

The screen (key 1) consists of 4 vibrating meshes with different sections, mounted on same number of frames, arranged in series on 4 decks and slightly sloped in order to facilitate sorting and distribution of the aggregates.

The aggregates so sorted are collected into the corresponding sloped decks underneath, from where they are conveyed by gravity into the corresponding hoppers.

The meshes are arranged on top of frames supported by a stiff structure and submitted to a vibrating movement horizontally.

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The vibrational movement is given by two eccentric masses driven by electric motors. The vibration amplitude is factory set. To ensure an adequate vibration, springs are fitted between the vibrating frames and the stationary structure.

The screen is enclosed inside a tight casing in order to avoid escape of the dust due to loading and vibration.

The meshes are made up of interlined steel wire of different diameters.

The frame and structure are made of steel.

A deviator, placed at the end of meshes, discharges the oversized particles to one side. The deviator is pneumatically controlled by a piston with built-in magnetic end-stop.

## 2.4.12.2 Hot bin

The screened aggregates are collected into a bin located underneath (FIG. 2.16).

The bin (key 2) is a vessel built of steel plate and laid by a frame made up of steel sections secured onto steel supports. The walls are of an overturned pyramid shape in order to ease flow of aggregates. Inside it is subdivided into 5 compartments (selection + by-pass), each ending with a hatch (key 3) operated by pneumatic pistons (key 4) with built-in end-stops.


By-pass bin is equipped with max level indicator rotary shaft type.

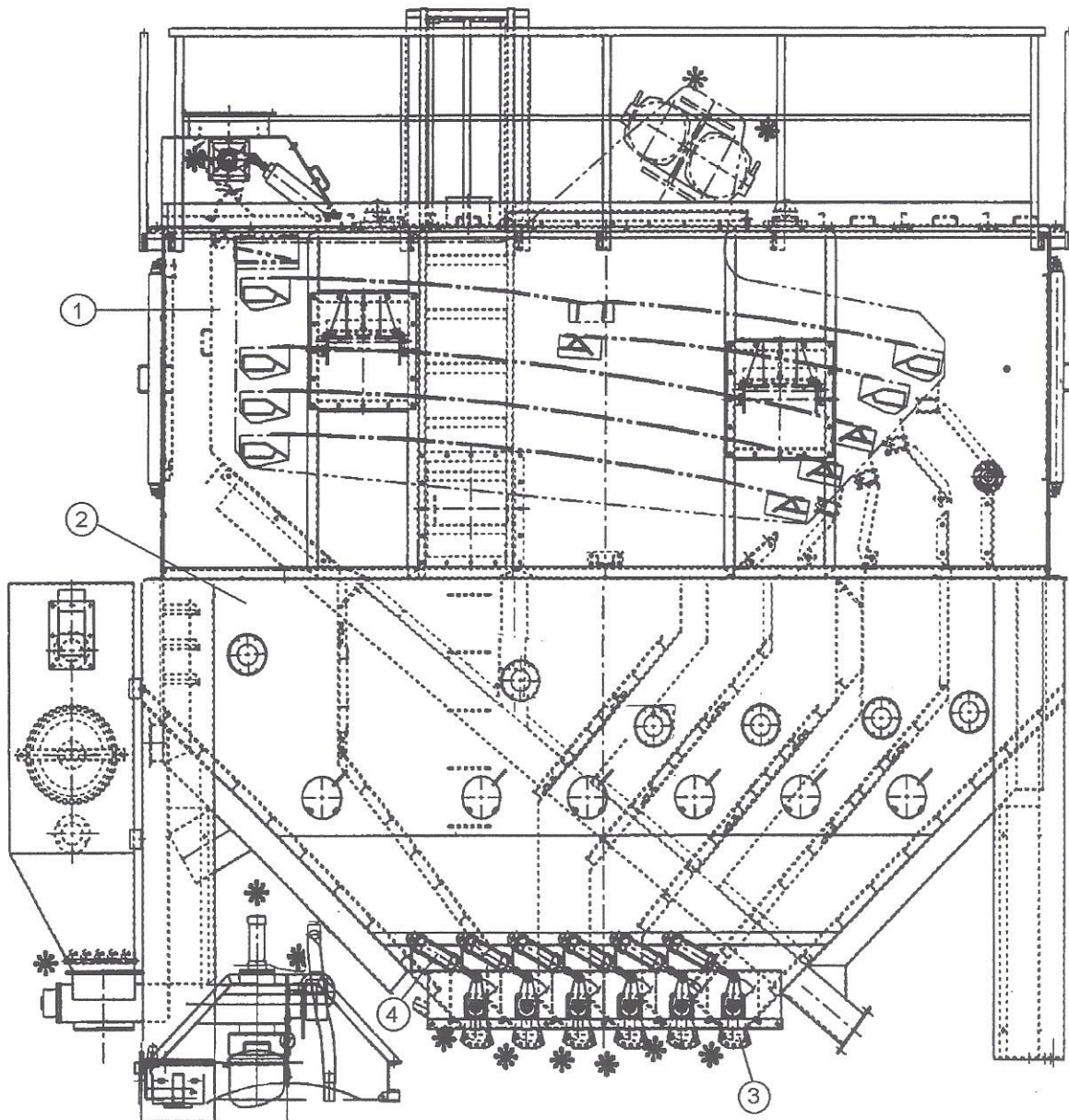
Hot bins are equipped with a continuous level indicators and a sample opening for collecting fractions of material to be tested.

Large side hatches are provided giving access to the hopper inside.

An overflow manifold discharges the excess aggregates to the ground.




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(\*) LUBRICATION POINTS (EACH SIDE)

FIG. 2.16: SCREEN & HOT AGGREGATES BIN

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### 2.4.12.3 Hot aggregate weighing hopper

The plant is equipped with 1 weighing hopper (FIG. 2.17) to accurately determine the amount of aggregates to be used in the bituminous conglomerate.

The weighing hopper is made up of an enclosed vessel (key 1) built of steel plates. Arms are bolted to the vessel and to the stationary structure of the tower. Between the stationary structure and the arms there are fitted three loading cells (key 4).

The upper part of each vessel has vertical walls, whilst the lower part has the shape of an overturned truncated pyramid in order to ease the discharge of material.

At the end of the vessel there is fitted an opening (key 2) to discharge the material into the mixer underneath. The discharge takes place through the opening of a hatch controlled by two pneumatic cylinders (key 3). A cylinder is fitted with mechanical end-stops.

The aggregates are forced by gravity from the hot aggregates hopper into the weighing hopper.

The products are discharged separately according to their size in order to accurately determine the relevant quantities.


Around the hopper there is installed an inspection shed with rails. This inspection shed can be accessed through ladders.

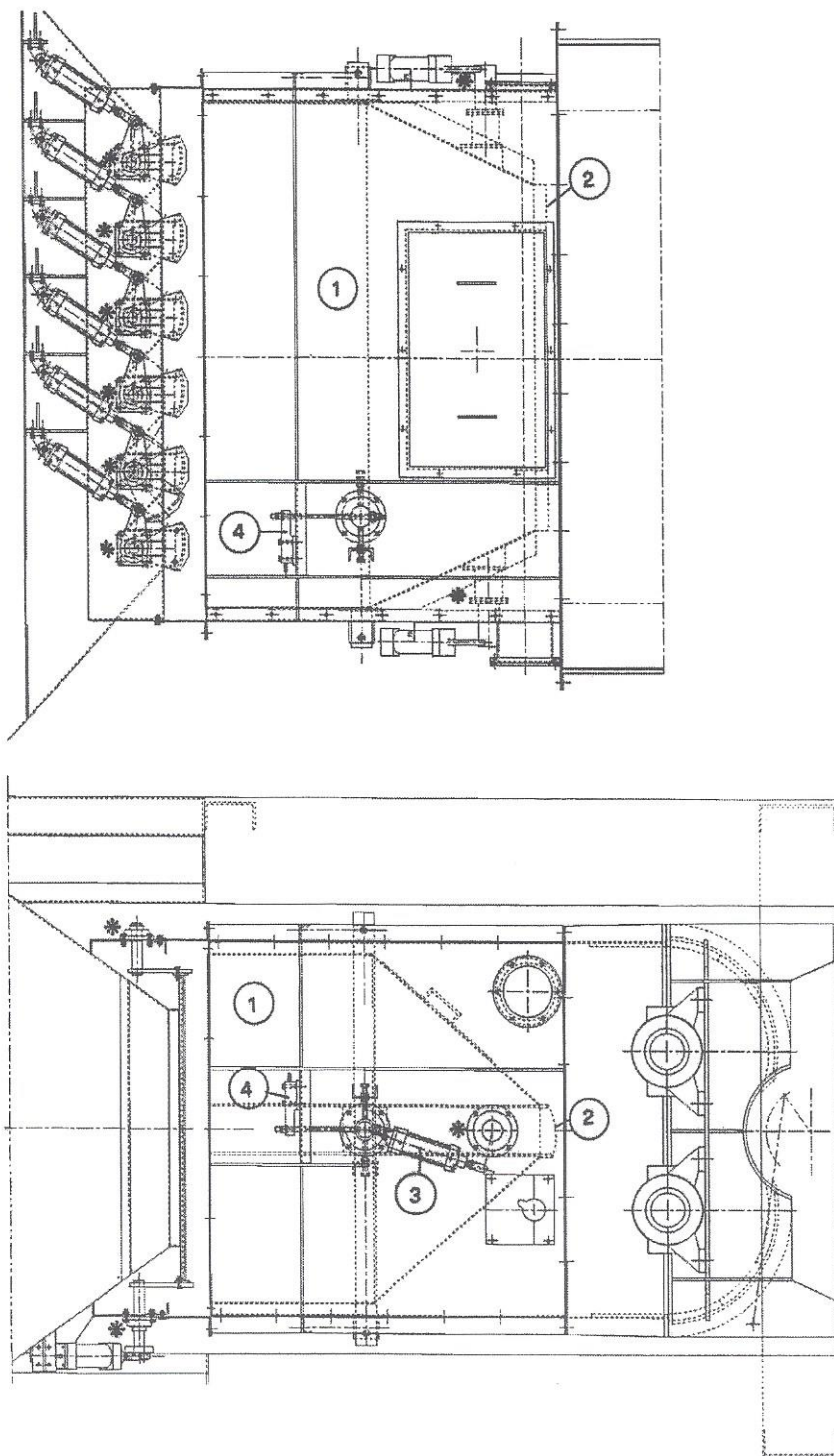
Weighing is controlled by SIMthesis control system.

Each loading cell sends out a signal - depending on the weight detected - to the control system which averages the values and determines the weight. Depending on the weight detected, it operates and adjusts the hot aggregate inflow.

#### COMPONENTS:

N. 3 loading cells


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(\*) LUBRICATION POINTS

FIG. 2.17: AGGREGATES WEIGHING HOPPER



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#### 2.4.12.4 Filler weighing hopper

The Plant is equipped with one weighing hopper to accurately determine the amount of sand and filler to be used in the bituminous conglomerate.

The weighing hopper (FIG. 2.18) consists of enclosed cylindrical vessels (key 1) built of steel plates. The vessel is secured to a stiff structure of the tower (key 2) through one welded connections, created in the top part of the vessel. Between the hopper connection and the supporting structure there is one loading cell (key 3).

The upper part of the vessel has cylindrical walls, whilst the lower part has the shape of an overturned truncated pyramid in order to ease unloading of material. An pneumatic vibrating device (Pos. 12) is fitted for to facilitate the discharge of the filler.

At the end of the cone there is an extraction opening with butterfly-type shut-off valve controlled by a pneumatic cylinder. The valve is fitted with mechanical limit stops that signal its state (opened or closed) A dedicated opening (key 11) allows for air relief from hopper inside.

The filler is carried from the tank to the vessel through worm conveyor (key 5).

Loading takes place in the upper part through a dedicated opening (key 6) created on the cover.

Connection to the corresponding worm conveyor is through hoses and pipe bundles (key 7, 8, 9, 10).

The material is extracted from the hopper via worm conveyors (key 4). Operation depends on the loading system. After every weighing, the pneumatically-controlled quick-closing valve closes and the weighed material worm conveyor starts automatically. At the same time the shut-off valve allowing for unloading the material into the mixer, starts operating. This valve keeps opened for a preset time (a few seconds) to allow for unloading all weighed material.


When unloading is over, then the shut-off valve closes: when it is fully closed, an acknowledgement is activated to allow for opening the pneumatically-controlled quick-closing valve and start a new weighing. Weighing is controlled by control SIMthesis system.

The loading cell send out a signal - which is proportional to the weight detected - to the control system.

Depending on the detected weight, it operates and controls the worm conveyors that carried the sand and the filler.

#### COMPONENTS:

N. 1 loading cell

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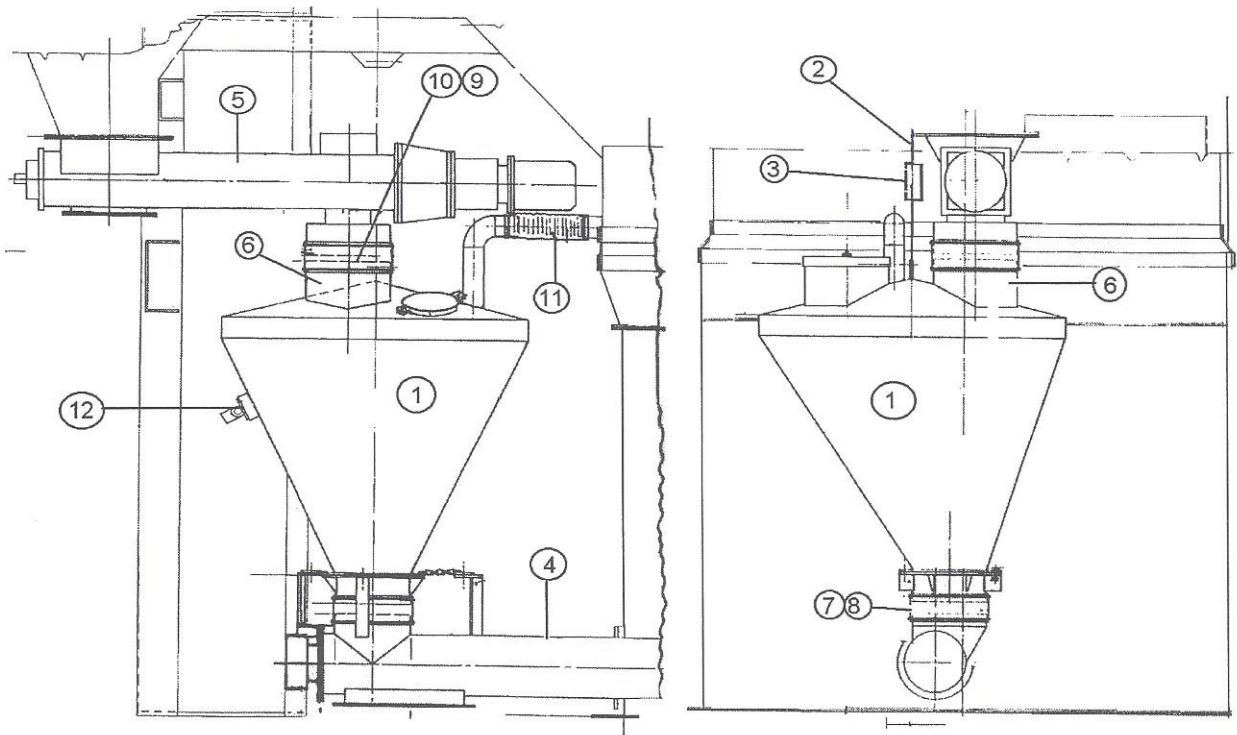



FIG.2.18: FILLER WEIGHING HOPPER

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### 2.4.12.5 Bitumen weighing hopper

The plant is fitted with one weighing hopper (FIG. 2.19) to accurately determine the amount of bitumen to be used in the conglomerate and a motorized valve connected to the hot bitumen circulating manifold. The motorized valve allows for the bitumen to flow to the weighing hopper during the conglomerate production. When the desired weight is attained, it is returned to the initial position in order to stop the flow and recirculate the bitumen.

The motorized valve is equipped with an end-stop that signals its state to the system.

The weighing hopper is made up of an enclosed cylindrical vessel (key 1), built of steel plates, heated on the outside by two resistors (key 7). The temperature inside the hopper is controlled by a thermostat (key 8). The vessel is secured to the stiff structure of the tower (key 2) by means of a support. Between the support and the hopper there is a bidirectional loading cell (key 3) arranged between tie-rods.

Bitumen is carried from the manifold to the hopper via a recirculation pump and a motorized valve (key 4). Loading takes place in the upper part through a dedicated opening (key 5).

In addition the upper part of the hopper is equipped with:

- Inspection hatch;
- Suction connection (key 6);
- Loading connection.

Weighing is controlled by SIMthesis system.


The loading cell sends a signal - proportional to the weight detected - to the control system. Depending on the weight detected it operates and controls the motorized valve that allows for loading the bitumen to the weighing hopper. When the desired weight is attained, the valve is brought back to the closed position in order to recirculate the bitumen.

The temperature inside the hopper is controlled by a thermostat.

#### COMPONENTS

- N. 1 loading cell
- N. 1 motorized valve
- N. 2 resistors
- N. 1 thermostat
- N. 1 max level indicator for bitumen filling control pump



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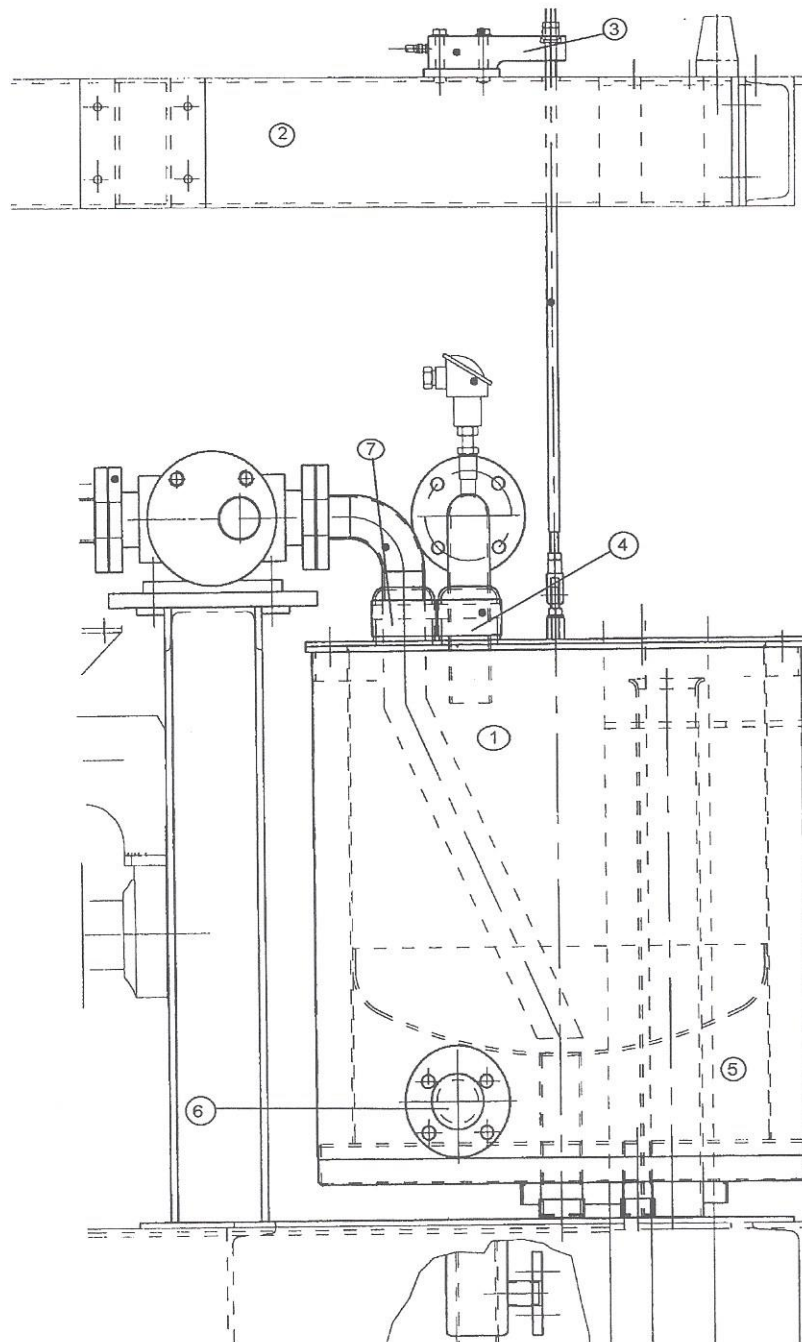



FIG.2.19: BITUMEN WEIGHING HOPPER

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## 2.4.12.6 Pump for spraying the bitumen into the mixer

The bitumen spraying pump (FIG. 2.20) withdraws all the bitumen inside the weighing hopper (key 1) and sprays it into the mixer (key 5).

The pump (key 3) is coupled to an electric motor through a coupling.

The pump takes suction of bitumen from bottom of the hopper and sends it to the sprayer ramp (key 6) located above the mixer.

The sprayers diffuse the atomized bitumen over the aggregates during the mixing phase. The ramp (key 6) is heated by the diathermic oil coming from the oleothermic heater.

COMPONENTS : See fig 2.20

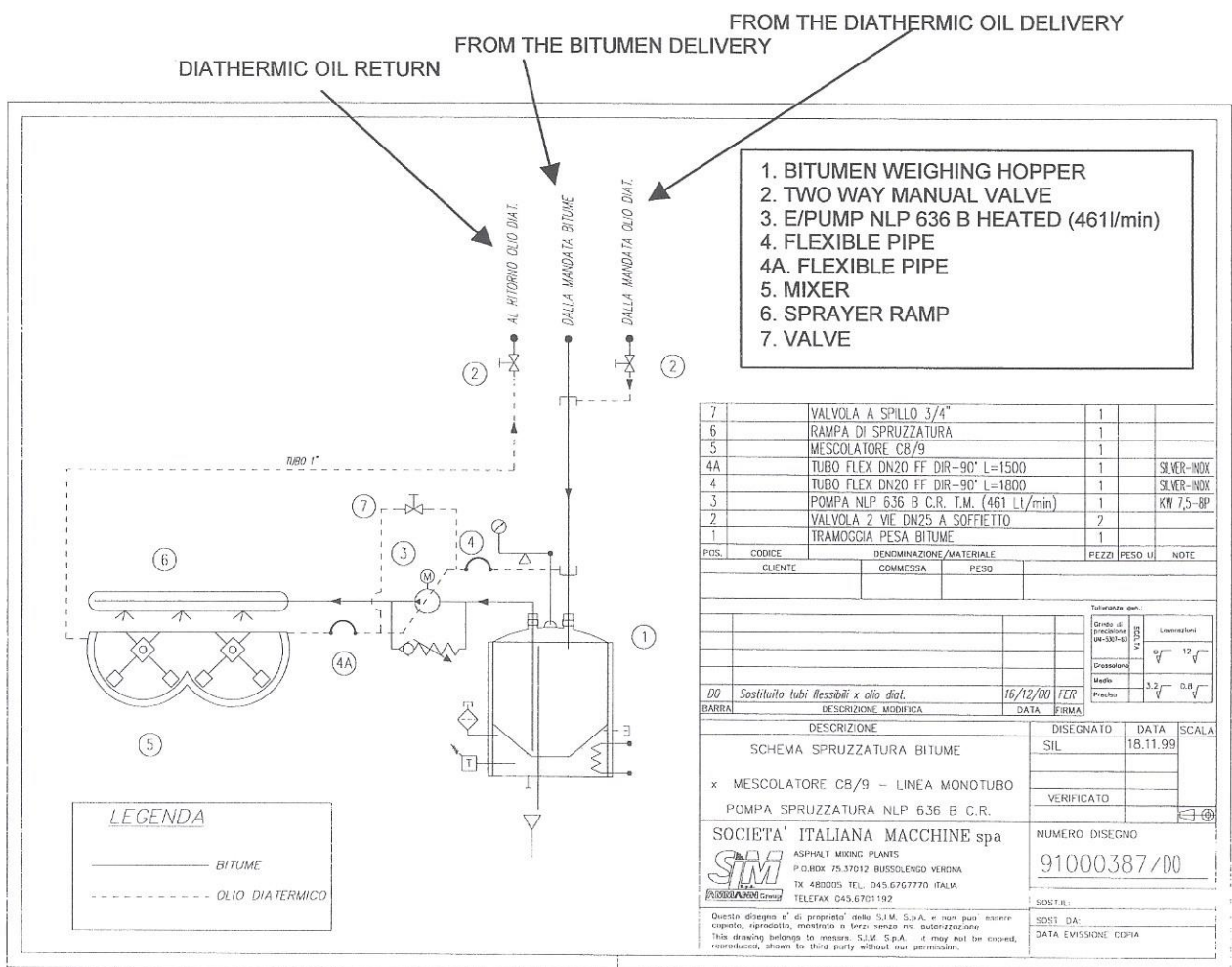



FIG. 2.20: PUMP FOR SPRAYING THE BITUMEN INTO THE MIXER

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#### 2.4.12.7 Mixer system

The plant is fitted with one mixer (FIG. 2.21) (1700kg. batch capacity) that mixes, for a preset time, the metered materials in order to get the desired finished product.

The mixer consists of a container which is opened on top. Inside the container there are revolving shafts (key 15) where arms (key 18) ending with blades (key 19) are suitably mounted. Outside the container is heated with the diathermic oil coming from the oleothermic heater.

The inside of the tank is coated with wearing shields (key 1...9) easy to replace, made of a special wear-proof Ni.Cr.Mo. cast iron. The shields are bolted to the tank.

The arms (key 18) are secured onto the shafts (key 15) by brackets (key 21) and bolts. The blades (key 17, 19) are secured on the shafts (key 15) by means of bolts (key 22). Arms and blades are made of cast iron.

The shafts are counter-rotating: motion is given by reduction gears (key 24) driven by an electric motor (key 28) .

The shafts (key 15) revolve on supports fitted with roller bearings (key 23), grease lubricated.

On the lower part of the tank there is provided a hatch for unloading the conglomerate, which can be opened by two pneumatic cylinders (key 32), controlled by solenoid valves (key 35). The pneumatic cylinders are fitted with mechanical end-stops.

The metered hot materials are carried into the mixer from above. First the large-size aggregates are loaded, then the sand and the fillers. During the mixing phase, the bitumen is sprayed. The cycle lasts about 45 seconds.

The blades' shape and arm configuration are specially designed to achieve a top quality mix.

The conglomerate so obtained is discharged into to the finished product bin.

The mixer is equipped with hatch with electric key.

The mixer data is collected, processed and checked by SIMthesis system.


#### COMPONENTS:

See fig. 2.22

#### 2.4.12.8 Tower anti dust system

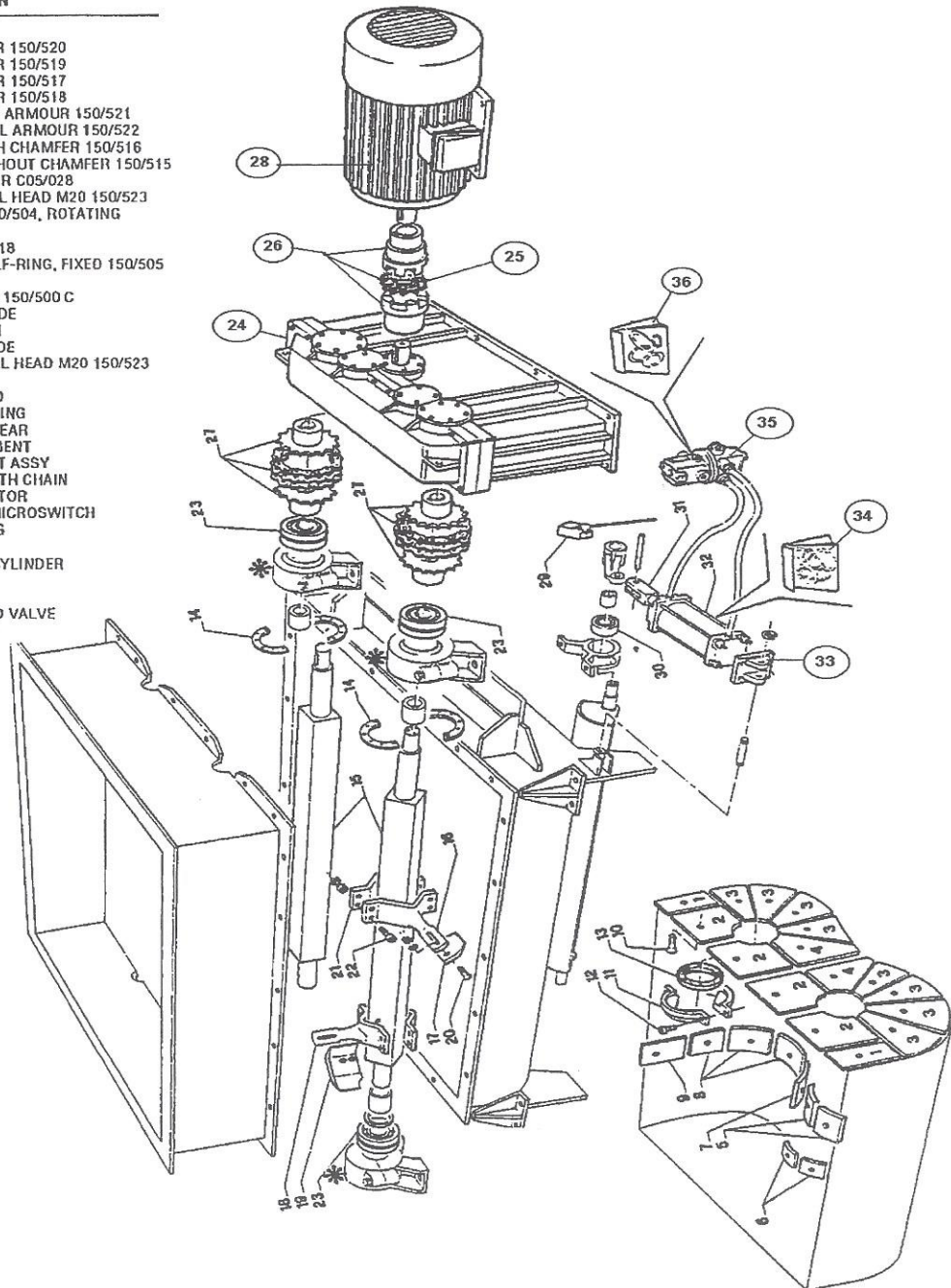
To avoid to powder air contamination the screen, the hot stone silos, the aggregates balance hopper and the mixer are closed inside an container. An pipe sucs the tower contaminated air and send it inside the scrubber inlet duct.



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POS. DENOMINATION

- 1 HEAD ARMOUR 150/520
- 2 HEAD ARMOUR 150/519
- 3 HEAD ARMOUR 150/517
- 4 HEAD ARMOUR 150/518
- 5 DOOR CENTER ARMOUR 150/521
- 6 DOOR LATERAL ARMOUR 150/522
- 7 ARMOUR WITH CHAMFER 150/516
- 8 ARMOUR WITHOUT CHAMFER 150/515
- 9 STEEL ARMOUR C05/028
- 10 BOLT, CONICAL HEAD M20 150/523
- 11 HALF-RING 150/504, ROTATING
- 12 SCREW
- 13 PACKING, 18x18
- 14 SEAL BOX HALF-RING, FIXED 150/505
- 15 SHAFT
- 16 CENTRALARM 150/500 C
- 17 CENTRAL BLADE
- 18 LATERAL ARM
- 19 LATERAL BLADE
- 20 BOLT, CONICAL HEAD M20 150/523
- 21 CAP 150/524
- 22 BOLT, M16x60
- 23 ROLLER BEARING
- 24 REDUCTION GEAR
- 25 ELASTIC ELEMENT
- 26 ELASTIC JOINT ASSY
- 27 COUPLING WITH CHAIN
- 28 ELECTRIC MOTOR
- 29 LIMIT STOP MICROSWITCH
- 30 BALL BEARING
- 31 FRONT FORK
- 32 PNEUMATIC CYLINDER
- 33 REAR HINGE
- 34 GASKETS KIT
- 35 AIR SOLENOID VALVE
- 36 GASKETS KIT



(\*) LUBRICATION POINTS

FIG. 2.21: MIXER

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## 2.4.13 FINISHED PRODUCT LINE

On completion of mixing, the bituminous conglomerate obtained is discharged into the skip and transferred either to the storage bins for eventual use.

The plant is equipped with a finished product line consisting of:

- 2.4.13.1 Storage Finished product silos
- 2.4.13.2 Cleaning plant

### 2.4.13.1 Finished product storage silo weighing type

The plant is equipped with 1 silo (key 1) (28m<sup>3</sup>), weighing type, divided in two sections, (FIG. 2.22) (14 m<sup>3</sup> each) to collect and store the finished product. Between the sections there are an channel for collect the reject aggregates or direct discharge on the truck. The silo lies on pedestals fixed to an apposite base on the ground under the tower.

The silo is an enclosed vessel with walls insulated on the outside with a double layer of rockwool and covered with aluminium plate. They are built in steel plates and supported by frames built of steel sections which lie on 4 pedestals secured to the ground. The upper part of the silo is covered by a single hood that acts as a cover (key 2).

The intake of the finished product, coming from the mixer, is through a dedicated opening, placed in the central part and equipped with a deviating plates (key 3.) The deviating plates allows the finished product to be sent to one silo or to the other (A), (B) or the central channel. The deviator is operated by means of pneumatic cylinders. (key 4)

The discharge of material takes place by gravity through discharge outlets in the lower part (key 5). Each outlet is fitted with one hatch (key 6) whose opening/closing is controlled by means of one pneumatic pistons (Key 7). Each pistons is fitted with a magnetic end-stop. Discharge outlets are heated by means an dedicated system.

Discharge outlet of the central channel (C) is equipped with hatch whose opening/closing is controlled by means of two pneumatic pistons One piston is equipped with a magnetic end-stop.

Each silo is fitted with:

- A max level indicator
- A pushbutton located on the platforms which allows the hatches to be opened manually in an emergency.

The plant is equipped with 1 weighing hopper (key 8) for the discharged finished product fitted under the finished product storage silo. The weighing hopper is made up of an vessel built of steel plates. Arms are bolted to the vessel and to the stationary structure of the tower. Between the stationary structure and the arms there are fitted three loading cells.


At the end of the vessel there is fitted an opening to discharge the finished product. The discharge takes place through the opening of a hatch controlled by two pneumatic cylinders. A cylinder is fitted with mechanical end-stops.

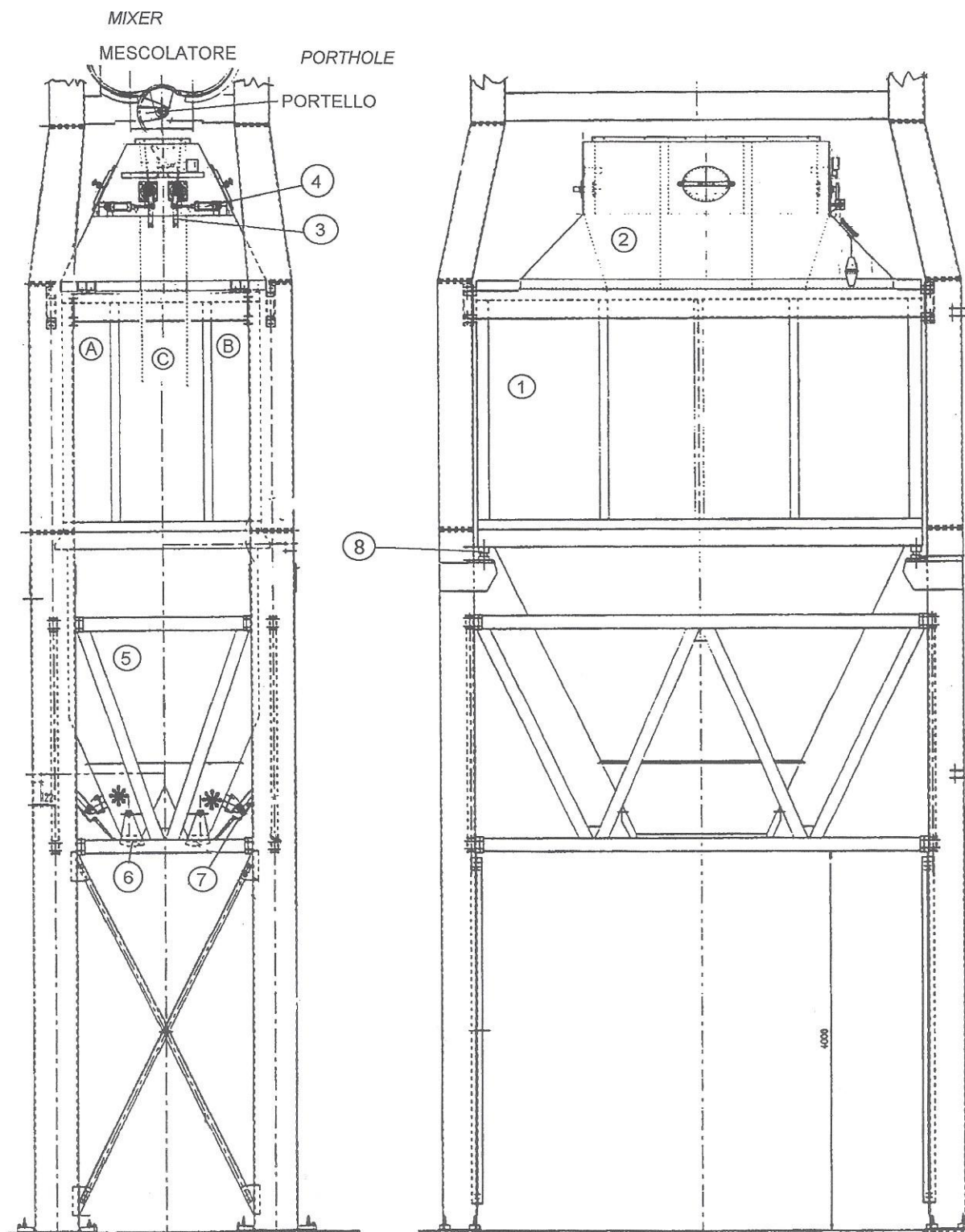
Weighing is controlled by SIMthesis control system.

Each loading cell sends out a signal, depending on the weight detected, to the control system which averages the values and determines the weight. Depending on the weight detected, it operates and adjusts the hot aggregate inflow.

The height of the unloading hatch is such as to allow the access, in the area underneath, of a machine for the loading of the material.




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(\*) LUBRICATION POINTS

FIG. 2.22: STORAGE FINISHED PRODUCT SILO



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### 2.4.13.2 Cleaning plant

The plant (FIG. 2.23) is fitted with a system for spraying liquid (naphta) for washing the bitumen weigher hopper and the mixer.

The plant is positioned beneath the finished product silo.

The plant is made up of:

- A pump;
- One line for the washing of the bitumen weigher;
- N. 1 solenoid valve for the activation of the spraying.

The system is manually operated and activated by pushbuttons, one located on one of the silo platforms and the other on the cabin.

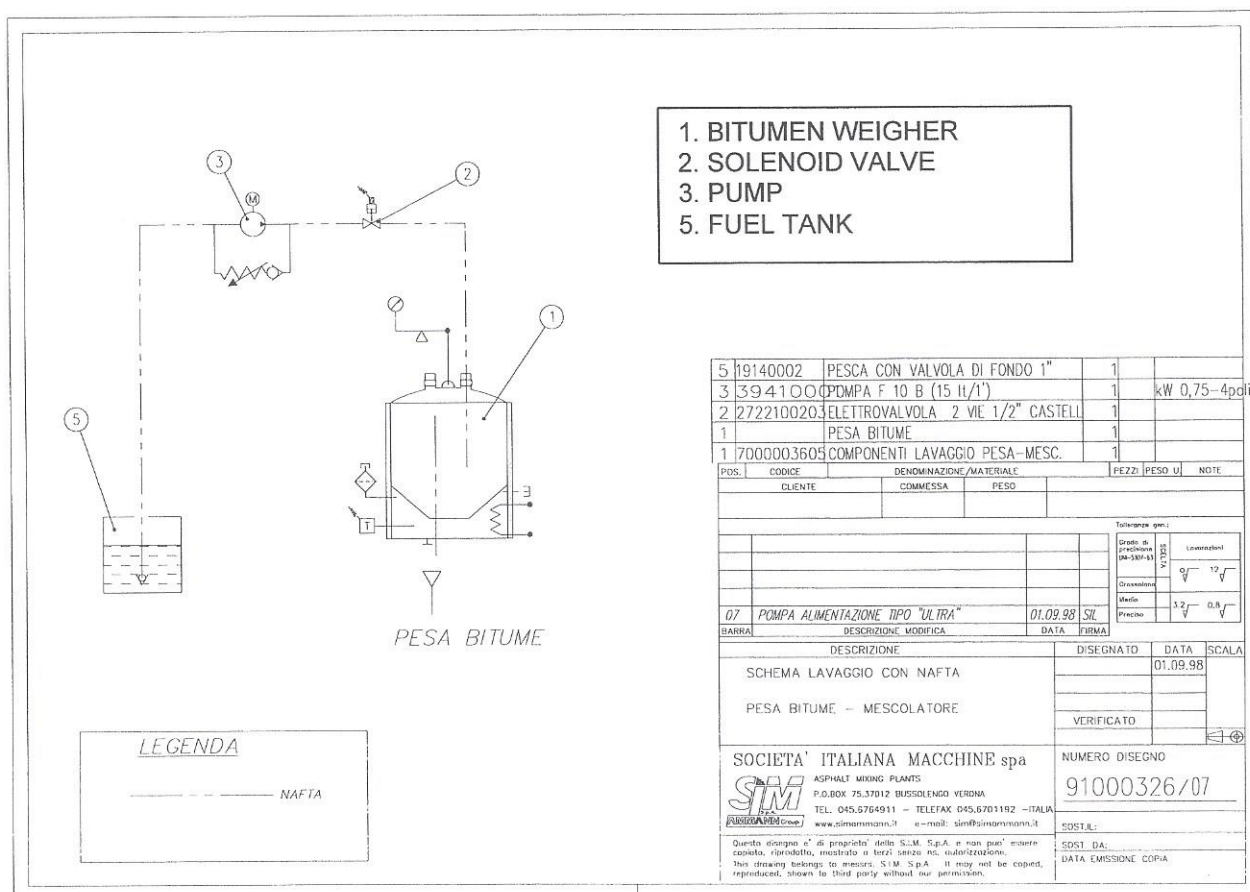



FIG. 2.23: CLEANING PLANT

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## 2.4.14 Auxiliary systems

The CB/140S QUICK plant is equipped with the following auxiliary system:

2.4.14.1 Diathermic oil circulation system

2.4.14.2 Compressed air system

### 2.4.14.1 Diathermic oil circulation system

The system consist of: (FIG. 2.24)

- Oleothermic heater (NO SIM SUPPLIED);
- Electrically-driven pump for diathermic oil circulation (key 10);

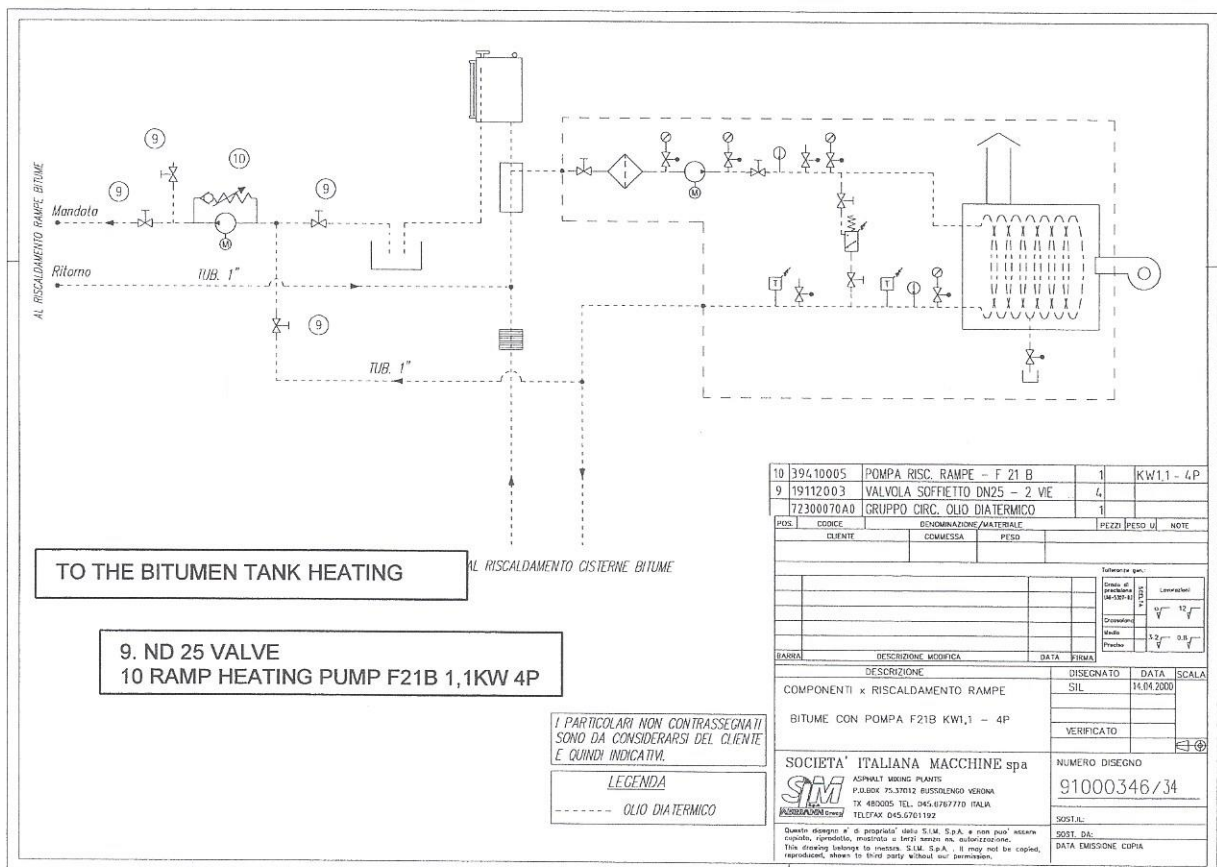



FIG. 2.24: DIATHERMIC OIL CIRCULATION SYSTEM

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#### 2.4.14.2 Compressed air system

The system consists of:

- A screw air compressor coupled to an e/motor (FIG. 2.25, 2.25a key 1). The compressor takes the air from the environment through a suitable filter (designed for a dusty environment), and then it sends the air into the storage tank. The filter is fitted with a clogging indicator.
- A control panel placed on the hood, containing a delivered air pressure indicator, a temperature indicator, hour-meter, pushbuttons to start and stop the electronic switchboard.
- A compressed air storage tank (key 2).
- A manifold from which the piping branches originate which feed the users through opening/closing solenoid valves.


Each branch is fitted with pressure regulator, filter, pressure reducing valve and bulb for leaving air lubrication (of oil drop type).

The pneumatic pistons of the screen are equipped inside with permanent magnets that signal the piston position to the control system.

The pneumatic pistons open and close the hatches located on the plant. The control is by a solenoid valve. Each solenoid valve controls a single pneumatic piston and is controlled by the console by means of voltage impulses sent according to a preset sequence. The solenoid valve is installed in parallel with the pneumatic cylinder. The valve is fitted with a system for emergency operation in manual mode should the supply system be faulty. The compressor keeps the circuit at the preset pressure.

For other information please see the enclosed instruction book



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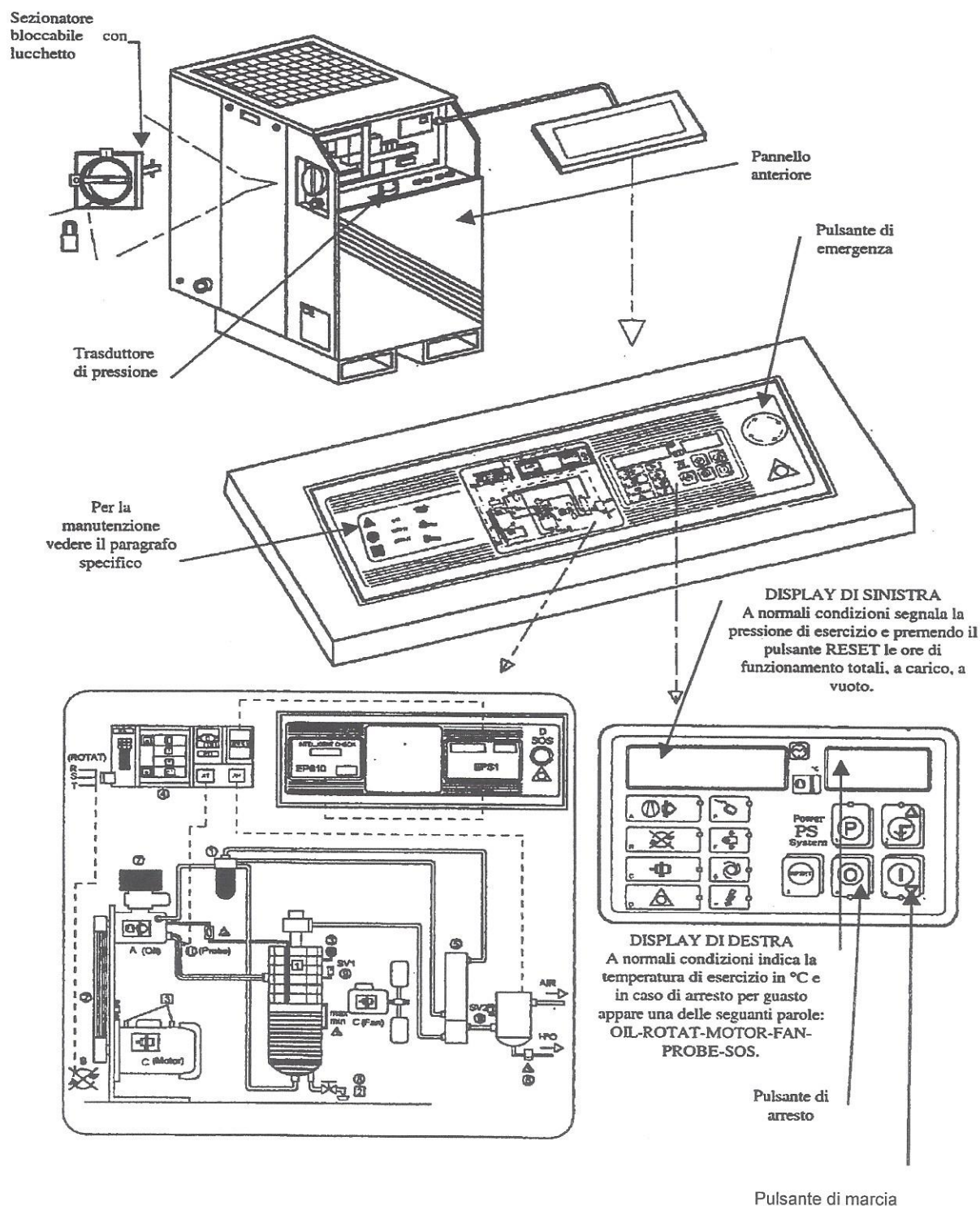



FIG. 2.25: COMPRESSORE ARIA

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#### 2.4.15 Control and monitoring system

The control and monitoring system is made up of A cabin containing (FIG. 2.26):

- Main electrish switchboard (FIG. 5.01)
- Electric switchn board for emergency manoeuvre, SIMThesis supply and balance tare (FIG. 5.02)
- Heating control panel (FIG. 5.03)
- Panels on fitted on plant (hot aggregates silo deck, prefeeders, mixer deck, filter etc) (FIG. 5.04)
- Portable pushbutton panel

The plant is controlled by a the SIMThesis system for plant monitoring and control complete with modem, video, printer and peripherals interbuses.

The switchboards and the microprocessor are installed inside the control cabin. The cabin is equipped with heatless glasses, rubber floor, electronic indication of smokes, aggregates and bitumen temperatures, air conditione hot and cold, microphone system with external loudspeaker.

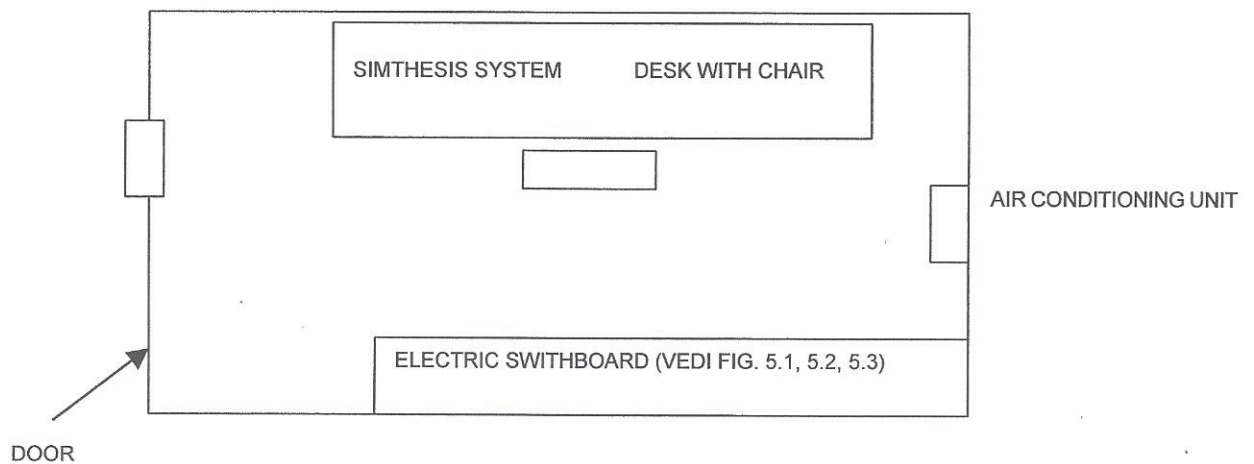



FIG. 2.26: CONTROL CABIN

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## 2.5 SITUATIONS OF DANGER

### ATTENTION DANGER OF DEATH

THE PLANT IS SUPPLIED AT 380V. IT IS THEREFORE FORBIDDEN:

- CARRY OUT WORK
- REMOVE PROTECTIVE DEVICES
- REMOVE COMPONENTS UNDER TENSION
- WITH THE PLANT CONNECTED TO THE ENERGY SOURCE

CONTACT WITH LIVE ELECTRIC CIRCUITS CAN CAUSE DEATH

### ATTENTION DANGER

When the plant is functioning the following are present:

- HIGH TEMPERATURE
- CIRCUITS UNDER PRESSURE
- MOVING PARTS
- PRESENCE AND EMISSION OF DUST
- RISK OF FIRE
- FALLING AND EXPELLED SOLIDS.


It Is Forbidden:

- Approach any hot part of the plant, except when the plant has been totally inactive for a long period of time, without taking due precautions to protect all parts of the body from high temperatures.
- Approach pipes and components under pressure (cylinders, compressors etc.) without first acting to discharge the pressure inside said components.
- Approach any part of the plant with moving parts without first cutting off the power supply to the plant or that part of it concerned and ensuring that they have completely stopped.
- Be in the vicinity of the plant without taking due precautions to protect all parts of the body from dust, in particular the face and ears.
- Operate on circuits or conductors which contain gas, solvents or petroleum derivatives without ensuring that any parts of the plant which could cause sparks or any form of explosion have been disconnected or placed in a state of safety. **THE MOST APPROPRIATE SAFETY CLOTHING MUST BE WORN.**
- Be inside or in the immediate vicinity of the plant without a safety helmet and other personal protection gear against falling and expelled bodies. The aggregates storage and transport area must be completely avoided until the plant is completely stopped.

### WARNING

**IT IS FORBIDDEN TO TAMPER WITH THE PROTECTIVE AND SAFETY DEVICES INSTALLED ON THE PLANT. ALWAYS FOLLOW THE INSTRUCTIONS IN THIS MANUAL IN EVERY SITUATION. THE FAILURE TO OBSERVE THE SIMPLEST SAFETY PROCEDURES CAN CAUSE GREAT DAMAGE TO PERSONS AND EQUIPMENT.**



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## 2.6 DESCRIPTION OF SAFETY DEVICES

The plant is fitted with the following safety devices which stop immediately the functioning of all machinery (FIG. 2.27):

- Red pushbutton on the electric panels
- Red pushbutton on mixer deck, screen deck, dryer cylinder, smoke exhaust;
- Electric key switch on the mixer, dryer cylinder, tower access door;
- Protective cables connected to microswitches on the two sides of the feed conveyor belt;
- Microswitches which automatically disconnect the electric panel when they are opened.
- Red pushbutton on the electric motors

NOTE: BEFORE DELIVERY A TEST MUST BE CARRIED OUT IN THE PRESENCE OF THE CUSTOMER TO VERIFY THE FUNCTIONALITY OF ALL THE SECURITY SYSTEMS INSTALLED ON THE PLANT.

P = STOP PUSHBUTTON

C = CABLE CONNECTED TO MICROSWITCHES

CH = ELECTRIC KEY SWITCH

### ATTENTION DANGER OF DEATH

THE PLANT IS SUPPLIED AT 380V. IT IS THEREFORE FORBIDDEN:

- CARRY OUT WORK
- REMOVE PROTECTIVE DEVICES
- REMOVE COMPONENTS UNDER TENSION

WITH THE PLANT CONNECTED TO THE ENERGY SOURCE

CONTACT WITH LIVE ELECTRIC CIRCUITS CAN CAUSE DEATH

### ATTENTION DANGER


When the plant is functioning, the following are present:

- HIGH TEMPERATURE
- CIRCUITS UNDER PRESSURE
- MOVING PARTS
- PRESENCE AND EMISSION OF DUST
- RISK OF FIRE
- FALLING AND EXPELLED SOLIDS.

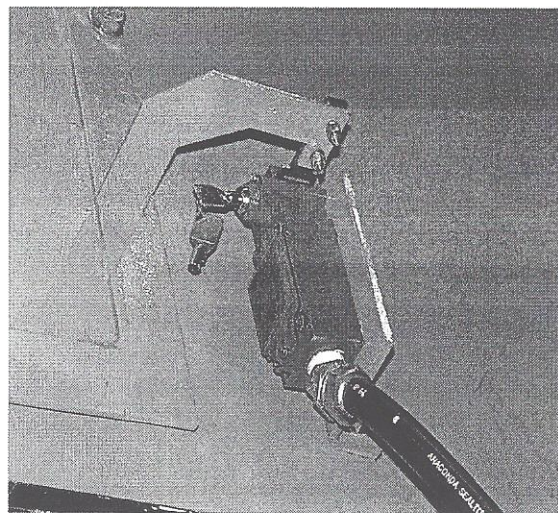
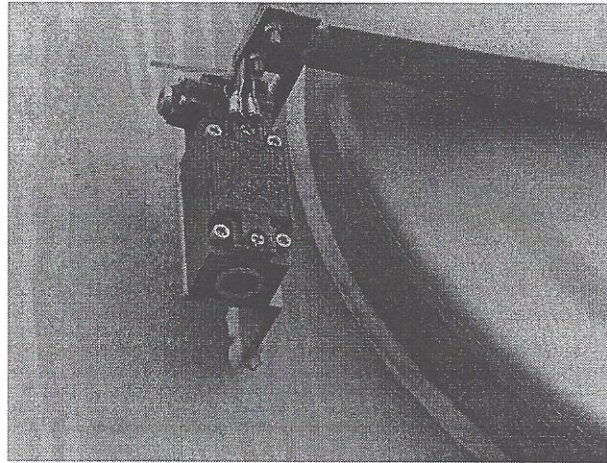
It Is Forbidden:

- Approach any hot part of the plant, except when the plant has been totally inactive for a long period, without taking due precautions to protect all parts of the body from high temperatures.
- Approach pipes and components under pressure (cylinders, compressors etc.) without first acting to discharge the pressure inside said components.
- Approach any part of the plant with moving parts without first cutting off the power supply to the plant or that part of it concerned and ensuring that they have completely stopped.
- Be near the plant without taking due precautions to protect all parts of the body from dust, in particular the face and ears.
- Operate on circuits or conductors which contain gas, solvents or petroleum derivatives without ensuring that any parts of the plant which could cause sparks or any form of explosion have been disconnected or placed in a state of safety. THE MOST APPROPRIATE SAFETY CLOTHING MUST BE WORN.




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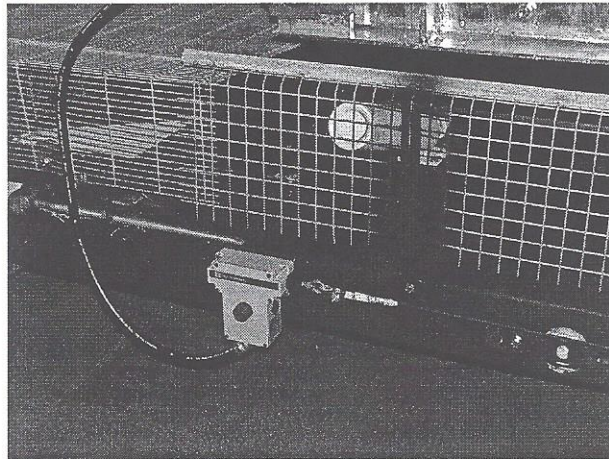
Electric key switch on the mixer, dryer cylinder, tower access door;



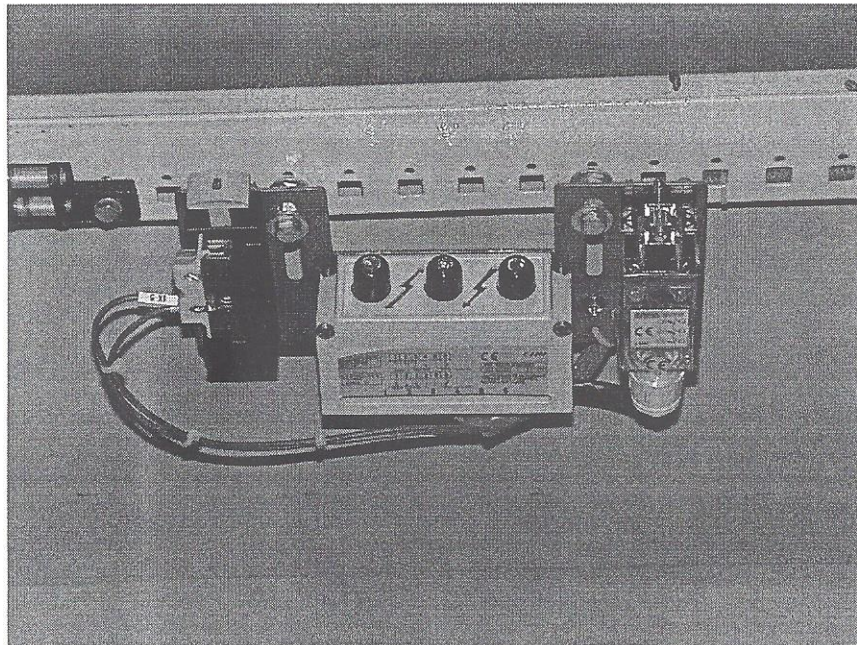


 <p>SOCIETÀ ITALIANA MACCHINE</p>	<p>SYSTEM</p> <p><b>CB/140S QUICK</b></p>	<p>TITLE</p> <p><b>INSTRUCTION BOOK</b></p>	<p>REVISION</p> <p>0</p>
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- Protective cables connected to micro switches on the two sides of the feed conveyor belt;



- Micro switches, which automatically disconnect the electric panel when they are opened.



NOTE: BEFORE DELIVERY A TEST MUST BE CARRIED OUT IN THE PRESENCE OF THE CUSTOMER TO VERIFY THE FUNCTIONALITY OF ALL THE SECURITY SYSTEMS INSTALLED ON THE PLANT.

 SOCIETÀ ITALIANA MACCHINE	SYSTEM  <b>CB/140S QUICK</b>	TITLE  <b>INSTRUCTION BOOK</b>	REVISION  0
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## 2.7 PERMISSIBLE ATMOSPHERIC CONDITIONS

The plant can function under the following conditions:

Temperature from:                   -5°C to +40°C  
 Humidity:                               atmospheric (no limit)  
 Altitude:                                500 sea level (max)