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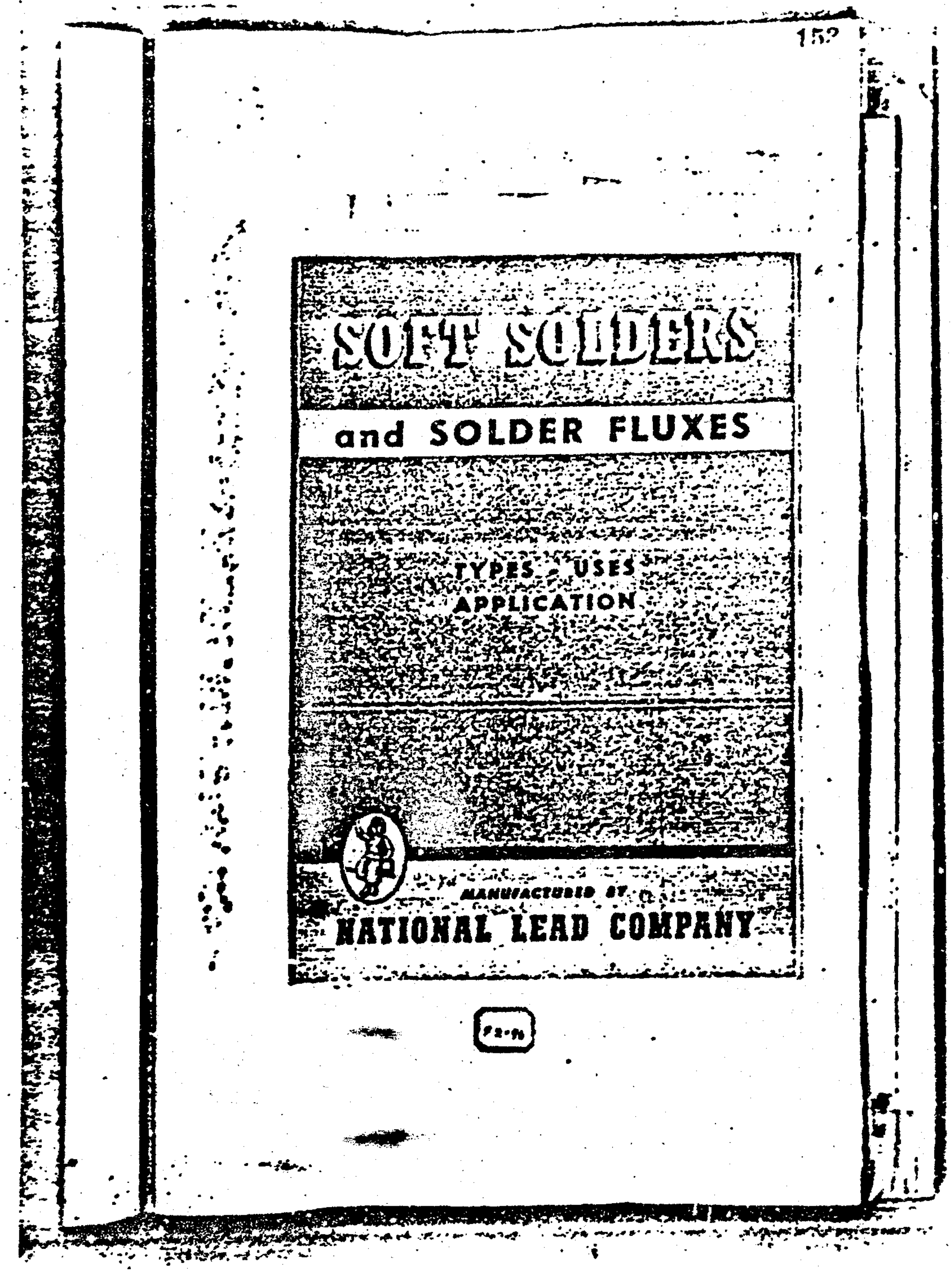

SOFT SOLDERS

and SOLDER FLUXES

TYPES - USES
APPLICATION

MANUFACTURED BY
NATIONAL LEAD COMPANY

F2-96

Introduction

In the average mind, solder occupies no high pinnacle. It is just another article of commerce.

Yet, if by some stroke of magic, all the solder in the world were suddenly to disappear, modern life as we know it would completely collapse. Transportation—planes, cars, ships—would stop. Swift communication by radio and telephone would be stilled. Electrical power, from giant dynamos to the smallest generator, would be no more. Even a major part of our food supply would be lost through the failure of mechanical refrigeration and the "leaking at the seams" of tin containers of all kinds—not to mention the many other common objects that would go out of order or fall apart such as gas meters, dairy equipment, metal band instruments and jewelry.

So solder is important. It has a particularly vital part in modern industrial progress as well as in many everyday things that contribute to our way of living.

In this booklet the varied functions of solder are discussed and a special attempt made to show how they are well met by the versatility and comprehensiveness of the National Lead Company line of its solders.

Your inquiry about any of these solders or a request for advice and help on a specific solder problem is always welcomed. Simply address the office nearest you. (See page 32.)

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National Lead Company

CHAPTER ONE

Story of Solder

What it is

Solder is one of Nature's enigmas. Here is a combination of metals usually lead and tin possessing properties foreign to the parent metals themselves. If you tried to join the seams of a tin can, for example, by using just pure tin you would melt the tin coating on the can. Because, of course, a tin can is really a steel can with a very thin tin coating. If you tried to use lead alone, it would be still worse for it takes 170 degrees (Fahrenheit) more heat to melt lead than tin.

Yet these two metals, combined as they are in solder, actually melt at a much lower temperature than either lead or tin. Thus solder makes it possible to join metals at a comparatively low heat and with no risk of damage.

This peculiar result of the marriage of the two metals has been known for many centuries. There are plenty of evidences of solder's use in ancient times and the Romans are generally credited with the introduction of soft solder. In fact, the word is derived from the Latin and the historian Pliny describes one of these mixtures, "tertiarium," consisting of equal parts lead and tin, the "half and half" of modern times. Actually, until the introduction of machine soldering, there seems to have been little fundamental change in the operation from Roman days until now.

Of course, there have been great strides in the improvement of the purity of solders. Better and more accurate refining processes make it possible to produce solder today that is not only reliable in its mixture but completely free from the impurities that interfere with the proper functioning of a solder.

The soft solders are almost always alloys of tin and lead although other combinations can be used, such as lead, tin and silver, for example. While a low melting point is the real reason for the wide use of soft solders, it is an equally important fact that they readily adhere to other metal surfaces.

In order to meet varied conditions of use there are many different compositions of the alloy, from those with very little lead to others in which the tin has been practically eliminated or even replaced.

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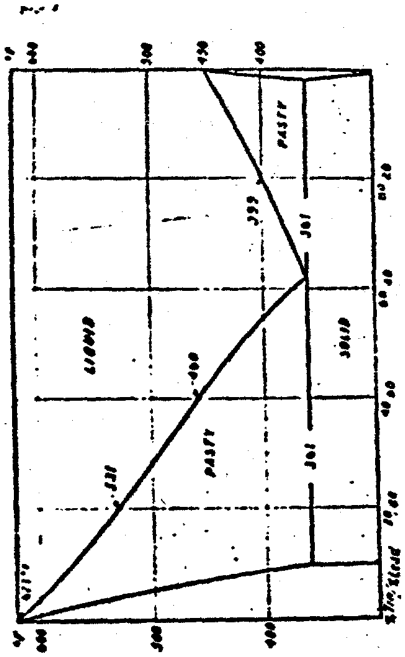


MELTING CHARACTERISTICS OF TIN-LEAD ALLOYS
(See ... page 11)

Most solder compositions, upon the application of heat, pass from the solid state through a semi-solid or pasty condition and finally to the completely liquid or free flowing state. The sole exception to this behavior is an alloy containing 63% tin. At 361 F. (183 C.) this mixture changes sharply from solid to liquid. There is no intermediate state.

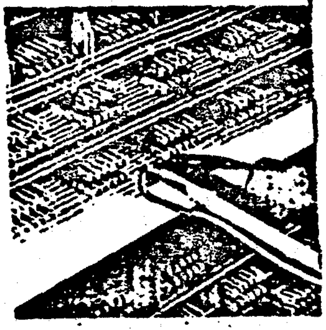
Eutectic Mixture

This latter mixture is known as the eutectic, which means free flowing and is the lowest melting point of the two metals. This intimate mixture of the tin and lead actually occurs in varying degree in nearly all the commercial tin-lead solder alloys. In any solder containing up to 63%, tin the solid metal formed during the freezing range is mostly all lead. As a consequence the liquid part grows richer and richer in tin until it finally reaches the eutectic temperature at which proven point the liquid solidifies and the solder is set.

As is shown by the diagram, the more lead in a tin-lead solder, the longer the interval between liquid and solid state. This is why a wiping solder must necessarily be a higher lead content solder whereas solders with over 50% tin are useful for other purposes.

When the tin content exceeds 63%, the solidification process is much the same except here the first crystals to form are almost pure tin instead of lead. The tin content of the liquid part then reduces until the eutectic is reached. It is clearly indicated by the diagram that the pasty range of the higher tin solders is not nearly so great as that of the higher lead mixtures.

National Lead Company's long experience in making solders for all the many and varied fields has resulted not only in a complete line of standard purpose solders but also in many specialty items. There is no soldering requirement that we are not equipped to meet accurately and efficiently. And this includes the type of alloy as well as the size and form in which it is furnished.



Soldering a step for [illegible] a telephone exchange

Courtesy Bell Telephone Laboratories

Where Solder is Used

Automotive. Anyone who has driven an automobile with a leaky or partially dry radiator knows how important this part of a car is. In every one of these radiators solder plays the vital part of holding the elements together. A radiator of average size will contain as much as seven or eight pounds of solder so the total amount of solder used for this purpose is very high indeed.

There are many different types of automobile radiators, such as tubular, honeycomb, flat tube and fin or [illegible]. All of them, however, are built up from many small units and these units of varying sizes and shapes, according to the particular method being used, are held together by solder. In some cases the solder is applied in a bath and in others the machine method is employed.

The top and bottom tanks of the radiator as well as the [illegible] from bottom and the filling caps are likewise held fast by solder.

Another important use of solder in the automotive field, and one [illegible] [illegible] mechanical efficiency as for appearance, is the body work. As yet it has not proved practical to construct an automobile body so that it is seamless. While many former joints have been eliminated, such as in the stamping of an entire roof, there are still certain irregularities. To fill these in so that when the car is painted not a trace remains, body solder is employed. This is a special mixture that works easily and forms a tough strong surface.

[illegible] an automobile radiator core [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

There is also a big use of this same solder in automotive repair, where dents and holes in body or fenders can be filled in and concealed.

Electrical. It is no exaggeration to say that our modern electrical development in all fields, communication, transportation, industry and the home is dependent to a surprising degree upon the use of solder. Only with this versatile product could all the necessary connections be made electrically sound and durable.

Body soldering with torch and [illegible] with spray gun

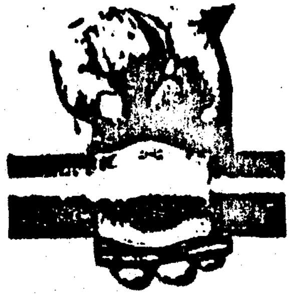
As an example of what solder means in this field, take the present day automatic telephone exchange. One serving a total of only ten thousand stations requires over eight million soldered connections. Just one telephone call can involve as many as [illegible] thousand soldered connections. It is, too, [illegible] [illegible] [illegible] [illegible] sending and receiving soldered connections are numbered in the millions.

Of course, all electrical motors and generators, no matter what the use or the size, involve soldered connections. There is no other practical way of making them.

Solder, in the form of wiping solder, also functions in the joining up of the thousands of miles of lead covered electrical cables in this country. After the wires are joined and soldered, they are again covered and protected by a lead sleeve with a "wiped joint" of solder.

Can Manufacture. The manufacture of tin plate containers has become one of our big industries. They are turned out by the millions in all shapes and sizes and in them making solder plays a most important part.

The side seams of cans would soon loosen and leak if not securely held and sealed with solder. In many cases the bottoms as well as the tops of cans are also soldered in place. Then, with those to be vacuum sealed, the final barrier to keep the can airtight is a drop of solder on the hole through which the air is extracted.



Wiping a joint in a lead pipe

Most of the soldering work can now be done by means of ingenious machines so that the entire process is on a production line basis.

Plumbing. A familiar sight in the plumber's shop or on the job is the [illegible] which holds a bath of molten solder. This is what the plumber uses for joining two pieces of lead pipe by the method known as "wiping a joint." For this purpose a solder with a wide plastic range is needed so that while it is cooling the operator has sufficient time to wipe or smooth up the joint with a piece of cloth before the solder solidifies completely. Solder is also used for the sweat fittings of copper tubing as well as in some plumbing fixtures such as copper water tanks, bath floats and the like.

Air Conditioning and Refrigeration. Both of these processes depend upon the functioning of units which may be termed "heat exchangers." Either the surrounding air gives up its heat to the unit as in a refrigerator or the reverse as in the case of air heaters. These consist of coils of tubes, [illegible] tubes and fins as well as other tubing. Here solder is employed not only for holding and strengthening the assemblies but as an aid in heat transfer by assuring the intimate contact of all the metal surfaces. Solder is likewise employed in joining many of the mechanical parts of air conditioning and refrigerating equipment as well as for the air ducts required in the [illegible] process.

CHAPTER TWO

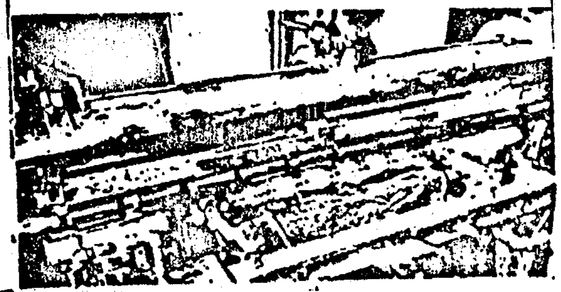
Soldering

Proper Conditions

While soldering is a relatively simple operation there are some definite requirements to be observed if the joint is to be a sound one. This holds true, of course, whether the work is done by hand or by machine. Not only the right solder but the correct technique must be employed.

The prime necessity is a clean, well fluxed, metal-to-metal contact between the parts to be joined and the molten solder. Unless this takes place, a poor joint or a complete failure is inevitable. Coupled with this requirement is the importance of proper formulation and quality in the solder and the cleanness of whatever flux is used. When defects occur in the solder, it is not by intention on the part of the reputable manufacturer. Most solder formulas are fairly simple and well known but manufacturing skill and proper equipment are the answer to whether it is good solder or the trouble making kind. There is a great deal more to the process than mere mixing. The metals themselves must be refined and refined again, until they are free from impurities, whether in the way of foreign metals or of dirt. Throughout the entire process, the same care and thoroughness must be exercised. The heat at which the solder is mixed and poured or extruded, the amount of stirring it receives and even the nature of the

Automatic side seam can soldering machine with hood raised to show flux applicator at left, solder bath in center and, at extreme right, buffing wheel for removing excess solder.



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lead used as heat as can affect the quality and working properties of the finished product.

Solder made up by the user from scraps is a dubious product because of the practical certainty that foreign matter has crept in. Dirt, copper particles, iron or steel filings are just some of the impurities that can cause trouble.

It is well for the solder user to remember that the quality of a solder is directly related to the reputation of the maker. The fact that National Lead Company has been making and selling

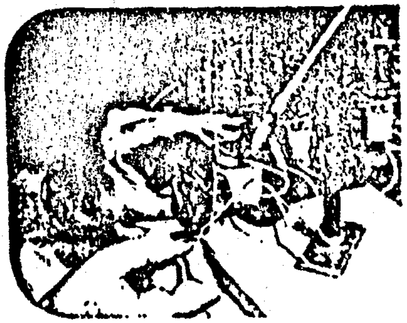
[illegible]

high quality solder for half a century is reason enough for the confidence of our many customers. It is likewise [illegible] assurance that anything we might say that, in National Lead solders, every user can be sure of getting that first requirement of a good job: a pure, carefully made solder.

Time Required

The time element is also important. The best joints are those where the solder is kept in a molten state just long enough to wet the surfaces but not so long that objectionable alloying with the surface can take place. The alloy so formed may result in brittleness. The time of heat application should be kept always down to the minimum, both for economy in production and to promote sound joints.

Torch soldering [illegible]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Methods in Use

There are several ways in which solder can be applied. The one used in each particular case is generally determined from the standpoint of cost, efficiency and the production of the correct type of joint. Those commonly used are as follows:

Iron or Bit. This is the oldest method and still widely used. The "iron", which is usually copper, may be of almost any size or weight. Sometimes aluminum faced with copper is used to reduce the weight. It can be externally heated or self heated by a gas flame or electrical heating element. The important thing is to use an iron large enough and with sufficient heat capacity to keep the work at proper temperature while the soldering is being done, without overheating the iron.

Torch. This is a somewhat more rapid process of soldering than the use of an iron. But it can only be used where heating of parts adjacent to the joint is permissible. Torch soldering may be done by hand or it may be semi-automatic where the work is mechanically conveyed through the flame at a rate to properly heat the parts and the solder then applied.

Spray. In this technique, solder in the form of wire is fed through a torch where it is melted by a gas flame and forcibly expelled by compressed air. The solder particles flatten out on the part and adhere well to any roughened surface. This method does not produce very strong joints but is suitable for such work as filling on automobile bodies and fenders.

Wiping. This is the method used in the joining of lead pipe as well as cable sheathings. It is entirely a hand operation where

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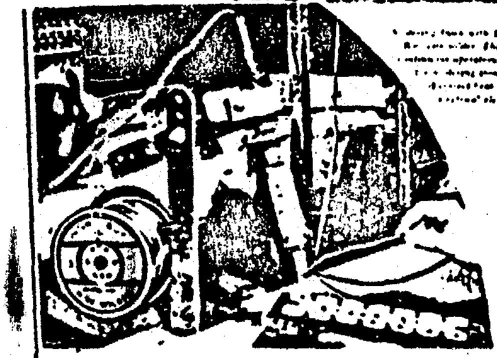

[illegible]

[illegible]

Bath. [illegible]

Sweating. [illegible]

Induction and Electrical Resistance. [illegible]

[illegible]

[illegible] Another form is a resistance element used to heat objects placed within it so that they can be soldered.

Automatic. [illegible] The sweating operation can be converted to automatic use by passing the articles through an oven or induction machine.

Strength of Soldered Joints

[illegible] of short duration well soldered joints are usually as strong or even stronger than the tensile strength (quick tests) of the solder employed. However, this strength may be greatly reduced where the load is of long duration.

As a specific illustration of this, the National Bureau of Standards has determined the following short and long time strengths of soldered joints on copper tube fittings. These couplings were sweated on with various solders and subjected to axial pull.

Solder Used			Maximum Allowable Shear Stress			
			Short Time	For Loads of Long Duration		
			[illegible]	[illegible]	[illegible]	[illegible]
Tin	Lead	Antimony	psi	psi	psi	psi
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	not tested
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	not tested

These findings may be considered as illustrative of the strength of good soldered joints in general. Of course, there are many times where strength is not too important. [illegible]

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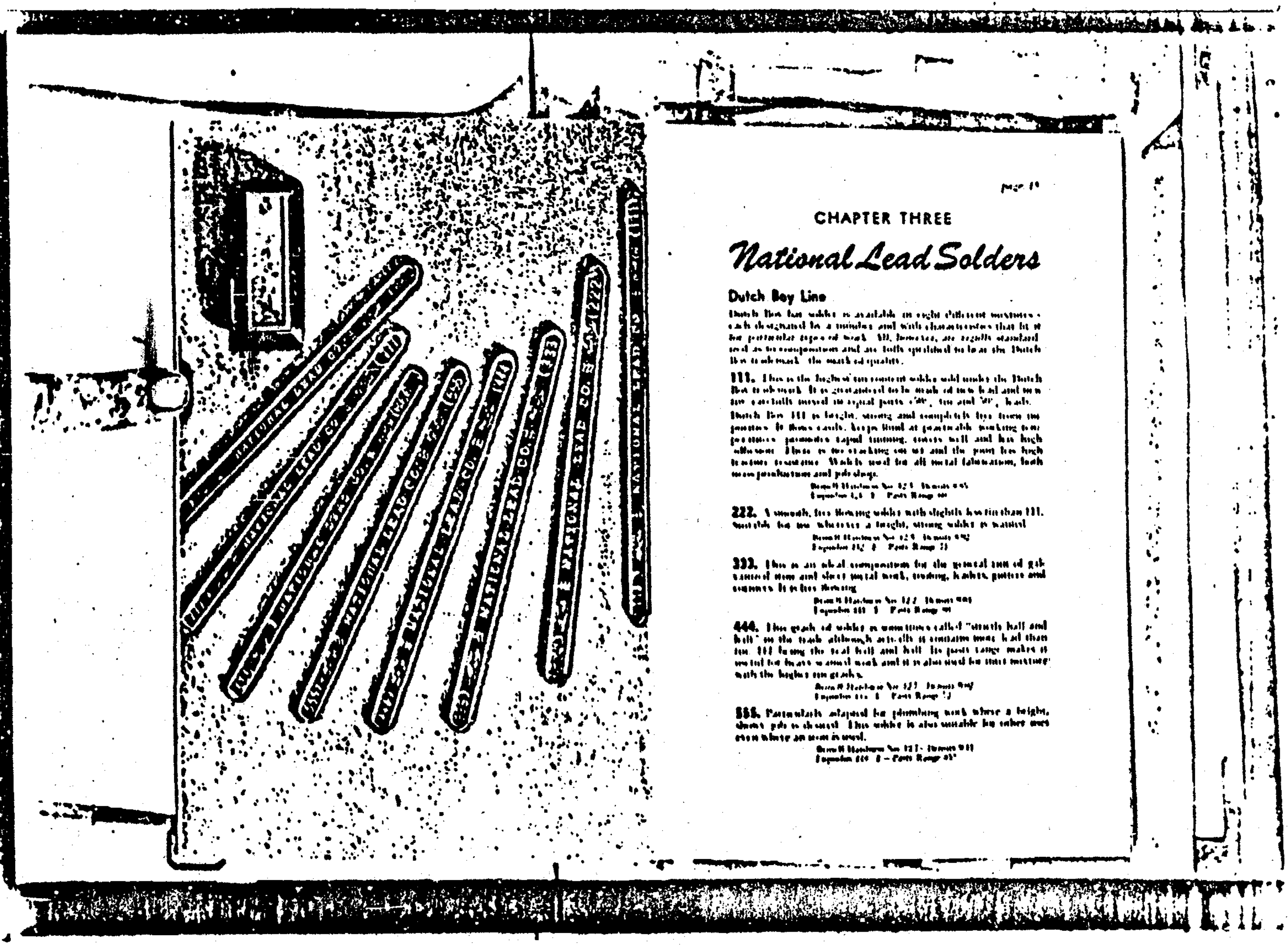


CHAPTER THREE

National Lead Solders

Dutch Boy Line

Dutch Boy bar solder is available in eight different mixtures, each designated by a number and with characteristics that fit it for particular types of work. All, however, are equally standard [illegible] and are fully qualified to bear the Dutch Boy trademark, the mark of quality.

111. This is the highest tin content solder sold under the Dutch Boy trademark. It is guaranteed to be made of new lead and new tin carefully mixed in equal parts (50% tin and 50% lead). Dutch Boy 111 is bright, strong and completely free from impurities. It flows easily, keeps fluid at practically working temperatures, promotes rapid tinning, covers well and has high adhesion. There is no cracking on set and the [illegible] has high tensile resistance. Widely used for all metal fabrication, both mass production and job shop.

[illegible]

222. A smooth, free flowing solder with slightly less tin than 111. Suitable for use wherever a bright, strong solder is wanted.

[illegible]

333. This is an ideal composition for the general run of galvanized iron and sheet metal work, roofing, [illegible], gutters and [illegible]. It is free flowing.

[illegible]

444. This grade of solder is sometimes called "strictly half and half" in the trade although actually it contains more lead than tin, 111 being the real half and half. Its [illegible] range makes it useful for heavy [illegible] work and it is also used for [illegible] with the higher tin grades.

[illegible]

555. Particularly adapted for plumbing work where a bright, [illegible] is desired. This solder is also suitable for other uses even where an [illegible] is used.

[illegible]

Page [illegible]

666. This is a most reliable and economical solder for chemical products, heat exchangers, can manufacturing and commercial shop work. Tins and wets copper, tin and terne plate readily. Forms good penetration and makes ductile joints not subject to "thinning" at [illegible] temperatures, operating under normal temperature ranges. It is also a good class dipping solder.

Brinell Hardness No. [illegible] Density [illegible]
[illegible] Pasty Range [illegible]
[illegible]

777. This solder has an unusually large percentage of tin for a wiping solder. When used for this purpose it can be reduced slightly with more lead.

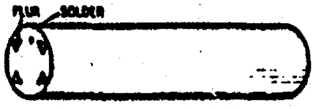
Brinell Hardness No. [illegible] Density [illegible]
[illegible] Pasty Range [illegible]
[illegible]

888. This is a select plumber's wiping solder, always uniform, with wide pasty range and good tinning properties. It wipes a joint that will not sweat, has butter-like consistency with no suggestion of graininess. Also ideal for cable splicing.

Brinell Hardness No. [illegible] Density [illegible]
[illegible] Pasty Range [illegible]
[illegible]

Dutch Boy Fluxrite

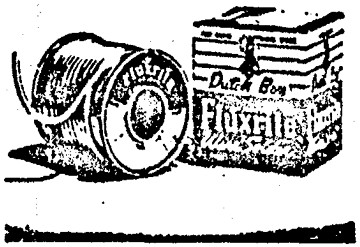
This is an entirely different type of wire solder and flux combination. Instead of the conventional hollow wire with a flux core, Fluxrite has the flux enclosed in four grooves on the outside of the wire (see diagram).



FLUXRITE WIRE SOLDER WITH FLUX ENCLOSED IN OUTSIDE GROOVES

This has the most important advantage of putting the flux on the work first as it should be for the best and most efficient soldering. The wire hits the [illegible] of the flux reach and cleanses the work and then the solder melts to complete the job.

With this unique wire solder it is also possible to assure a total lack of slag spots. You can be certain that every [illegible] length contains flux in the correct amount.



Fluxrite contains a rosin flux and comes in a variety of compositions and diameters to suit your specifications. Also can be furnished in the form of rings or other special shapes to be specified by you. Ideal for all types of electrical, telephone and radio work.

It has been very successfully used in soldering operations in soldering aluminum heating, showing distinct advantages over the conventional cored wire solder. Another field for which it is particularly adapted is in soldering in sweating copper and brass parts where the Fluxrite is preplaced in proper position.

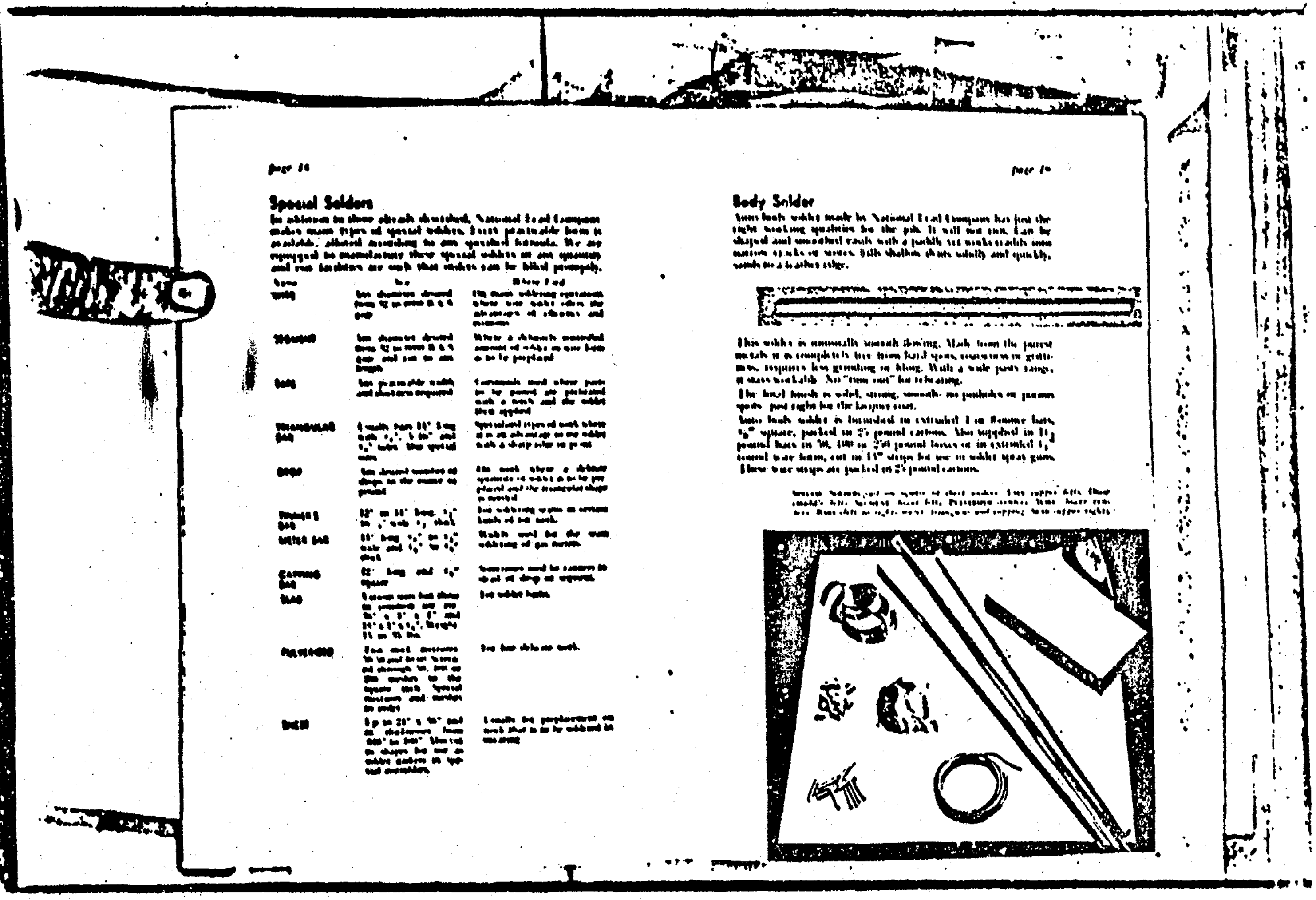
Dutch Boy Flux Core Solder

This is hollow solder wire filled with flux. The acid types are suitable for all general work where wire solder is called for while rosin core solder is especially designed for making trouble-free joints on electrical, telephone and radio work.

Both types are stocked in three diameters 1/8", 3/32", and 1/16" on 1, 5, 10, 25 and 50 pound spools. However, any other diameters from [illegible] to [illegible], as well as special gages, can be furnished on order and supplied without delay.

National Lead Company is also widely experienced in the manufacture of wire solder with a great number of special fluxes of many different degrees of strength. These include not only [illegible] grade rosin and the standard zinc chloride acid flux but special rosin combinations for use under low temperature requirements, or on parts excessively oxidized. Also noncorrosive, quick acting fluxes harmless to plated metal as well as liquid acid and solid acid and [illegible] compounds for use on lead.

We are well equipped, therefore, to supply any special requirements in a wire core solder, both in size and type of wire and in the most suitable flux for the purpose.



Special Solders

Body Solder

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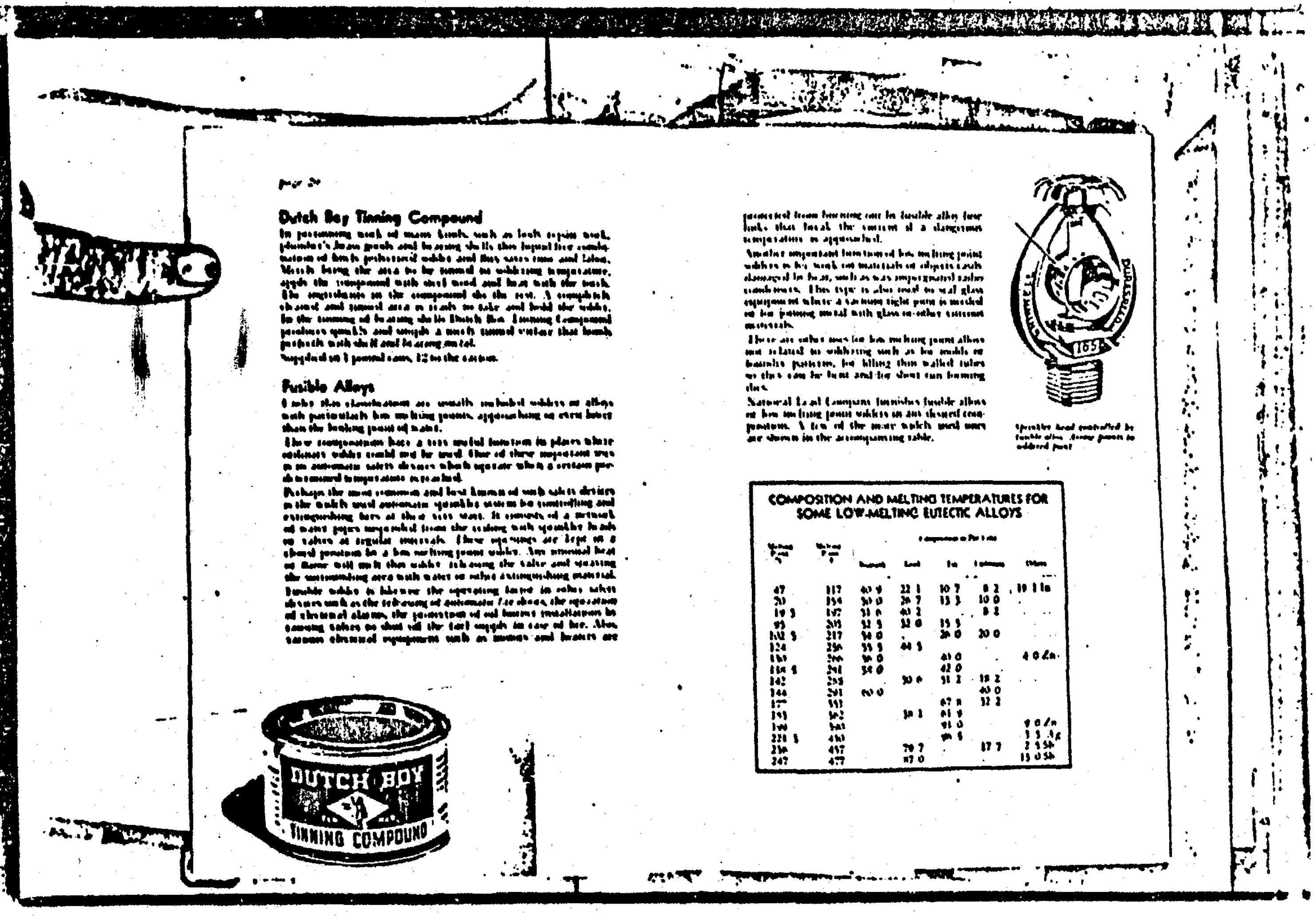
DUTCH BOY
TINNING COMPOUND
DURASPEED
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Dutch Boy Tinning Compound

In performing work of many kinds, such as body repair work, plumber's brass goods and bearing shells this liquid-free combination of finely powdered solder and flux saves time and labor. Merely bring the area to be tinned to soldering temperature, apply the compound with steel wool and heat with the torch. The ingredients in the compound do the rest. A completely cleaned and tinned area is ready to take and hold the solder. In the tinning of bearing shells Dutch Boy Tinning Compound produces quickly and simply a nicely tinned surface that bonds perfectly with shell and bearing metal.

Supplied in 1 pound cans, 12 to the carton.

Fusible Alloys

Under this classification are usually included solders or alloys with particularly low melting points, approaching or even lower than the boiling point of water.

These compositions have a very useful function in places where ordinary solder could not be used. One of these important uses is in automatic safety devices which operate when a certain predetermined temperature is reached.

Perhaps the most common and best known of such safety devices is the widely used automatic sprinkler system for controlling and extinguishing fires at their very start. It consists of a network of water pipes suspended from the ceiling with sprinkler heads or valves at regular intervals. These openings are kept in a closed position by a low melting point solder. Any unusual heat or flame will melt this solder releasing the valve and spraying the surrounding area with water or other extinguishing material.

Fusible solder is likewise the operating factor in other safety devices such as the releasing of automatic fire doors, the operation of electrical alarms, the protection of oil burner installations by causing valves to shut off the fuel supply in case of fire. Also various electrical equipment such as motors and heaters are protected from burning out by fusible alloy fuse links that break the current if a dangerous temperature is approached.

Another important function of low melting point solders is for work on materials or objects easily damaged by heat, such as wax impregnated radio condensers. This type is also used to seal glass equipment where a vacuum tight joint is needed or for joining metal with glass or other vitreous materials.

There are other uses for low melting point alloys not related to soldering such as for molds or foundry patterns, for filling thin walled tubes so they can be bent and for short run forming dies.

National Lead Company furnishes fusible alloys or low melting point solders in any desired composition. A few of the more widely used ones are shown in the accompanying table.

Sprinkler head controlled by fusible alloy. Arrow points to soldered joint.

COMPOSITION AND MELTING TEMPERATURES FOR SOME LOW-MELTING EUTECTIC ALLOYS

Melting Point °C	Melting Point °F	Composition in Per Cent				
		Bismuth	Lead	Tin	Cadmium	Others
47	117	44.7	22.6	8.3	5.3	19.1 In
70	158	50.0	26.7	13.3	10.0	
91.5	197	51.6	40.2		8.2	
95	203	52.5	32.0	15.5		
102.5	217	54.0		26.0	20.0	
124	255	55.5	44.5			
130	266	56.0		40.0		4.0 Zn
138.5	281	58.0		42.0		
142	288		30.6	51.2	18.2	
144	291	60.0			40.0	
177	351			67.8	32.2	
183	362		38.1	61.9		
199	390			91.0		9.0 Zn
221.5	430			96.5		3.5 Ag
236	457		79.7		17.7	2.6 Sb
247	477		87.0			13.0 Sb

Stainless Steel Solder

This solder has exceptional tinning and wetting characteristics and low fusion temperature to avoid buckling of sheet metal. Makes strongest possible joint. Supplied in wire form or in [illegible] and 1½ pound bars.

Pecos Solder

This low tin solder is a specially formulated alloy that has met with wide acceptance because it has working qualities comparable with solders of a much higher tin content.

Pecos is fast tinning and fast setting. While it has a higher liquidus point than a solder rich in tin, it applies more readily than the usual low tin solder. This minimizes oxidation and heating of soldering irons.

Pecos solder is furnished in both bar and wire form.

Silver Content Solders

National Lead Company has developed several solders of a tin-lead-silver combination. The addition of silver in carefully regulated proportions gives these solders certain qualities that make them ideal for many specialized uses. They have met with enthusiastic reception in important solder uses.

These special solders are not to be confused with the wartime solders where silver was used to replace tin and which were sometimes difficult to handle and uncertain in their action. All of the National Lead solders have been well tested in practice and will be found thoroughly reliable and easy to use.

Information about silver content solder that will meet your particular requirements will be gladly furnished upon request.

Soldering by the induction heating method. The assembled parts with solder preformed go on conveyor belt at right, then pass between induction heating [illegible] [illegible]

[illegible]

CHAPTER FOUR

Fluxes

Purposes of Flux

While flux is purely an adjunct to soldering and forms no part of the completed joint, it is fully as important as the solder itself. Without the proper flux and its careful use, an unsatisfactory solder joint is sure to result.

The functions of a flux are three in number. First, it removes oxide or other surface film from the work after, of course, the parts have been made physically clean. Second, it promotes heat transfer and forms a protective layer over the joint during the soldering operation to exclude air and prevent oxidation before the solder freezes. Third, it reduces the interfacial tension between the solder and the metal being soldered so the solder can rapidly "wet" the surface. In addition to doing these essential things, a flux should be easy to apply and economical to use. It should have no corrosive residue to attack the joint and give off no fumes which are injurious to the operator.

General Types

There is no such thing as an all-purpose flux or one that will work properly under all conditions and on every type of work. The flux should be chosen for the work in hand and there are many kinds from which to choose.

In general all fluxes can be grouped under one of three classes: corrosive, neutral or noncorrosive.

Corrosive Fluxes. Fluxes in this grouping are known also as acid or salt type fluxes. These include the chlorides of zinc, ammonium, calcium, magnesium, aluminum and other metals. Chloride fluxes, of which zinc chloride is the most common, are very fast working and highly effective in removing oxide. Oxidized metals of almost any type may be readily soldered when a chloride flux is employed.

The principal disadvantage of this type of flux lies in the residue, which attracts atmospheric moisture. Unless removed by careful washing, this will result in corrosion of the base metal. This residue is also electrically conductive which rules out the use of chloride fluxes in almost all electrical work.

Neutral Fluxes. Fluxes of this class, which are chemically neutral, are of the mild type. Their use is confined chiefly to easily soldered metals such as clean brass, copper, lead and tin plate. Rosin and is typical of the neutral fluxes. A familiar form is the "plumber's candle" for wiping joints on lead pipe and cable sheathing.

The residue from neutral fluxes is generally not objectionable and therefore it is seldom necessary to remove it after soldering.

Non-corrosive Fluxes. This group is typified by rosin, by far the most widely used. There are other agents available and in use but by far none has approached the popularity of rosin.

The prime advantage of this flux is the character of the residue, which being noncorrosive and nonconductive, makes the flux ideal for many types of work where cleaning is impracticable. Most electrical work requires noncorrosive flux.

Fluxes in the rosin group are relatively weak in their fluxing action, however, and for this reason their use is limited to easily soldered base metals, such as are found in tin plate containers and most radio and electrical parts. Pretinning is a distinct aid.

Nalco Fluxes

National Lead Company, as a result of long experience and familiarity with the practical applications of solder, has developed a number of fluxes which are being marketed under the Nalco name. These cover a wide range of uses so that within the following group the average solder user will find a flux to efficiently meet his requirements, whatever they may be.

FLUX No. 1

Soldering Fluid. This is an acid free but corrosive type flux for use on copper, brass, steel, tin and terne plate. It is a general purpose flux for plumbing, refrigerating, air conditioning, metal caskets, auto bodies and work where residue can be removed.

FLUX No. 2

Tinner's Flux. Compounded especially for galvanized iron work, this is an extremely active liquid flux that will remove the zinc coating beneath the solder and thus prevent brittle joints.

FLUX No. 3

Stainless Steel Flux. This is a liquid flux for use on stainless steel which results in neat, sound joints with a minimum of harmful fumes. It is extremely active.

FLUX No. 4

Dipping and Coating Flux. As the name suggests, this strong, acid free fluid flux is especially designed for the hot dip coating of parts in solder. The water content is low to minimize spattering.

FLUX No. 5

Sweat Tube Fitting Flux. This liquid flux was developed for soldering sweat copper tube to pipe fittings (sometimes called stream lines) where it is essential for the solder to penetrate into the joints by capillary attraction. The flux promotes rapid flow of the solder, including even low tin and silver lead solders, and greatly aids the joining operation.

It is also useful for other types of work on copper, brass or steel where rapid action and high penetration are necessary.

FLUX No. 6

Liquid Rosin Flux. A completely noncorrosive rosin flux in a volatile solvent, it provides a reliable, fast acting flux for all general work where the liquid form is more convenient and efficient.

FLUX No. 7

E3A Flux. This flux is a solid rosin base material which leaves a hard, dry residue that is guaranteed noncorrosive. It meets the Navy Bureau of Ships specifications for a noncorrosive flux.

Soldering a terminal unit in an amplifier for voice frequency carrier telegraphs

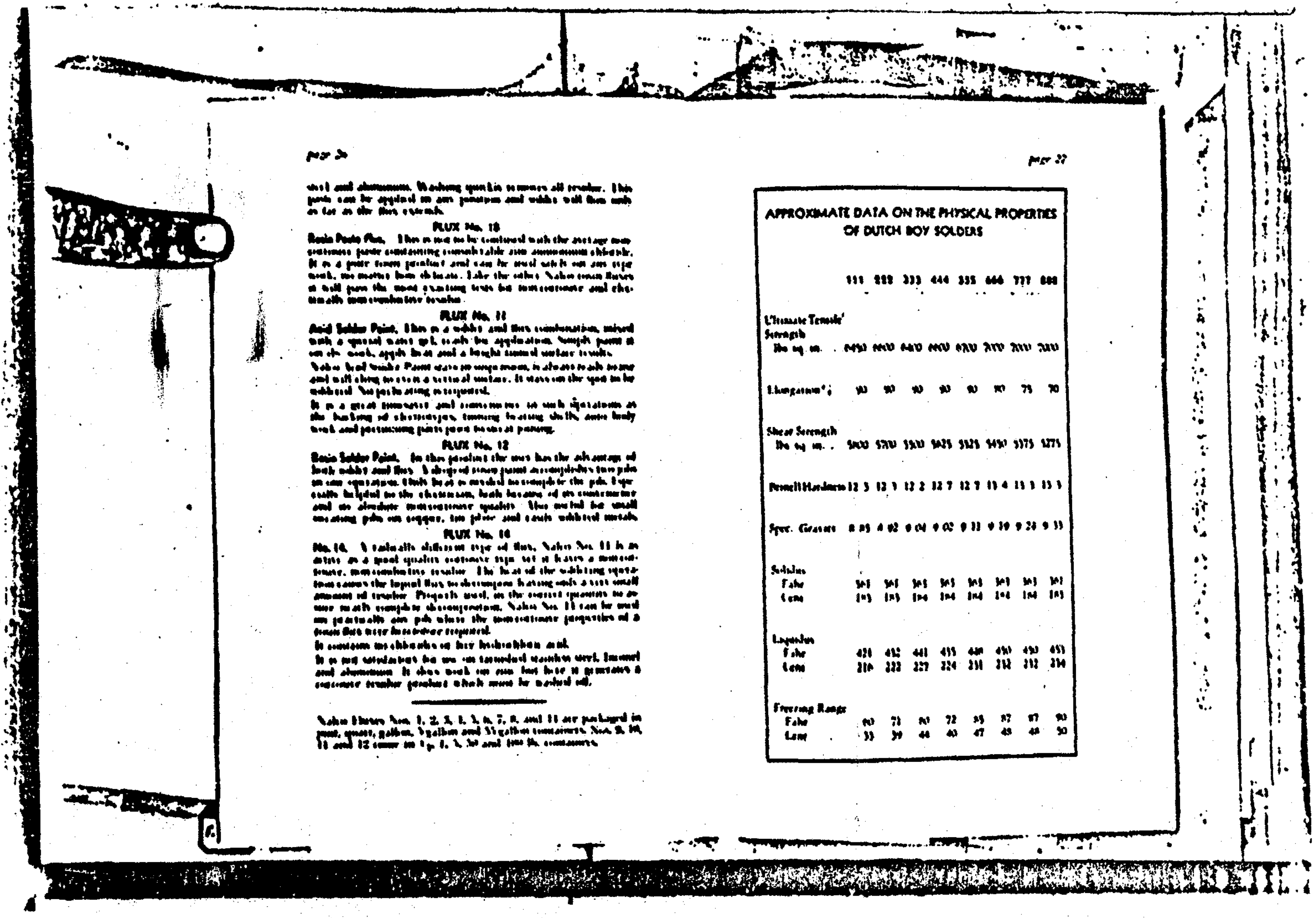
Courtesy
Bell Telephone
Laboratories.

FLUX No. 8

OPS-1A Flux. This solid flux, of the neutral type, is especially adapted for soldering on brass although it works equally well on copper, tin and terne plate. Should be used with adequate ventilation because of its somewhat unpleasant odor, due to its special composition.

FLUX No. 9

Acid Type Paste Flux. This is an unique and powerful product which leaves a completely water soluble residue. It can be used on most clean metals except stainless



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[illegible] Washing [illegible] removes all residue. This paste can be applied in any position and solder will flow only as far as the flux extends.

FLUX No. 10

Rosin Paste Flux. [illegible]

FLUX No. 11

Acid Solder Paint. [illegible]

[illegible]

[illegible]

FLUX No. 12

Rosin Solder Paint. [illegible]

FLUX No. 16

No. 16. [illegible]

[illegible]

[illegible]

[illegible]

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APPROXIMATE DATA ON THE PHYSICAL PROPERTIES OF DUTCH BOY SOLDERS

	111	222	333	444	555	666	777	888
Ultimate Tensile Strength lbs sq. in.	6450	6600	6600	6600	6700	7000	7000	7000
Elongation %	90	90	90	90	90	90	75	70
Shear Strength lbs sq. in.	5600	5700	5500	5625	5525	5450	5375	5275
Brinell Hardness	12.5	12.3	12.2	12.7	12.9	13.4	13.3	13.3
Spec. Gravity	8.85	8.92	9.04	9.02	9.11	9.19	9.24	9.33
Solidus								
Fahr	361	361	361	361	361	361	361	361
Cent	183	183	184	184	184	184	184	183
Liquidus								
Fahr	421	432	441	433	446	448	448	455
Cent	216	222	227	224	231	232	232	234
Freezing Range								
Fahr	60	71	80	72	85	87	87	93
Cent	33	39	44	40	47	48	48	50

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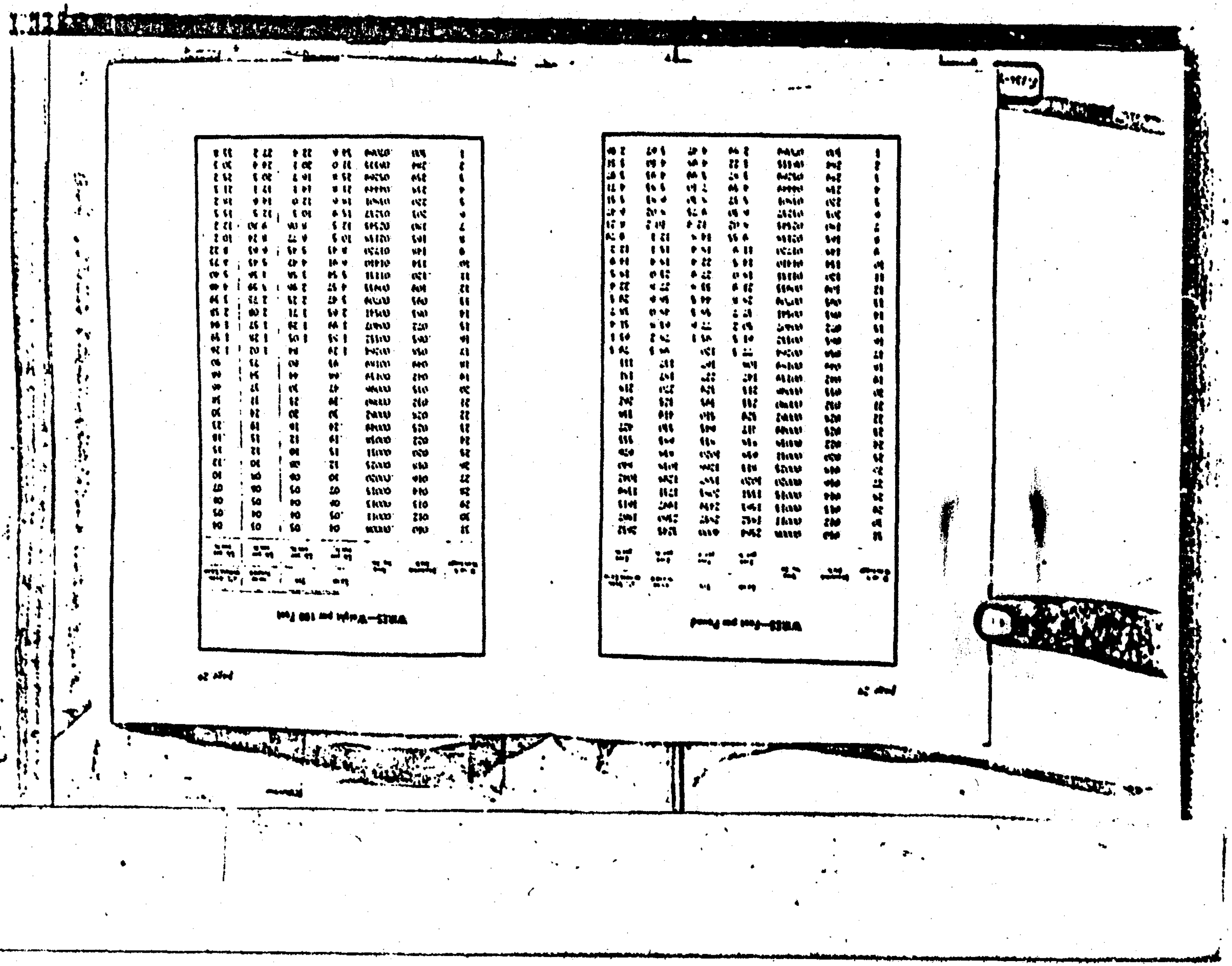

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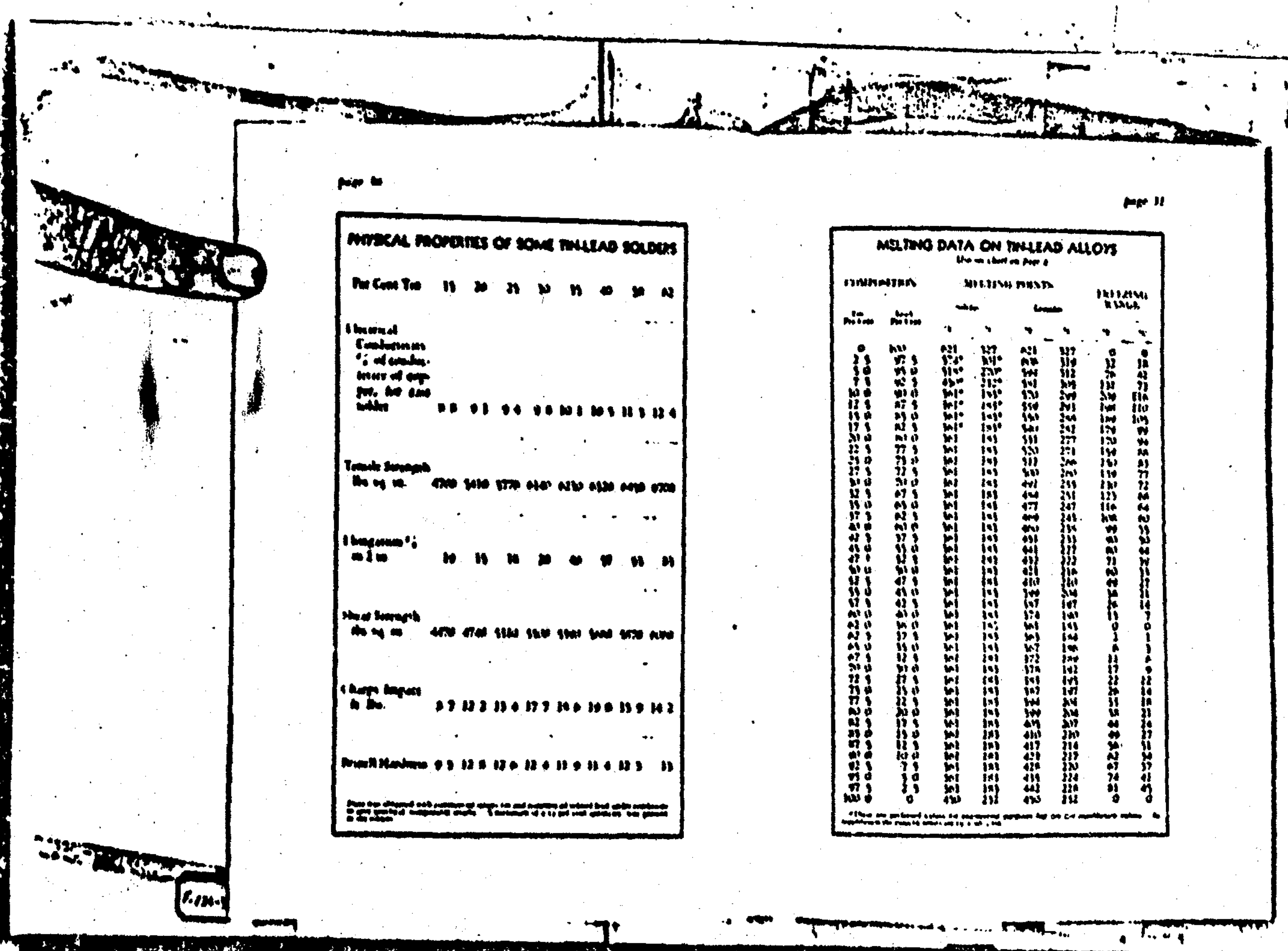

page 10

PHYSICAL PROPERTIES OF SOME TIN-LEAD SOLDERS

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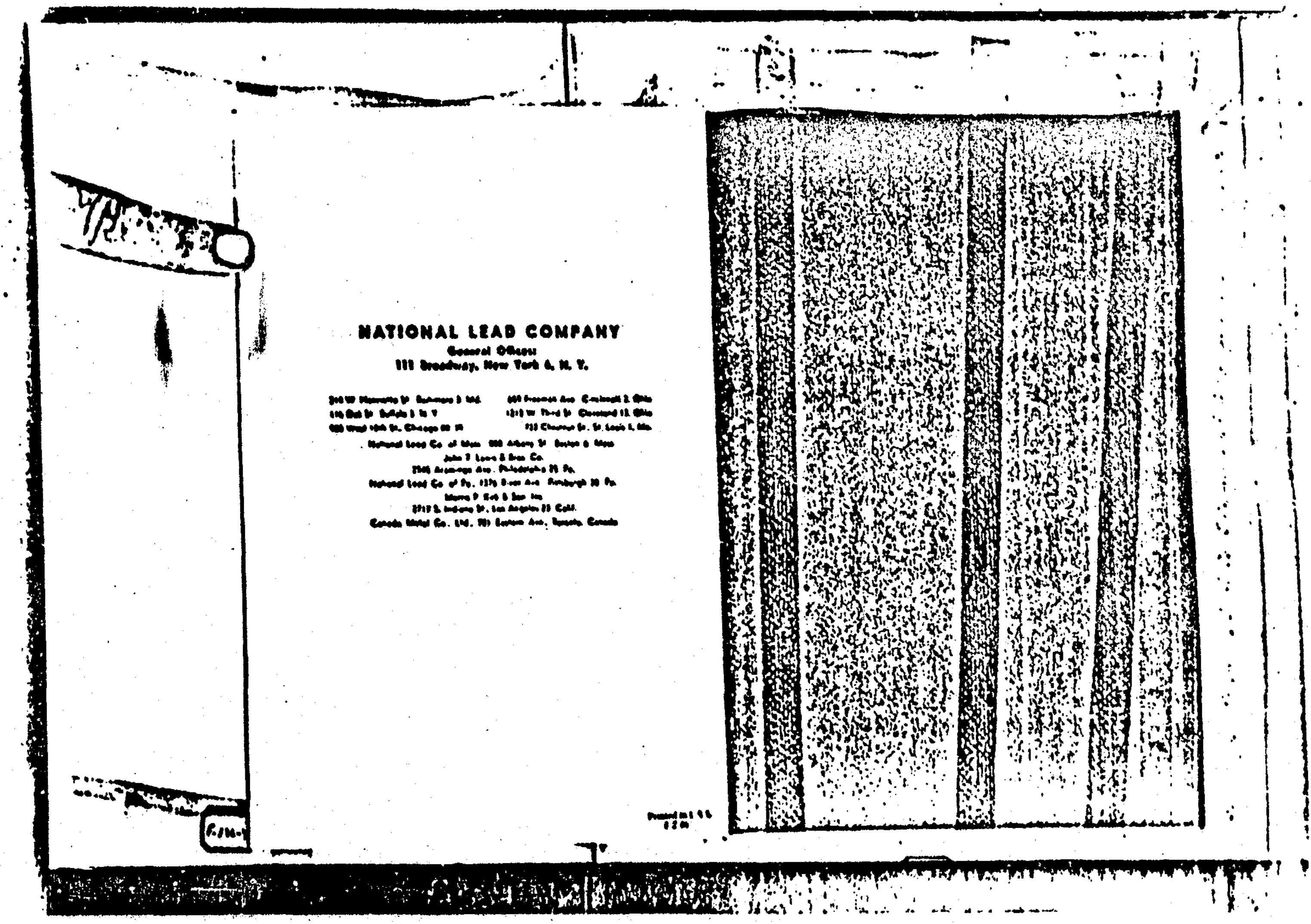
MELTING DATA ON TIN-LEAD ALLOYS



NATIONAL LEAD COMPANY

General Offices

111 Broadway, New York 6, N. Y.

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