

Two ESP Power Supply Patent Technologies

WANG Weixue¹, FANG Aimin¹, ZHENG Zhengguang², JIANG Chao²

(1 China Guodian Cooperation Environmental Protection Institute, Nanjing 210031, PR China

2 Zhejiang Jinhua East China Environmental Protection Co., Ltd, Jinhua 321016, PR China)

Abstracts: Two ESP power supply technologies introduced in this paper use “amplitude modulation & phase shift” as key technique, overcome most of the weakens on the basis of all the advantages of SCR phase shift and voltage regulation technique, improve the performance and collection efficiency of ESP in the bad condition, as well as has energy saving effect.

“SCR amplitude modulation & phase shift high voltage (HV) power supply patent technology” which updated form the SCR phase shift and voltage regulation technique, totally perverse existing ESP power supply system, can accomplish technical upgrading without stopping production.

“Integrated SCR amplitude modulation & phase shift high / low voltage power supply patent technology” has accomplished the integration of ESP high/low voltage power supply system with two patents of “amplitude modulation & phase shift” and “3 W industrial control machine”, and decrease its size of hardware by 4/5 than existing SCR phase shift and voltage regulation system.

Keywords: power supply, ESP, amplitude modulation & phase shift, 3 W industrial control machine

1 INTRODUCTION

SCR phase shift and voltage regulation for ESP is the most widely and longest used because of its technique advantages. However, in the bad condition, performance and collection efficiency of ESP will greatly decrease and it is the vital disadvantage.

In 1980s, aiming at main problems of ESP SCR phase shift and voltage regulation, the author drew a conclusion that amplitude modulation & phase shift power supply technique can improve the collection efficiency of ESP by line industrial experiment. In later 1990s, we developed ESP integrated SCR amplitude modulation & phase shift high/low voltage power supply device, and successfully upgraded several ESP power sources of 300 MW coal fired boilers. However, the system was still too large, feed main power electric cables are increased twice, and production must be stopped and existing power supply system must be removed for upgrading.

2 AMPLITUDE MODULATION & PHASE SHIFT HIGH VOLTAGE (HV) POWER SUPPLY DEVICE

2.1 Technical Innovation

ESP SCR amplitude modulation & phase shift HV power supply device has three technical innovations below:

2.1.1 First is Totally Preserving Active Duty SCR Amplitude Modulation & Voltage Regulation Technology

ESP SCR amplitude modulation & phase shift patent technology totally preserves all the technical features of SCR amplitude modulation & voltage regulation technology which makes it has three competitive advantages in the future popularization:

(1) All advantages of active duty SCR amplitude modulation & voltage regulation technology is preserved.

(2) The original manufactures can quickly batch produce this novel devices, and production quantity is guaranteed.

(3) It is beneficial to quick popularization in the enterprises which use active duty devices. There will be no extra technical difficult to the enterprises in technique upgrading.

2.2.2 Second is Accomplishing New Voltage Regulation with Technical Method Innovation

Voltage regulation principle of ESP SCR amplitude modulation & phase shift patent technology is a combination of active duty SCR phase shift & voltage regulation method:

(1) Two same SCR phase shift voltage regulation circuit are added on the basis of active duty SCR phase shift voltage regulation circuit.

(2) Three inputs of the SCR phase shift voltage regulator are paralleled as public input, and three outputs are independent.

(3) Three outputs of three SCR phase shift voltage regulator are connected in corresponding to three inputs of HV rectifier.

In bad condition or frequent change, compared to practical effect of active duty SCR phase shift voltage regulation HV power supply technology, new technology has three advantages:

(1) Performance is improved than before.

(2) Collection efficiency is greatly increased (dust emission concentration decreases by 20%-50%).

(3) It has an energy saving effect with same output power (10%-20%).

2.2.3 Third is Obtaining Market Competitive Advantages by Structure Innovation

To accomplish its structure innovation, ESP SCR amplitude modulation & phase shift device takes technical

measures of “three integration” which are:

(1) HV control units of each ESP field are integrated to a HV control cabinet, and it is called weak electricity control system integration.

(2) Amplitude modulation & phase shift voltage regulator is moved to the top of ESP and integrated with the HV transformer, which is called strong electricity voltage regulation and rectifier system integration.

(3) Existing power supply system and new added devices are integrated as new power supply system, which is called new / old devices integration.

Three advantages for market competitive are:

(1) Saving remarkable modification cost.

(2) Active duty devices are totally preserved.

(3) Production stop is not necessary for modification, and it can be done any time.

2.2 Voltage Regulation Circuit and Hardware for Power Supply Devices

2.2.1 Voltage Regulation Circuit Principle of Main Circuit Amplitude Modulation & Phase Shift Voltage Regulator

It is shown as Fig. 1. Voltage circuit is composed with existing SCR amplitude modulation & phase shift circuit and two new added same circuits. Three outputs of three SCR phase shift voltage regulator are connected in corresponding to three inputs of HV rectifier.

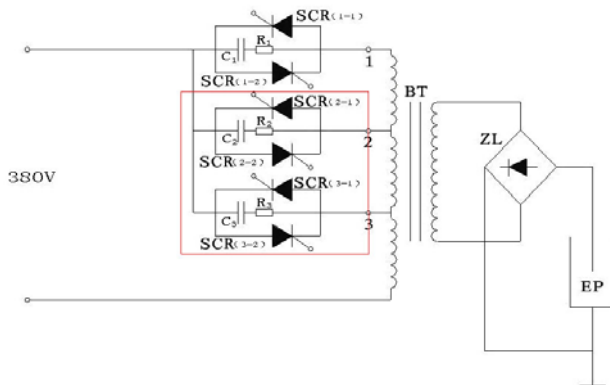


Fig. 1 Voltage regulation circuit principle

2.2.2 Hardware for SCR Amplitude Modulation & Phase Shift Devices

It mainly includes two parts:

(1) Silicon Controlled Rectifier (SCR) Amplitude Modulation(AM)/ Integrative Control Cabinet

One set integrator control cabinet can make integration of one cell of ESP (three fields or four fields) into a same size integrated control cabinet

(2) SCR AM / phase-shifting regulator

One set of SCR AM / phase-shifting (PS) regulator is made by three groups (together six pieces) SCR and is sealed up into oil tank.

2.2.3 Technological Updating on the Active Service Power Supply

The newly added equipments are integrated into one system with original apparatus and also keep original power supply system.

(1) A set of AM/PS integrated cabinet is added into each existing control cabinet of ESP cell.

(2) The newly added AM/PS regulator oil tank is connected with the existing commutator on the top of ESP.

(3) All the apparatus, including original and newly added ones, are connected by power cables into a new power supply system.

The online technological updating of a ESP power supply (two cells, four fields), usually needs three or four days.

3 INTERGRATED SCR AM/PS HIGH-LOW VOLTAGE POWER SUPPLY SYSTEM

3.1 The System Layout of SCR SP High-low voltage Power Supply System of Our Country Active Service ESP

Take two sets ESP (two cells, four fields) for a 300 MW boiler as an example, the system layout of high-low power supply system as follows:

(1) 16 sets of high-voltage control cabinet.

(2) 16 sets of high-voltage commutator transformer.

(3) 5 sets of low voltage control cabinet. Each cell needs a low-voltage control cabinet and a low-voltage integrated cabinet control the whole four low-voltage cabinet.

(4) One set of center supervisor. The two ESPs' power supply are controlled by the center supervisor.

(Sometimes two boilers use a supervisor together.)

3.2 The System Layout of the Integrated SCR AM/PS High-low Voltage Power Supply System

Take the same example as above, when use the new system, the system layout of the high-low voltage power supply are as follows:

(1) 4 sets of integrated high/low voltage computer controlled cabinets. (The same size as the SCR SP voltage regulator.)

(2) 16 sets of integrated AM/SP voltage regulator/rectifier. (the AM/ SP voltage regulator is placed in the high voltage rectifier's oil bank.

3.3 Technology Innovation of the Integrated SCR AM/PS High-low Voltage Power Supply System

The main objective innovation of the system is the adoption of the proprietary technology, namely 3W industrial control machine. The unique innovation is as follows:

3.4 High Integrated/Superpower Function/Miniaturization

3.4.1 High integrated

3 W industrial control machine integrates many technological elements together, including heavy-current and

light-current, control and driving, parametric detector and intelligent instrument, failure prediction and alarm-protection, produce process controlling and intelligence adjustment, network communication and information management.

3.4.2 Superpower function

The hardware of the 3 W industrial control machine integrates eight functions together as follows: control and adjustment function, direct driving (small power apparatus), parametric detection, intelligence instrument function, failure-prediction, alarm protecting, network communication, operation management.

3.4.3 Miniaturization

Despite superpower function, the machine has a very small size: 180 mm (high)×80 mm (wide)×160 mm (deep).

3.5 Generalization and Humanization

3.5.1 Generalization Design

3 W industrial control machine has a uniform design. When the machine is used in different situation, a change of connector and soft-medium mode will be compatible. Any

complicated control can be fulfilled by only one industrial machine.

3.5.2 Humanization

Controlling circuit needn't to investigate. It doesn't need to loose bolt, either a line when checking the failure. All the trouble-solving will be finished in one minute.

4 THE CONCRETE PROGRESS MADE BY THE TWO PROPRIETARY TECHNOLOGY

The core part of the two proprietary is the AM/ PS technology. It retains the advantages of the traditional SCR AM voltage regulator technology, but also overcomes their main shortcomings. After using the new technology, the operation parameters and dedusting efficiency has a promotion when ESP works under bad operation condition. Meanwhile it has energy-saving effect.

The updating on the present active service ESP power supply system retains the existing power supply and can be fulfilled online.

The newly technology makes the size of ESP' hardware (control cabinet) greatly reduced (reduced by 80%).