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## A Study on Evolution about Combine's Color and Its Regulation

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### Abstract

Based on dividing the times of combine's color evolution, affecting its the main factors is analyzed, the main color characteristics of different periods are proposed, summing up the evolution regulation of combine's color, provide the basis for the combine's color design in the future.

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### Introduction

With society's progress, the development of science and technology, the constant appearance of new material, new craft, and changes of people's aesthetic concept, the evolution of combine' color shows obvious times characteristics. Combines reflecting the times characteristics and the development level of advanced science and technology, meeting people's aesthetic requirements, having beautiful color will be welcomed by users, and they have strong competitive ability in the market.

The invention of the harvester is much earlier than the tractor. Since the earliest record harvest mechanical invention, it has been nearly two thousand years of history. During the long process, the harvester form has been changed [1], its color has also been changed.

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## 1. Combine the division of times [2]

Though, combine modelling design in agricultural machinery belongs to a branch of industrial design, It has its own characteristics, so cannot copy the division of times of industrial design, and should have their own times characteristics.

Specific times is divided into:

In ancient times:	Human beings appeared - 1869
In modern times:	1870-1937(in 1870, invented the first harvester)
In contemporary:	1938 - present

Among them:

In early contemporary:	1938-1949 (in 1938, invented the first self-propelled combine)
In middle contemporary:	1950-1970
In recent contemporary:	1971-1990
In late contemporary:	1991 – present

## 2. The influencing factors in the evolution of the combine's colour [3]

At different times, the appearance of some combine's colors is not accidental, it is related to many factors.

In ancient times, combine's color was the nature color; In modern times, combine's color was mainly affected by the nature factors; In early modern, changes of combine's color was mainly affected by social factors—war and peace; In middle modern, changes of combine's color was mainly affected by social factors—peace, stability, fashion color, aesthetic idea and so on; In recent modern, changes of combine's color was mainly affected by the development of science and technology, the improvement of people's living standards, people's aesthetic consciousness and so on; In late modern, changes of combine's color was mainly affected by the development of science and technology, social harmony, fashion color, people's aesthetic level and so on.

Of course, changes of combine's color was sometimes constrained by the domestic and regional geographical environment, climate environment, national factors, the political system and so on..

In addition, nature environment is also one of factors which restrict changes of combine's color. The natural environment are mainly: 1) yellow ( mature crops);2) blue and white,(the vast blue sky, sun, etc.).

## 3. The evolution of the Combine's color

### 3.1 The ancient "combine" color

The earliest records about harvest machinery see reference [4]. The records about barley, wheat ear device from ancient Rome (Pliny the Elder) (In the seventy s of the 1th century ) is shown in figure 1. It was used to collect grain by the Gaul.

After, in quite a long time, the device only was improved. The real design of harvester was the end of the 17th century. In 1826-1828, Partric Bell designed and produced a practical harvesting machinery, as shown in figure 2. He is considered the father of agricultural machinery.

Figure 3 is the earliest harvester (in 1838). This harvester used gear and chain wheel transmission, improve the performance of the harvester.



Fig.1 Gaul's harvester

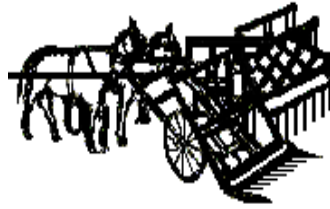


Fig.2 Bell's harvester



Fig.3 The earliest harvester



Fig. 4. Marsch's binder machine

In 1850, Marsch brothers designed binder machine as shown in figure 4. This machine uses some transmission device and some auxiliary mechanism, to reduces the labor intensity.

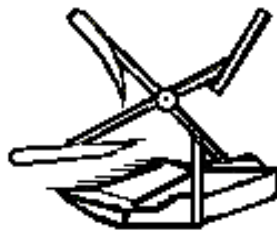


Fig. 5. The rocker harvester

In 1868, the rocker harvester was invented, as shown in figure 5.

Harvester is the crystallization of mankind wisdom.

Ancient "combine" is mostly made of wood, so their color was the wood color. In order to prevent decay, the wood was generally painted with transparent tung oil. In the late, cutting parts were usually made of iron, they were painted with black paint, their sides were painted with black paint or red paint. But the body was wood color.

### 3.2 Modern combine's color

In 1870, the mankind invented the first combine [4], it marked the beginning of design and manufacturing of modern combine. In spite of the steam engine was invented, but it had not been applied to the tractor, so combine still needed a large numbers of animals to drag.

During 1920 to 1930, the combine harvester had been improved in some technology, using steel structure, the antifriction bearing, to improve the durability and life of combine harvester. That V belt drive was widely

used and driving wheels by rubber tire were replaced with the steel wheels greatly improved the combine harvester transmission performance. This times combine's color was mostly red.

In the late 1930 s, self-propelled combine harvester was researched. In 1938, the first batch of self-propelled combine harvester, were designed and produced. It marked the beginning of modern combine use.

During this period, the combine's colour like most agricultural machinery colour such as tractors, was mainly grey and black or red.

### 3.3 Early modern combine's color

Combine's color with grey and black gradually disappeared, its color was mainly red, later purple appeared. Combine's color was not as tractor's color had larger change. Because the tractor can both be used as other agricultural machinery power, and can be driving on the highway transportation, people saw the tractor longer time than combine, so they attached great importance to the design for tractor's color only do not taken the combine's color.

### 3.4 Middle modern combine's color

Like tractor's color, people paid attention to the color design of combine. Although the using time of combine is relatively concentrated, is also relatively short, the workload is big, the labor intensity is high, the operators are easy to fatigue.

Before and after the 1960s, people began to attach importance to the man-machine engineering. Color design has a great effect for improving the environment and mood of operators.

The study on color had been used in combine, to its color became richer, and to apper dark green, sky blue, grass green, dark brown color of combine, breaking the previous pattern of unifying the whole country which was given priority to with red, fuchsia.

Figure 6[5] is combine with sky blue. Figure 7 [5] is combine with light brown .



Fig. 6 sky blue combine



Fig.7 light brown combine



Fig.8 yellow combine



Fig. 9 yellow color belt

During this period yellow combine had seen as shown in figure 8. Because color of the mature grain is yellow, people was not easy to identify them. So, this kind of colour is very few.

### 3.5 Late modern combine's colour

In the 1970s, in order to further "beautify" combine , color belts of horizontal segmentation were commonly used in it. Figure 9 is John Deere combine with yellow color belts of horizontal segmentation. Figure 10 is international combine with black belts of horizontal segmentation. Color belts not only improve drab feeling due to large area color ,but also has the effect of the lower center of gravity, and increase the machine stability; The driver's cab is the operator's workplace, which color selection is particularly important. The color of indoor is usually light gray, light green and light brown, this kind of color can make a driver quiet, peaceful; The color of cab roof is mostly white, it not only highlight the feeling of the machine forward ,but also easy to identify it in the field.



Fig.10 black color belt



Fig. 11 combine with grass green, gray and red

Into the 1980s, many colour (no more than three colors) began to appear on a combine, to make combine look lively, light. Figure 11 is combine consisting of "grass green, gray and red" . Figure 12 [5] is combine consisting of "purple + white + black".

After entering the 1990s, the peachy and orange combine appeared (see figure13 and 14 [6]). In interior color design, maintained the late modern features. The design of driver's cab had human nature, in addition to increasing the automatic control, automatic monitoring, air conditioning and other devices, some was also equipped with a radio, CD player, etc., greatly improved the driver's indoor environment and labor conditions.



Fig.12 combine with purple,white and black



Fig. 13 the peachy combine



Fig. 14 the orange combine

It is worth mentioning that, in the 1960s designed the half feeding type of rice and wheat combine harvester, after years of development, constantly improve and perfect their performance, but the color change is not big, mainly in "red + white" and "blue + white. because on one hand, the combine harvester volume smaller," red + white "and" blue + white "colour, enough to make out in the field; On the other hand, because the manufacturer's corporate image and tonal, all products are based on this color.

#### 4. Conclusions

Through the evolution and development of various periods combine's colour, you can see that the previous period's colour is the base of the later period, the later period's colour is the inheritance and development of the previous period.

Red has long been the mass-tone attune of combine's color since the invention of combine. Purple is the mainstream of combine's color since the modern, and green and blue has long been favor color since the middle modern. More color will be the development of combine's colour in the future.

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