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REFRACTORY METAL COMPOSITIONS

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This invention relates to refractory metal alloys.

An object is to provide a new and superior alloy of a very fine grained structure.

It is a further object of the invention to provide a material which possesses superior physical properties, and particularly a higher ductility than pure tungsten.

It is another object of the invention to produce an alloy which shows excellent characteristics when used as an electrical make and break contact, such as reduced contact resistance, less tendency for arcing, pitting and transferring during operation.

It is a still further object of the invention to provide a new material which will have a low coefficient of expansion and can be used for lead-in wires, or specialized thermostatic bi-metals.

It is a further object of the invention to provide a new alloy composition which can be used as filament support or for radio tube applications.

Another object of the invention is to provide a new alloy having excellent characteristics for use as an X-ray target.

It is a further object of the invention to provide a material of high melting point and high recrystallization temperature, which can be used as electrical resistance wire.

Other objects of the invention will be apparent from the following description, taken in connection with the appended claims.

The present invention comprises a combination of elements, methods of manufacture and the product thereof, brought out and exemplified in the disclosure hereinafter set forth, the scope of the invention being indicated in the appended claims.

While a preferred embodiment of the invention is described herein, it is contemplated that considerable variation may be made in the method of procedure and the combination of elements, without departing from the spirit of the invention.

According to the present invention, an improved alloy is contemplated, having the following ingredients present in substantially the ranges of proportions by weight given below:

	Percent
Tungsten	80 to 99
Molybdenum	1 to 20
Rhenium	.01 to 10

This alloy is especially well suited for electrical make-and-break contacts although it is evident that alloys within the above range can be used for other purposes. Following are examples of specific compositions:

		Percent
a.	Tungsten	97
	Molybdenum	2
	Rhenium	1
b.	Tungsten	89.8
	Molybdenum	10
	Rhenium	.2
c.	Tungsten	80
	Molybdenum	10
	Rhenium	10
d.	Tungsten	94
	Molybdenum	3
	Rhenium	3

In carrying out the invention, the alloys are usually formed from finely divided particles, of the three elements by subjecting the powder to a high pressure (after properly mixing) to form an ingot or special shapes. Pressure may be increased to a degree that porosity in the ingot or special shapes is materially reduced. The ingot or special shapes then may be sintered and forged or swaged, rolled or drawn, to a convenient shape, from which the various parts can be manufactured, for which this alloy is particularly suitable.

It is understood that one or more of the ingredients can be present originally in the form of oxides or other chemical compounds, and can be reduced together to the metallic state. Since very high sintering temperatures are necessary, the different ingredients will diffuse in a very short time, completely into each other, and form a very homogeneous alloy consisting either of solid solutions, or solid solutions and eutectic phases, which will have improved physical, chemical, and electrical properties.

The melting points of the finished alloys are above 2900 degrees C. The specific gravities will vary with the percents of molybdenum present, molybdenum being the element of lowest specific gravity, 10.2 grams per c. c. while rhenium has the highest specific gravity, 20.5 grams per c. c.

We have found that our new alloys have a lower electrode emissivity than pure tungsten. This is of advantage if the new alloys are used for electrical make and break contacts.

A large number of tests conducted on the use of the alloys described for electrical make and break contacts indicated that the material described herein is superior to pure tungsten when operated either against a contact of similar com-

position or having selective polarity when operating against binary alloys of tungsten-molybdenum or tungsten-rhenium, or molybdenum-rhenium.

A great increase of efficiency from the standpoint of resistance and transfer characteristics has also been noted, when contacts of the above composition are operated against a pure metal, such as tungsten or molybdenum, or compounds of these metals such as carbides or borides. It is understood, of course, that superior results can be obtained by selecting the proper combination of ingredients, as well as the composition of the coordinating or mating contact.

In general, it has been possible to obtain operating characteristics of such a nature as to increase the total operating life to three to four times that of make and break contact combinations of prior art materials.

We have found that the desirable characteristics described above will not be disturbed if small proportions of other ingredients are present, such as, iron group metals, as, iron, cobalt and nickel, or small percentages of tantalum, columbium, chromium and manganese.

We have also found that we can use our new ternary composition as a refractory base for a metal composition consisting of high melting point materials, taken from the group molybdenum, tungsten and rhenium, impregnated with low melting point materials, taken from the group copper, silver and gold.

With the present alloy, among others, the objects specifically aforementioned are achieved. Since certain changes in producing the above alloy and certain modifications in the composition which embody the invention may be made, without departing from its scope, it is intended that all matter contained in the above description shall be interpreted as illustrative, and not in a limited sense.

What is claimed is:

1. An alloy composed of:

	Percent
Tungsten	80 to 99
Molybdenum	1 to 20
Rhenium	.01 to 10

2. An electric make-and-break contact formed of a metal composition composed of 80 to 99% tungsten, 1 to 20% molybdenum and .01 to 10% rhenium.

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