PC Series Vacuum Ceramic Filter

User's Instructions Manual

Shengnuo Group

3nd Edition

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PART 1 INTRODUCTION

1.1. Descriptions

1.1.1. General

The Vacuum Ceramic Filter consists of ceramic filter plate, rotator, slurry tank, discharge scraper, distributor, agitating device, cleaning device (including ultrasonic cleaning & acid cleaning), frame, vacuum system, pipe system, filtrate discharge system, automatic lubricating system, automatic acid-dosing system, discharge chute, valve and PLC automatic control system (can be made as remote control system). The structure of main parts of the filter is shown in the following figure.

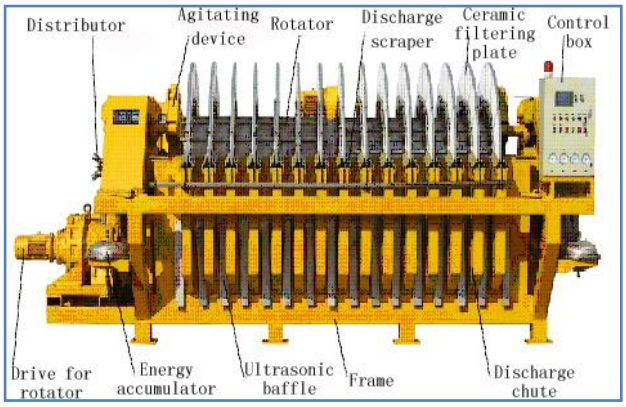

Fig. 1-1 Front View

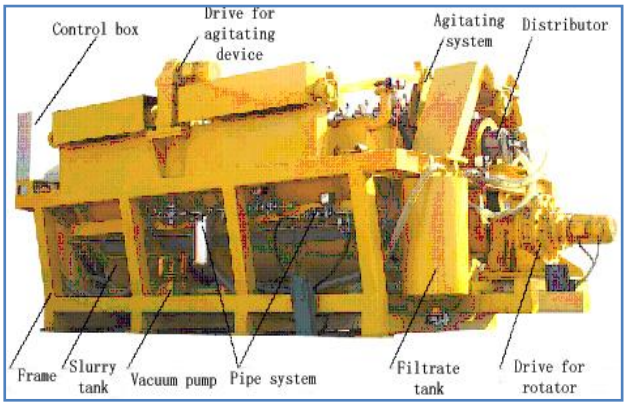

Fig. 1-2 Back View

1.1.2. Working principle

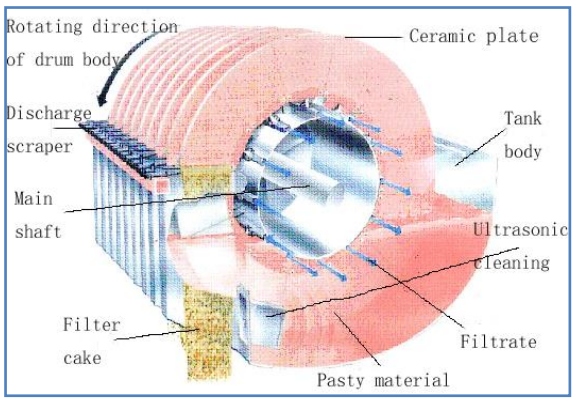

Fig. 1-3 Work Principle

Driven by the main shaft, the filter plate rotates to the direction of scraper. Under effect of vacuum system (vacuum pump, filtrate tank, distributor and relevant pipes), the filter plate below slurry level absorbs the slurry while the filter plate from slurry level to scraper makes the material (absorbed on it) dry. The filtrate goes into filtrate tank where from it is drained through discharge system (filtrate pump and relevant pipes). When the filter plate reaches the position of scraper, the cake is taken out by scraper and then given through discharge chute onto conveying belt. After discharge of material, the filter plate is cleaned in the way of pressure flowing (cleaning takes place once after each circle of rotation). So a few of residue caused by clearance between filter plate and scraper is cleaned out, and the function of filter plate is restored during operation.

After certain time (normally, 7 hours), it is necessary to clean the filter plate by means of detergent (normally, it is nitric acid depending on characteristics of material) and ultrasonic. So the materials & foreign matters stopped in pores of filter plate or absorbed on surface of filter plate are cleaned out, and the function of filter plate is restored during operation.

The Vacuum Ceramic Filter adopts PLC full-automatic control system. Both full-automatic operation and manual operation are possible to provide flexibility & convenience.

1.2. Performance and Features

1.2.1. Performance

a. Vacuum > 0.09MPa (except for plateau area)
b. Rotating speed of filtering disc: 0 ~ 41.5s/r (frequency changeable stepless speed regulation)
c. Rotating speed of agitating device: 0 ~ 3.75s/r (frequency changeable stepless speed regulation)

d. Pressure for reverse cleaning: 0.06 ~ 0.12MPa (continuously adjustable)

e. Restore of filter plate function: through reverse cleaning (cleaning takes place once after each circle of rotation); through combined cleaning (ultrasonic and detergent) that normally takes place once every 7 hours (each time 45 minutes) depending on characteristics of material and on technological process..

1.2.2. Structural Features

1.2.2.1. Ceramic Filter Plate

By utilizing the production technology of our patent, the filter plate consisting of two pieces of cavity-structures which is produced by mainly using corundum-based material. The process include raw-material classification, cleaning & selecting, mixing, high-accuracy molding through die stamping, stage-wise high-temperature roasting, repetitious painting of function layer, cleaning & choosing, finalizing gluing, performance testing, packing and placing in storehouse.

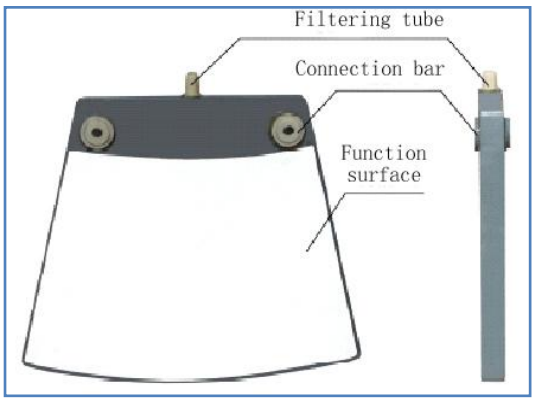

Fig. 2-1 Outlook of Filter Plate

Repetitious roasting and layer-after-layer painting are adopted. Thus, the arrangement of pores (interior is big, exterior is small-normally with diameter of 1.0μm) is clear; the resistance at restoring of filter plate's function is small; the cleaning of filter plate is easy; the surface layer is of high strength and wear-resistant. The two pieces of cavity-structures are glued together using epoxy glue imported. The gluing is of high strength and is corrosion-resistant & wear-resistant.

Filtering tube is made from Teflon or stainless steel. Teflon tube possesses better ductility that provides better capability against temperature-changes and deformation. Stainless steel tube possesses high strength but less capability against deformation. The customer can choose different kinds of filtering tube according to working conditions.

Now there are different kinds of ceramic filter plate in the market. Due to irregular crystal structure of silicon carbide, the filter plate made of silicon carbide possesses disadvantages such as pore channel is irregular, cleaning for eliminating stoppage is difficult, brittleness is high, wear-resistant capability is low, there is no capability against chemical corrosion.

There is ceramic filter plate, which is roasted in the way that the two pieces of cavity-structures are together as one unit. This kind of filter plate possesses advantages such high rate of finished products (due to less times of roasting and less technological processes) and low cost of production. But it possesses the disadvantage of low gluing strength causing low pressure (<0.12MPa; by higher pressure the plate will be broken for reverse cleaning that is very unfavorable for restoring of plate function through cleaning. Thus, the capability of filter is low that causes increment of filter numbers, which means high investment and high operation cost for customer.

The ceramic filter plates produced by our plant have been proved as successful in many beneficiation plants treating ores of copper, lead, zinc, iron, silver, sulfur, gold etc. The filter plates are of high strength, easy to be cleaned for restoring of plate function. The maximum pressure for reverse cleaning reaches 0.3MPa that increases the performance of reverse cleaning & combined cleaning and raises remarkably the operation indexes of the filter. The service life of the filter exceeds 2 years that saves the investment & operation cost of customer.

In Fushun Hongtoushan Copper Ore Mine of Liaoning province, Weigang Iron Ore Mine of Jiangsu province, Baiyinnuoer Lead-Zinc Ore Mine of Inner-Mongolian province and Huili Lead-Zinc Ore Mine of Sichuan province, the Vacuum Ceramic Filters made by our plant have successfully replaced the unsatisfactory filters made by other plants.

1.2.2.2. Rotator

The rotator consists of main shaft, drum body, connection plate and rotator's drive. The main shaft is welded with drum body as a unit. The inside is supported by multiple structures. The connection plate is welded onto drum body while the ceramic filter plate is mounted on the connection plate. As a complete unit, the main shaft with drum body & connection plate is fabricated, installed and calibrated to ensure the accuracy. The rotator is made from No. 304 material imported that reaches a service life over 15 years.

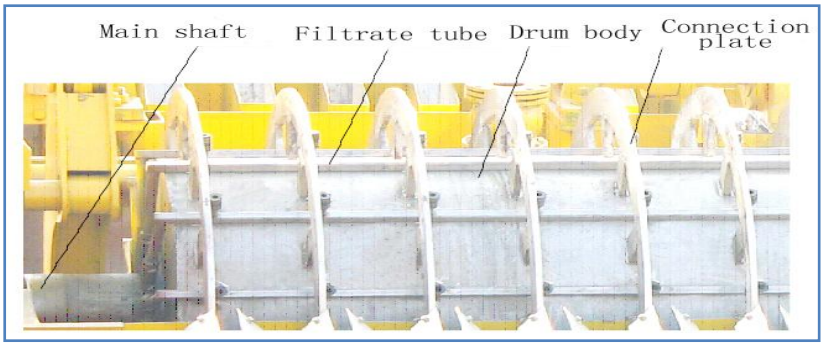

Fig. 2-2 Rotator Structures

Filter below 60m^2 adopts direct drive through driving device (motor and reduction gear) and rotator. This kind of drive possesses the advantages of simple structure and reliable running.

Filter over 60m2 adopts such a drive: driving device is put beneath main shaft; soundless tooth form chain is used. This kind of drive possesses advantages such as the arrangement is optimum, the dimension of the filter is reduced, the problems (drive surface sealing is difficult, noise is big, wear of part is severe, operating rate is low) are solved. The problems such as complicated maintenance, difficult adjustment & repair are also solved.

The design reduction ratio of drive system is 1:1003. Steeples speed adjustment (0 ~ 41.5s/r) is possible through frequency converter that can well meet customer's requirement of adjusting production indexes.

Motors and reduction gears belong to common equipment. Manufacturing technology of such equipment in China is guaranteed. Therefore it is unnecessary to import such equipment from foreign countries. Motors and reduction gears made by great enterprises in China can provide perfect operation performance, good reliability & interchangeability, and also remarkably save customer's cost for maintenance & repair.

1.2.2.3. Distributor

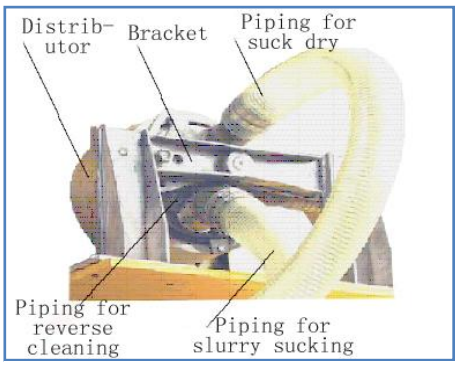

Fig. 2-3 Distributor Structure

The distributor is designed to have "slurry-absorbing zone", "drying zone", "reverse cleaning zone" and "pre-loosening zone" (behind suck dry zone). The advantage of "pre-loosening zone" is: Before the cake reaches the position in front of scraper, the vacuum is disappeared; thus the resistance for scraping is diminished and the friction force between scraper, cake and filter plate is reduced. Thus, the service life of scraper and filter plate is prolonged and the thorough scraping-out of cake is ensured. Besides, the reverse cleaning resistance becomes small, and the restoring of filter plate function can be well carried out. All these are favorable for increase of equipment operation capability and improvement of other production indexes.

The distributor is supported by bracket having double support points. Compared with cantilever support, the double-support-points bracket has the following advantages: support force is distributed evenly; static and dynamic discs of

distributor are matched well; sealing performance is good; loss of vacuum and reverse cleaning pressure is small. These advantages are favorable for increase of production indexes, reduction of wear of parts, decrease of operation cost and rise of equipment availability.

The dynamic disc of distributor is made of self-lubricating Teflon of which the sealing performance is good and the service life is long. Other parts are made from No. 316 material that possesses high anti-wear and anti-corrosion capability.

1.2.2.4. Piping

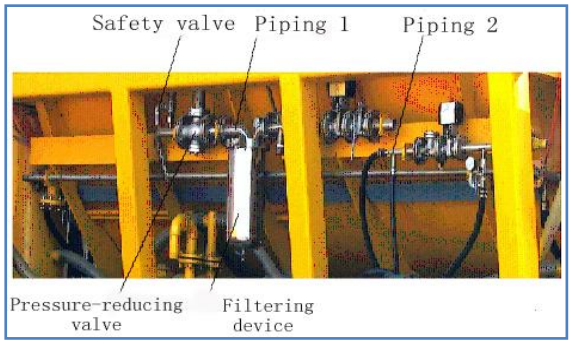

Fig. 2-4 Pipeline Outlook

There are two loops of piping. Piping 1 is used for reverse cleaning (for restoring of filter plate function) and flushing-out of detergent. Piping 2 is used to loosen the accumulations in discharge valve and to provide water seal for vacuum pump. Such kind of design possesses the following advantages: the length of piping for cleaning is diminished; the resistance for cleaning is reduced; the production index of filter is raised; the back-flowing of slurry due to failure of piping parts is avoided; the safety of filter running is increased. On piping 1, energy-storing tank is connected that is used to balance and control the cleaning pressure thus ensure the performance of cleaning. The piping and parts mounted on it are able to withstand a pressure of 16kg/cm2. No.316 material can meet requirement about high reverse cleaning pressure and anti-corrosion.

1.2.2.5. Agitating system

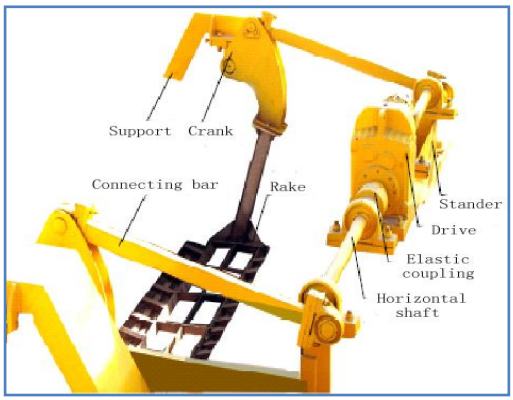

Fig. 2-5 Agitating System

Agitating device is the key part of the filter because the state of particles suspended in slurry directly influences the production indexes & smooth running of the filter. Our agitating system is designed as an integrated unit consisting of drive (motor, reduction gear), horizontal shaft, connecting bar, crank and rake.

The rake is designed as plate-type supporting net structure. Under precondition of no increasing of deadweight, the rake can improve the performance of filtering because it makes the materials to be filtered be distributed evenly in slurry tank. Elastic coupling is added on horizontal shaft to increase the safety of agitating system's running.

The reduction ratio of agitating device is designed as 1:90. The maximum speed rate of agitating is 3.75s/v, which can be determined by customer in accordance with state of material settling.

1.2.2.6. Ultrasonic cleaning system

The outlook of ultrasonic cleaning device is shown in Fig. 2-6

The ultrasonic cleaning system consists of power supply box and energy converter. The working principle of ultrasonic cleaning system is the follows: Through energy converter, the high frequency oscillation signals from ultrasonic generator are changed to high frequency mechanical oscillations, which are transmitted into media. While the ultrasonic in regular thin-to-dense & dense-to-thin change radiates forward in the detergent, the detergent flow generates tens of thousands of micro-bubbles. The micro-bubbles existed in detergent oscillate under effect of sound field.

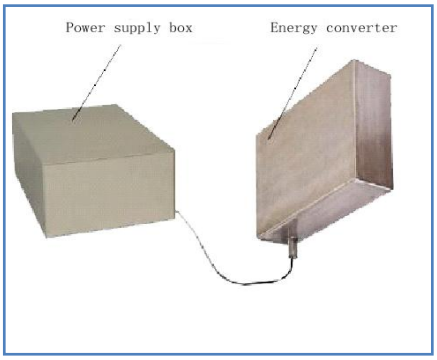

Fig. 2-6 Ultrasonic Cleaning System

As the sound pressure reaches a certain level, the micro-bubbles expand quickly until they abruptly shrink. The abrupt shrinkage of micro-bubbles generates shock wave producing thousands of atmospheres, which break the non-soluble matters adhered on filter plate surface and make the matters be distributed in detergent. Under effect of shock wave, the particles stopped in pores of ceramic filter plate are also separated from the plate thus the plate is cleaned.

In the design of power supply box, the followings are adopted: world-advanced integration technique; high-power metallic oxide semiconductor field effect transistors (MOSFET), pulse width homogenizing (PWH) technique; voltage controlled oscillators (VCO); x-band microwave transmitters (XMT). Protective measures in relation to overload, over-current, over-voltage, under-voltage and soft starting are provided to electric loops. Voltage in a wide range of fluctuation can be used safely. The manipulation is very easy. Field effect transistors and integrated circuits are made from elements & parts imported that can last for more than 5 years.

In the design of energy converter, all unfavorable working conditions are considered. Full-coverage and no-dead-corner cleaning of filter plate is ensured. The casing of energy converter is made of stainless steel that is wear-resistant and corrosion-resistant.

1.2.2.7. Automatic Control System

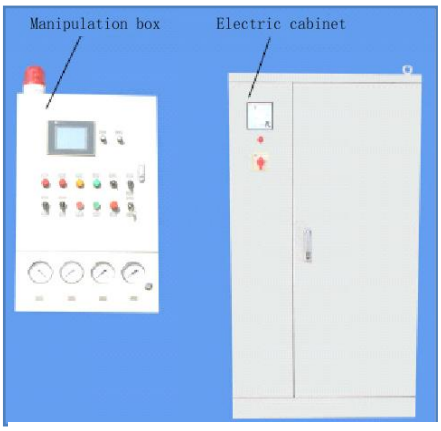

Fig. 2-7 PLC System

The automatic control system consists fully of imported PLC elements and electric actuating parts. The programs for control are optimized reasonably that allow both automatic operation and manual operation thus the manipulation is easy and flexible. Slurry level, filtrate level, pump's operation state and valve's operation state can be directly & visually displayed. There is long-life & convenient light-touch keys for sending commands.

Frequency changeable stepless speed adjustment for rotator and agitating system is stable, reliable and of energy-saving type. Troubles & failures of equipment can be displayed at any time with complete information. The switch for trouble-shooting allows positive & negative rotating of rotator that provides convenience for maintenance & repair and is favorable for increase of operating rate. The automatic control system is equipped with the followings: vacuum protection to avoid trouble expansion; belt interlocking to prevent trouble transfer; temporary-stop switch & emergent-stop switch to facilitate maintenance & repair and treatment of emergency cases.

PLC elements themselves have remote control interfaces connected through cables with industrial television in control room. All the information within PLC can be displayed as visualized figures at screen of industrial television that facilitates the monitoring of running state of different filters. Remote manipulation of filter is also possible because there is function of transmitting production data.

Power is supplied separately to PLC system, frequency changing elements and dynamic electricity system (they are arranged in separated cabinets) to avoid mutual interference. The hardware of automatic system is imported from Schneider Co. of France, Siemens AG. of Germany and Mitsubishi Co. of Japan.

1.2.2.8. Discharge scraping system

The discharge scraping system is a patent of our plant possessing advantages of simple structure and easy operation & maintenance. The scraper is made from tool-purpose ceramic material (containing 95% of Al2O3) demonstrating good mechanical properties and anti-wear capability.

1.2.2.9. Vacuum & Filtrate Discharging System

The vacuum system consists of vacuum pump, filtrate tank, anti-corrosion chemical pump and relevant pipelines. The pipeline system adopts advanced design to ensure a vacuity > 0.098MPa (except in area with high altitude).

The principle of vacuum & filtrate discharge system is shown in the following figure.

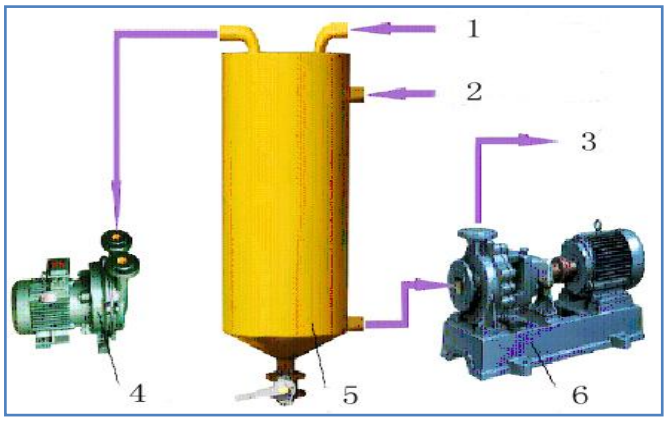

Fig. 2-8 Principles of Filtrate Discharge System

1. To be connected with suck dry pipeline (distributor)
2. connected with slurry sucking pipeline (distributor)
3. Filtrate
4. Vacuum pump
5. Filtrate tank
6. Anti-corrosion chemical pump

1.2.2.10. Slurry Tank and Framework

The shape of slurry tank is designed as per filter's working principle and per agitating system's moving track with the goal of reducing material's settlement. In the design, static and dynamic loads are systematically analyzed. According to careful calculation, the structural form and material specification are determined. Besides, the slurry tank and framework are integrated together as one unit through a reasonably designed supporting plate thus providing robustness and reliability. The slurry tank is made of 5mm thick No. 304 stainless steel providing a service life more than 15 years.

1.2.2.11. Advantages in the aspects of technical development, application and popularization of Vacuum Ceramic Filter

Shengnuo Group has developed second generation of Vacuum Ceramic Filter characterized by better performance and wide utilization using the internationally advanced ceramic technology, depending on the domestic technical forces of tens of scientific and research institutions including Tsinghua University and combining with the properties of all kinds of filtering materials and technological conditions. The filters have been used in more than 30 enterprises all over China covering the materials of the beneficiation plants of copper, lead, zinc, iron, silver, gold and sulphur. The results are so good that the obvious economic and social benefits are achieved.

1.3. Introductions to Shengnuo Group

Shengnuo Group has started to develop and make Vacuum Ceramic Filter since 1990s. The factory has developed a serial Vacuum Ceramic Filter of 0.25-120m^2 until now and has owned independent intellectual property right for Vacuum Ceramic Filter and ceramic filter plate. The products have been sold to all corners of the country based on the advanced technical strength, excellent performance of products and high quality after-sales services in the last 7 years. Our customers can be

found from Shandong in the east to Xinjiang in the west, from Yunnan in the south to Heilongjiang in the north. According to the statistics, 150 sets of Vacuum Ceramic Filters and 1115 sets of ceramic filter plates have been sold out up till now, thus making the factory become the largest Vacuum Ceramic Filter products supplier in China and the quality of products and after-sales services are high appreciated by the customers. Through large scale production practice and products popularization and application, we have accumulated many experiences and returned them to the technical and production links and customers after uninterrupted summarization to improve continuously the design and manufacturing level and practical application level of Vacuum Ceramic Filters and to further bring the excellent performance of Vacuum Ceramic Filters into full play. So far, Shengnuo Group is the largest Vacuum Ceramic Filter products supplier in China.

1.3.1. Advanced Features of the 2nd generation VCF

It was in mid 1990s that the foreign companies started to develop and popularize to use Vacuum Ceramic Filters in scale. At that time, neither the quality nor performance of the ceramic filter plate and Vacuum Ceramic Filters was perfect enough. Aiming at properties and production technology of metallic ore beneficiation materials, our factory optimized systematically the ceramic filter plates and Vacuum Ceramic Filters to upgrade the technology to the level of second generation depending on the domestically famous scientific and research institutions like Tsinghua Universities. The specific measures were as follows.

1.3.2. Improvement of ceramic filter plate

α-A1203 with high hardness, good quality and better hydrophilicity was selected as main material and material of clay category with high effective composition and stable physical and chemical properties was selected as auxiliary material. The sintering technology with high temperature but small temperature difference was adopted to produce filter plate with high strength, easy to clean out, high productivity and long service life. It has been proven that the technical features of the improved ceramic filter plates have superiority over the similar products made domestically and abroad on the market through the comparative application in Fushun Hongtoushang Copper Mine, Sichuan Huili Lead-zinc Mine, Jiangshu Weigang Iron Ore Mine, Ansteel Wuyang Mining Company, Shandong Lunan Mining Company, Chengde Baotong Mining, Jinchuan Nickel Industry and so on.

1.3.2.1. Improvement of gas-liquid distribution system

Because the metallic materials have high density, the filtering cake is easy to adhere on the filter plate with strong adhesive force, high scraping resistance, so the filter plate and Scraper bar are very easy to be damaged. Meanwhile due to high hardness of metallic material, the particles sucked into the pore are not easy to wash out and the reverse flushing in the production process is not as thorough as expected, so after a cycle of operation, the combined pickling and ultrasonic cleaning will not be desirable, the filter plate will be blocked seriously, the operation will be in abnormal conditions and the service life of the plate will be greatly reduced as time passes.

Additionally, the distribution valve is added on the suck-off pipeline to facilitate the customers to adjust the output and water content of the filtering cakes satisfying the demand of the customers.

1.3.2.2. Improvement of mechanical structure

There is a big difference between metallic ore beneficiation flowsheets and the properties of materials are quit different too. In order to increase the adaptation of Vacuum Ceramic Filter, the strength of the parts like mixing, drum, frame and so on and the relevant power are strengthened during design to make them meet the requirements of all kinds of material filtering.

1.3.2.3. Improvement of pipeline system

One pipeline was adopted for the first generation of the vacuum ceramic filter. With long single pipeline, the resistance was very high for the reverse flushing and flushing results was not so good. At the same time, it is very to have slurry flow back, block the whole pipeline and affect the normal operation when the non-return valve is in fault condition. Aiming at this problem, single pipeline was changed to 2 pipelines to shorten the length of reverse flushing pipeline and improve the reverse flushing effect, meanwhile the pressure relieve valve and safety valve are installed on the pipeline to raise the safety of the operation.

1.3.2.4. Improvement of automatic control system

The ultrasonic level meter was adopted for the first generation of Vacuum Ceramic Filter. The fluctuation of level of slurry and water vapor may cause malfunction of the level meter. Therefore the radio frequency level meter was adopted to replace ultrasonic level meter and PLC made by GE or Schneider was selected and the electrical elements of Siemens or Schneider were used to improve interference killing ability of the whole control system thus making the equipment running smoothly and reliably.

After systematic improvement of equipment and overall optimization, the performance the second generation of the complete Vacuum Ceramic Filter has been greatly improved to fully meet the requirement of filtering materials from the beneficiation plants of copper, lead, zinc, iron, silver, gold and sulphur. It has been proven from the production practice that the operation of equipment is reliable and the technical indexes are excellent. Up till now, the customers of Fushun Hongtoushan Copper Mine, Sichuan Huili Lead-zinc Mine, Wuhan Iron and Steel Complex, Jiangsu Weigang Iron Ore Mine and Chengde Baotong Mining that used the first generation of Vacuum Ceramic Filter made by others, but not satisfactory with the products have changed to use our products.

1.4. Development History of VCF

The first generation of Vacuum Ceramic Filter was developed by foreign companies. The Vacuum Ceramic Filter was successfully developed by Outokumpu, Finland in early 1980s and popularized to use in early 1990s. The main utilization fields included nonferrous metallurgical mines and non-metallic concentrates filtering (such as, copper, lead, zinc and sulphur).

The second generation of Vacuum Ceramic Filter is to change the slip-casting type filter plate into two-piece binding type filter plate so that the strength of filter plate increases and the performance of Vacuum Ceramic Filter is improved. We have done a lot of tests with Tsinghua University in the national laboratory to make fundamental increase in the performance, so we own independent intellectual property right on the product.

The third generation of Vacuum Ceramic Filter is to optimize and improve the overall structure of the existing Vacuum Ceramic Filter according to the characteristics of iron concentrates in order to make the filter fully meet the requirements of iron concentrates filtering and to upgrade substantially the technical performance. The application of Vacuum Ceramic Filter in domestic metallurgical mine started from Guangdong Fankou Lead-zinc Mine. They first imported the filter in 1995 and then other enterprises like Hongtoushan Copper Mine followed. Just from then on the domestic Vacuum Ceramic Filter makers started to develop Vacuum Ceramic Filter. There was almost no trouble for Vacuum Ceramic Filters developed by others and used directly in the ferrous metallurgical mines because of location of the factories.

Their products are sold mainly to the ferrous metallurgical field without much change. But it is different with our situation. The nearest enterprise is Ansteel and all beneficiation plants are of iron ore beneficiation. Our first customer is Donganshan Sinter Plant. Due to the fine disseminated grain size of iron material and direct floatation with fat acid, the floatation concentrates are fine, slimy and sticky and difficult to filter causing high water content of filtering cake, serious loss of metals, pollution of surroundings and bad quality of sinter. Before technical modification, iron concentrate filtering of Donganshan Sinter Plant was an internationally difficult problem in the beneficiation circle. Many scientific research institutions at home and abroad

have done a lot of test on the filtering of iron concentrates of Donganshan Sinter Plant with disc filter and disc press filter. In 1998, Outokumpu did the test with Vacuum Ceramic Filter in Donganshan Sinter Plant, but the results were not satisfactory. Donganshan Sinter Plant has been using the complicated thickening and filtering flowsheet with three stages thickening and two stages filtering to maintain the production. However with the development of steel enterprises, the existing problems have already affected the normal operation of Ansteel. The management of Ansteel had several meetings with the final resolution of stop operation of the plant. Facing this situation, Donganshan Sinter Plant was more than happy to accept the new technique and new equipment. Through discussions, the agreement for commercial test was reached. But the tribulation started after we sent our prototype machine to the site and installed it and commissioned. Comparing with nonferrous concentrates, the iron concentrates has high density and high hardness. Because the magnetite concentrates with coarse size and fast settling speed from No. 2 beneficiation workshop was filtered joining with floatation concentrates, the complicated material properties had brought a great difficulty to the Vacuum Ceramic Filter. At the first, the agitating system was overloaded, within short period of time; the agitating rake was unable to move due to pressing down. We immediately modified the matching power, transmission method and installation mode of the agitating system. This problem was solved, but the other one came. Because the iron concentrates have high density, the adhesion on the surface of filter was very high, so the scraping resistance is high, thus causing serious damage of filter plate and Scraper bar and further causing unsatisfactory reverse flushing and unexpected availability of the Vacuum Ceramic Filter. Through repeated practices, a pre-fluffing mechanism was added to the distributor in the design, in this case, filtering cake would be fluffed before touching the Scraper bar. The second problem was solved and came the next one, which is a problem of filter plate of the Vacuum Ceramic Filter. As the core components of the Vacuum Ceramic Filter, much more concerns were given to it. However we took roundabout course at the beginning of the development. At that time, we worked with several experts of silicon carbide and refractory and spent a long time to determine the recipe and production process. The samples were sent to Hongtoushan Copper Mine for test; the technical performance was not so bad, but there existed many problems like uneven distribution of material on the filter surface, scratches in the surface by coarse size particles, angle of rupture, falling-off of surface layer, difficult cleaning and restoration for the iron concentrates of Donganshan Sinter Plant. Under this circumstance, we worked with the reputable and most senior professors of National laboratory of Tsinghua University and jointly tackled the key problems. Through thousands of tests, we selected the recipe of high strength, high percentage of opening area, even distribution and easy for cleaning and restoration from dozens of recipes, meanwhile we improved the equipment and modified technological process; finally the problems of the filter plate were solved. At the same time we changed Siemens PLC of serial S7200 into the products of GE or Schneider, changed ultrasonic level meter into radio frequency level meter and changed all electrical elements into Schneider's product, thus enhancing the anti-interference ability of the overall control system and further working reliably and smoothly. In order to avoid flowing back of slurry to damage other completing equipment when the non-return valve fails, one more pipeline was added to make operation of the filter even safer. Additionally, we modified the scraping mechanism and simplify the overall structure so that it is not only simple and neat, but also easy for adjustment. All in all, the project of Donganshan Sinter Plant was a litmus test for us in developing the Vacuum Ceramic Filter. We have stood up the test and taken it as a good opportunity to further develop the technology of Vacuum Ceramic Filter. Subject to a serial improvement and modification, our Vacuum Ceramic Filter product now has extensive application and safer and reliable operation. The technical performance is excellent. From this point of view we have promote the development of ceramic filtering technique. Our Vacuum Ceramic Filter product belongs to second generation of Vacuum Ceramic Filter products. In 2002, 14×30m^2 Vacuum Ceramic Filters were selected in the technical modification project of Donganshan Sinter Plant, which has become the largest model project for using ceramic filtering technique in the country even in the world. According to the calculation, Ansteel Donganshan Sinter Plant is able to increase economic benefit of about 30 million Yuan per year due to energy conservation, consumables reduction, simplified thickening and filtering flowsheet to avoid metal losses and so on. The most important is that the project has solved pollution problem of Yangliu River, which was polluted for dozens of years by Donganshan Sinter Plant, gained obvious economic and social benefits and made the enterprise which was almost shut down revitalize again.

PART 2 THE INSTALLATION

2.1. The installation processes

- The installation is according to the steps below: Framework--case--stirrer--roller--scraping System--tube system--electric system(PLC);
- To separate the machine follows the contrary steps.

2.2. To hoist machine

After the equipment is delivered to the work place, choose a matching crane according to the weight of the equipment, then hoist the machine by hooking the lifting bolt on the machine. Keeping the balance and even the speed is necessary during the process.

2.3. Installation

a) The installation needs conform to the actual circumstance. The pipe's drop-in-level and slope should satisfy the demand of feeding, discharging, overflowing and so on, meantime the convenience of discharging, transportation, space for operating, testing, repairing should be considered.

b) The foundation of the machine can bear the weight of the machine and a certain degree of shock proof.

c) The bottom of the machine should have at least 1m high space.

d) The filtering pump should be installed 3m lower than the bottom of the machine.

e) All the leg-like supports must be on a horizontal surface. The error of the height of both rollers' ends should be less than 2mm.

f) To ensure the machine works regularly and efficiently, the following conditions are required:

- Compressed air for VCF: Pressure 0.5-0.7MPa, Maximum of instantaneous consumption of air 40m^3/h, diameter of solid < 5um.
- Circulating water: Pressure 0.5-0.7 MPa is for sealing the vacuum pump's water ring, cleaning the ore magma tank. Cleaning is 20min each time. Consumption of water is 6-8m^3 per set each time. (the time and consumption are reference valve)
- Clear water: Pressure 0.3-0.5 MPa is for allied wash, solid content < 5ppm. Cleaning is 45min each time. Consumption of water is 5-7 m^3 per set each time. (the time and consumption are reference valve)
- Acid for cleaning. The concentration of nitric acid for cleaning is 30-40%, and it will be diluted in the allied wash. Cleaning is 45min each time. The consumption of water is 20L per set each time. (the time and consumption are reference valve)
- Ore magma's condition. PH=1-12, temperature 5-10℃. Hydrofluoric acid, phosphoric acid, hot alkali and organic solution are not allowed to be contained. Vitriol is not recommended and kept away from chloride.

g) Condition of environment: Temperature 5-50℃ water is strictly prohibited for electronic device.

h) Storage condition for Vacuum Ceramic Filter: Temperature: 5-50℃, Moisture< 80%.

PART 3 OPERATION

3.1. Operation Panel

3.1.1 Switch of system operating method:

To choose the machine works manually or automatically according to program. After connecting to the power or crush stopping, the machine will be at initial state. The operator can choose the operating method by press this button. In normal situation, after choosing to work automatically, the equipment will start up roller, stirrer, filtering pump, vacuum pump, close discharging valve, open feeding valve, and be in work state. If there is a problem in any step or part, the system will stop starting up the program, and go back the manual state. Refer to the working filter machine, operator can shut the machine down by setting the "auto-manual" at "manual". Then the feeding valve will closed, the machine will keep working till the slurry reduce to a certain level. After cleaning the discharging valve, the discharging valve will open. After the ore magma tank is empty, the engine will stop; the cleaning valve will open and clean the tank; the machine will stop after cleaning, then discharging valve is open, the system is at manual state.

3.1.2 Switch of Filter Plates cleaning:

To choose the cleaning will be the manual method or automatic method according to program. No matter the machine is at manual state or auto state, the operator just need to set the switch at "manual" position, the machine will start cleaning immediately. If the machine is working automatically, firstly the automatic working will stop, then empty the tank and clean it, if it is working manually, the machine will pass the stop step, after cleaning the tank then start to clean the Filter Plates.When you set the Filter Plates cleaning in "Auto" position, if the machine is at automatic working state, the machine will not start to clean automatically till the circulating time is finished. If the machine is at "manual" state, the machine will pass other steps to clean the Filter Plates.

3.1.3 Switch of pause :

To pause the machine or start it up again. When the pause switch is "on" to a normally working machine, the machine will stop working for a certain period. Meantime the roller, vacuum pump, filtering pump will be stopped, feeding valve is open, stirrer will work, until the pause switch is "off", the machine will start to work again. During the period of the machine works automatically, if the alarm goes off, the machine will be paused , too. In such case, the operator need to re-set the alarm by using the reset/reposition switch and then use the "pause" button to start up the machine again.The pause button will not working when the machine is starting up, stopped and during the period of cleaning.

3.1.4 Reset/reposition button:

To set the alarm again. Because of the machinery's failure or other failure make a warning of the machine stop working, before you start up again, you must fix the failure and reset the alarm by using the reset button, then start up the machine.

3.1.5 Crashstop button:

Crashstop the working program and empty the ore magma tank. Because of any accident or particular, operator can shut down the machine by using this button. During the machine works automatically, if the stirrer stop, the system will be at the Crashstop state.

3.1.6 Button of roller maintenance:

When checking and maintaining the roller and the Filter Plates, the system is at manual or pause state, to turn off the manual

button on the operating box and the touch screen, and then by using the "left turn-right turn" switch and crashstop button to check and repair conveniently.

3.1.7 Stirrer's speeding potentiometer:

For stepless adjustment of stirrer's frequency. According to the character of material and requirement technology, the solid do not deposit the standardization.

3.1.8 Roller's speeding potentiometer:

For stepless adjustment of roller's frequency. The principle is that the roller turns faster, the production will be bigger. But the production should be according to real situation.

3.1.9 Touch screen:

To show the state of the machine, alarm information and manual control (startup/shutdown, open/close valve) display and amend machine's reference number and so on.

3.1.10 Pilot lamp: to show the working state of the machine.

Example: ○=lamp off ⊗ =lamp on ⛒ =lamp flashing

The details as below:

Manual	Auto	Pause	Cleaning	Remarks
○	○	○	○	No option after turning on or Emergency stop
⊗	○	○	○	Manual state
○	⛒	○	○	From manual to auto startup
○	⊗	○	○	Automatic state
○	○	⊗	○	Pause state
⛒	○	○	○	From auto to manual shutdown
○	○	○	⊗	Manual wash
○	○	○	⊗	Auto wash
⛒	⛒	⛒	⛒	Pilot lamp checking when startup

Table 1 Lamp Indications

3.2. Automatic operation

In normal production, the filter machine works automatically, and accordingly to the program which is set up already by using PLC. The progress: startup-production-automatic shutdown-allied wash-startup again. The detail as below:

To turn on the main power supply, use reset button to turn on the power control, to set the system in 'auto' position, the cleaning method's button is set in "auto", too. When the machine get into the startup program, the stirrer, roller, vacuum pump, filtering pump will start up, the discharging valve close, the running water enter into reverse circulation pipe, the ore magma/slurry will feed into the tank, after a prearranged time, the running water will be changed for filtrate for reverse circulation. And then the ultrasonic liquid meter and feeding valve control the liquid level, the electrode in the filtrate tank and discharging valve control the liquid level, and start solid-liquid separation. After a set working period, the machine shut down automatically, close feeding valve, the machine will continue to work till the slurry level reduce to the set level, system start to clean the discharging valve, after reaching the set time, the discharging valve will be opened, and empty the slurry tank to the lowest level, then engine stops, the slurry tank will be washed according to time setting, then vacuum pump, filtering pump, stirrer stop, filtrate discharging valve, vacuum pipe valve and reverse circulation valve are closed. The system get into allied wash program: the running water valve of reverse circulation is open, discharging valve is closed, cleaning valve of slurry tank is open, until reach the new highest level, the acid pump start working, the concentration of acid will be about 1%. After a set time, ultrasonic producer start working. Both acid and ultrasonic clean the Filter Plates together. After a set time, the cleaning is stopped, and reverse circulation valve is remained

open, in the time setting, clean the tubes and Filter Plates , wash and empty the slurry tank. After all that is finished, the next production period will start.

3.3. Manual operation method

When there is a particular need or a accident, we use manual method, to start up or shut down the valves. Do not use manual method operating the machine unless you know the working principle and all the parts of equipment very well.

3.4. How to shut down

3.4.1.Press "pause" button to shut down

To stop a regular working machine for a little while, press "pause" button, then the feeding valve is closed, and all other parts of machine will stop working except the stirrer. If there are some minor failures as follows, the system will pause automatically: the engine of acid pump is too hot, the water level of filtrate pump is too high, the engine of filter pump is too hot, the engine of vacuum pump is too hot, the filtrate backwash is failure, and the roller's frequency transformer is failure. After the problems are solved, just press the reset button, then the machine will be back to the automatic working state.

3.4.2.Press "manual-automatic" button to shut down

When the machine is working regularly, set the "manual-automatic" button in the "manual" position, the machine will get into stopping program (for details please read the automatic operation method), after the stopping program ends, the system goes back to the manual state.

3.4.3.A short time shut down for maintenance

To turn on the "maintain" button, press "pause" to shut the machine down, at moment all buttons on the control panel are locked except one which can control roller's direction and make the short time maintenance more convenient. After the maintenance, just switch off the "maintain" "pause" button, then the machine will work again.

3.4.4.Crash stop

When the machine is working regularly, after pressing "crashstop" button, all the engines will be shut down. After a short period, the discharging valve will open and flush the tank, solve the emergency. Before starting up again, unlock the "crashstop" button, press the reset button to reset, then choose a operation method to start up. If there are any serious failure as follows: a failure of starting up the stirrer, roller and vacuum pump, vacuum pressure has a failure, stirrer has a failure.

3.4.5.A long time shutdown

Before the long time shutdown, the machine needs to be cleaned completely and carefully, especially the roller, Filter Plates, slurry/ore magma tank, and the automatic ultrasonic cleaning, acid cleaning will be used, too.

3.5. How to cleaning

By using the "clean" button to realize the cleaning, when operator set this button at "manual" position, the system will start to clean immediately; when operator set it at "automatic" position, the system will start to clean according to prearranged cyclical time.

When the machine is working automatically, if starting to wash at this moment, firstly the system will shut the machine down, then empty the tank, the actual cleaning will be started.

When the cleaning starts, if the machine is manual state, system will pass the shutdown step, after flushing, the cleaning progress will start. sThe cleaning will accord with the set program , include the method and the time of cleaning (acid, ultrasonic or allied cleaning), the time setting need refer to the quality of cleaning staff and the cleaning result.

During the cleaning, the PH on the Filter Plates needs to be check regularly. PH 1-1.5 is OK, if is not, the volume of the acid supply need to be adjusted. If the cleaning starts from the automatic state, after cleaning finished, the system will get into automatic startup, start to work regularly; if the cleaning starts from the manual state, after cleaning finished, the system will be back to

manual working method.

When it is cleaning, if the running water's pressure < 0.3 MPa , then there is a possibility of the strong acid flows into the Filter Plates, so checking the relevant link and take a action to the problem are necessary, after regain the hydraulic pressure, then start to clean.

3.6. How to stop cleaning

If need to stop the cleaning process, can set the " cleaning method" at "manual" position, the cleaning process will be stopped, the machine will wash out the acid on the Filter Plates, then goes back to the initial state. Refer to the crashstop of the acid wash, the machine will warn "acid, not cleaned—reset or clean", at moment if the water pressure has no problem, can reset alarm, start up automatic operation. If there is no other choice but to stop the machine, operator must wash out the acid on the Filter Plates and in the slurry tank by manual control. The steps as follows:

3.6.1. Turn the roller manually

3.6.2. Hand open the backflush valve of the running water

3.6.3. Check the backflush pressure it should be 0.08—0.12 MPa;

3.6.4. Open the flushing valve of slurry tank to clean for 3 min

3.6.5. Backflush must last at least 10 min

3.7. Checking and Ajustment during operating and cleaning

3.7.1. Ore magma's level

To keep ore magma's level in a certain height is very important, the higher level, the longer time for producing the filter cake, the higher production and the moisture of the filter cake will also increase.

Using the touch screen to set the liquid level and the delayed reaction, if the liquid level is different from the setting point, the feeding system, ultrasonic liquid meter need to be checked.

3.7.2. Filter Plates

During the operating and cleaning process, Filter Plates need to be checked regularly, if there are damages, they need to be fixed immediately.

3.7.3. Vacuum degree

The vacuum degree determines the difference of pressure between filter cake and Filter Plates. It is a main factor and to be checked regularly through reading the vacuum pressure's meter.

3.7.4. Backflush pressure during the regular operating

Backflush pressure during the regular operating should be 0.08—0.12 MPa , if the pressure is higher than that, adjust the pressure immediately, to avoid the damage of the Filter Plates, if it is lower , check the filtering core is clean or not; the pressure is normal or not; the decompression valve is normal or not.

The reason of very low backflush pressure is the filtering core is blocked. A standardization of checking the condition of filtering core is the different volume between before filtering and after filtering.

3.7.5. Backflush pressure during startup and cleaning

During the startup and cleaning, the machine backflush by using running water, the pressure before filtering should be 0.3—0.5 MPa, if it is lower than that, check the machine as follows: the supply of running water is normal or not, pipe pump is normal or not, the filtering core is blocked or not.

3.8. Touch screen

Function	Limit		Unit	Setting
	Min	Max		
Roller's startup & shutdown, manual control			——	——
Stirrer's startup & shutdown, manual control			——	——
Vacuum pump startup & shutdown, manual control			——	——
Filtering pump startup & shutdown, manual control			——	——
Discharging valve of slurry tank off/on, manual control			——	——
Discharging valve clean off/on, manual control	off	on	——	——
Backflush's filtrate valve off/on, manual control	off	on	——	——
Backflush's running water valve off/on, manual control	off	on	——	——
Feeding control valve	40	96	%	%
Cleaning method: acid clean	no	yes	——	yes
Cleaning method: ultrasonic	no	yes	——	yes
Time setting: acid clean	1	120	min	45
Time setting: ultrasonic	1	120	min	50
Feeding valve off/on, manual control	off	on	——	——
Flushing valve of slurry tank off/on, manual control	off	on	——	——
Vacuum pipe valve off/on, manual control	off	on	——	——
Filtrate discharging valve off/on, manual control	off	on	——	——
Ultrasonic off/on, manual control	off	on	——	——
Acid pump startup/shutdown, manual control	off	on	——	——
Warning records finding	off	on	——	——
Auto-wash circulating; setting point	1	350	hour	7
Auto-wash circulating: circulation time			hour	7
Alarm goes off, checking impulse	off	on	——	——
Alarm's lamp flash checking impulse	off	on	——	——
Actual volume/level of slurry	0	100	%	
Actual pressure of backflush (optional)	0	40	0.1pa	——
Working hour of automatic method	0	——	hour	——
The last date, time and method of cleaning	——	——	——	——
Vacuum working time	1	120	1sec.	120
Vacuum checking time	10	200	0.1sec.	200
Delayed opening of discharging valve	5	200	1sec.	60
Flushing time of discharging valve	1	30	Min.	2
Flushing time of slurry tank	1	30	Min.	5
Flushing time of Filter Plates	1	30	Min.	10
Max filling time of slurry tank	1	30	Min.	30
Max empty time of slurry tank	1	30	Min.	30
Max slurry feeding time	1	30	Min.	30
Max filling time of filtrate tank	1	30	Min.	5
Max pressure of backflush(optional)			0.1pa	
Setting point of tank's lowest level	0	10	%	10
Setting point of filtering level	20	60	%	60
Resetting time for operation	10	6000	0.1sec.	1200
Set word of command(0: No word of command)	0	32767	——	——

Table 2 Functions on Touch Screen

3.9. Operation notice

3.9.1. The condition of regular operating

3.9.1.1. Pressure of air supply 0.5-0.7Mpa, pressure of feeding, discharging and drain valve 0.1Mpa.

3.9.1.2. Pressure of clear water for back washing 0.3-0.5 Mpa.

3.9.1.3. Pressure of mineral chute water 0.5 Mpa

3.9.2. The problems need to be checked and solved during the production

3.9.2.1. The operator cannot do manual operation unless knowing the working principle and process very well.

3.9.2.2. Adjust the vacuum's water volume; the water volume can be determined from the sound of the vacuum pump, the condition of air and the vacuum degree. The louder of the noise means too much water, the vacuum degree is less than 0.08 Mpa means water volume is too small.

3.9.2.3. Stirring frequency should be adjusted to 24Hz, rolling speed should be adjusted according to concentration of slurry and thickness of filter cake.

3.9.2.4. Checking the condition of the distribution head, using lubricant to lubricate every work period.

3.9.2.5. Check the lubricant cup every work period, if there is a shortage , fill up at once.(50# engine oil).

3.9.2.6. Check the backflush pressure before and after filtering, when the difference exceeds 0.1 Mpa , means the filtering core for backflush is blocked, should be changed.

3.9.2.7. Always check the conveyer belt, the conveyer belt stops, the filter machine shuts down.

3.9.2.8. Check the accumulation of ore on the scraper and the discharging groove, clean them in time , to prevent the damage to the scraper.

3.9.2.9. If there is any ore magma in the groove, when manual operating, turn on the stirrer, to prevent the deposition.

3.9.2.10. If there is a necessary to crashtop or pause, firstly increase the rolling speed, after the filter cake is thinner, then crashstop or pause.

3.9.2.11. Operator check the temperature and the sound of engine every work period, if there are any errors , must be solved and reported in time.

3.9.2.12. Operators check all the valves to see will they be opened nimbly every work period.

3.9.2.13. If the machine stops for 30min or above caused by failures or other reason, the machine should be cleaned by allied wash firstly to prevent the Filter Plates being blocked.

3.9.3. Combined wash

3.9.3.1. When empty the slurry tank and clean it, check the accumulation of ore magma, if there is any, need to be cleaned assistance with hands. Every time when you wash it , the liquidometer on the bottom must be cleaned.

3.9.3.2. Before cleaning, make sure there are acid in the acid can, dilute the acid according to the concentration, the acid concentration should be 30-40 and not allowed to be more than 40. When adding and diluting the acid, must pay attention to the safety, wash the spattered acid on the skin immediately.

3.9.3.3. No matter the manual or automatic wash, pay attention to the water level in the slurry tank, before startup the ultrasonic wash the water level must be over the Filter Plates.

3.9.3.4. Check the acid degree on the Filter Plates PH＝1-3, if it is necessary, adjust the feeding volume of acid accordingly.

3.9.3.5. Interrupting the cleaning process caused by a failure, the Filter Plates and the slurry tank should be cleaned by hand.

PART 4 MAINTENANCE

Before maintaining, make sure the machine is at the shutdown or maintenance stage.

4.1. Changing and adjusting the Filter Plates

4.1.1. Setting the machine at maintenance stage, at moment, manually control the roller rollback.

4.1.2. Clean the Filter Plates which is going to be removed and its surroundings by water.

4.1.3. According to the graph as below, take off the bolt firstly, then screw off the nut and take out the Filter Plates horizontally from the fixed bolt.

4.1.4. According to the Filter Plates's abrasion, to fix and discard the boards.

4.1.5. Installation is the other way round to disassembly, to position the Filter Plates is according to the number of filling pieces.

4.1.6. Refer to the dry Filter Plates, after installation, make sure the Filter Plates is completely wet before filtering.

4.2. Adjustment of scraper

4.2.1. Release the locking bolt of the locking nut and adjusting bolt of the reversal bolt(NO.4)

4.2.2. To decrease the gap between the Scraper and the Filter Plates, need to solid the adjusting bolt; to increase the gap, need to loosen the bolt, the suitable gap is 0.5-0.8mm.

4.2.3. After adjusting, locking the nut and locking the reversal bolt gentlely.

4.2.4. If the scraper and the Filter Plates are not parallel, adjust by loosing the bolt (NO.6), but make sure the dimension accord with the drawing, then locking the bolt.

4.3. Adjustment of distribution head

4.3.1. To adjust the pressure of the distribution head

4.3.2. Locking the nut, make the spring's length meets the requirement (35mm), to realize the adjustment.

4.3.3. To adjust the position of the backflush

4.3.4. Loosen the bolt of the fan shape board, turn the board to a certain position, locking the bolt, the best backflush position is the Filter Plates just pass the scraper.

4.4. Maintenance cycle

Detail table of maintenance cycle

Maintenance Item		Maintenance cycle				Remarks
		2 weeks	3 months	Half year	1 year	
Scraper		Check	Adjust			
Filter Plates		Check				
Distribution Valve			Lubricant			
	Valve seal		Check	Change		
	Laying		Check	Check	Change	
	Seal ring				Check	
	Fixed spring		Adjust			
	Glide axle			Check		
Pressure of swell can		Check	Adjust			
(roller, stirrer) gear's lubricant					Change	Change 50# engine oil once in the first 500 hours
(roller, stirrer) axle's lubricant						160g for roller & axle 20g for other parts
Stirrer's coupling bolt		Check			Change	
Axle seal			Check			
Vacuum pump			Check			
Filtrate pump			Check			
Acid pump			Check			
filtrate tank					Clean	
Decompression valve			Check	Clean		

Auto valve			Check			
Pressure meter			Check			
Air decompression valve			Check			
Pipes			Check			
Electric device	Ultrasonic producer		Check			
	Electrode of filtrate level		Check			
	Switches and buttons		Check			
	Pilot lamp		Check			

PART 5 FAULT CLEARANCE

Appearance	Cause analyses	Fault clearance
Stirrer warning,	Frequency transformer	Check, repair or change it
Operation stops	Stops working	Check, repair or change it
Stirrer warning, delay or overtime of startup	Stirrer's engine stops working	Check, repair or change it
Stirrer warning, frequency transformer error	Frequency transformer is too hot, electric relay trip.	Off and on the power, reset,if it continue to warn, check the engine and frequency transformer
Roller warn, operation stops	Frequency transformer stops working	Repair or change it
Roller warning, delay or overtime of startup	Roller's engine stops working	Repair or change it
Roller warning, frequency transformer error	Frequency transformer is too hot, electric relay trip.	Off and on the power, reset,if it continue to warn, check the engine and frequency transformer
Filtrate Tank warning, level is low.	1.electrode out of control or electric relay no working	1. repair & change the electrode or electric relay
	2.discharging valve is not closed	2.check&repair electromagnetism valve and pellet valve
		3.fill half of filtrate tank then start up the filter machine
Filtrate Tank warning, level is high.	1.filtrate pump no working	1.repair or change the engine or pump
	2.discharging filtrate too slow	2.adjust the adjusting valve on the filtrate pump
	3.electrode out of control or electric relay no working	3. repair & change the electrode or electric relay
	4.filtrate pump's discharging valve is not open	4.repair discharging ,electromagnetism or pellet valve
		5.half the filtrate
Filling overtime	Electrode & electric relay no working	Change them
Filtrate Tank warns itself is not under vacuum condition, and stops working	1.check the vacuum pump is working or not	1.repair, change engine, coupling, pump's engine
	2.check the valve of the filtrate Tank is normal or not	2.check electromagnetism valve and startup system
	3check water sealing is normal or not	3.check or adjust water pressure
	4.check pipe, filtrate Tank, distribution valve, and fix the leakage	4.change the broken parts
	5.check leakage on Filter Plates	
	6.check pressure gauge	
	7.check discharging valve of filtrate can is closed or not	
Under the automatic working condition, the time of filling the filtrate Tank is too long.	1.cleaning valve is not open	1.repair&change electromagnetism valve and air valve
	2.no water supply	2. resupply the water
	3.sewage's discharging valve is not closed	3.repair & change the broken parts
Liquidometer of slurry tank error	Liquidometer no working	Repair, change

PART 6 ELECTRIC CONTROL SYSTEM

6.1. Operation of electric control system

6.1.1. Operating introductions on electric component

6.1.1.1. Introduction of system's operating panel:

- 1SA: Startup switch, use for choosing the working method of electric control system. There are three positions: left is "manual"; middle is "vacant"; right is "auto"
- 2SA: Optional switch of cleaning method, use for choosing the cleaning method. There are three positions: left is "manual"; middle is "vacant"; right is "auto". During the filter machine's working period,left turn the switch, the system gets into " semi-automatic", the pilot lamp(4H) will be on; During the working period, right turn the switch(switch locked), system starts counting time automatically, and will clean automatically according to the time setting.
- 1SB: "pause" button, press once the system will be paused, press again the system will work again. This button will only work when the machine is working automatically.
- 2SB: "reset" button, when the operation is starting, press this button can start up the power supply; after fault clearance, press this button, can unlock the system, system works again.
- 3SB: "Method" optional switch. Left is "operate". Right is "maintain". Use for switching the between automatic operating and roller's maintenance. Before the roller works, right turn the switch, start the roller's maintenance function, at moment can switch the "roller maintain"(3SA)to prograde or rollback. When the machine is working , press pause button(1SB)to pause the machine, then right turn the "method" (3SA), the machine will go back from the operation process, start the maintenance function, at moment use(3SA) to prograde or rollback. When the maintenance finished, switch it back to the left, press the reset button again, the machine will resume to work. When the switch is at "maintain" method, other buttons on the touch screen will be disappeared.
- 4SB: System "crashstop" button. Use for crashstop the working machine. The button is mechanical self locking button, can be released by turning right. When it is pressed, it will cut off the power supply.
- 3SA: "roll maintain" switch. Use for switch the roller between prograde and rollback. This switch will only work when the "method"(3SB)is at "maintain" position(right)
- VR1: "stir speed" adjusting potentiometer, use for adjusting the stirrer's working speed.
- VR2: "roll speed" adjusting potentiometer, use for adjusting the roller's working speed.
- 2H: "manual" pilot lamp, when the lamp is on, it means system is in "manual "method.
- 1H: "auto" pilot lamp, when the lamp is flashing, it means automatic operation is starting; when the lamp is on, it means system's automatic operation has been started up, "auto" method is on.
- 4H: "clean" pilot lamp, when the lamp is on, it means system is in cleaning process.
- 3H: "Pause" pilot lamp, when the lamp is on, it means the system is paused.
- CMP: Touch screen. Make use of the touch button can operate system manually. Through the error information on the screen can find out the cause of the error. There are also operating situation and operating notice displayed on the screen.

6.1.1.2. Touch screen(CMP)introduction as follows:

6.1.1.2.1 Home page:

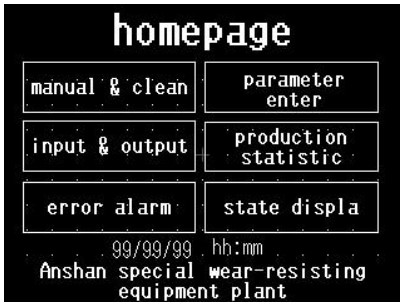

Fig. 6-1-1 Homepage Screen

a) Manual operation and clean setting: press and turn it to the manual operating page, then press the "manual" button to on and off all engine and valves.

b) Input & output state: press and turn it to the input & output state page, can exam the on & off situation of all parts.

c) Warning record: press and turn it to the warning record page, can find out the cause of error, white words mean the happening error, black words mean the cleared error.

d) Parameter enters: Press and turn it to parameter enter page, then can enter

and amend the parameter.

e) Production statistic display: Press and turn to the production statistic display page. The accumulating time of automatic operation, last cleaning method, the next automatic cleaning time can be seen on this page.

6.1.1.2.2 Manual operation page:

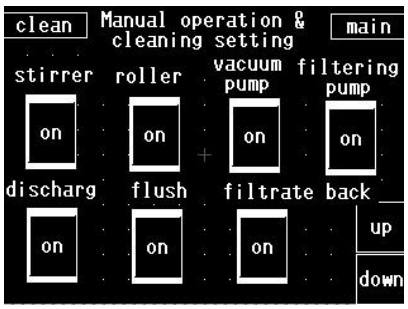

Fig. 6-1-2 Manual Operation

The manual operation of the following graph will be effected after "startup" switch (1SA) turn to "manual" and manual pilot lamp" (2H) is on.

In the graph, all the buttons are off except the "tank's discharging valve". Caution: after manual operation, all the buttons should be turned off on the screen.

6.1.1.2.3 PLC input & output state page

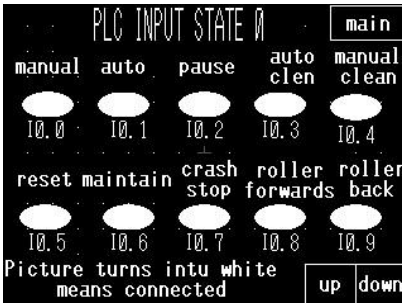

Fig. 6-1-3 PLC Input State

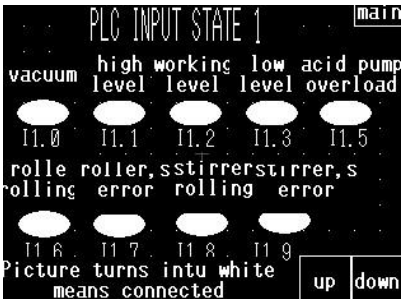

Fig. 6- 1-4 PLC Input State 1

In the following page, white is on; black is off. Refer to the connection graph of PLC input & output to check this part. Pay attention to the actual connecting situation of the hard switches (often opening point/often closing point).

- Input state on the panel of operating box (part)

Examples: "crashstop"(4SB), the connecting point of electric circuit is often opening point, so the "crashstop" changes into white in the graph, it means the often opening point is connected, I8=1 (PLC input address); When press the "crashstop", the often opening point is cut off, so when the "crashstop" is dark, it means this point is cut off, I8=0. The others are the same. "acid pump over loading" is connected to the overloading protection point of hot electric relay(6RJ)(often opening point), when it is white means this point is connected, the engine is normal; Dark means it is cut off, the engine is overloaded. "other protection", "roller error", "stirrer error" , white are normal. After starting up, they are still dark means error.

- Output state (part)

When the circle is white means the machine is connected and working. Example: "vacuum valve" change into white means connected to the power, at moment the vacuum valve is closed. "Discharging valve" is closed when it is connected to the power, opened when it is not.

6.1.1.2.4 Filter machine's working state page

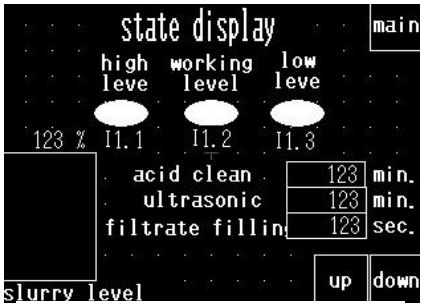

Fig. 6-1-5 State Display

When it shows "auto operation" means the machine working automatically. "Acid cleaning time" shows the remaining time in the acid clean; "filtrate filling timer" shows the time of the filtrate level raise to the working level. If this time is too long, it means the vacuum and the filtrate system have problem. "Slurry level" shows the slurry level in the slurry tank. The data will be shown as percentage.

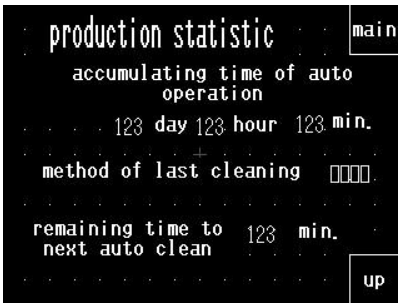

Fig. 6-1-6 Production Statistic

6.1.1.2.5 "production statistics" page Shows: the accumulating time of filter machine's auto working time "last cleaning method";"remaining time for next cleaning"(counting backwards, the function will be only effected when the machine is working automatically)

6.1.1.2.6 PLC's parameter page

Six page in total, by entering the code to open the parameter's pages and set the parameter. Press the parameter enter on the home page the left corner appears enter code "***", a key board will be shown, key in: AAA; then press "Enter", will enter into each parameter's pages. After parameter has been amended, the go back this page.

Caution: This operation must be handled by the production technician; the regular cannot enter parameter to avoid any damage to the regular operation.

6.1.1.2.7 "parameter enter" page (part)

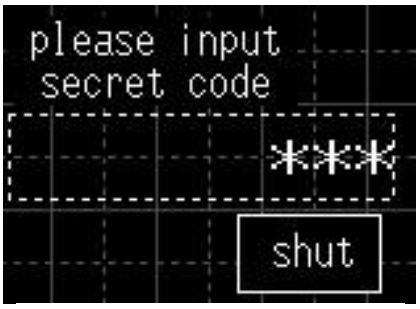

Fig. 6-1-7 Password Input Screen

The detail is in the "parameter establishment of filter machine on the touch screen" the ultrasonic cleaning time should be 5-10 min. longer than acid clean. (The actual setting is according to actual situation).

Caution: "The remaining time for next cleaning" on this page shows the remaining time and is not for setting. The self-cleaning time-gap (8 hours) cleans take each work period as suitable.

6.1.1.2.8 Setting of cleaning time and method

When the cleaning method does not choose, the clean procedure can not normally carry out. When choice, when touches "the acid cleaning" with the finger or "the ultrasonic wave" the circle diagram frame, attempts the frame to white for selects this cleaning method; touches again , attempts the frame to change darkly for cancels this cleaning method.

6.1.2. Filter machine's operation

6.1.2.1. The preparation for starting up

First, closes left side of the electricity cabinet the main power switch (Q), transforms in the cabinet gate the change-over switch (HK) observes the voltmeter (V) whether three phase voltage reading is normal. Observes on the manostat the voltmeter and whether the indicating lamp is normal. After normal, release the crashstop button on the operation panel (4SB), according to "the replacement" the button (2SB), this time in the cabinet control power source then starts puts through. After connecting to the power, then start up and operate the machine according to production.

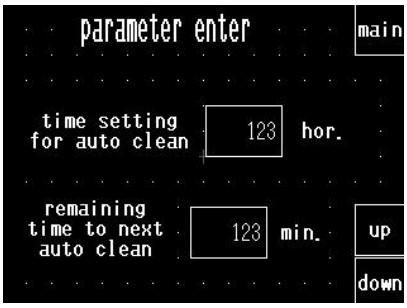

Fig. 6-1-8 Parameter Input Screen-1

6.1.2.2. Manual operation

6.1.1.2.1 Turn "startup" to the left—"manual", the pilot lamp (2H) is on, system get into "manual operation method". The manual operation of the electric system must be worked under this situation.

6.1.1.2.2 To operate by pressing the buttons on the "manual operation and cleaning setting" on the touch screen(CMP), during the operation, pay attention to the closing of pipe's valve, and the operation should be according to the handbook.

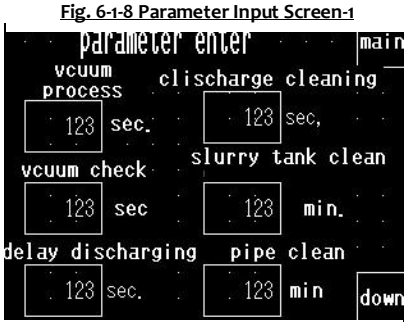

Fig.6-1-9 Parameter Input Screen-2

Caution: when finishing the manual operation, all the buttons on each page should cut off, and then select the "switch" to change to another operation method. During the manual operation, press " crashstop"(4SB), everything will be stopped. But must cut off all the touch buttons on the screen before release the crashstop button, otherwise the machine will continue to work, the accident can be occurred.

6.1.2.3. Automatic operation

6.1.2.3.1 How to start up the automatic operation: release the crashstop(4SB), check the air pressure, conveyer belt and the preparation of all pipes. When they are ready, can turn the "startup" to the right, then the machine will start working automatically. After starting up the machine, the pilot lamp (1H) is on, it means the system is in automatic processing.

During the production, the situation can be known and controlled through each meters and touch screen. The situation of the close-open of all pipes, the level of filtrate tank and slurry tank, and the feeding valve can be known in the "production state" and "input/output" page.

6.1.2.3.2 Automatic clean: turn the "cleaning method" (2SA) to the right. In the automatic processing, after the machine reach the setting time, system will clean itself and goes back to the auto working process after the cleaning.

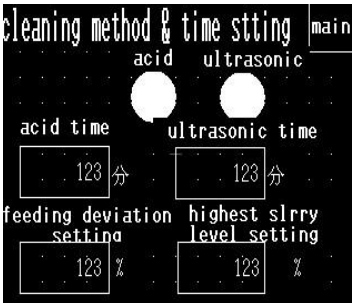

Fig. 6-1-10 Cleaning & Time Setting

6.1.2.3.3 "Semi-auto cleaning": in the auto working process, can get into the semi-auto cleaning any time. At moment can turn the "clean method"(2SA) to the left, the cleaning pilot lamp (4H) is on, system gets into semi-auto clean processing , and the whole processing is same to the auto one. When the cleaning finished, the system will go back to the manual state.

6.1.2.3.4 Automatic shutdown: in the auto working process, turn the "startup" (1SA) to the left, the "manual" position, system gets into automatic shutdown state. Stop feeding, discharging and closing all pumps and valves. If want to work again, must start up again.

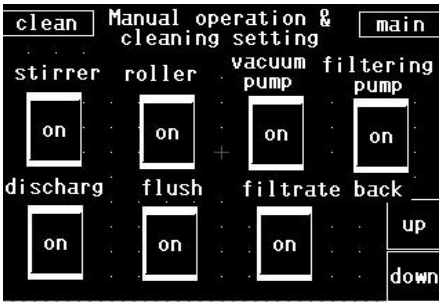

Fig. 6-1-11 Setting of Cleaning and Manual Operations

6.1.2.3.5 "Pause": when machine is paused, all parts will be shut down and closed except the stirrer. "pause" only can be used when the machine is operating automatically and pilot lamp (3H) is on.

1) "Pause" by operator: press once to pause the machine, and press again to work.

2) "Pause" by accident: during the production, the system can be paused by some failures. After fault clearance, press " reset" (2SB) and "pause" (1SB)can release the pause and work again.

6.1.2.3.6 Crashstop: when crashstop, the system will discharge the slurry from the tank. Please pay attention.

1) "crashstop" by operator: when there is a emergency during the production, press "crashstop"(4SB), the whole parts will be shut down, the output power supply will be cut off.

2) "crashstop" by accident: when a crashstop is caused by the serious, the system will discharge the slurry automatically.

6.1.2.4. Roller's maintenance(refer to manual operation)

6.1.2.4.1 "startup" switch to left—"manual" position, this is manual operation method, the pilot lamp(2H)is on, at the same time, turn the "method" (3SB) to "maintain".

6.1.2.4.2 At moment, can turn "roller maintenance" (3SA) to the left, roller turning forwards, will stop when the switch is released; turn to right, the roller will rollback, at moment, roller is rolling slowly, speed control's potentiometer is not working.

6.1.2.4.3 There is no system switch and roller switch on the control panel among some machines, but the control can be affected though the touch screen.

6.1.2.4.4 When machine operating automatically, can press the "pause"(1SB) to pause it, at moment turn "method" (3SB) to the right, the " maintain" position, by turning the "roller" switch right and left to control rolling forwards , backwards and slowly. When back from it, turn (3SB) to "operate" position (left), press "reset" can go back to the auto stage.

6.1.2.4.5 If change auto to manual, can switch the "method" to "manual".

Caution: After you turn it, the discharging valve will open, if you want to close it , can be realized though touch screen.

6.1.3. Electric system's error analyses

There are error checking and finding in the electric system, the relative information will give the reason and the part of that error.

6.1.3.1. Error's finding

If an error is occurred during the production, the alarm will warn. At the same time of warning, machine will pause by little error and shut down by serious accident. At moment the cause of accident should be checked on the screen, and the alarm will not stop before the problem is solved. The following details are on the warning page.

6.1.3.2. Interlock protection in electric control system

Interlock protection in manual operation:

6.1.3.2.1 Interlock of roller's prograde and rollback

6.1.3.2.2 When turn on acid pump, the backflush valve and running water: pump will be opened automatically and vacuum valve will be closed. When open the backflush valve, the running water pump will be opened automatically.

6.1.3.2.3 The slurry in the slurry tank must cover the ultrasonic board (the slurry is more than 68%), then plug the ultrasonic producer to the power supply.

6.1.3.2.4 Feeding and discharging are interlocks to each other.

6.2. Electric drawing and relative information

To know the electric control system well, the relative information of electric drawing, meters and control parts will be shown as follows:

6.2.1 Electric principle drawing (see Fig. 6-2-1)

6.2.2 Compilation of relative device's information

6.2.2.1. Introduction of UDK—201/G model electric level control

UDK-201/G model electric level control is mainly used for controlling the feeding and discharging of running water and sewage.

6.2.2.1.1. Working principle

Auto control system consist s the connection of ①, ⑦, ⑧three terminals, and transducer E1, E2, E3 three electrode sticks, through the connection of ②-③-④ three terminals and a engine's end.

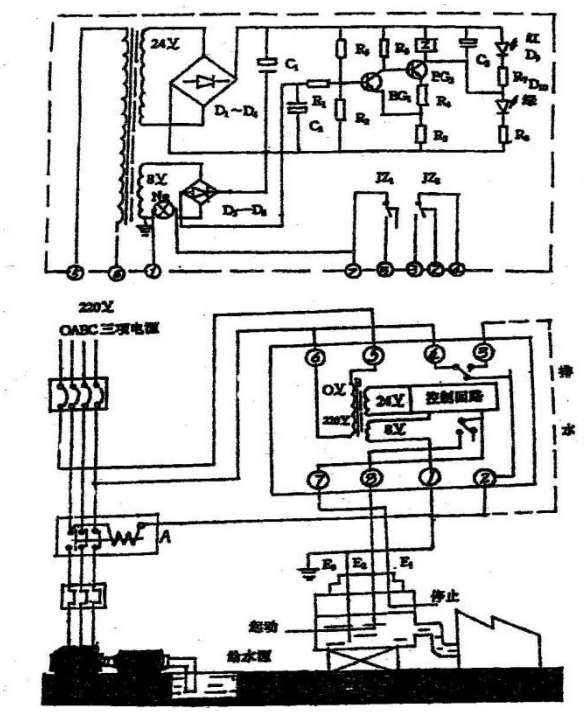

Fig. 6-2-1 Principle Drawings of UDK-201/G

6.2.2.1.2. The working principle of UDK-201/G model:

Connect the coil terminals of electromagnetism switch A and terminal of connector pin ②, through close touch point ④, connect 220V.AC 或 380V.AC power(③, be of no effect) after the meter connects to the 220V.AC power, suppose the level is below E2 electromagnetism stick, under this situation in the control cables the audion G1 connected, G2 cut off, so the electric relay will not attach. Because of ②, are the often close points, the engine will start to work and start up the water pump, fill the filtrate Tank, at moment liquid level is raising, and the green pilot lamp is on.

When the level reaches E2, the situation remains the same.

When the level reach E1, the electrode E1, E2, E3 will be on state, at moment, audion in the control cables G1 is cut off, G2 is on state, so the electric relay is not attached, ②, ④ connecting points change from often close point to often open point, meantime, through E1, E2 water resistance, electric relay will lock itself, water pump stops. At this moment, liquid level is

decreasing, the pilot lamp is red.

When the level reduces under E1, because of the effect of the self-lock, the situation remains unchanged.

When the liquid level is lower than E2, the control cable goes back to the last situation,②, ④ connection point change from often open point to often close point, water pump start filling the can.

Under regular situation, the liquid level should always be kept between E1 and E2.

When the water is being discharged, connect the coil terminals of electromagnetism switch to connector pin ③, connect to power by connector④. (② be of no effect)

At this stage, the working process is when liquid level reaches E1,electric relay is attached,③, ④connection point will cut off, water pump start to discharge. When liquid level reaches E2,③, ④connection point will be connected, water pump stops discharging, and continue to repeat this cycle.

6.2.2.1.3. Introduction of UDK—201/GH model electric level control:

After the meter connect to the 220V.AC power, suppose the liquid level is under E2, under this situation, the electroded will not be connected, amplifier's audion G1 cut off, G2 connected, electric relay attached, terminals ④, ② will close, the engine starts up the water pump to fill the can. At moment the level is raising and green pilot lamp is on.

When the liquid level reaches E2, the situation remains the same.

When the level reaches E1, E1, E2, E3 the electrode is connected by the liquid. G1 connected, G2 cut off, electric relay released, ④, ② connection points will open, water pump shuts down. When the level reduces below E1, because of E1, E2 water resistance between the electrodes are self locked, water pump remain stop. The pilot lamp is red.

When the level is lower than E2, G1 cut off, G2 connected, electric relay connected, ②, ④ connection points are closed, control cables go back to the last state, water pump start to filling the liquid can again.

In normal condition, the liquid level is always kept between E1 and E2, and continues to repeat all the time.

When the water is being discharged, connect the coil terminals of electromagnetism switch A to connector pin ③, connect to power by connector④.(② be of no effect)

At this moment the working process : when liquid level reaches E1, electric relay cut off,③, ④ connection points are closed, water pump starts discharging. When the liquid level reaches E2, electric relay is connected,③, ④ connection points are open, water pump stops discharging, and this cycle will repeat all the time.

6.2.2.1.4. The use of the controller

controller's eight legs plug ⑤, ⑥connect to 220V.AC power, ⑦, ⑧, ① connector pin connect to transducer's electrode E1, E2, E3, ②, ③, ④connector pin on the output terminal of DC electric relay.

The following test should be done for meter before use

Connect eight legs plug ⑤, ⑥ to 220V.AC power, then connect ①, ⑧ connector pin, state remain unchange, then short

circuit①, ⑦ connector pin, at this moment , should hear a sound of electric relay connecting, a multimeter can be applied to measure output connecting point,②, ④ should be cut off ③, ④ should be connected, then cut off ①, ⑦short-circuit, state remain unchanged, then cut off ①, ⑧short-circuit cable, electric relay release to last state,output points ②, ④ are connected,③, ④ are cut off, means meter is normal, test is done.

Electrode stick and container's inner wall must have at least 100mm gap, if there are two level controller in one container, the gap between two electrode sticks must more than 300mm.

Avoiding juxtapose controller and electromagnetism switch. Especially separate the meter and power line and high pressure line to avoid interference

6.2.2.1.5. Maintain

Electrode stick in the liquid should be cleaned every six months with sand paper to clean electrode stick. To avoid the resistance is too high, check the stainless steel's electrode is solid or not, and the electrode and container inner wall's insulation.

6.2.2.2. SENS9060 shockproof meter /introduction of switch

6.2.2.2.1 Summarization: SENSE9060B shockproof meter is use for measuring oil, water and powder, this instrument indentifies as continuing volume and switch output, reducing the effect of flowing, temperature and media greatly, making use of radio frequency and measurement of capacitance technology together, and making the compound electric capacity of lying the quality opposite with the height of thing single.

6.2.2.2.2 Drawing of structure and principle(See Fig. 6-2-2)

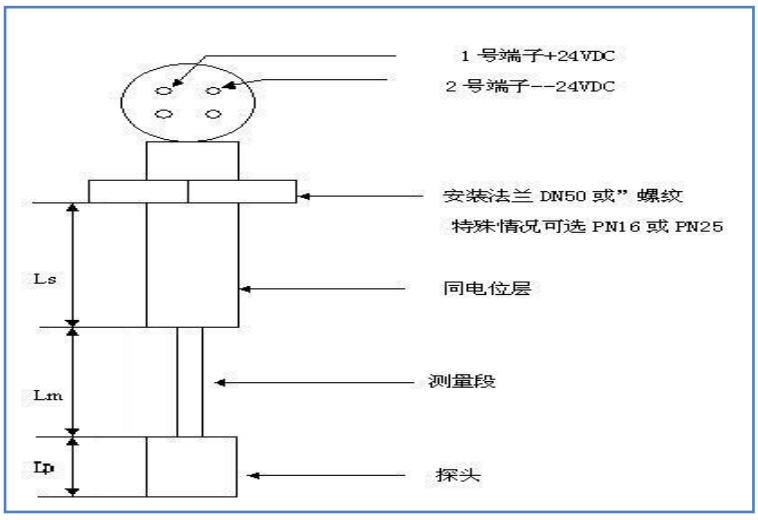

Fig. 6-2-2 Connecting Terminals

6.2.2.2.3 Considerations for choosing a model:

- Temperature scope and pressure inside tank
- Tank height, material (conductor or not), any holes on the inner wall and placket's measurement.
- Highest and lowest value or control value on the interface
- Interface output value two lines 4-20mA or work place display
- Continue value or switch value(1 or 2)
- Choose roof position and inner wall installation method

6.2.2.2.4 technological Regulations:

- 9060B meter's two lines 4-20mA's loading can be 1000ohm, deliver distance can be 1 km
- Precision is ±0.5%, the switch output can indentified as single and two points electric relay output.
- Transducer structure can be hard stick and soft stick, can choose install from the top or one side.
- 9060B staff level meter's head should be in the circumstance of lower than 200℃, 10Mpa, transform parts is between -30℃~+60℃

6.2.2.2.5 Regulated program

Instrument in the lab has been determined. At work place, if the difference is too big, then needs indicate again, steps as below:

1) After installment, check the connection line;
2) Adjust the liquid level to zero, adjust potentiometer PZ(102), make the output is 4.00 mA;
3) Adjust to a certain level(for example 50%), adjust PS(104);
4) Potentiometer, make the output is 12.00MA;
5) Adjust the liquid level to zero, if there is a error then repeat the step 2), 3);

6.2.2.3. Introduction to ultrasonic cleaning device

6.2.2.3.1. The structure:

Ultrasonic clean devices include power supply and transducer:

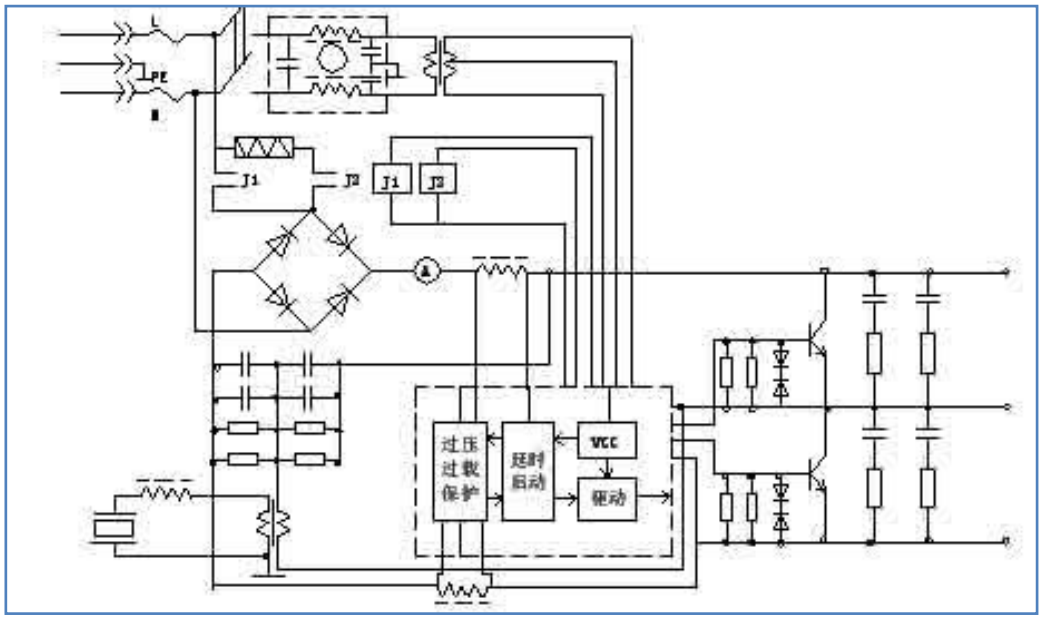

Fig. 6-2-3 Principle Drawing of Ultrasonic Cleaning Device

1) The function of ultrasonic producer is to change the power supply of regular frequency (50HZ) into the power supply of ultrasonic wave (25KHZ). Transducer is provided. This device use the modern electronic technology, the inverter circuit use new model switch IGBT. Circuit is more stable and reliable; System has overloading protection, delay power supply and power stable.
2) Transducer: The shell of transducer is made of stainless steel, take the argon-arc welding to make the sealed shell, resonance is installed in side shell. Transducer is transform the ultrasonic into mechanical oscillations, then transmit to cleaning liquid.

6.2.2.3.2. Working principle of ultrasonic cleaning device

Ultrasonic cleaning device is to use higher than 20KHZ frequency, through transducer to transform high frequency mechanical oscillations to cleaning liquid. In the cleaning process, high and low frequency ultrasonic radiate in turns, make the liquid flowing and produce many mini bubbles. These mini bubbles can produce high pressure suddenly and continuously, bombard

object surface and the dirty mark in the blind side constantly quickly peeling off.

This kind of function calls to get empty to turn erosion function, the super voice wave makes use of this kind of function realization to clean function.

6.2.2.3.3. Introduction and notice

1) Voltage is 220V/50HZ;
2) Cleaning liquid must be added, strictly prohibit to clean without water, in the slurry tank ,the water must cover the shock board, then can connect to the power;
3) Temperature of cleaning liquid cannot higher than 60℃;
4) Ultrasonic producer's engine box must keep away from water , very hot and causticity air;
5) Ultrasonic transducer must be carried carefully, cannot be crashed and shocked;
6) The connection of shock board must keep dry and insulating;

6.2.2.3.4. Maintenance of cleaning device

1) When slurry level reach 70%, under manual operation state press startup of ultrasonic on the touch screen, then it will work.
2) There are two situations can cause ultrasonic producer shut down:one is overloading instantly, at moment turn off the power for a moment then turn on again , will be fine. If it is overloading all the time, need to check the connection box carefully, to see what is wrong, the producer, connection or shock board. If is cable, then dry it; if is shock board , then change it. The maintenance must be done by a specialist.
3) During the operation pay attention to the fan, change it, if it is broken.

6.3. Electric errors

After an error, if it is not serious, then the electric system will pause; if it is serious, then the machine will have a crashstop, meantime the alarm (JB) will warn. The operator can find out the reason of error from "error warning record" page on the touch screen, then repair it. If it is a regular error, the problem can be solved according to the electric principle drawing and relative information.

6.3.1. Parameter establishment of the filter machine on the touch screen

Does a filter production craft parameter establishment, whether related filter regular production, these parameters establish are improper, but also can have the breakdown. Therefore, time establishment parameter please refers to the following explanation to carry on.

The Explanation of a filter various electricity's parameter establishment

6.3.1.1. Vacuum Processing time
Establishment scope; 1~600 Second, General Hypothesis: 120 Second, this value should be bigger than Filter Plates which Filled ore the time.
6.3.1.2. Vacuum inspection time
Hypothesis scope: 1~60 Second, General Hypothesis: 20second.
6.3.1.3. Extension of opening the ore Emitting valve
Establishment scope; 5~200 Second General Hypothesis: 60 Second
6.3.1.4. the time of ore Emitting valve

Establishment scope; 1~30 Second General Hypothesis: 2 Second

6.3.1.5. washing time of tank

Establishment scope; 1~30 Second General Hypothesis: 5 Second

6.3.1.6. washing time of Pipeline

Establishment scope; 1~30 Second General Hypothesis: 10 Second

6.3.1.7. the time of filling the Cleaning water

Establishment scope; 1~30 Second General Hypothesis: 10 Second

6.3.1.8. the time of washing and Discharging the air

Establishment scope; 1~30 Second General Hypothesis: 30 Second

6.3.1.9. The time of filling the filtrate

Establishment scope; 1~1800Second General Hypothesis: 300 Second

6.3.1.10. Max slurry feeding time

Max filling time, Establishment scope; 1~200Second General Hypothesis: 30Second

6.3.1.11. Slurry tank lowest fluid position of Slurry tank

Establishment scope; 0~25% General Hypothesis: 10%

6.3.1.12. the fluid position of ore tank discharging

Establishment scope; 20~60% General Hypothesis: 40%

6.3.1.13. The biggest fluid position hypothesis of filling the ore

Establishment scope; 40~96%

6.3.1.14. Deviation amount hypothesis of filling ore

Establishment scope; 1~20%

6.3.1.15. acid cleaning

Establishment scope; 1~120% General Hypothesis: 40Second

6.3.1.16. Ultrasonic cleaning time hypothesis of Ultrasonic

Establishment scope; 1~120second General Hypothesis: 50second

6.3.1.17. The supposes fixed point of self-cleaning supposes

Establishment scope; 1~350hour General Hypothesis: 7hour

6.3.1.18. purging method designation of cleaning

You can choose two purging methods. If you don't choose one, "the clean procedure" will enable to carryout, paying attention

6.3.2. Electrical maintenance

The daily maintenance of electrical system is very important regarding filter electricity, asks the user not to neglect.

In the electrical system, the application electric control, part maintenance, reference to the factory instruction, there are several opinions to refer

6.3.2.1. The waterproofing of electrically controlled cabinet and electrically controlled box waterproofing

6.3.2.2. When cleaning the machine, please pay the most attention to keep the electrically controlled cabinet, the box, the part on the operating box board away from the water. In order to avoid the nonessential losses.

6.3.2.3. Keep dustproof away from electrically controlled cabinet, battery case.

6.3.2.4. The filter production environment is worse, some many electric conduction dust. Therefore, in attention regular cleaning up electrically controlled cabinet, battery case electrical part dust. This is very important. General, a month cleans up a time, specifically regards the production environment dust size to deliberate.

6.3.2.5. The cleaning of Filtrate Tank's power connection port

6.3.2.6. The electricity pitch point fluid position control electrode, is the stainless steel stick, center the lower extremity with the insulation Porcelain isolation, the time steadily, in the filtrate dressing medicine fluid has been able to

deposit on the electrode, the insulation Porcelain on, on the electrode root's insulation pole, like this can cause between the electrode to short-circuit, creates the vacation fluid position signal. Therefore, must regularly clean up this electrode, the concrete time visible pulp nature deliberates. General, the magnetic separation pulp, a month cleans up a time, chemistry elects pulp 20 day to clean up time

6.3.2.7. Maintenance of Ore tank liquidometer

The measuring rod of the ore liquidometer measures, is inserted in ore magma it measure the capacitance between the material and the pole which if contacts comes indirectly to reflect the material the altitude. Therefore must pay attention: This surface of pole should not have the powdered ore, and so on. after cleaning, this pole should not be buried by slime. You should pay attention to the production and must wash the pole regularly. In order to avoid produces the false signal.

Table 3: Questionnaire of electrical system's error

NO.	Indicated Errors	Analysis of the error	Opinion of dispose
1	"Reports without the vacuum"	● The vacuum pipeline and the system leak air ● The power connection of vacuum meter is not stable (often opening point is closed or shaked) or the holding wire is separated. ● The value of the vacuum is too high ● "the parameter establishment is inappropriate:" "or the Slurry tank does not have pulp"	● Inspect whether the vacuum pipeline, the ceramics filter the board leaks air, filtrates, the opening on the vacuum degree regulating valve to is too big. ● Check table pitch point and its line. ● According to produces the actual situation to enactment this value, generally for >= 0.7 Pakistan about ● Once enactment: This time should be bigger than for the ore arrives the pulp, cover ceramics filter the board the time. When the tank does not have the pulp, you should inspect gives the ore pipeline.
2	filtrate pot "the high spacing" warning	● causing by the failure filtrates discharge valve ● wrong signal: High spacing electrode leakage ● The electrode controller (SWI) loses control	● Change or inspect the air passage of the valve1. ● Clean the contamination between the electrode; The electrode flange plate wiring column scours the water ● change SW1
3	The filtrate surpasses "the low spacing" (warning)	● The filtrate discharged valve has not been closed strictly ● There is something wrong with the vacuum or attracts, attracts the thick liquid pipeline ● "The low spacing" the electricity pitch point electrode return route leads the way	● Inspection filtrate discharge valve and pipeline ● inspects whether there is the vacuum degree and the Aspiration pipeline ● Inspect the electrode and the segment or the electrode controller (SW3)..
4	the time of the filtrate fills is too long" (warming)	● Vacuum degree is not enough ● The filtrate discharge valve has not closed strictly ● The filtrate fills the time" Supposes the definite value too small, smaller than fact production situation	● Inspect vacuum return route, the discharge valve on the filtrate pot. ● Inspect the filtrate discharge valve and its pipeline ● Reset "the value of filtrate filling the time", until to the production actual value.
5	The PLC memory electrical voltage is low.(warning)	Electrical voltage in the PLC power source is low.	change the battery
6	Vacuum overloading(warning)	● vacuum's engine overloading; ● electric relay broken; ● any missing item in power supply ● signal line short-circuit	● check pump's overloading ● check or change the electric relay; ● check any missing item in contactor ● check signal in circuit

7	Feeding time is too long (warning)	● feeding pipe is blocked, feeding valve is closed; ● slurry feeding is not enough ; ● max feeding time setting is too short; ● a leakage in discharging valve	● check feeding valve and pipe; ● check is there enough slurry; ● set feeding time according to the actual needs.; ● Inspect the ore valve and its control air course.
8	Uncontrolled voltage (warning)	● The systems control voltage (has not attracted for the 1KA relay gathers) ● There is something wrong with the Direct-current power supply 18LQ system	● Press the "reset button" start control power source or check KA return route; ● Inspect the direct-current power supply system.
9	The time of Slurry tank discharging air is too long.(warning)	● When cleaning, the time of the Slurry tank discharging air is more than the definite value ● The row of ore valve has not been opened ● The Slurry tank air discharging time" is too small	● Inspect the discharge valve and its the control air course; ● "The Slurry tank discharge air time" the value should be more than the actual.
10	The time of cleaning water too is long(warning)	● The discharge valve has not been closed ● The Slurry tank flushing washing pressure is insufficient; ● The Slurry tank flush valve has not been opened.	● Inspect the discharge valve return route; ● Inspect the Slurry tank flushing hydraulic pressure ● Again supposes "the note full water time" the parameter.
11	Ultrasonic cleaning effect is not good.(some or particular Filter Plates)	● return circuit of ultrasonic is broken; ● shock board's circuit is broken or short-circuit ● producer's circuit is broken	● Check is there any electricity in the return circuit (it should be 1.2A), identify is the fuse link broken. ● Check is the shock board short-circuits, is the connection broken. ● circuit board change original part, adjust again
12	Filtrate pump's engine is overloading.(warning)	Filtrate pump's engine is overloading.	
13	Error of roller's frequency transformer (warning)	● Frequency transformer error (I19=0). ● signal line(5A3)is broken	● check the error number from the window of frequency transformer, find the solution from the introduction ● check signal return circuit(5A3)
14	Roller's startup time is too long.(no signal response)	● operation signal of frequency transformer(I18)not delivered PLC, circuit is broken(5A2); ● Frequency transformer is not working, potentiometer VR2's inner connection no good or broken. ● No three item plug, frequency transformer no power output.	● Check signal line(5A2); ● Change or cut off Speed setting potentiometer. ● Check cut-off machine (2Q1), is the connection (2KM1) connected.
15	Operation error of roller's frequency transformer(no signal response)	● Operation error of frequency transformer; ● Operation signal(I18)no delivered to PLC, short circuit.	● Check frequency transformer's error number from its window ● Check and fix the circuit.
16	Error of stirrer's frequency transformer(warning)	● Frequency transformer error(I21=0) ● Signal line(5A5)broken	● Check frequency transformer's error number from its window ● Check signal line's(5A5) return circuit
17	Starting time of stirrer is too long (no signal response)	● Operation signal of frequency transformer(I20)is not delivered PLC, circuit(5A4)broken ● Frequency transformer is not working, speed setting potentiometer (VR1) inner connection is no good or leading line is open. ● No three item plug, frequency transformer no power output	● Check signal line(5A4) ● Check link line and potentiometer ● Check broken circuit device(1Q1)contactor(VKM1)

18	Conveyer belt is no working	The operation signal is not connected to PLC(I26)	Check signal's return circuit
19	Acid pump overloading (warning)	● Acid pump is overloading(I17=0); ● Signal line is broken(5A1)	● Check acid pump and its engine ● Check 5A1 circuit
20	Fan of electric box is overloading or switch of power is off.	● Fan's engine is overloading(I30=0); ● switch of power is off(19A) ● signal line is broken(5B6)	● check fan's engine; ● switch the power on(9Q); ● check signal line's return circuit(5B7)
21	Fan of electric box is overloading or switch of power is off.	● Fan's engine is overloading (I31＝0) ● power's switch is off(9Q) ● signal line is broken(5B7)	● check fan's engine ● switch the power on ● check signal line's return circuit

Table 4 Error Checking List of Frequency Transformer

Error No.	Error's appearance	Key points for checking	solutions
E. oC1	When increasing speed, transformer output electricity, cut off output	Is it increasing speed suddenly; is output short circuit landing	Longer the time of speed increasing
E. oC2	When operation is even speed, transformer output electricity, cut off output	Burden change suddenly or not; is output short circuit landing	eliminate the burden's change
E. oC3	When the operation is lowing the speed, transformer output electricity, cut off output	Lower speed suddenly to operate; is output short circuit landing;	Longer the time of speed reducing
E. oV1	When increasing the speed, because of recycled power, make the main return DC circuit's voltage is too high, stop output. This situation also can happen when power system has voltage waves.	Is acceleration too slow?	Decrease "accelerating time"
E. oV2	When operation is even speed, because of recycled power, make the main return DC circuit's voltage is too high, stop output. This situation also can happen when power system has voltage waves.	Burden is change greatly or not	eliminate the burden's change according to needs to use brakes or increase the power.(FR-HC)