The Application of Diesel Engine: From 21st Century to Modern Life

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Abstract. In this article, the author investigates the evolution and development of diesel engines, examining various types and their diverse applications. The analysis covers the advantages and drawbacks of these engines from the 20th century to the present, highlighting how efficiency and environmental concerns have become central to diesel engine innovation. Despite significant advancements, many challenges persist. The progress in engine technology has led to the creation of robust and time-tested engines, yet addressing the residual issues remains critical. As technology evolves, it is crucial to manage these developments effectively, ensuring that emerging problems are not overlooked. The future of diesel engines hinges on the continuous improvement and adoption of more advanced technologies to meet the growing demands of efficiency and sustainability. To achieve this, ongoing research and development are essential to overcome existing challenges and pave the way for innovative solutions that align with environmental and efficiency goals. This comprehensive analysis underscores the importance of balancing technological advancement with responsible management of new and existing issues.

Keywords: Diesel engine, vehicle, internal combustion engine.

1. Introduction

With the development of the internal combustion engine, people have built different kinds of machines to deal with tremendous conditions. From the air to the ocean, choosing what kinds of engines to use depends on the features of various environments. At first, people just found it had higher efficiency, which can reduce needless waste. As time went on, however, new problems were appearing: efficiency was not just only thing they needed to care about. During the mountain area, how to increase the torque was waiting for people to resolve; in the air, the demand for security and higher density allowed people to invent new engines. The author of this paper will pay attention to the application of diesel engines, an essential engine with big use, even though people have to deal with lots of drawbacks of diesel engines. Learning from the history of the application of diesel engines is a good way to make progress in the engine. It is hard work to learn about different kinds of engines through a long history, but this significant work should be done. Especially in the modern world, people care about more things like the environment, healthy life and recreation. Despite people always thinking about why people use it, looking back on the application of diesel engines that will help engineers improve the engine, figuring out how much pollution or waste was produced by this engine and good commercial performance in the market are equally important to understand how it is going to be in the future. Here is a belief that maybe people can find some inspiration from the history. In the end, from this article, there will always be something useful to help the diesel engine of the future become better.

2. The History of Using Diesel Engines during the Early 20th Century

When German inventor Otto first produced internal combustion engines, the gate of a new world was opening. There were lots of people who did something to improve or create the engine in another way with several ambitious ideals. Many people, including Rudolf Diesel, tried to improve themselves. Fortunately, Rudolf Diesel succeeded, even though his claim that combustion could be

made to take place in an internal combustion engine isothermally was regarded as a novel in the old days [1].

2.1. The Use of the Land for a Long Time

It was surprising that people spent a long time using diesel engines in different kinds of vehicles after the invention of the diesel engine. At the early age of the diesel engine, Rudolf Diesel had said that the diesel engine would be applied widely after solving some problems of the diesel engine. However, people made diesel engines on the truck in the 1930s [1]. As shown in Fig. 1, this is a picture of the first engine made by Diesel:

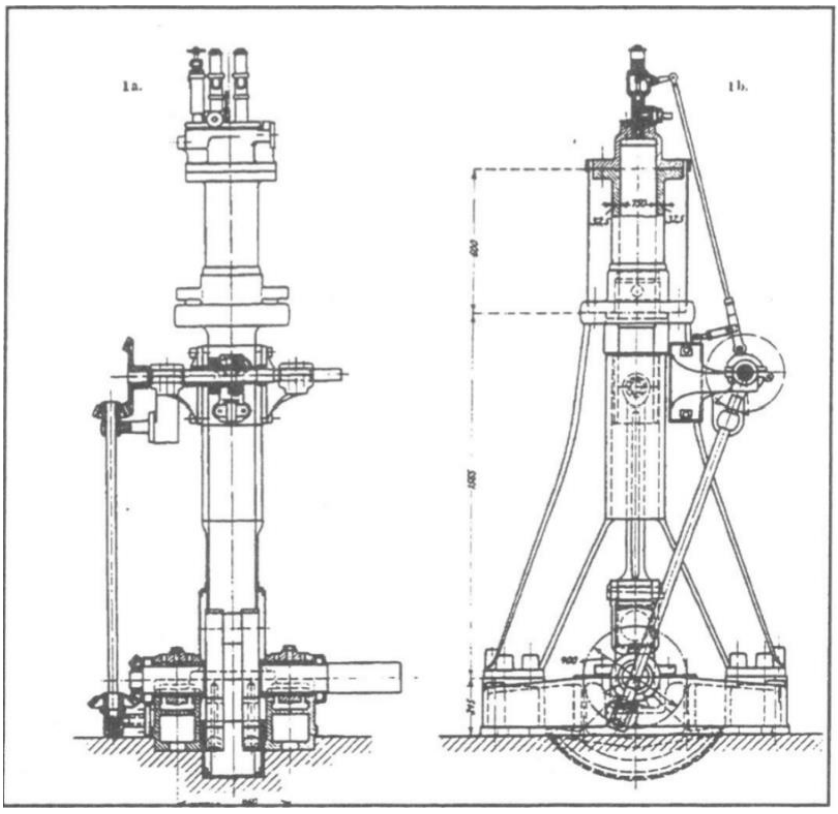

Figure 1. The first engine was made of Diesel [2]

However, its first appearance was not lucky enough. In the steam age, people enjoyed the time that they had cheap fuel---the coal to satisfy their daily life. Diesel was more expensive at that age, so some people doubted if the diesel engine could be helpful in the world. Maybe the environment and the increasing demand for connection will give the answers.

Not just the truck, because of the connection with land transportation, some of the diesel-electric cars began to appear in Sweden. Some people thought these diesel-electric cars were similar to the gasoline-electric cars, which were used to a considerable extent in the various parts of Sweden [3], but they still became successful products in this country within the cool area. However, until the 1920s, several countries did not use diesel-electric cars broadly, and some countries put the diesel engines on the bigger vehicles, which need stronger power in the vast environment---the ocean.

2.2. The Use in the Ocean

It is very easy to understand why people chose the diesel engine on the ship. Going back to the steam age, steam engines with lower efficiency and speed became an obstacle to international communication.

At the close of 1912, there were some five hundred diesel vehicles in use. The engines developing as much as 6000 horsepower had been constructed for marine work, and the engines of 2800 horsepower had been installed and were in successful operation. Even for some special vehicles, such

as submarines, the only choice was the diesel engine because of its smaller size and ease of reversing [3]. This is the photo of the diesel engine in a submarine (Fig. 2).

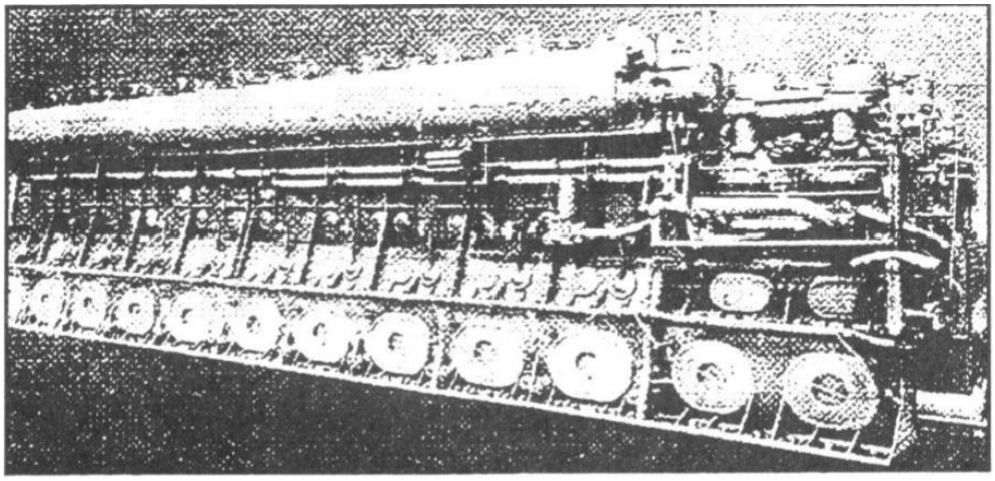

Figure 2. Submarine diesel engine in 1917 [2]

At the beginning of using diesel engines on ships, people still had to face lots of problems like higher costs and much stronger engines on the surface of the ocean or underwater. Stopping creating was impossible.

Some countries have built new systems, for example, the air-independent propulsion system, to deal with tough situations in the ocean, especially when marine vehicles stay in the water for a long time. To deal with the sorting of oxygen and protecting the submarine, the German navy produced the first closed-cycle diesel engine, which had higher efficiency and durable navigation ability during World War 2. This engine belonged to the air-independent propulsion systems. From the end of the Second World War to the Cold War, the closed-cycle diesel engine was still a hot topic in the navies of different countries.

3. Why Did It Have to Be the Diesel Engine

It is necessary to supply multiple reasons why people use the diesel engine.

Without thinking too much, people can easily find that there were many kinds of machines having appeared in this world, and there were also different vehicles in various conditions. Because of the development of transportation, people have invented engines that use lots of fuel to satisfy ordinary service. However, a tremendous number of people do not feel about how the scientists made decisions on the different kinds of engines or the single reason they have not learned about the other reasons behind the application. According to all of the reasons, the author believes that people can know more details to make everything reasonable.

3.1. The First Reason: Diverse Fuel

Energy has always been an important topic in human history. From timber to whale oil and from coal to petroleum, people never stop steps to get cheaper and available energy with inevitable conflict. In that case, finding a method to supply the energy in different ways is necessary. At the early age of the 20th century, scientists created diesel engines that could run on animal oils, even lard oils and fish oils have been used with success [3]. However, these sources are too expensive to use unless there is something emergent, which means people have to use them. Are there any answers that can resolve the energy crisis? Maybe mixing different fuels is a good solution.

The development of dual fuel (Diesel-CNG) engines for SUV applications in India seems to be successful [4]. Dual fuel technology has caught the attention of researchers as an important technology that can increase the availability of fuels like Compressed Natural Gas. With a number of potential advantages, such as fuel flexibility, higher compression ratio, better efficiency and less

modification on the existing diesel engines, scientists find a new way to reduce waste and consumption.

After thinking about the consumption, it does not mean that the public will be satisfied with the combination, even though the dual-fuel engine seems suitable for lots of people.

3.2. The Second Reason: Lower Cost

This reason is similar to the first one. To some extent, both of them may try to reduce consumption and find a way to ease current problems like the sort of energy. However, it is worth noticing that sometimes the first reason is just suitable for several countries. For example, Brazil can make corn become the fuel. In contrast, some countries that do not have enough fields to build tremendous are difficult to own this ability. In other words, a higher cost than Brazil is not worth it for them. The one thing the public can understand is that the less energy the machine uses, the less money people will spend. And more importantly, there are some unique elements in diesel engine cars. For instance, policies and markets are the elements that cannot be controlled easily by nature. From these two points, the Europeans loved this engine.

In the 1990s, several European countries like France had a large number of diesel-powered passenger cars [5]. Saving fuel is important for improving energy security and restraining the growth in carbon emissions from transportation. Of course, there must be other assistance that can reduce the prices. In most European countries diesels tend to be used more for commercial activities. To develop the economy, government policies were positive for lots of activities and markets including the markets of diesel engine cars. Taxation policies became compelling elements that encouraged people to make their favorite decisions.

3.3. The Third Reason: Market Popularization

With the development of society, these formats two reasons are not enough to explain because the places people paying attention are more and more. If one thing wants to dominate the world, it has to be common in many different ranges. In that case, without broad use, the diesel engine will probably fail in the business field, even though the diesel engine is cheap or more efficient. In the 1990s, Germany and France gradually increased diesel engine domains from 5 years to 10 years. These two countries wanted to dominate the market of smaller vehicles. And this time, with the help of taxation again and the improvement of technology, nearly 50 percent of new cars sold in 1995 were diesel cars [5].

Lower prices, less consumption and the broader and broader market are all the three reasons mentioned in this article. From these three elements, it is easy to find that the points that people pay attention to are always changing. At first, people just cared about how it would consume the fuel and its efficiency, and then people found extra assistance like taxes and markets. The more things people think about, the more advanced diesel engines will be. Nevertheless, more problems are going to emerge with concerns of humans.

4. Non-Negligible Problems

As people all know, nothing can be smooth sailing. The successful performance of diesel engines also has a lot of problems and drawbacks. Some of them can be resolved but the other things are hard to say. With the progress of time, more and more people have noticed some problems that were never found before. For example, the crisis of energy excess emission is becoming a more important point to be paid attention to. People cannot predict these problems for at least one hundred years.

4.1. The Big Trouble of Design Defects

The drawbacks of diesel engines can be divided into two parts. The first part is about the external effect, which includes several environmental pollution problems and performances in the market, and another one is the internal influence that will always be regarded as design and technical issues.

In 1973, the first petroleum crisis emerged. This accident situation damaged the market of gasoline cars. With the higher prices, many drivers turned their visions to diesel cars because of higher efficiency and energy-saving. The performance of diesel engine cars was beautiful, but there were still some drawbacks people did not care about at that time. However, in 1975, Automotive Engineering recommended the wider use of diesel engines. It also presented that diesel engines had to figure out exhaust gas limits for the problems of acceleration, vibration and drivability [6].

Also, the diesel engine is noisier and has more of a cold starting problem [7]. In some extremely cold areas, the local people do not even turn off the engine because if the engine is stopped, the liquid in the engine will be frozen. However, these problems were not so important that the designer tried to resolve them at that moment. If it were not for the petroleum crisis, it would be hard to say the diesel engine can be popular especially in the United States of America.

4.2. The Tremendous Trouble about the Emission

Because of the wide use of diesel engines, people have to face external problems, especially for emissions like particulate matter, nitrogen oxides, sulfur oxides and smoke [8]. The most important thing is health. The U.S Mine Safety and Health Administration mentioned that about 34000 subsurface workers are exposed to diesel exhaust, and there are more than 200,000 surface miners exposed to diesel exhaust from some 120000 engines [9]. A pungent smell can destroy both humans and nature. To deal with such problems, people will think and operate for a long time. It will be very hard. Maybe the most useful way to resolve these problems is using alternative fuel. However, this kind of complete change is incredible. The technical and operational limitations are too many to use substituted energy, such as renewable alternative fuel.

In Japan and America, scientists tried to find a new way to a new compression ignition combustion and concept to reduce NOx and smoke emissions drastically. According to a series of research, they required more and more research activities even though the way they found them was not clear [10].

5. What Should People Do

It is hard to judge if the diesel engine is better or not. Especially in modern life, there are lots of things people never think about before. The crisis of energy, pollution and exhaust emissions is becoming important nowadays, but they are hard to imagine that people have noticed and done something to prevent these things a long time ago. To make a better future and guarantee a healthy life, lots of effort has been put into it. As for the market, there are many things people should modify.

6. Conclusion

In this article, the author mentions three parts of the diesel engine, from the history of application to the advantages and drawbacks. Each of them has a different significance. The using time of diesel engines is not too long in human history, but from this history, the public can understand how powerful the diesel engine is. The public can also assume what it should look like in the future. The second part is about the advantages of diesel engines. Because of its beautiful performance in the market, lower cost, and flexible duel strategy, there is a good impression in the world. People are more and more likely to buy diesel-engine cars, especially in Europe. The third part can be regarded as the drawbacks of diesel engines. Some technical flaws and environmental pollution are becoming urgent for scientists to deal with. For nature and a healthy life, people need to protect themselves in new ways. It would be a hard but important job in recent years. According to these three parts, the author believes that people rediscover the development of diesel engines from many things. It is extremely important for students who want to learn about diesel engines in the future without any basics. In this article, actually, there should be more materials and dates, but as for considering which one can be a typical example, the author deletes lots of instances. With higher productivity, one day, people could have the ability to build increasingly stronger diesel engines.

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