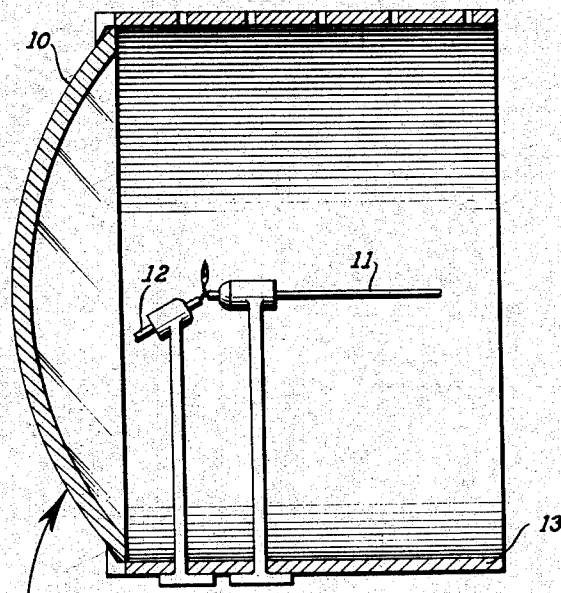
Aug. 18, 1942. A. V. HARRIS 2,293,206

MIRROR

Filed March 14, 1935



MIRROR, PREFERABLY PARABOLIC, COMPOSED OF AN ALLOY COMPRISING COBALT, 15% TO 35% CR; 0.5% TO 6% W AND/OR MO; AND ABOUT 1% C.

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MIRROR

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2 Claims. (Cl. 88—105)

The invention relates to light projectors, and refers more specifically to high intensity electric arc light projectors of the types used as searchlights and floodlights, and to rolled, optically figured, and polished metal mirrors.

In recent years the demand for intense illumination for ships and harbors, airports, and various naval, military, and industrial purposes has led to the development of electric arc lights of extremely high intensity. Such lights commonly comprise slender carbon electrodes impregnated or cored with flame-producing material, for instance, rare earth metal fluorides. These electrodes are forced to carry heavy currents, often upwards of 200 amperes at 90 volts for a 16 millimeter diameter electrode. The intense heat developed and the hot particles of carbon and of core material thrown by the arc, severely damage in a short time the materials ordinarily used for the light reflecting surface of the projector.

Silvered glass mirrors have been most commonly used as the reflecting means in light projectors. Such mirrors are extremely fragile, being unable to withstand, for example, the vibration of more than three or four rounds of heavy gunfire or even slightly careless handling. Moreover, the intense heat of a high intensity arc tends to alter the optical figure of a glass mirror, and elaborate cooling arrangements are required. Hot particles of carbon and of core material pit the glass and adhere to it. Further, humid or salt air and the corrosive products of the arc rapidly attack the silver backing of these mirrors.

It has been proposed to use various bright metals, either in the form of a solid plate or affixed in various ways as a surface to a backing material, as the reflecting surface of a light projector. Thus, nickel, cadmium, chromium, and rhodium plated mirrors and solid stainless chromium steel mirrors have been proposed, as well as nickel alloy mirrors containing chromium and molybdenum or tungsten. None of these materials has been a pronounced success, for the reason that none has possessed to a fully satisfactory degree the ability to retain persistently a high percentage reflectivity, mechanical strength, resistance to staining and pitting, resistance to hot particles of carbon and salts, and an accurate optical figure.

It is an object of the invention to provide a light projector of the high intensity electric arc type provided with a mirror characterized by a persistent retention, under the normally destructive influences of the high intensity arc and the atmosphere, of a high percentage reflectivity, mechanical strength, and an accurate optical figure.

This and other objects of the invention are attained by a figured and polished hot-rolled metal mirror having substantially the composition: 15% to 35% chromium, 0.5% to 6% metal of the group consisting of tungsten and molybdenum, carbon in amounts not over about 1.25%, and the remainder cobalt with which there may be associated small amounts of iron, nickel, manganese, and silicon. Preferably, the tungsten-molybdenum group metal forms at least 2% of the composition. A preferred composition consists of 30% chromium, 5% tungsten, 1% carbon, and the remainder cobalt.

I have found that a mirror of the composition and physical condition above specified possesses a number of unique characteristics which make it preeminently suitable for efficient cooperation with the high intensity arc light source. It possesses a very high percentage reflectivity for the entire visible spectrum, comparing favorably in this respect with silver-backed glass; and its reflectivity is retained far longer under adverse conditions than is the reflectivity of the silvered glass. It effectively resists tarnishing by salt water, humid air, fluorides, hydrogen sulfide, cyanogen compounds, and other corrosives encountered in use. It persistently retains its optical figure under the most difficult conditions of heat and mechanical shock, and its mechanical strength is such that it requires no special protection or cooling devices. It is extremely hard, even at elevated temperatures, and resists scratching and rough treatment. The "sputter-in" of high intensity arc carbons which frequently throws hot particles of carbon violently against the mirror with disastrous consequences to silvered glass or to metal structures heretofore used, has little or no effect upon the mirror of the invention: the hot carbon particles do not mar or adhere to the mirror.

Aside from the extraordinary characteristics of long life and sustained efficient service possessed by the novel mirror of the present invention, its use in light projecting apparatus results in many advantages of simplicity, lightness, ruggedness, and ease of operation in such apparatus, for the reason that the cumbersome cooling devices ordinarily required may be eliminated. In fact, the mirror itself may constitute the rear closure for the light projector, thus improving the lightness, balance, and maneuverability of the projector by the elimination of the separate rear

closure and cooling devices usually found necessary.

A typical embodiment of the invention is illustrated in the attached drawing which shows a searchlight barrel 13 closed at one end by a mirror 10 composed of cobalt, chromium, carbon, and either tungsten or molybdenum or both, in the proportions described herein. A light source is supplied by suitable electrodes 11 and 12 to which an electric current is supplied by appropriate leads (not shown) in the customary manner.

The mirror of the invention has been made and tested in sizes up to about 36 inches, and has proved to be far superior to any mirror heretofore known, particularly when used in a light projector in combination with a high intensity carbon arc electric light source.

It may sometimes be desired to increase the ductility of the mirror of the invention at the sacrifice of some of its resistance to scratching and corrosion. In such a case, the content of tungsten-molybdenum group metal may be lowered below the preferred minimum of 2%, and may even be entirely eliminated.

I claim:

1. A rolled, optically figured, and polished metal mirror characterized by its persisent retention, when exposed to the action of corrosive media, heat, or mechanical shock, of its optical figure and reflectivity, and having substantially the composition: 15% to 35% chromium, 0.5% to 6% metal of the group consisting of tungsten and molybdenum, carbon in substantial amounts in the neighborhood of 1% but not over about 1.25%, and the remainder cobalt and incidental impurities such as small amounts of iron, nickel, manganese, and silicon.

2. A rolled, optically figured, and polished parabolic searchlight mirror characterized by its persistent retention, when exposed to the action of humid air, salt spray, the corrosive products emitted by high-intensity arc electrodes, heat, or mechanical shock, of its parabolic figure and reflectivity, and having substantially the composition: 30% chromium, 5% tungsten, 1% carbon, and the remainder cobalt.

ALBERT V. HARRIS.