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DESIGN OF A DRAG-REDUCING SYSTEM FOR SMART BAR CONVEYING CHAIN PLATE

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Abstract. This paper presents a solution to the issue of high frictional resistance between the chain plate and guide rail in cigarette conveying systems, which can result in chain plate failure. The proposed solution is an intelligent drag reduction system that incorporates lubrication and automatic dust removal. The system includes a conveyor chain plate, supporting roller assembly, air knife dust removal assembly, chain plate lubrication assembly, and controller. The controller manages the dust removal assembly's air source output and the lubrication of the chain plate assembly through the opening and closing of an electromagnetic valve, which controls the oil output to decrease resistance. Experimental testing of the system shows that it effectively reduces the chain plate's frictional resistance in the cigarette conveying line, resulting in improved system efficiency

Key words: cigarette conveyor chain plate; drag reduction system; controller

1. Introduction. Currently, the intelligent cigarette conveyor chain resistance-reducing device used in the cigarette conveying system mainly detects the data fed back by the running resistance of the conveying chain plate of each channel. It compares the feedback data with the set threshold according to the feedback data. Suppose the resistance value is greater than the threshold. In that case, the system will compress the air in the corresponding channel, automatically remove dust and add lubricating oil, thereby reducing the resistance of the chain plate. Currently, the commonly used lubrication methods in the bar cigarette conveying system include brushing or artificially adding lubricating oil to the driving sprocket of each motor power head. For dust removal, this method will usually transfer dust to other channels, causing secondary pollution, which is inefficient and increases labor, which is not conducive to dust removal.

Lim[6] present a detailed optimal control design based on the general finite element approach for a structure's integrated design and control system. Wang[11] investigate the effect of the stretching-bending coupling of the piezoelectric sensor/actuator pairs on the system stability of intelligent composite plates. The objective of muFly[8] is to build a fully autonomous micro helicopter comparable to a small bird in size and mass. The trajectory tracking problem of a closed-chain five-bar robot is studied [2]. In the end, Maslák[7] presents a design for converting current labeling using bar codes into labeling using RFID tags. Tsuge[10] uses path synthesis techniques to design four-bar linkage modules to constrain the movement of a 3R chain. The fundamental research question is: how could an intelligent city production system change supply chain design? In answering this question Kumar[5] developed an integrative framework for understanding the interplay between smart city technological initiatives (big data analytics, the industrial Internet of things) and distributed manufacturing on supply chain design. Motivated by the desire for high-throughput public databases[9, 4] design incentive-compatible protocols that run "off-chain", but rely on an existing cryptocurrency to implement a reward and/or punishment mechanism. Abdel-Basset[1] present DEMATEL and AHP in neutrosophic environments to deal effectively with incomplete, uncertain, and incomplete information. Chung[1, 3] consider an innovation in dynamic supply-chain design and operations:connected smart factories that share interchangeable processes through a cloud-based system for personalized production.

Currently, the plastic chain plate online lubrication system configured for the cigarette conveying system of the cigarette factory realizes online automatic detection of the chain plate running resistance and comprehensive analysis. The average running state of the chain plate is the chain plate running state. The detection device

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detects that the chain plate pulse data is relatively uniform. The abnormal operation of the chain plate is mainly manifested by bumping, creeping and breaking. When the pulse data of the chain plate detected by the chain plate operation state detection device is relatively large, it indicates that the chain plate has to bump or to creep. When the pulse continues to output, it means that the chain plate is broken and stopped. Standard dedusting methods are: manually blowing the dust scattered on the chain plate surface by using a compressed air gun on the surface of the cigarette conveying line and transporting it for a long distance. Generally, the drive head of the conveying line will be arranged in multiple sections. Only manual blowing can be carried out on the segmented chain plate to reduce the running resistance of the chain plate. The dust purged has yet to be recycled in a centralized way, causing secondary pollution. In addition, it is necessary to add lubricating oil manually, The usage can not be accurately controlled, and the inner side of the chain plate is not evenly smeared. If too much smearing is done, it is easy to penetrate the surface of the chain plate and pollute the delivered cigarette products; When there is dust on the chain plate, the lubricating oil will firmly adhere the dust to the chain plate, thus increasing the running resistance of the chain plate. Low working efficiency and high labor intensity.

The contribution of this research lies in the design and implementation of an intelligent drag reduction system for cigarette conveying, which addresses the issue of high frictional resistance between the chain plate and guide rail. By incorporating lubrication and automatic dust removal, the proposed system reduces the frictional resistance of the chain plate, thereby improving the efficiency of the conveying system.

The system design includes several components, such as the conveyor chain plate, supporting roller assembly, air knife dust removal assembly, chain plate lubrication assembly, and controller, which work together to achieve the intended reduction in resistance. The controller's ability to manage the dust removal assembly's air source output and the lubrication of the chain plate assembly through an electromagnetic valve allows for precise control of the oil output and ensures that the system operates optimally.

The experimental testing of the system further validates its effectiveness in reducing the chain plate's frictional resistance, which is crucial for the smooth and efficient operation of cigarette conveying systems. Therefore, this research's contribution is significant in terms of improving the efficiency and reliability of cigarette conveying systems and may have broader applications in other industries that rely on similar conveying systems.

The plastic chain plate online lubrication system is a set of integrated systems specially designed for the plastic chain plate of cigarette conveying lines and application scenarios.

1.1. System model. The plastic chain plate online lubrication system is a complex system that consists of several different components working together to achieve efficient and reliable operation. The system includes several sets of online lubrication and dust removal devices, automatic lubricating oil supply devices, centralized dust collection devices, single independent drive heads, and the main control system.

The online lubrication and dust removal devices are responsible for applying lubricant to the chain plates and removing any dust or debris that may have accumulated on them. The automatic lubricating oil supply devices are used to control the flow of lubricant to the chain plates, ensuring that the plates are adequately lubricated without being over-lubricated, which can result in additional issues such as build-up and accumulation of debris.

The centralized dust collection devices are designed to collect and dispose of any dust or debris that may be generated during the operation of the system. The single independent drive heads are responsible for driving the chain plates and ensuring they move along the conveyor as required.

The control substations are used to manage and control the individual components of the system, ensuring that they operate as intended. Finally, the main control system is responsible for overseeing the entire system's operation and coordinating the various components to ensure that they work together efficiently.

Figure 1.1 provides a graphical representation of the system's components and how they are connected, allowing for a better understanding of the system's overall design and operation. Overall, the plastic chain plate online lubrication system is a complex but crucial system that enables the efficient and reliable operation of conveyor systems that rely on plastic chain plates.

The line lubrication and dedusting device mainly consist of the lubricating oil pot, the oil pot high-level detection sensor, the oil pot low-level detection sensor, the precision electric pump, the single-channel compressed

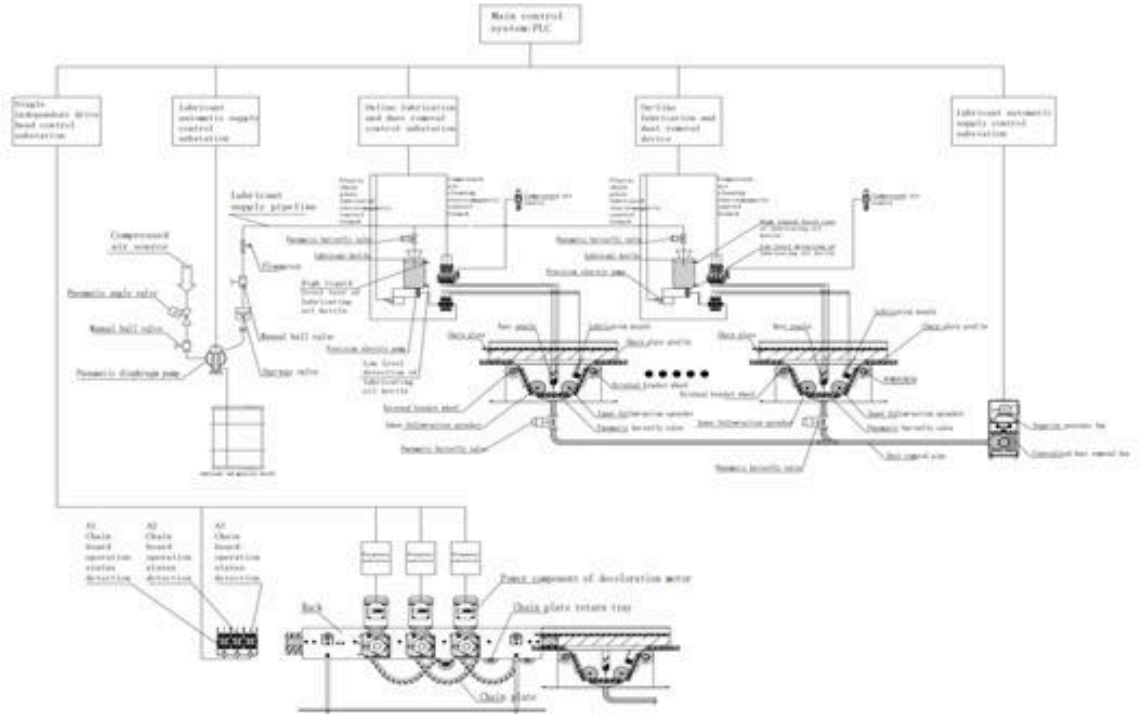

Fig. 1.1: The overall design of the system

air dedusting control solenoid valve group, the lubricating oil circuit control solenoid valve group, the dust blowing nozzle, the outer supporting roller 01, the outer supporting roller 02, the inner supporting roller 01, the inner supporting roller 02, the centralized dust hopper, the lubricating nozzle, and the online lubrication and dedusting control substation.

The working principle of the online lubrication and the dedusting device is to change the chain plate of this section from the original straight section to a U-shaped track by reasonably arranging the outer supporting roller 01, outer supporting roller 02, inner driven sprocket 01, and inner driven sprocket 02. The purpose is to avoid the installation position of the dust-blowing nozzle and the lubricating nozzle and to facilitate daily maintenance and overhaul. The internally driven wheels 01 and 02 adopt the sprocket structure. The advantage is that the sprocket engages with the inner side of the chain plate so that the chain plate will not deviate from left to right during operation, which will lead to failure during the U-shaped track return. The lubricating oil pot is equipped with an oil pot high liquid level detection sensor and an oil pot low liquid level detection sensor. When the oil pot is at a low liquid level, the system automatically starts the automatic lubricating oil supply device to send lubricating oil to the high liquid level alarm, and the supply is suspended. The single-channel compressed air dedusting control solenoid valve group starts the solenoid to connect the compressed air source to purge and dedust the inner side of the chain plate when the system needs single or multiple-channel chain plate dedusting. At the same time, the centralized dust suction hopper directly below is used to collect the dust purged to avoid secondary contamination and clean the dust expressed by the chain plate. The lubricating oil circuit control solenoid valve group starts the solenoid to switch on the precision electric pump when the system needs to add lubrication in a single way. Then the precise electric pump will deliver the oil to the lubricating nozzle at a constant speed in a fixed amount to lubricate the chain plate.

In this paper, an intelligent rod cigarette conveying chain plate resistance reduction system is designed to reduce the frictional force between the system channel and the chain plate to provide a simple structure, easy

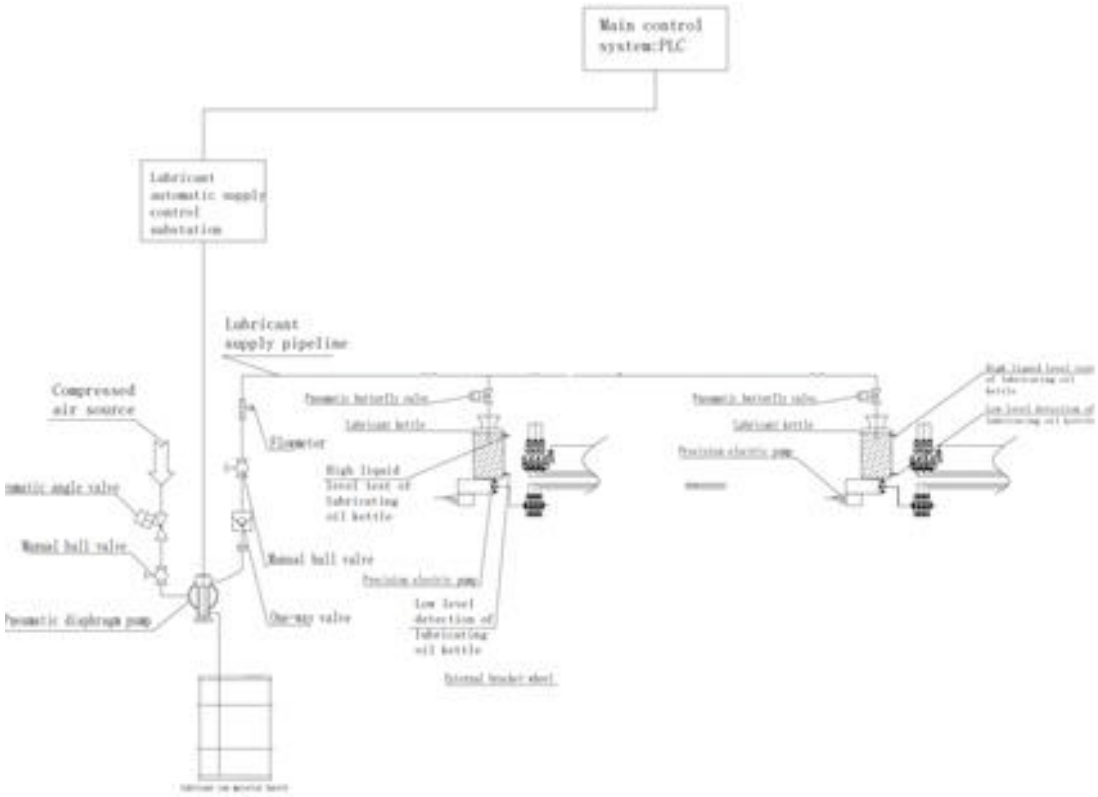

Fig. 2.1: The automatic lubricating oil supply device

to use, and low-cost generation method for the cigarette conveying generation system. Improve the tobacco bar conveying system's production efficiency and chain plate life.

2. The design of the system.

2.1. Process design drawing. The automatic lubricating oil supply device is mainly composed of lubricating oil raw material barrel, pneumatic diaphragm pump, flowmeter, manual ball valve, one-way valve, pneumatic angle valve, lubricating oil supply pipeline, pneumatic ball valve, lubricating oil pot, automatic lubricating oil supply control substation, etc.

For the control process of the resistance reduction system of the smart cigarette conveyor chain plate, it removes the dust one by one according to the number of channels of the conveyor line, and the time for dust removal can also be set according to the length of the conveyor line. The process flow is shown in Figure 2.1. In addition, before lubricating the conveyor chain plate, the chain plate needs to be dusted. After the dust inside and outside the chain plate is blown clean, a reasonable time can be set according to the length of the chain plate. Since the total amount of lubricating oil is constant, different time needs to be set for each conveying channel to lubricate the chain plates. Under normal circumstances, the drag reduction system of the smart bar conveying chain plate runs for one day for dust removal, while for the chain plate, it runs for a lubricating operation after two days. In addition, the chain plate resistance reduction system is provided with a man-machine interface, and the operator can switch the working mode of the system, that is, the manual mode or the automatic mode, through the button.

The working principle of the automatic lubricating oil supply device is that when the main control system feeds back the low liquid level signal of the lubricating oil pot of this station from an online lubricating and dedusting control substation, the pneumatic ball valve of the branch of this station will be opened automatically,

and the pneumatic diaphragm pump will automatically supply the lubricating oil through the pipeline to the oil pot until the high liquid level signal is detected. The flowmeter set at the outlet of the pneumatic diaphragm pump is the limit protection value of the equipment when adding lubrication each time because the volume between the high liquid level and the low liquid level of the lubricating oil pot is determined. When the refueling exceeds the set value and a high liquid level alarm is received, the system judges the high liquid level meter fault alarm to avoid pollution and waste caused by the overflow of lubricating oil; The flowmeter also has the function of accurate measurement and statistics, facilitating the lean management of the workshop. The manual valve is set to facilitate daily inspection, the pneumatic angle valve controls the start and stop air source of the pneumatic diaphragm pump, and the one-way valve is set to prevent leakage caused by oil circuit backflow.

The figure depicts various components of the chain plate resistance reduction system. The dust removal and lubricating oil supply assembly is represented by the numeral 1, the chain plate lubrication assembly by 5, the oil pot by 12, the electric plunger pump by 13, the dust removal solenoid valve by 14, the oil supply solenoid valve by 15, and the inner chain plate fan knife dust removal assembly by 41, and the outer chain plate air knife dust removal assembly by 42.

The specific process involved in the operation of the system is as follows: The system targets the power of a single motor on each conveyor line and is equipped with a dust removal air knife and nozzle on both the inner and outer sides of the power head. The system then adjusts the working time of the resistance reduction system device by collecting the motor current signal of each channel. If the collected current signal falls within the normal range, the conveyor chain plate is dusted first, and the dedusting time can be set freely. After three cycles of normal operation, the system sprays lubricating oil on the chain plate.

If the motor current changes for a specific conveying channel exceeds the normal range, the dust removal operation will be carried out for two cycles initially. If the current change does not return to normal, the system will start spraying lubricating oil until the current returns to the normal range. If the system's current does not decrease at this point, it indicates that an obstacle is blocking the system, and the system will issue an alarm.

In summary, the figure shows the components of the chain plate resistance reduction system and the specific process involved in its operation, which includes dust removal, lubrication, and monitoring of the motor current signals to ensure efficient and reliable conveyor operation

2.2. Design of supply components. The schematic diagram of the new dust removal and lubricating oil supply components is shown in Figure 2.1. In figure, 11 is the installation base plate, 121 is the high oil level detection sensor, and 122 is the low oil level detection sensor. The supply assembly part of this paper is provided with a high oil level detection sensor at the upper end of the oil pot and a low oil level detection sensor at the lower end. The oil level sensor uses an ultrasonic sensor, and the low oil level detection sensor mainly detects when the lubricating oil in the oil pot is consumed to the maximum liquid level, and issues an alarm to prompt to add lubricating oil.

2.3. Design of conveyor chain plate device. The diagram of the conveyor chain plate device is shown in Figure 2.3. In the figure, 2 is the chain plate of the conveyor line, 31 is the outer supporting wheel assembly, 32 is the inner supporting wheel group, 41 is the air knife dust removal assembly of the inner chain plate, and 42 is the air knife dust removal assembly of the outer chain plate. The lubricating component 5 in the chain plate device is composed of a grease nozzle mounting frame and a grease nozzle nozzle, and the specific components are a grease nozzle nozzle, an oil inlet nozzle, and a grease nozzle bracket, the number of which is 6 respectively. In addition, the air knife dust removal assembly of the chain plate includes the outer chain plate air knife dust removal assembly and the inner chain plate air knife assembly, and inside the chain plate device, the lubricating component is installed inside it, and its transmission line channel is based on the oil nozzle. Set the sprinkler head. Therefore, the length of each conveying channel is different because the conveying line is affected by its position.

2.4. Design of the dust removal component of the outer chain plate. The outer dust removal air knife assembly of the chain plate device is shown in Figure 2.4. In the figure, 421 is the outer air duct mounting frame, 422 is the outer air knife, and 423 is the outer air inlet connector. The inner chain plate dust removal air knife assembly mainly includes the inner air duct mounting frame, the inner air knife and the inner air inlet joint. Among them, the dust removal solenoid valve controls the air source output of the inner dust removal air

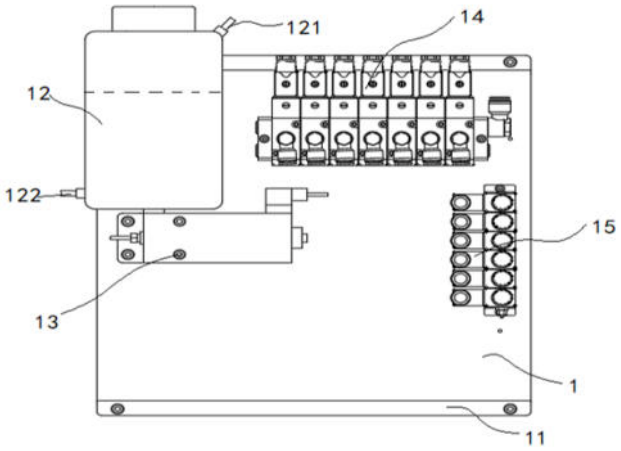

Fig. 2.2: Partial schematic diagram of dust removal and lubricating oil supply components

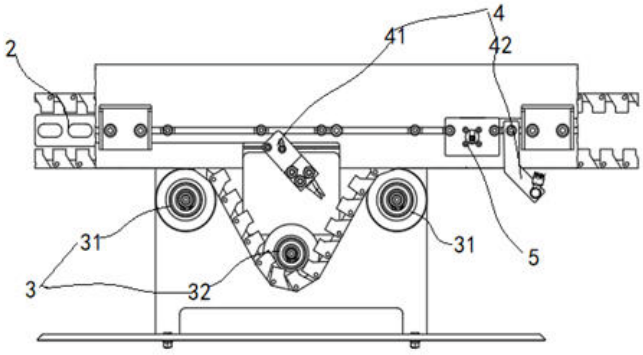

Fig. 2.3: Partial schematic diagram of conveyor chain plate device

knife and the chain plate, and the outer dust removal air knife is controlled by a general dust removal solenoid valve. Because the inner side of the chain plate contains a lot of dust, the resistance of the chain plate to run increases. For this reason, the air knife dust removal component on the inner side is equipped with an air knife according to the channel of the conveying line. In the same way, the inner air knife is also set with a corresponding solenoid valve according to the dust removal component to remove the outer dust and set an air intake air source on the outer chain plate to remove dust from all the conveying channels.

2.5. Design of the dust removal component of the inner chain plate. The schematic diagram of the dust removal assembly of the inner chain plate is shown in Figure 2.5. The standard width of the designed chain plate is 75mm, and the width of the air knife is 62mm. The material is made of ABS plastic material to obtain the corresponding shape by injection molding, and 16 return grooves are set between the ribs. The notch is output, thereby forming a compressed air flow, which covers the inner side of the entire chain plate. When the air knife assembly of the inner chain plate removes dust, the inner side contains a lot of dust, which increases the running resistance of the chain plate. Therefore, setting air knives at the channel openings of each conveying line can speed up the outflow of dust.

2.6. Design of the controller. The main control unit adopts PLC, which has a powerful DP function. Since there are many slave stations, 414-2DP, which requires a powerful DP function, is selected as the control core. At the same time, it is equipped with two digital input modules 421, each with 32 There are 32 switch

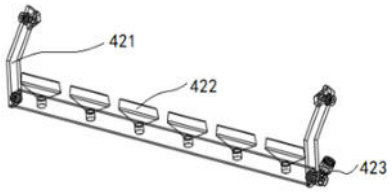

Fig. 2.4: Schematic diagram of the dust removal assembly of the outer chain plate

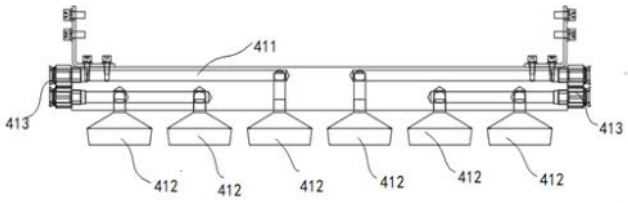

Fig. 2.5: Schematic diagram of the dust removal assembly of the inner chain plate

quantity output points in each block of 422 and 32 switch quantity input points. This CPU has various functions such as large-capacity timers and counters, fast processing speed, self-diagnosis and self-protection, and scalability, which are sufficient to meet the technological and functional requirements of the system. Because there are many slave stations, an IM467 with integrated DP processing function is selected as the master station. This module is selected as another master station, because it has more powerful DP function, which makes the system have stronger processing and coordination ability for DP network.

2.7. Design of online lubrication system of plastic chain plate. At present, the online lubrication system of the plastic chain plate adjusted to the tobacco conveying system of the tobacco industry has online automatic detection and comprehensive analysis of the working resistance of the chain plate. The abnormal operation of the chain plate is mainly manifested by stumbling, creeping, breaking, and other phenomena. When the chain plate running condition detection device detects that the pulse data has a relatively large peak fluctuation, the chain plate is tripping. or crawling. When the pulse is continuous, this indicates that the chain plate has broken and stopped. Standard dust removal methods are to manually blow the dust scattered on the surface of the chain plate with a compressed air gun on the surface of the tobacco transmission line and transmit it to a long distance. Generally, the driving head of the transmission line is placed in many parts. Only the segmented chain plate can be manually cleaned to reduce the working resistance of the chain plate. Is available and the cleaned dust is not recycled centrally, causing secondary pollution.

In addition, it has to be done manually. When adding lubricating oil, the method of manual acquisition cannot precisely control the amount of use, and it does not rub the inside of the chain plate evenly; when it is rubbed too much, it can easily penetrate the surface of the chain plate and contaminate the tobacco products being transported, and when there is dust on the chain plate, the lubricating oil will stick to the dust well. , sticks to the chain plate and increases the working resistance of the chain plate. Work productivity is low, and the labor intensity is high. Online Plastic Chain Plate Lubrication System is an integrated system for plastic chain plates and application scenarios in cigar conveyor lines. The plastic chain plate online lubrication system mainly consists of several sets of online lubrication and dust removal devices and their control substations, automatic lubrication oil supply devices, and their control substations, centralized dust collection devices and their control substations, single-channel independent driving head and their control substations, main control system, and other components.

2.8. Design of line lubrication and dust removal device. The working principle of the centralized dust collection device is that multiple sets of online lubrication and dust removal devices set in the plastic chain plate online lubrication system are connected in series through the dust removal pipeline, and each online lubrication and dust removal device is set with a centralized dust hopper and a branch pneumatic butterfly valve. When the system starts the dust removal function of the online lubrication and dust removal device, the negative pressure fan is also started at the same time, which will purge the dust through the centralized dust suction hopper, collect the dust purged to avoid secondary pollution and also clean the dust expressed by the chain plate.

In-line lubrication and dust removal equipment are mainly composed of a lubrication oil tank, oil tank high fluid level detection sensor, oil tank low fluid level detection sensor, precision electric pump, single-channel compressed air dust removal control solenoid valve group, and lubrication oil circuit. Control solenoid valve group, blower. Dust nozzle, outer support shaft 01, outer support shaft 02, inner support shaft 01, inner support shaft 02, centralized dust bucket, lubrication oil nozzle, online lubrication, and dust control substation. The working principle of the online lubrication and dust removal device is to change the chain plate of this part from the original straight part to a U-shaped path by placing the outer support roller 01, outer support roller 02, and internal drive gear in a reasonable way. 01, the internal drive gear 02. , its purpose is to avoid the installation position of dust-blowing nozzle and lubrication nozzle, to facilitate daily maintenance and repair. The advantage of using the gear structure of internal drive wheels 01 and 02 is that the chain plate meshes with the inside of the chain so that the chain plate does not tilt from left to right during use, which can cause damage during the return of the U-shaped trajectory. The lubricating oil tank has a high oil tank fluid level detection sensor and a low oil tank fluid level detection sensor. When the oil tank fluid level is low, the system automatically activates the lubrication oil supply device. Will raise the oil to a high fluid level, give an alarm and temporarily stop the supply. A group of single-channel compressed air dust control solenoid valves is used in the system to clean single-channel or multi-channel chain plates from dust, initiate an electromagnetic connection to the compressed air source, clean the inside of the chain plate, and remove dust., and at the same time a centralized dust hopper directly below. A vacuum cleaner collects the blown dust and cleans the dust the chain plate represents to prevent secondary pollution. The lubricating oil circuit control solenoid valve group is used to start the electromagnetic connection of the precision electric pump when it is necessary to add lubricant to one channel in the system, and the precision electric pump is transported and charged evenly and quantitatively to the lubricating oil nozzle. chain plate.

2.9. Design of automatic lubricating oil supply device. Automatic lubricating oil supply equipment usually consists of a lubricating oil raw material barrel, gas diaphragm pump, flow meter, manual ball valve, check valve, gas angle valve, lubricating oil pipeline, gas ball valve, lubricating oil tank, and automatic lubricating oil device. . components such as supply control substations are shown in Figure 2.6. The working principle of the automatic lubricating oil supply device is that when the main control system returns the low-level signal of the station lubricating oil tank, the pneumatic ball valve of the station branch will automatically open. The gas diaphragm pump will automatically supply the lubricating oil to the lubricator through the pipeline until the high fluid level signal is detected. Adjusting the flow meter at the outlet of the gas diaphragm pump determines the volume between the high fluid level and the low fluid level of the lubricant, so it is the safety limit value of the equipment each time the oil is added. level alarm, the system filters high-level gauge faults and alarms, avoiding contamination and waste from lubricant overflows; the flow meter performs accurate measurement and statistical functions, which is convenient for workshop management. The manual valve is configured to facilitate daily inspection, the gas angle valve is used to start and stop the air source of the gas diaphragm pump, and the check valve prevents the oil circuit from flowing back and leaking.

2.10. Design of single-channel independent drive head. The working principle of the single independent driving head is to arrange the power components of the reduction motor one by one according to the conveying channel, which is used to drive the chain plate to move forward, and the return idler of the chain plate is used to protect the chain plate from entering the profile smoothly. When the driving head drives the chain plate, the normal running state of the chain plate is the running state of the chain plate. The detection device detects that the pulse data of the chain plate is relatively uniform. The abnormal operation of the chain plate is mainly manifested by bumping, creeping and breaking. When the pulse data of the chain plate

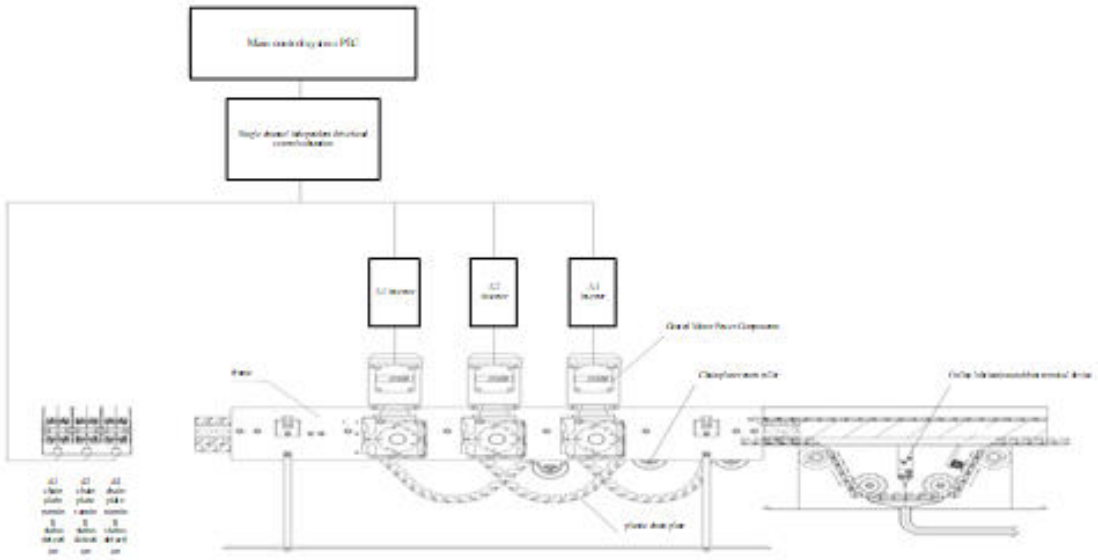

Fig. 2.6: Single-channel independent drive head

detected by the chain plate operation state detection device is relatively large, it indicates that the chain plate has to bump or to creep. When the pulse continues to output, the chain plate is broken and stopped. The single-channel independent drive head control substation suspends the reducer through the frequency converter and gives an alarm.

The single-channel independent drive head comprises gear motor power components, frequency converters, chain plates, racks, return rollers, chain belt running detection components, and single-channel independent drive head control substations. 9. The working principle of the single-channel independent drive head is to arrange the gear motor feed components one by one along the transmission channel, which is used to drive the chain plate forward, and the chain plate is used to protect the return roller. Prevent the chain plate from entering the profile smoothly. When the drive head operates the chain plate, the normal state of the chain plate, the operating state detection device detects that the pulse data of the chain plate is relatively uniform. The abnormal operation of the chain plate is mainly manifested by stumbling, creeping, breaking and other phenomena. When the chain plate running condition detection device detects that the pulse data of the chain plate has a relatively large peak fluctuation, it means that the chain plate is tripping. or crawling. When the pulse is continuous, it means that the chain plate has stopped, and the single-channel independent drive head control substation suspends the reducer through the frequency converter and gives an alarm.

3. Result Summary. The research aimed to solve the problem of high frictional resistance between the chain plate and guide rail of the cigarette conveying system. An intelligent drag reduction system with lubrication and automatic dust removal was designed, which consisted of several components, including a conveyor chain plate, supporting roller assembly, air knife dust removal assembly, chain plate lubrication assembly, and controller.

Experimental tests were conducted on the system, and the results showed that it effectively reduced the frictional resistance of the chain plate of the cigarette conveying line. The system achieved this by reducing the amount of dust on the chain plate through the use of air knife dust removal assemblies and lubricating the chain plate through the use of lubrication assemblies. The controller controlled the electromagnetic valve to achieve this.

The research also discussed the working principle of the single independent driving head, which was used to drive the chain plate forward and protect it from entering the profile smoothly.

The paper also presented a system model that provided a detailed description of the various components of the system and how they work together to reduce frictional resistance.

The research successfully developed an intelligent drag reduction system with lubrication and automatic dust removal that effectively reduced the frictional resistance of the chain plate in the cigarette conveying line. The results of the experimental tests provided evidence of the system's effectiveness, and the detailed system model provided a clear understanding of how the various components worked together to achieve this.

4. Conclusions. In this paper, based on the actual needs of workshop production and process, the intelligent rod cigarette transportation resistance reduction system is developed so that the conveyor chain plate reduces the resistance between components in sorting cigarettes and enhances the working life of the components. And improve the generation efficiency. The system has the characteristics of a simple structure, stable operation, safety, and reliability. , When there is a fault in the process of conveying the cigarette, an alarm message can be issued in time, and the controller is used to automatically control the air knife dust removal component and the storage capacity of the lubricating oil to reduce the dust and remove the lubricating oil in time. The system improves the effective operation rate of the overall production equipment and enhances the quality monitoring system of the production operation environment.

REFERENCES

[1] M. Abdel-Basset, G. Manogaran, and M. Mohamed, *Internet of things (iot) and its impact on supply chain: A framework for building smart, secure and efficient systems*, Future generation computer systems, 86 (2018), pp. 614–628.

[2] L. Cheng, Z.-G. Hou, M. Tan, and W.-J. Zhang, *Tracking control of a closed-chain five-bar robot with two degrees of freedom by integration of an approximation-based approach and mechanical design*, IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics), 42 (2012), pp. 1470–1479.

[3] B. D. Chung, S. I. Kim, and J. S. Lee, *Dynamic supply chain design and operations plan for connected smart factories with additive manufacturing*, Applied sciences, 8 (2018), p. 583.

[4] A. Kothapalli, A. Miller, and N. Borisov, *Smartcast: An incentive compatible consensus protocol using smart contracts*, in Financial Cryptography and Data Security: FC 2017 International Workshops, WAHC, BITCOIN, VOTING, WTSC, and TA, Sliema, Malta, April 7, 2017, Revised Selected Papers 21, Springer, 2017, pp. 536–552.

[5] M. Kumar, G. Graham, P. Hennelly, and J. Srai, *How will smart city production systems transform supply chain design: a product-level investigation*, International Journal of Production Research, 54 (2016), pp. 7181–7192.

[6] Y.-H. Lim, S. V. Gopinathan, V. V. Varadan, and V. K. Varadan, *Finite element simulation of smart structures using an optimal output feedback controller for vibration and noise control*, Smart materials and structures, 8 (1999), p. 324.

[7] O. Maslák and I. Andrisková, *Labeling options for postal shipments by passive rfid technology*, in CBU International Conference Proceedings, vol. 3, 2015, pp. 475–481.

[8] D. Schafroth, S. Bouabdallah, C. Bermes, and R. Siegwart, *From the test benches to the first prototype of the mufly micro helicopter*, Journal of Intelligent and Robotic Systems, 54 (2009), pp. 245–260.

[9] Y. Sun, Q. Guo, S. Zhao, K. Chandran, and G. Fathima, *Context-aware augmented reality using human–computer interaction models*, Journal of Control and Decision, (2022), pp. 1–14.

[10] B. Y. Tsuge and J. M. McCarthy, *Synthesis of a 10-bar linkage to guide the gait cycle of the human leg*, in International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, vol. 57137, American Society of Mechanical Engineers, 2015, p. V05BT08A083.

[11] S. Wang, S. Quek, and K. Ang, *Vibration control of smart piezoelectric composite plates*, Smart materials and Structures, 10 (2001), p. 637.

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