The Technology Introduction of Chain Boiler Energy Conservation Transformation

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Abstract. Introduced the present status of chain boiler efficiency is low, the system analysis of the chain boiler optimization and upgrading of technology, for the whole progress of chain boiler to provide some ideas and reference.

1. Introduction
Energy structure is given priority to with coal in our country, in 2016, the total energy consumption in China is about 4.36 billion tons of standard coal, which accounts for 60% of total energy consumption of coal, coal-fired industrial boilers and coal consumption of about 600 million tons per year, is the second largest coal consumption is second only to that of coal-fired power plants. Widely used chain coal-fired boilers, common problems mainly has two aspects: on the one hand, the boiler thermal efficiency and operation output too low. The average operation efficiency of around 65%, with about 15% of the energy saving potential; On the other hand, the boiler emissions cannot meet the national or local environmental protection standard. If you can to energy conservation and environmental protection to optimize existing chain boiler, is expected to reduce the coal consumption of 30 million tons a year. It is of great significance to energy conservation and emissions reduction in China.

2. The Basic Structure and Principle of the Chain Boiler
Chain coal-fired boiler is mainly by the coal feeding system, chain grate, boiler body, economizer and air preheater and other major parts. Its working principle is to point to in the process of coal combustion heat after conversion to produce steam or into hot water, but not all the heat was effective transformation, but the part there will be no work consumption. In general, the larger the boiler combustion efficiency is higher. But for industrial boiler, the evaporation capacity of the boiler size is according to the size of size and investment demand of steam to decide, not blindly pursuing big.

No fuel in the chamber of a stove or furnace combustion is expelled, the heat loss is called the mechanical incomplete combustion heat loss. It is a major project of boiler heat loss, usually after smoke heat loss. It includes the following three parts: namely, not burning of carbon in ash, along with the smoke lost not burning carbon, sedimentation in flue ash in the burning of carbon. There are many influence factors in incomplete combustion loss, such as fuel properties, combustion mode, excess air coefficient, combustion equipment, furnace and furnace structure gas-solid mixing situation, etc. This article mainly discusses the optimization of furnace arch structure, secondary air device layout, three aspects of automatic control, to reduce the mechanical incomplete combustion heat loss and incomplete combustion of gas loss, improve the thermal efficiency.
3. The Chain Boiler Efficiency Modification Technology

3.1. The Furnace Arch Optimization Techniques
Furnace arch is actually made special shaped refractory furnace front wall and back wall, generally divided into arch before and after the arch, some in the stove and the arch, arch is by the chamber of a stove or furnace in hanging between before and after the arch of refractory components. The function of furnace arch mainly has two aspects: one is to strengthen the mixture of airflow in furnace. Second, reasonable organization thermal radiation and heat within the furnace flue gas flow. When the types and characteristics of coal are different, and the furnace arch effect of focus is also different. Such as: when burning low volatile anthracite, the fuel is the biggest difficulty is not easy to catch fire, then the arch design and decorate, should be given priority to ensure the timely of fuel on fire; And when burning high volatile bituminous coal, separating out due to a large amount of volatile matter concentration inside the furnace gas distribution is very uneven, so, at this time of the arch design and decorate, should give priority to in order to strengthen the mixture of air, for full combustion of volatile matter and burning.

Our country coal quality difference is very big, once the user has to change the gasification of coal source, is likely to lead to the furnace arch is not adapt to the new coal, fire, difficult is ash carbon content increases, this is also lead to one of the reasons of low efficiency of chain coal-fired boilers in our country. In order to improve the furnace arch of the adaptability of coal and coal burning rate, researchers developed some new type of furnace arch in practice, such as adjustable furnace arch. This kind of furnace arch of the idea is to through the arch design for sliding or rotating parts, or rotation Angle can be adjusted according to different types of length, adapt it to the burning of coal. Furnace arch regulating activities more flexible, but because of moving parts, still can free activities, to ensure that the high temperature materials and the manufacturing technical requirements are relatively high, is not conducive to promoting.

Traditional usually adopt the method of pure experience to the design of furnace arch, xi ’an jiaotong university, this paper proposes a group of alpha burning flame of the fire bed furnace arch design new method -- the momentum synthesis furnace arch design, concrete method is to make the airflow in furnace form "alpha" form flow route, the high temperature air in front of the furnace to form big return, for the new fuel heating, make fire conditions improve, and is advantageous to the coke particles in gas separation and the blockade, reduced the volume of fly ash, and improve the efficiency of the boiler.

Invented by professor Huang Xiangxin double type furnace arch, has better adaptability of coal, good energy saving effects have been achieved in practice. Behind the arch general design is relatively low and long, and the head tilt down, the word "people" shape. Before the shape of the arch is similar, double type furnace arch hence the name.

Although these new types of furnace arch in the energy saving effect of practice has been made, but because of the lack of design theory and design specification, it is difficult to directly by the chain boiler factory production, users are generally in the use of traditional arch find fire difficult or inefficient, commissioned designers. The design process is dependent on the engineering experience.

3.2. Layer Combustion Technology
Chain grate fire conditions is poorer, rely mainly on the furnace cavity flame radiation heat and arch. The top of the coal fire first, then gradually burned down, there is an obvious on the grate of the delamination area, is divided into five zones. Fuel preheating dry in the new combustion zone, occupies a considerable area on the grate. Then fuel release volatile, and burning. Going really fierce, burning from the lower part of grate have run out of oxygen in the air in the oxidation zone quickly and combustion products and water vapour rise after the reduction zone, immediately by the hot coke knowledge reduction. Finally formed at the end of the chain grate gray chengyang district. Way is adopted widely in the chain grate into coal: coal, grain and coal dust mixed together in front of the coal into the furnace coal scuttle, by weight of chaotic to fall to grate, after the board reaches a certain
height control coal seam thickness, coal with mobile together into the furnace chamber combustion. In combustion phase, need a lot of air from the fire grate bottom blowing coal seams, because the coal on the fire grate is mixed with coal and coal dust, coal dust prevented from air supply under the fire grate, oxygen is not fully and the general hot carbon reaction, oxidation zone thickness of coal seam thickness ratio will be less, means less carbon reaction of carbon dioxide with general heat produce less carbon monoxide, emit less heat, this is very bad for fuel combustion; Again, coal slack in the middle, becomes coated with coal dust, dust coal burning ash block coal grains and oxygen to keep contact, not fully burning coal grain, the grey fish increased carbon content. So not refitted air supply chain grate often appears, need positive pressure decay of positive pressure combustion, arch before and after the serious slagging, fire bed partial, such as crater phenomena.

General configuration is the current industrial chain boiler coal hopper blending the door, this kind of configuration there is a lot of shortcomings. Coal column, such as: the door heat deformation, lead to different thickness of coal seam; Coal gate control device for poor working conditions, which can't play a regulatory role; Coal failure alarm board cooling water to the cooling effect, the leakage of water also worsens fuel ignition and combustion. These failures occur, it need us to stop the furnace maintenance, will affect the normal production and cause huge economic losses. Therefore, we need to improve the existing coal feeder.

Nowadays, the commonly used into layered coal scuttle improvement scheme is replaced. Layered coal scuttle can improve coal way, improve the ignition conditions, reduce coal leakage, reduce the ventilation resistance, enhance the moisture evaporation, loose coal, increase the contact area of coal with air, so as to achieve the goal of fuel burn adequately.

3.3. Air Distribution Technology
In the combustion of coal seam when the required air supplied by wind at the bottom of the warehouse. Early to use the way of air supply system storehouse chain boiler, namely only are an integral part of the supply chain under the warehouse, this way of air distribution, although simple, but because in the combustion of coal seam from ignition to strong, and then to go out in the whole process of the air demand is different, so the supply air volume and air distribution system storehouse form burning air was not needed for the match. Due to air volume is close to uniform, and combustion in the medium term into apparent, so in the middle of the medium-term caused extreme lack of oxygen, but due to the low and extremely rich oxygen combustion on both ends. So, if you want to ensure medium-term combustion enough air, must further increase the coefficient of excess air, which also causes on both ends of the air volume is too large, increase exhaust losses, affect the efficiency of the boiler.

To overcome this defect, the modern boiler in single wind warehouse improvement for wind warehouse, in order to realize the segmented with the wind, the wind a storehouse of air flow through the damper control. Breeze warehouse combination formed different way of air distribution, common are as soon as possible with the wind, delay after the wind and strong winds blow, as soon as possible with the wind is in the chain grate first nerazzurri warehouse give big air volume, in order to to coal burning as soon as possible. And delay the air distribution in the rear part of the supply air volume, after strong winds blow to the center of gravity of the more backward. The air distribution mode is put forward in practice, but they will influence on what is the internal combustion is a lack of in-depth research.

Segmented with the wind with the wind for a series of storehouse have markedly improved, but because the wind warehouse number is less, the wind in the same positions may still cannot adapt to severe changes needed for combustion air. For this, the researchers in windy warehouse and on the basis of the proposed improvement project of "small cowl winds storehouse", namely in the wind to the top of the silo equipped with small ventilator, make the air in the same wind warehouse also can adjust further refined, so, the supply of air under the grate along grate can more precisely adjust, make it more tend to be air demand curve, at present this kind of small ventilator system was still in the stage of trying to change.
3.4. The Chain Boiler Automation Technology

Using the computer for automatic control process of boiler operation, to send air volume, ventilation rate, automatically adjust the amount of fuel, water, etc.; And to send air volume, hearth negative pressure, drum water level, steam pressure, steam flow, flue gas oxygen content, water temperature, water, emissions, furnace temperature, flue gas temperature, hot air temperature before and after the air preheater and economizer flue gas temperature automatic detection and analysis before and after treatment.

The automated task in the process of boiler combustion is mainly adapt fuel quantity of heat to the boiler load, as well as combustion safety guarantee boiler combustion efficiency. Attention should be paid to ensure the stability of the air pressure boiler combustion, ensure the given value of negative pressure in the furnace. The boiler control system three volume is the basis of the boiler automatic adjustment. These three-adjustment amount is the amount of fuel, air volume and air volume. Due to the system of boiler is very diversiform, adopt what kind of control system is not unified. Optimizing system is mainly done on the basis of the testing equipment. Optimizing system mainly measurements, focus on the parameters of the combustion monitoring, such as the parameters of the coal dust monitoring. This kind of system can timely diagnosis and guiding boiler automation system, the analysis of the problems has certain ability. Optimized system is proposed, but in order to realize the closed loop operation still need people to complete, this kind of operation personnel usually has a rich experience and high level.

4. Conclusion

Although in recent years with increasing environmental pressure, gas boiler gradually replaces coal boiler in all large and medium-sized cities, but in the economic development of our country energy efficiency is low and the consumption structure is not reasonable, this process is a long-term process. Because of this, it is necessary to improve the coal-fired boiler energy saving technology, said in a certain sense, coal-fired boilers in our country and bring effect has important practical significance.

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