UNITED STATES PATENT OFFICE.

JAMES WEBSTER, OF BIRMINGHAM, COUNTY OF WARWICK, ENGLAND.

METALLIC ALLOY.

SPECIFICATION forming part of Letters Patent No. 377,918, dated February 14, 1888.

Application filed June 8, 1886. Serial No. 204,538. (No specimens.)

To all whom it may concern:

Be it known that I, JAMES WEBSTER, a subject of the Queen of Great Britain, residing at Birmingham, in the county of Warwick, England, engineer, have invented a new and useful Metallic Alloy; and I do hereby declare that the following is a full, clear, concise, and exact specification of the invention, and one which will enable any person skilled in the art of mixing metallic alloys to make and use the same.

My invention relates to the compounding and manufacture of an improved metallic alloy which is better adapted than other known alloys for the production of any article of manufacture which requires a metal possessing in a high degree, as compared with known metals or alloys, any or all of the following properties: strength, tenacity, hardness, capacity for vibration, capability of taking a high polish, and non-liability to corrosion.

I wish to point out at this juncture that it is practically impossible for me to give here a complete list of all the articles at present in use or known in the arts which could be advantageously manufactured in my improved alloy, for to do so would make the specification prolix and verbose, and therefore the reverse of concise, and, as it is well known, a specification of an invention is required to be concise. Besides, if I were to give *seriatim* a full list of all the articles at present in use or known in the arts which could be advantageously manufactured in my improved alloy, there would necessarily be omitted therefrom some articles yet to be invented, or some application of the alloy which is not yet apparent. I therefore indicate the uses to which my invention can be put by pointing out those of its properties in respect of which it excels the alloys in use or known at the present time, said properties being, as stated above, strength, tenacity, hardness, capacity for vibration, capability of taking a high polish, and non-liability to corrosion. To this category I now add that this alloy is easily fusible, can be cast in the ordinary method, and is readily forged and machined, so that if any person is in search of a metal which must, for his particular purpose, possess any or all of the above-mentioned properties, then is the alloy which is the subject of my invention the material he requires. In virtue of its hardness and non-liability to corrosion, it is well adapted for the bearings of heavy shafts, as well as for any parts of a machine which work at a high velocity and under heavy pressure. In virtue of its tenacity or toughness and strength, combined with its non-liability to corrosion, it is an excellent material for the manufacture of marine propellers and for metal ship furniture generally. In virtue of its tenacity it is an excellent material for the manufacture of high-class wires, sheets, and seamless drawn tubes. In virtue of its capacity for vibration, wires drawn from my alloy are superior for percussion-instruments—such as pianos—to any of the wires now in use. A wire drawn from this alloy will, when it is struck, vibrate longer than any other piano-forte wire tested under the same conditions. For the same reason this alloy is a valuable metal for gongs, bells, the combs of musical boxes, and trumpets. Its closeness of texture and hardness and consequent capacity for receiving a high polish, coupled with its power of retaining this polish in virtue of its non-liability to corrosion, make my alloy exceedingly valuable as a raw material for the artistic metal-worker and manufacturer of imitation jewelry, watch-cases, and guards. In virtue of its strength, hardness, and non-liability to corrosion, it is very well adapted for the manufacture of cooking-utensils and table-cutlery. In virtue of its strength, tenacity, fusibility, malleability, close texture, and capacity for being machined in a machine-tool—*e. g.*, a lathe or planing-machine—it is of great utility to the mechanical engineer when the quality of the work expected from him compels him to choose the best metal which he can procure.

In carrying my invention into effect, I pre-

pare a preliminary alloy by melting together, according to any convenient and well-known method, the following metals in the proportions specified. This preliminary alloy I call, for convenience of reference, the "No. 1 alloy."

No. 1.

Copper	200 pounds or	66.67 per cent.
Tin	80 pounds or	26.67 per cent.
Aluminium	10 pounds or	3.33 per cent.
Bismuth	10 pounds or	3.33 per cent.
	300	100.00

When the alloy compounded according to the proportions specified above has been thoroughly mixed, it is cast into blocks of a convenient size for use in the preparation of the alloy which is the final product of my invention. For instance, as the proportional weight of alloy No. 1 is—as specified in the next table—four and one-half pounds in three hundred pounds, it will be convenient to cast it into blocks of four and one-half pounds each.

I next proceed to compound and melt together the metals forming the alloy which is the final product of my invention, and which I call "No. 2" for the sake of distinguishing it from No. 1, above mentioned. The following are the several metals to be used in the proportions specified:

No. 2.

Copper	164 pounds or	54.7 per cent.
Nickel	70 pounds or	23.3 per cent.
Spelter	61½ pounds or	20.5 per cent.
Alloy No. 1	4½ pounds or	1.5 per cent.
	300	100.00

Or, if the metals used in compounding the 1.5 per cent. of No. 1 alloy be set out in detail, the figures will be as follows:

Copper	54.7+1.0= 55.7
Nickel	23.3
Spelter	20.5
Tin	.4
Aluminium	.05
Bismuth	.05
	100.00

In the preparation of my improved metallic alloy I use the flux described in an application for Letters Patent filed November 17, 1885, Serial No. 183,105; and I wish it to be distinctly understood that the use of this flux for facilitating the fusion of the metals entering into the composition of my alloy and for purifying it is essential to the success of my invention. The resultant alloy is cast into blocks of a size and shape suitable for the after processes of recasting, rolling, drawing, or the like.

In the process of melting the alloys above specified the ordinary precautions against loss by evaporation are to be taken.

The relative proportions of simple metals specified, both with respect to alloy No. 1 and alloy No. 2, are to be adhered to within five per cent., calculated upon the proportion specified—that is to say, the proportion of copper in No. 1 alloy may be varied in either direction to the extent of ten pounds only; but no advantage will be gained by varying the proportions specified, and I prefer that they be strictly adhered to. They have been calculated so as to make proper allowance for any of the minor losses by absorption or evaporation incidental to careful fusing.

The following are the results of an analysis of my alloy:

No. 1.		No. 2.	
Copper	67 per cent.	Copper	53
Tin	28 per cent.	Spelter	22.5
Bismuth	3 per cent.	Nickel	22
Aluminium	2 per cent.	Tin	.5
		Aluminium, Bismuth	1.5
	100		99.5

In order that the differences between my present invention and other alloys known or in use at the present time may be clearly apprehended, I will take the cases of silverine, the composition of which is specified in the "Metallurgical Review," vol. 1, p. 602, and of a British patent granted to me for a "bismuth bronze," being No. 4,636 of A. D. 1882, September 29. I quote these two cases as illustrative of the state of the art of making alloys at the date of my application for Letters Patent for my present invention.

First, as to the differences in the respective compositions of silverine and of the alloy which is the subject of my present invention. The inventor of silverine patented three different alloys, the respective ingredients and their proportions being, before mixing, as follows:

	I.	II.	III.	Average.
Copper	79.5	75	71	75.17
Nickel	16	16	16.5	16.18
Cobalt	1	2	1.25	1.41
Zinc	1	2.25	7.5	3.58
Tin	1	2.75	2.5	2.08
Aluminium	.5	.5	.....	.33
Iron	1	1.5	1.25	1.25
	100.00	100.00	100.00	100.00

I may here remark that the "Metallurgical Review" quotes from the "Annales des Mines," but is inaccurate in two places. "Alumina" is printed instead of "aluminium" and a percentage of 2.5 opposite it in the third column of proportions, where there should have been a blank. These inaccuracies do not appear above.

The following table will show the substantial difference in the proportions of average silverine and of my No. 2 alloy, comparing, of course, the quantities specified in each case:

	Average silverine.	My No. 2.	Differences calculated upon the proportion in the silverine.
Copper	75.17	55.7	A diminution of 27 per cent.
Nickel	16.18	23.3	An increase of 40 per cent.
Zinc	3.58	20.5	An increase of 470 per cent.
Tin	2.08	.4	A diminution of 80 per cent.
Aluminium	.33	.05	A diminution of 85 per cent.
Bismuth	.....	.05	
Cobalt	1.41	.....	
Iron	1.25	.....	
	100.00	100.00	

It is evident, therefore, that the difference between average silverine and the alloy which is the subject of my present invention is very great and that the similarity is only superficial; and I wish it to be distinctly understood that I do not lay any broad claim to be the inventor of an alloy compounded of copper, nickel, zinc, tin, aluminium, and bismuth, for such alloys are already well known. The gist of my invention does not consist in the selection of the particular metals which I make use of, but in the relative proportions in which they are mixed together.

Secondly, as to the differences between the invention of bismuth bronze described in the specification of British Letters Patent No. 4,636 of A. D. 1882, granted to me, and my present one. The two inventions resemble each other in this respect: The first part of each invention is the compounding of a preliminary alloy, a certain proportion of which enters into the second or final alloy. In the said specification there are two preliminary alloys specified; but as the second one of the two is more like the No. 1 alloy of the present invention than the first one, I quote said second one for the purpose of comparison. The respective percentage compositions are as follows:

	Preliminary alloy for bismuth bronze.		No. 1 alloy of the present invention.
Bismuth	1 pound	or 6 per cent.	3.33 per cent.
Aluminium	1 pound	or 6 per cent.	3.33 per cent.
Tin	15 pounds	or 88 per cent.	26.67 per cent.
Copper	...	...	66.67 per cent.
	17	100	100.00

The No. 1 alloy of my present invention differs from the preliminary alloy for the bismuth bronze in having only about half as much aluminium, about half as much bismuth, and one-third as much tin. Moreover, there is 66.67 per cent. of copper in it—a metal which is absent from the bismuth-bronze preliminary alloy. Then as to the final alloys in the bismuth-bronze process and in the present invention, respectively, the differences are clearly indicated in the following table:

	Final alloy of the bismuth-bronze process.	No. 2 alloy of the present invention.	Differences calculated upon the percentage in the final alloy of the bismuth-bronze process.
Copper	69	55.7	A diminution of 20 per cent.
Spelter	21	20.5	
Nickel	9	23.3	An increase of 158 per cent.
Tin	.88	.4	A diminution of 45 per cent.
Aluminium	.06	.05	
Bismuth	.06	.05	
	100.00	100.00	

It is evident that the differences between my improved alloy and the bismuth bronze are in point of composition substantial and not merely superficial, for, as I have pointed out above, I make no broad claim to the use of the metals which enter into the composition of my present invention, inasmuch as I am quite aware that alloys of the same metals which I principally use are already known, and the gist of my invention does not consist in the selection of the particular metals which I make use of, but in the relative proportions in which they are alloyed.

I have already pointed out the characteristic advantages of my present invention over other alloys, and I now have to add that these characteristic advantages are directly the consequence of and depend upon the distinctive peculiarities in respect of the said relative proportions of the several metals used which I have pointed out above by way of comparison with alloys previously known.

I claim—

A metallic alloy containing copper, spelter, nickel, tin, aluminium, and bismuth in the following proportions by weight, viz: copper, 53; spelter, 22.5; nickel, 22; tin, .5; aluminium and bismuth, 1.5.

In testimony whereof I have hereunto set my hand this 27th day of May, 1886.

JAMES WEBSTER.

Witnesses:
FRAS. HY. FISHER,
THOS. COOKE,
Clerks to R. Harding Milward, Notary Public, Birmingham.