GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, LOWER CIRCULAR ROAD, CALCUTTA-17.

Specification No. 95420, Application No. 95420 dated 31st August, 1964. Complete Specification left on 26th May, 1965. Application accepted 30th March, 1966.

Index at acceptance—9A+E [XXXIII(1)]—64B1 [LVIII(4)]—129D+N [XXXV]

PROVISIONAL SPECIFICATION.

IMPROVEMENTS IN OR RELATING TO SOLDERING OF ALUMINIUM CABLES.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, RAFI MARG, NEW DELHI-1, INDIA, AN INDIAN REGISTERED BODY INCORPORATED UNDER THE REGISTRATION OF SOCIETIES ACT, (ACT XXI OF 1860).

The following specification describes the nature of this invention.

This is an invention by BALKUNJE ANANTHA SHENOI, Scientist, RAMACHANDRA SUBRAMANIAN, Senior Scientific Assistant, and SRINIVASAN CHAKRAPANI, Junior Laboratory Assistant, all of the Central Electrochemical Research Institute, Karaikudi-3, Madras, India, all Indian citizens.

This invention relates to improvements in or relating to the technique of soldering aluminium cables.

Hitherto it has been proposed to solder with imported proprietory fluxes and solders.

This is open to the objection that they have to be imported at heavy cost and involve fluxes which give out poisonous fumes.

The object of this invention is to obviate these disadvantages by using materials available in India and is without the dangers of poisonous fumes.

To these ends, the invention broadly consists in using a flux and solder based on Tin for jointing cables with a 100 Watt soldering iron or blow lamp. The flux consists of RHN-NH_2HX with hydrofluoric acid and boric acid in non aquous solvent to which is added a soap of bivalent metal.

The following typical examples are given to illustrate the invention:

EXAMPLE 1.

The surface to be soldered is coated with the flux and heated till it fumes with a hot iron. Then it is 'tinned' with the solder. The two ends to be soldered are held close to each other and then the molten solder is applied to flow well. The flux is prepared by dissolving RHN-NH_2HX where R is H or an aromatic ring and X may be OH or halogen, mixed with Boric acid and Hydrofluoric acid in non aqueous solvent containing an amino group. The solder is Tin based containing Tin 40—80 gms Lead 20—60 gm and Zinc 0—30 gm with the addition of a metal of First group in the periodic table 0—1 gm.

EXAMPLE 2.

The same Technique is used but in the flux R HN-NH_2HX is used in place of hydrazine where R is an aromatic group and X stands for halogen.

The following are among the main advantages of the invention:

(1) Time of soldering is short
(2) Soldering flux and solders are of indigenous origin
(3) Can be applied to Aluminium or aluminium alloys
(4) It is cheap
(5) Strength of joint is very good.

R. BHASKAR PAI,

Patents Officer,

Council of Scientific & Industrial Research.

Dated this 24th day of August 1964.

COMPLETE SPECIFICATION.

IMPROVEMENTS IN OR RELATING TO SOLDERING OF ALUMINIUM CABLES.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, RAFI MARG, NEW DELHI-1 INDIA, AN INDIAN REGISTERED BODY INCORPORATED UNDER THE REGISTRATION OF SOCIETIES ACT (ACT XXI OF 1860).

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed.

This is an invention by BALKUNJE ANANTHA SHENOI, Scientist, RAMACHANDRA SUBRAMANIAN, Senior Scientific Assistant and SHRINIVASAN CHAKRAPANI, Junior Laboratory Assistant, all of the Central Electrochemical Research Institute, Karaikudi-3, Madras, India, all Indian citizens.

This invention relates to improvements in or relating to the technique of soldering aluminium cables.

The development of a flux for soldering of aluminium and aluminium alloys is beset with many difficulties. One of the main difficulties is the impervious oxide film on the aluminium surface which is difficult to remove. Even when the oxide film is removed by scratch brushing or filing, it reforms immediately and quickly builds up to 60-100 Å within half an hour. Solders do not flow in certain types of joints. The resistance to corrosion of solder joints is much more dependant on solder compositions. Aluminium does not alloy easily

The joining of aluminium cables should not be tedious, expensive or require special equipments. The method of joining should be readily adaptable for field use and should be applied readily by ordinary plumber on the shop floor or in an open field with conventional equipments.

It is stated (Symp. on Aluminium and its alloys in Elec. Engineering—Pub. by ADA Dec. 1957) that although fluxing operations in the soft solder technique indicate no substantial progress, more recently proprietory compounds have been developed in other countries for soldering of aluminium cables, and aluminium alloys. Particularly our country is dependent on these imported fluxes and solders for aluminium cable joining, a teething problem to be faced under the present drive for substituting copper cables by aluminium cables.

Hitherto it has been proposed to solder aluminium cables with fluxes and solders imported from other countries at a heavy cost involving foreign exchange.

The object of this invention is to develop a flux and solder for aluminium cable jointing use of which will only demand a little more care than for soldering of copper cables.

Another object of invention is to use chemicals and country or which can be manufactured easily.

A third object of the invention is to develop a solder for aluminium cable jointing which could withstand the corrosion of the joints due to exposure to different types of atmospheres in this vast country.

Price : TWO RUPEES.

The present invention consists of a flux composition for use with solders specially developed for jointing aluminium cables with the equipment and techniques that are now used for soldering copper cables. The flux composition has for its ingredients hydrazine or a derivative of hydrazine conforming to the formula R. NH-NH_2 HX (where R is an aliphatic or aromatic group and HX is water or hydrogen halide like HCl, HBr or HF) hydrofluoric acid, boric acid dissolved in non-aqueous solvent of an aliphatic amine. A further feature of this formulation is that this composition may be diluted with water or alcohol to get a less viscous flux and small amounts of a metallic soap are added which aids wetting of the aluminium surface by the flux. A special feature of the flux is that it can be used for solder copper or its alloys with each other or aluminium and its alloys. The present invention also consists in the development of solder compositions with a good resistance to humid and saline atmospheres. Added feature of these solders is that the resistance of the wire is not altered after soldered joints are made even after exposure to the corrosion tests in humid and saline environments. A still further feature of the solders are the melting point is sufficiently low and the molten solder flows freely and have a good penetration and wetting action on the aluminium surface effecting a very good joint strength. The solders are all of the TLZ type with traces of metals of the first group added to improve the appearance, melting and strength of the soldered joint. The main feature of this formulation lies in that it has avoided the use of cadmium in such solders. This step in formulating the solder has the following advantages thereby the liquidus temperature is lowered which means a lower pouring temperature, less damage to cables and cable sheaths, less fuming of flux and well filled joints.

The same flux and solders can be used for jointing aluminium to copper cables in the same conventional way of soldering copper cables also.

Jointing of aluminium wires or cables to brass wires is also feasible with the use of this flux and solders.

By use of torch heating, the leak holes in aluminium tanks can be plugged in water tight by using this flux and solder.

The following is detailed description of the preparation of the flux:

The requisite amount of hydrofluoric acid is mixed with a calculated quantity of boric acid. Into this is dispersed the metallic soap (Solution I). Into the non-aqueous aliphatic amine solvent of desired volume is added the hydrazine or its derivative of the said formula RNH-NH_2HX to get a clear liquid (Solution II). A desired volume of solution I is then stirred into a specified volume of solution II to get the flux. If need be, necessary amount of water or alcohol may be added to get a thinner form a flux.

The proportion of the ingredients used may be varied within the following ranges:

Hydrofluoric acid	100 to 300 ml
Boric acid	60 gm to 100 gm
Metallic soap	0 to 20 gm
Aliphatic amine	400—800 ml.
Hydrazine or its derivative of formula RNH=NH_2HX	1-12 gm.

The solders are prepared by melting together the proportions of the metals in a graphite crucible of sufficient volume over a heating over and then pouring them into moulds of 1/4" dia. rods to get the rod form. The rods may be drawn through wire drawing machine to get the solder in the form of wires of desired gauge size to get them in the wire form.

The proportion of the metals used may be varied within the following ranges:

Lead	5—60% by wt.
Tin	10—70% by Wt.
Zinc	5—50% by wt.
Aluminium	0— 5% by wt.
First group metal	0—1% by wt.

MGIPC—L—25 Patent/66—10-8-67—100.

The following examples are given to illustrate the invention. The flux was prepared by mixing the ingredients in the proper proportion by mixing solutions I and II:

Solution of Boric acid in hydrofluoric acid	250 ml	I
containing the metallic stearate	10 gm	
Aliphatic amine	750 ml	II
containing the derivative of hydrazine. R NH-N_2HX	10 gm	

The cable after cleaning is brushed with flux and tinned with the solder. The two ends to be soldered are held close to each other and then the molten solder is poured over the joint and allowed to flow well. Conventional blasting technique for soldering of aluminium cables are thus possible with the said solder and flux.

For soldering small wires such as connecting leads etc., after tinning the ends to be soldered, the electrical soldering rods (100 watts) can be used to make the joints.

We claim:

1. A flux composition having for its ingredients an organic aliphatic amine as the solvent base.

2. A flux composition as claimed in 1 where hydrazine or its derivative conforming to the formula RNH-NH_2HX is added.

3. A flux composition as claimed in 1 and 2 to which is added a solution of boric acid in hydrofluoric acid.

4. A flux composition as Claimed in 1, 2 and 3 to which a metallic soap is added.

5. A flux composition as claimed in any of the four preceding claims wherein the proportion of the ingredients used are within the following ranges:

Hydrofluoric acid	100 to 300 ml.
Boric acid	60 to 80 gm.
Metallic soap	0 to 20 gm.
Aliphatic amine	400 to 800 ml.
Hydrazine or its derivative RNH-NH,HX	1 to 12 gm.

6. A flux composition as claimed in any of the preceding claims for use in conjunction with a lead-tin solder for soldering copper or its alloys.

7. A solder based on Lead, Tin and Zinc within the following range for soldering purposes in combination with flux as in the Claims 1 to 5.

Pb 5—80 per cent.; Tin 0—70 per cent.; Zn 5—50 per cent.; Al 0—5 per cent.

8. A solder composition as in Claim 7 to which small amounts of a metal in the first group of the periodic table within the following ranges is added. I group metal 0—1 per cent.

9. A solder and a flux composition as in the Claims 1 to 7 above for soldering aluminium or aluminium alloys or aluminium cables of AAC or ACSR type.

10. A solder and a flux composition as in the Claims 1 to 7 above for soldering aluminium cables with copper cables.

11. A method of soldering or the like wherein a flux composition or a solder composition as substantially described in the preceding claims and examples used.

R. BHASKAR PAI,

Patents Officer,

Council of Scientific & Industrial Research

Dated this 27th day of June, 1965.