

RESEARCH ON THE DEVELOPMENT TREND OF ANTI-VIRUS MASK TECHNOLOGY BASED ON PATENT MEASUREMENT

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ABSTRACT

The coVID-19 outbreak in 2019 is the most serious public health emergency in recent years. As an important protective tool against coVID-19, the supply guarantee of anti-virus masks will play a vital role in the development of the situation. This paper will, from the perspective of patent measurement of anti-virus mask related patent information from the macroscopic measurement (patent application, the applicant for a patent, the IPC classification number, legal status) make a comprehensive analysis, the anti-virus mask technology innovation and improvement, power epidemic prevention and control, promote our country and even the global response to the significant public health emergencies of supporting ability of science and technology to provide theoretical support.

Keywords: patent analysis, anti-virus mask, patent measurement, medical mask

1.0 INTRODUCTION

The 13th Five-Year Plan Outlines the need to strengthen basic medical and public health services. The COVID-19 outbreak in 2020 made the Party and the government pay more attention to public health emergencies, and the government released many documents on epidemic prevention and control during the epidemic. The Proposal of the CPC Central Committee on Formulating the 14th Five-year Plan for National Economic and Social Development and the Long-term Goals for the year 2035, released on November 3, 2020, sets out six major goals for economic and social development during the 14th Five-Year Plan period. One of them is that the national governance efficiency has been improved, the system and mechanism for preventing and resolving major risks have been constantly improved, the ability to respond to public emergencies has been significantly enhanced, and the level of natural disaster prevention has been significantly improved [1]. And anti-virus masks, medical supplies, drugs, as an important tool to solve the epidemic, their supply guarantee will play a vital role in the development of the situation[2].

The development of anti-virus mask technology is mainly in production technology and materials. The main raw materials of anti-virus masks are spunbonded cloth and melt-sprayed cloth prepared by thermoplastic polymers. However, with the increasing use of masks, the

pressure of environmental protection in the later treatment is greatly increased, and most anti-virus masks have disadvantages such as poor moisture absorption and comfort. For example, the bridge of the nose of a mask can easily damage the bridge of the nose of a healthcare worker after prolonged use.

The key to determining the protective performance of a mask is the filter material, whose fibre diameter, shape and stacking structure will affect the filtration efficiency and resistance pressure drop of a mask [3]. At present, most masks are made of 3-layer nonwoven fabric, which has limited filtration efficiency. Moreover, the respiratory resistance will increase with the increase of the number of layers of nonwoven fabric, making the wearer feel uncomfortable in breathing, which will also lead to the poor fitting degree between the mask and the face, reducing the sealing of the mask and seriously affecting the filtration efficiency. Therefore, it is difficult to find a material with stronger air permeability and better filtration rate.

With further improved the national public health emergency management system, people's health consciousness, safety consciousness gradually strengthened, for respirator filter efficiency and comfort, breathing resistance requirements will be higher and higher, to improve the existing respirator with the comprehensive performance of the material, solve the breathing resistance is big, closely fitted and comfortable enough, reduce the leakage risk, improve security [4].

2.0 DATA SOURCES AND RETRIEVAL METHODS

2.1 Data Sources

Patent retrieval is the premise of patent analysis. The reasonable selection of patent database is the key to guaranteeing the recall and precision of patent literature retrieval[5]. There are many patent retrieval databases in China, such as Dainnojoy, National Intellectual Property Office, Baiting Net, Zhihui Bud, SootPat patent retrieval and so on. In this paper, we use Innojoy patent retrieval database to search and analyze related patents of anti-virus mask.

2.2 Data Retrieval

In order to fully understand the content related to anti-virus mask technology, we searched a lot of relevant materials related to the mask field in advance (patent literature, academic papers, journals, technical papers, product manuals, and industry association websites). After comprehensive sorting, we constructed the technical breakdown table of the field of anti-virus masks by combining the four key links of the mask industry chain -- mask products, key raw materials, and production equipment and disinfection technology with the production process of anti-virus masks.

According to the technical breakdown in Innojoy patent retrieval system, check the Chinese invention patent, utility model in China, the Chinese patent of appearance design of three types, points the industrial chain link input keywords, respectively, with the name, this paper, the power requirement and product specification limits as the main field, between branches are connected by the OR operator to get the final retrieval article number is 27275.

3.0 PATENT ANALYSIS

3.1 Annual analysis of patent applications

We have summarized the annual number of applications for anti-virus masks over a 20-year period (2001-2020), as shown in Figure 1. The data for 2020 is incomplete and only for reference. According to the trend chart, the number of patent applications for anti-virus masks increased significantly in 2003, and the number of patent applications for anti-virus masks fluctuated little from 2004 to 2008, which continued to increase after 2008 and peaked in 2017. Investigate its reason, 2003 SARS outbreak, 2009 H1N1 flu epidemic, China's mask patent application number increased a lot. Patent applications for masks have peaked again recently because of the COVID-19 outbreak. Demand is the key to production and invention.

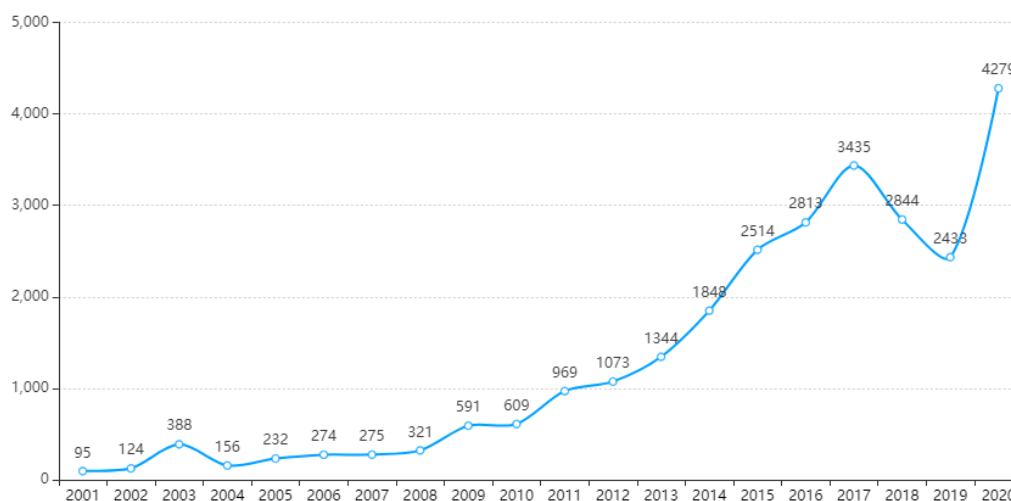


Figure 1 Trend of annual application for anti-virus masks

In 2001, through a secondary search of patent data, it was found that among 95 patents related to anti-virus masks in 2001, 33 were patents related to mask manufacturing methods and mask manufacturing devices. There is also a patent to overcome the traditional gauze mask loose texture, can not remove odour defects, providing dust can not only remove odour, but also can remove odour, disinfection and sterilization function in line with the characteristics of the human face mask. The patent number is CN2514859Y. After testing, the dust resistance rate of the utility model is $\geq 91.0\%$, inspiration-resistance is $\leq 20.7\text{Pa}$, appreciation value of inspiration-resistance is $\leq 88\text{Pa}$, appreciation value of wet resistance is $\leq 129\text{Pa}$, the lower visual field is ≥ 64 degrees, the leakage rate is $\leq 10\%$, weight is only 19g, which is suitable for the use of society, labour prevention, medical treatment, health care and other industries. In 2002, there were 124 patents related to anti-virus masks. Among them, a utility model patent of CN2531822Y China Patent No. (ZL) CN02202955.9 is a utility model patent of "New Mask" filed by Li Jiani. Effectively solved the previous wear mask when breathing out, will make the glasses fog technical problems. This is because the new mask is

designed with elastic straps so that hot air escapes from the sides of the mask as you breathe out. This shows that China's early mask technology not only pays attention to the improvement of the mask protection index but also pays attention to the comfort degree of wearing the mask.

3.2 COMPOSITION analysis of IPC technology

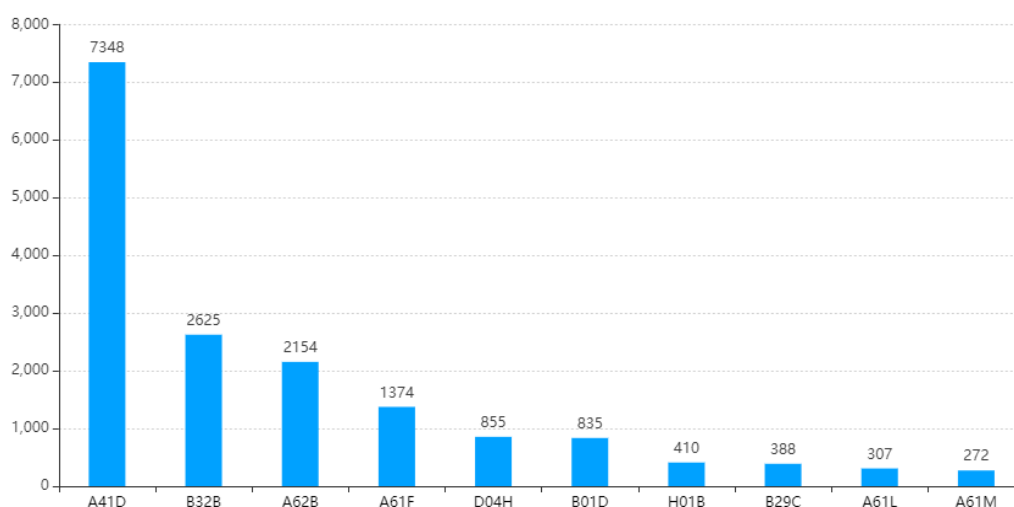


FIG. 2 Bar chart of IPC technology composition (small class)

Through the ANALYSIS of IPC technology composition patents in the field of anti-virus mask technology, it is found that 27275 patent applications are mainly distributed in A41D, B32B, A62B, A61F, D04H, B01D, H01B, B29C, A61L and A61M. Among them, A41D (clothing, outerwear, protective clothing, clothing accessories) had 7,348 patent applications, accounting for about 26.94% of all patent applications. It is the most important technical field of national defence virus masks in China. The second is B23B (foamy and honeycomb thin layer products), which also occupies a large proportion in the IPC technology composition, indicating that China attaches great importance to the research and development of the efficiency of anti-virus mask filtering virus. Meanwhile, A62B (lifesaving, fire fighting, lifesaving equipment) and A61F (medicine or veterinary medicine, hygiene) are also hot technical fields of anti-virus masks.

3.3 Analysis of the total number of patents in provinces and cities

See Figure 3 for the distribution of patent applications in major provinces and cities in China in the field of anti-virus mask production.

Chinese patents in the field of anti-virus mask production are mainly distributed in Jiangsu, Guangdong, Zhejiang, Shandong, Shanghai, Beijing, Fujian, Anhui, Hubei, Henan and other

provinces and cities. Among them, Jiangsu province is the region with the strongest technical research and development strength in the national anti-virus mask production industry, with 5,006 applications in China, accounting for about 18.98% of the national patent applications. Guangdong was the second, with 3,920 patent applications in China. As the second-largest technology-intensive distribution area, Guangdong accounted for 14.86% of patent applications in China. Then there is Zhejiang, which has 3,411 patent applications in China, accounting for 12.93%. Again after being in Shandong, Shanghai, Beijing, Fujian, Anhui, Hubei, Henan and so on, these provinces and cities in China's patent applications are: 2039, 1419, 1302, 1247, 1142, 820, 705 of them, respectively, in the national patent applications of the 7.73%, 5.38%, 4.94%, 4.73%, 4.33%, 3.11%, 2.62%, these provinces and cities in technology research and development strength is relatively strong.

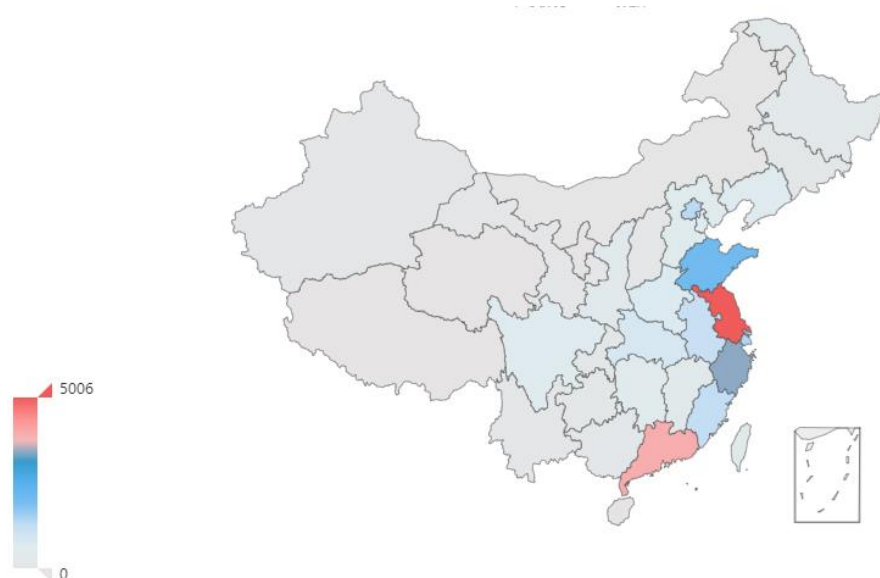


Figure 3 Analysis of application volume of provinces and cities

3.4 Analysis of patent technology transfer

Patent assignment refers to the contract whereby the patentee, as the transferor, transfers the ownership or ownership of the patent for invention or creation to the transferee, who pays the agreed price.

According to the annual patent transfer data from 2011 to 2020, a total of 1,506 mask patents were transferred in 10 years, showing an increasing overall trend. In 10 years, the number of patent transfers has risen from 31 in 2011 to 278 in 2020 (the data for 2020 is incomplete, just for reference). The highest number of transfers in recent years was 319.

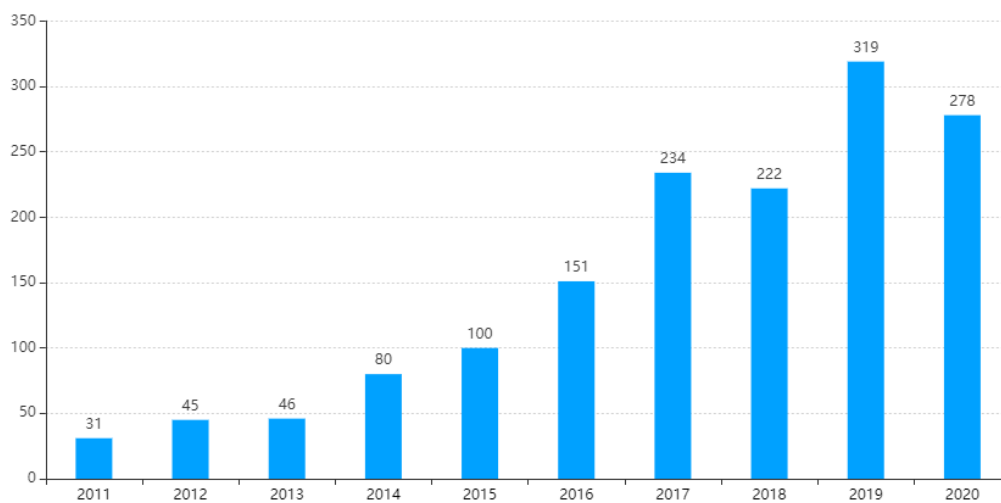


FIG. 4 Bar Chart of annual Patent technology transfer

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 The conclusion

Through the patent literature analysis of China's mask technology, it can be concluded that China's mask technology has been very mature after more than ten years of development. From the annual trend of patent applications, the number of patent applications increased year by year before 2017, indicating the continuous development of anti-virus mask technology in China. From the perspective of legal status and patent technology transfer, China's anti-virus mask patent has a large number of applications, but the practical value is not high. From a technical point of view, the balance between filter and comfort is a technical challenge that has yet to be overcome.

4.2 Suggest

Based on the above analysis, the following suggestions are proposed for the development of anti-virus mask technology:

1. Enterprises should pay attention to the cooperation between production, education and research

From the perspective of industrialization, most of the patents for anti-virus masks in China are applied by enterprises, that is, independent research and development within enterprises, and there are few cooperation with groups such as universities and scientific research institutions.

2. Strengthen the tackling of technical difficulties

Although the development of mask technology in China has generally entered a mature stage, the existing anti-virus mask technology cannot meet the market demand.

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