

NEW SCREWDRIVERS, PRODUCTION AND IDENTIFICATION

Although no literature can be found which relates that marks made by new, unworn tools are identical, investigative personnel sometimes express this belief as a basis for disregarding crime scene marks made by new tools. The comment is expressed primarily in the area of prying instruments. Screwdrivers appear to be frequently misused as prying instruments of this type.

In 1969 the results of a German study of new screwdrivers was published indicating each new screwdriver produced striations different from its companions.(1) In 1968 an American study of cheap, mass produced screwdrivers was published which agreed with the German study, but showed each of the tools possessed some identical characteristics which could be transferred to crime scene marks used to mistakenly identify a specific tool.(2)

In 1974 a project was undertaken to determine if better quality screwdrivers from the same production lot possessed identical characteristics that could also be used to mistakenly identify a specific tool. Seventeen major tool manufacturers in the United States were contacted and asked to provide two screwdrivers from the same lot and of a type most likely to be used for prying purposes at a crime scene. The method of manufacture was also requested. Seven responded with screwdrivers and six with information about production processes. The production information is presented in the appendix.

Photographs of the marking surfaces of these tools were prepared and are presented here for your information and use in demonstrating characteristics of new screwdriver blades. Six conclusions are drawn from examining the blades and should be somewhat apparent from the pictures, and other data supplied by the contributors in the appendix. First, although two blades from a given company are generally alike, a crime scene mark bearing striations or a detailed impression could be matched to the specific tool.

Second, both gross and fine characteristics vary from one company's blades to another.

Third, the variation from one blade to another may provide a means of identifying a brand -- model of screwdriver from a crime scene mark.

Fourth, the variation in manufacturing processes from one company to another may also be used to identify a brand and model of screwdriver from a fragment left at a crime scene, before the tool is located.

Fifth, the amount of work required to establish a reference file of just screwdrivers, or a file of data about them rather than samples of each tool, may be enormous, but does not appear to have been researched to date. Nor has much been reported about the relative frequency with which such tools as screwdrivers of different models and values are involved with crimes.

Sixth, if the concept of identifying screwdrivers from their crime scene signatures is valid, it may also apply to other tools commonly associated with crime scenes, such as bolt cutters.

Should anyone desire to study the illustrated screwdrivers, they can be obtained by contacting me at Hqs, USACIDC; 2nd and R St, SW; Washington, DC 20318. Their tips have been kept protected during and since the photographs were made. In addition, I have 100 smaller, mass produced screwdrivers in some six sizes and styles, from the same company, which are new, should you desire to study them.

Acknowledgements: Special appreciation to the Photo Division, Armed Forces Institute of Pathology, Washington, DC, for several hundred man hours expended over about eight months to produce the illustrations used in this presentation. Of course the photo work wouldn't have been possible without the cooperation of the seven companies that provided the screwdriver blades. They were Stanley Tools, Rosco Tools Inc, Mephisto Tool Co, Inc; Great Neck Saw Mfrs, Inc; Upson Tools, Inc; Vaco Products Co, and XceLite. Upson provided an additional set of two blades that were equal in length to the other blades, but too slender to be used as a prying device. Stanley Tools must also be commended for the useful background information. (Of passing note is the use of a Stanley wood chisel in the Lindbergh kidnapping.) Lastly, the German information would not have been available except for the translation services of the National Criminal Reference Service. The opinions expressed in this article are those of the author and do not necessarily reflect the opinions of the Department of the Army or the Department of Defense.

James V Vandiver, Army CID

REFERENCES

1. Winkler, "Die Industrielle Massenproduktion von Schraubendrehern und die Moglichkeiten ihrer Identifizierung als Spurenleger", Kriminalistik, 22, #6, pp 303-305, 1969.
2. Burd and Gilmore, "Individual and Class Characteristics of Tools", Journal of Forensic Sciences, 13, #3, pp 390-396, 1968

APPENDIX: Screwdriver Production Processes Provided by Participating Manufactuerers

1. Stanley Tools:

"Introduction

It is a logical assumption that each screwdriver, old or new, has its own signature or personality. This signature may change with use. No two screwdriver manufacturers produce screwdriver bars in exactly the same way. The tooling and processes used do impart distinguishing characteristics which can lead back to the point of manufacture.

Purpose of the Tool

The purpose of the screwdriver is to drive and/or remove the appropriate size wood, machine, sheet metal and self tapping screw made in all head styles; flat, round, fillister, etc. There is considerable overlap in screwdriver sizes relating to the size of screw on which they can properly operate.

Abuses

Common screwdriver abuses include:

1. Using as a pry bar, lever or aligning bar.
2. Using as a struck tool, such as a chisel, a gouge, an ice pick or a punch.
3. Used as a striking tool, such as a hammer.

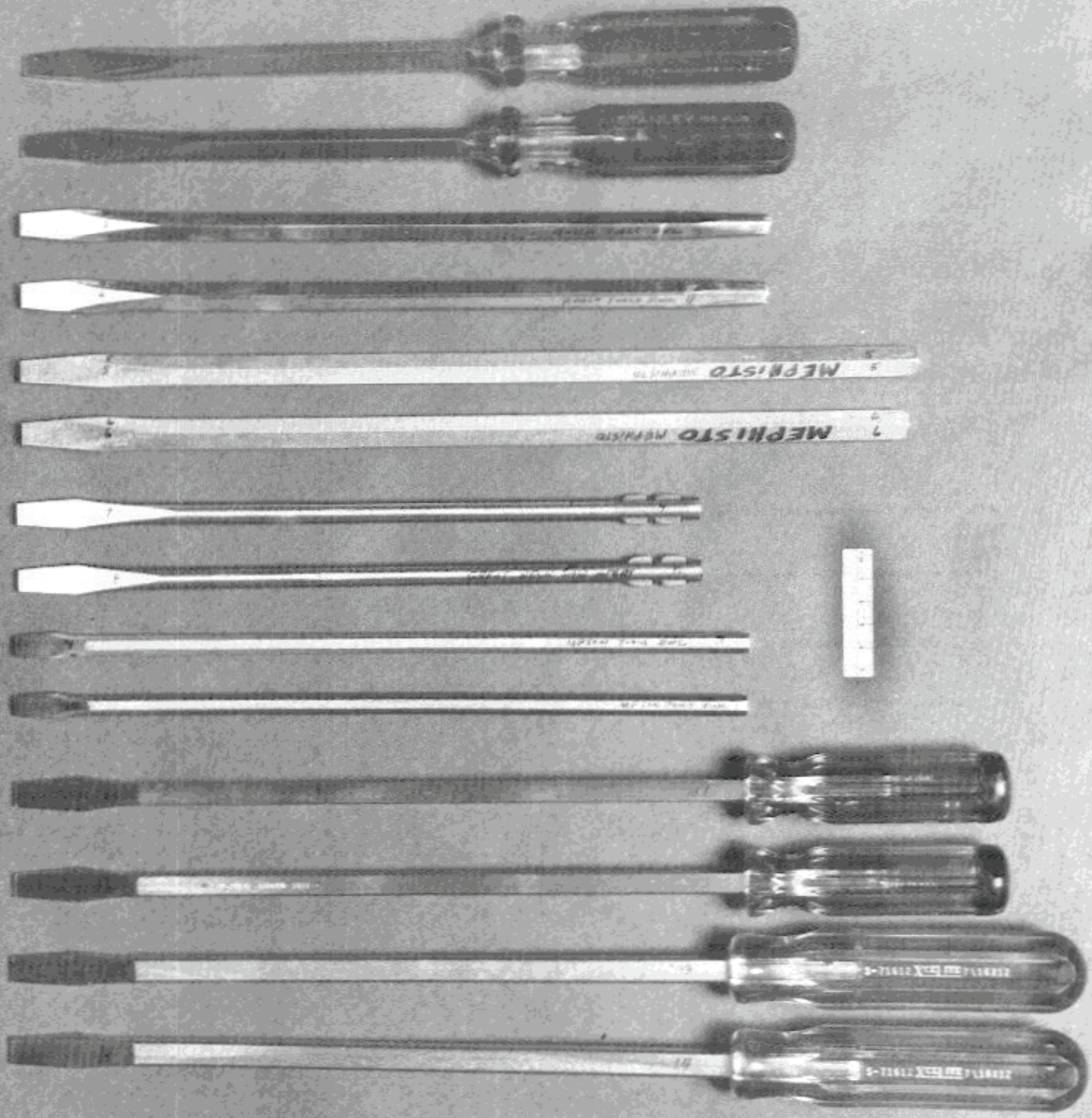
Design

The basic components of screwdrivers are:

1. Bar-made of steel
2. Handle-usually made of plastic.

Wood is sometimes used for the handle and a steel ferrule is added to reduce the tendency of the wood handle to

FIG 1



split. Ferrules are held on in a variety of ways including knurling, riveting, etc.

Both the handle and the bar are formed in a myriad of shapes and sizes. The steel bars are made using a variety of steel formulas, all of which can be hardened after forming. Several steel companies produce bars, rods, and wire that can be formed into suitable screwdriver bars. It is interesting to note that within a given steel specification such as 10B53, each steel company will produce a discernable difference in the end product while maintaining the basic industry standard for that particular formula. Metallurgical examination can in most cases, trace a given piece of steel back to its point of origin.

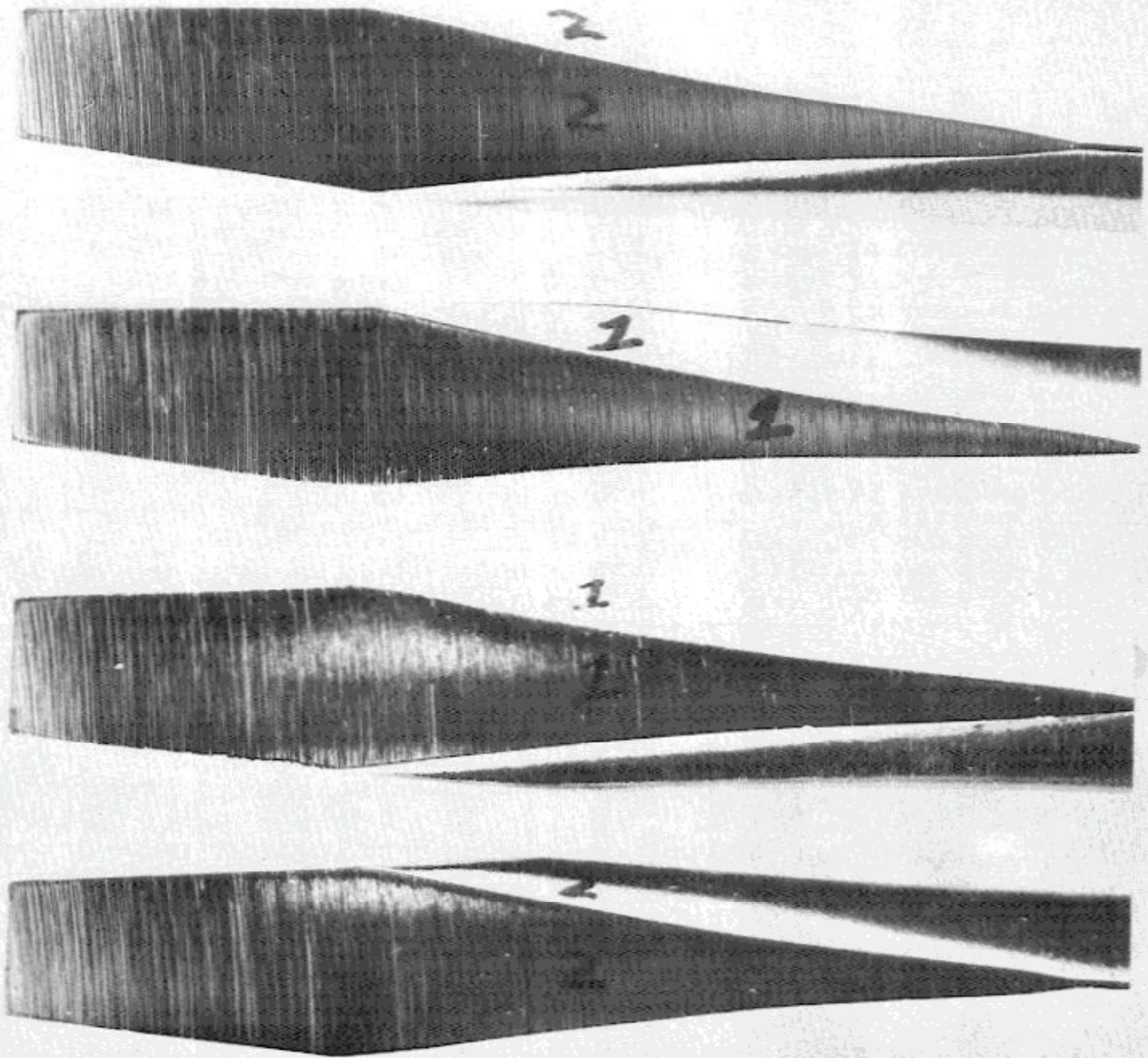
The demand for screwdriver bars is so great that a few companies such as Roxton, Rosenberg, and Cornwall-Patterson produce bars for all of the industry. Major screwdriver manufacturers also are tooled to make their own bars relying on the forementioned outside sources for special small volume shapes and for leveling in periods of peak demand. Screwdriver bar sizes and shapes are pretty well governed by industry and international standards.

Plastic handles present a most distinguishing physical attribute. Each manufacturer has its own conception of the best size, shape, and color combination. Few industry standards exist for the handle. Handle material (plastic) is largely dependent on price and physical requirements. The low cost screwdriver usually uses polypropylene or vinyl and appears in the discount trade. Cellulose acetate and cellulose acetate butyrate (CAB) appear in high grade products. Aside from wood, no other material is known to be used to any extent in screwdriver handle manufacture.

Manufacturing Operations

Screwdriver bars are produced in a large variety of ways using a range mechanization from hand to fully automatic. Basic metal working processes include shearing, forging, grinding, polishing, welding, and upsetting. Finishing processes include heat treating, annealing, burnishing, polishing, plating, lacquering, and straightening. The Marketing Department in most companies plays the principal role in determining how the end product shall look. Manufacturing costs play an important role in how close a given product is to come to the specification established by Marketing and Engineering.

FIG 2



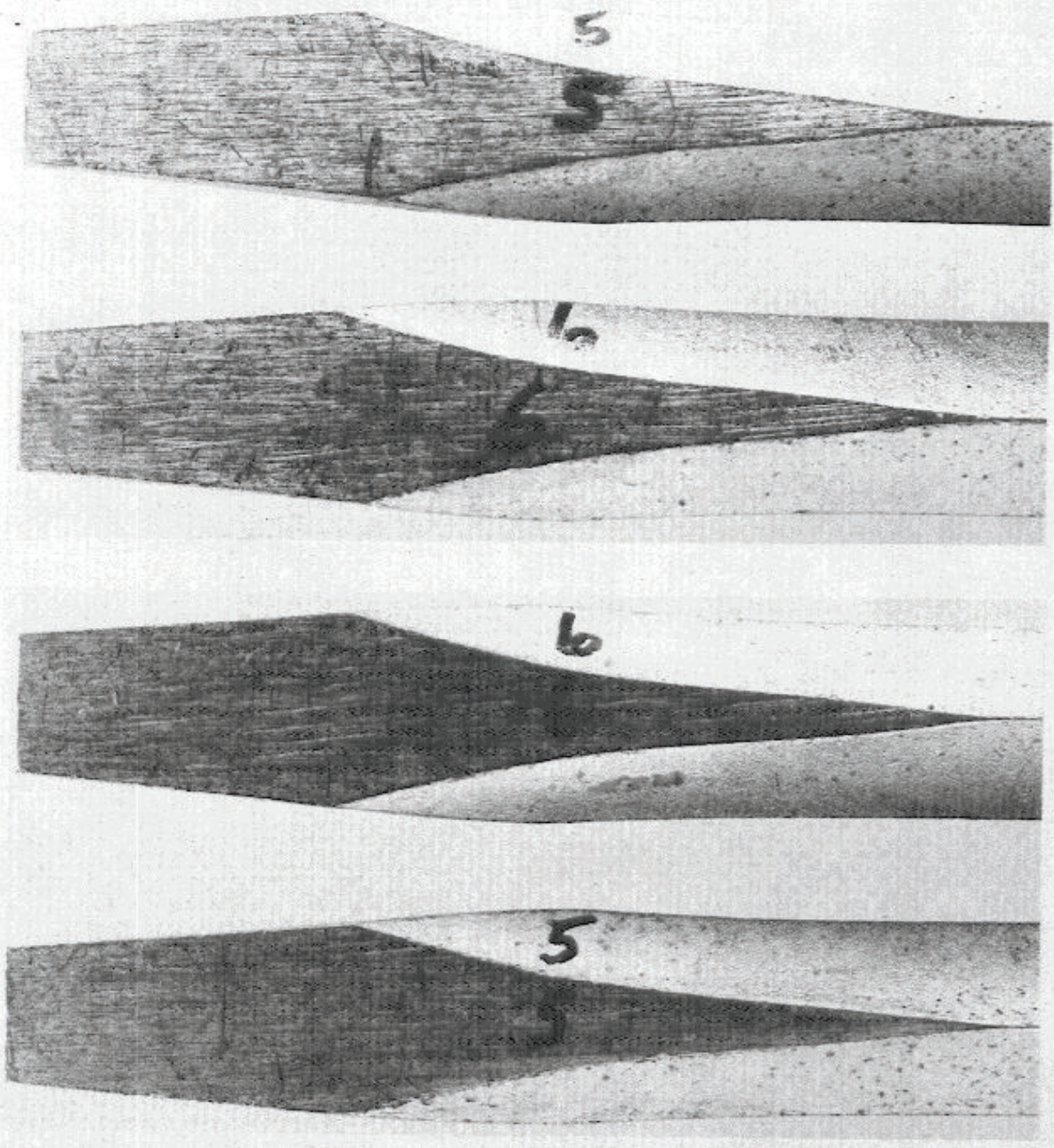
1 CM 1 2

FIG 3



1 CM 1 2

FIG 4



1 CM 1 2

Stanley Manufacturing Processes

Bar

1. Cut (shear) off to length.
2. Forge to flatten the tip.
3. Trim to form the shape of the tip.
4. Wing to form the ears which retain the bar in the handle.
5. Shot blast the surface to normalize or standardize the surface in appearance.
6. Heat treat to harden and temper the bar.
7. Grind to size using a variety of grinding wheels or grinding belts. In some cases all surfaces of the tip are ground and in other cases only the flats are ground.
8. Polish to give a luster.
9. Plate or lacquer to provide corrosion protection.

Handle Manufacturing

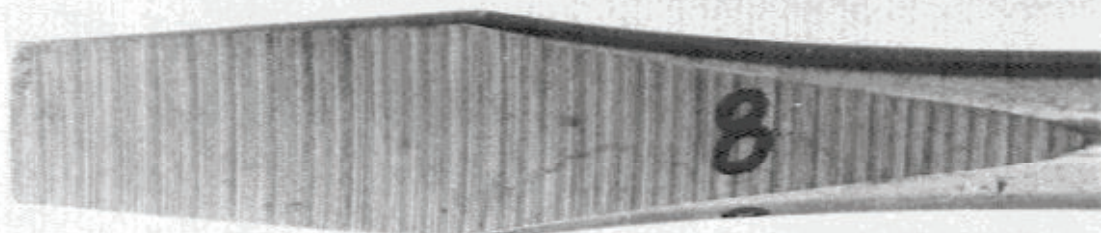
1. Extrude rod from cellulose acetate or CAB.
2. Grind rod to size.
3. Turn rod to shape.
4. Wash.
5. Vapor polish.
6. Mark or brand.

In the case of the low end of the Stanley line which utilizes polypropylene the screwdriver bar is placed in a mold and a handle is molded over the bar.

The above synopsis of operations serves to outline the manufacturing processes associated with screwdriver manufacturing as done by the Stanley Works. Several of the operations impart unique characteristics to the surface involved and it is reasonable to assume that no two screwdrivers are made exactly alike since the grinding wheels wear down fairly rapidly and several operators are involved in performing the same operations, each with his own little techniques or idiosyncrasies of operation.

No two screwdriver manufacturers produce their product in exactly the same way and certainly they don't use the same tooling, so the forging, shearing, grinding, heat treating, polishing, and plating operations do turn out to be unique to a given manufacturer and probably can be cataloged to distinguish the subtle differences. The only hazard encountered in this approach is the previously mentioned fact that bar manufacturers of a specialty nature

FIG 5



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FIG 6

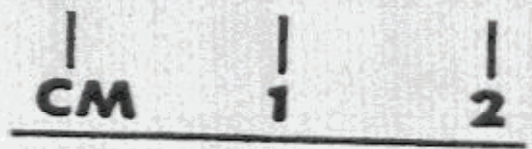
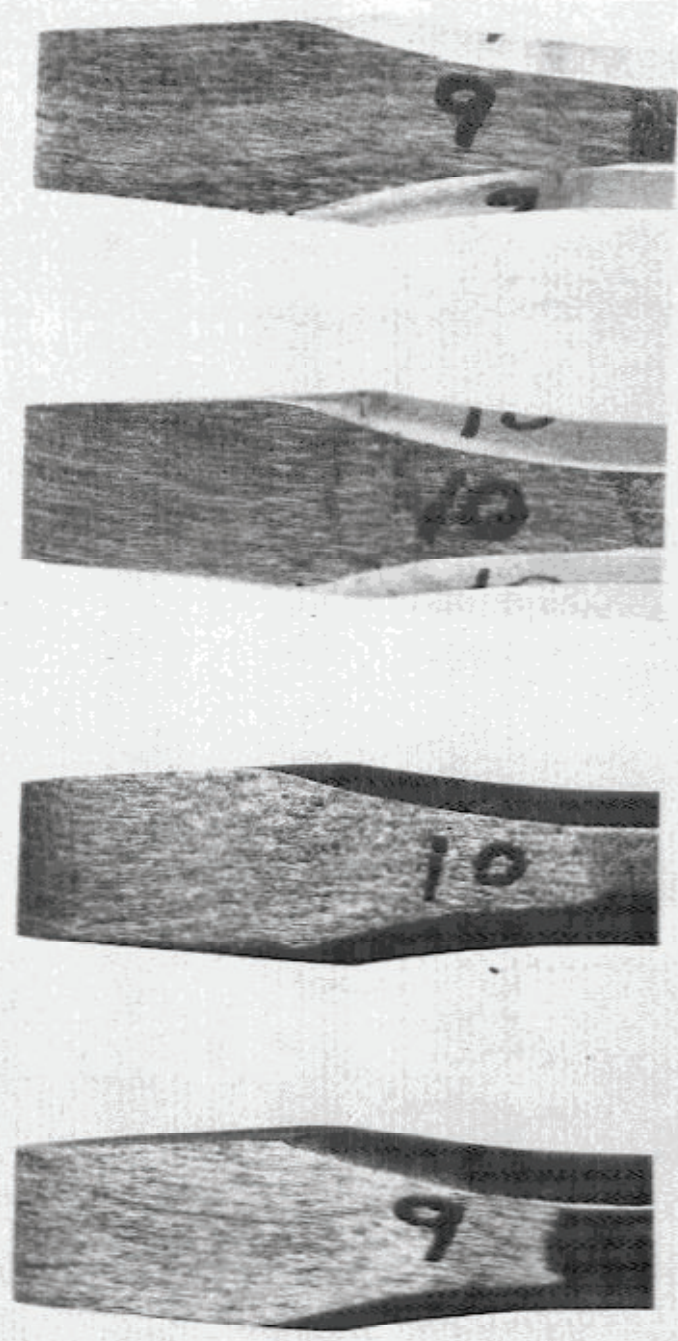
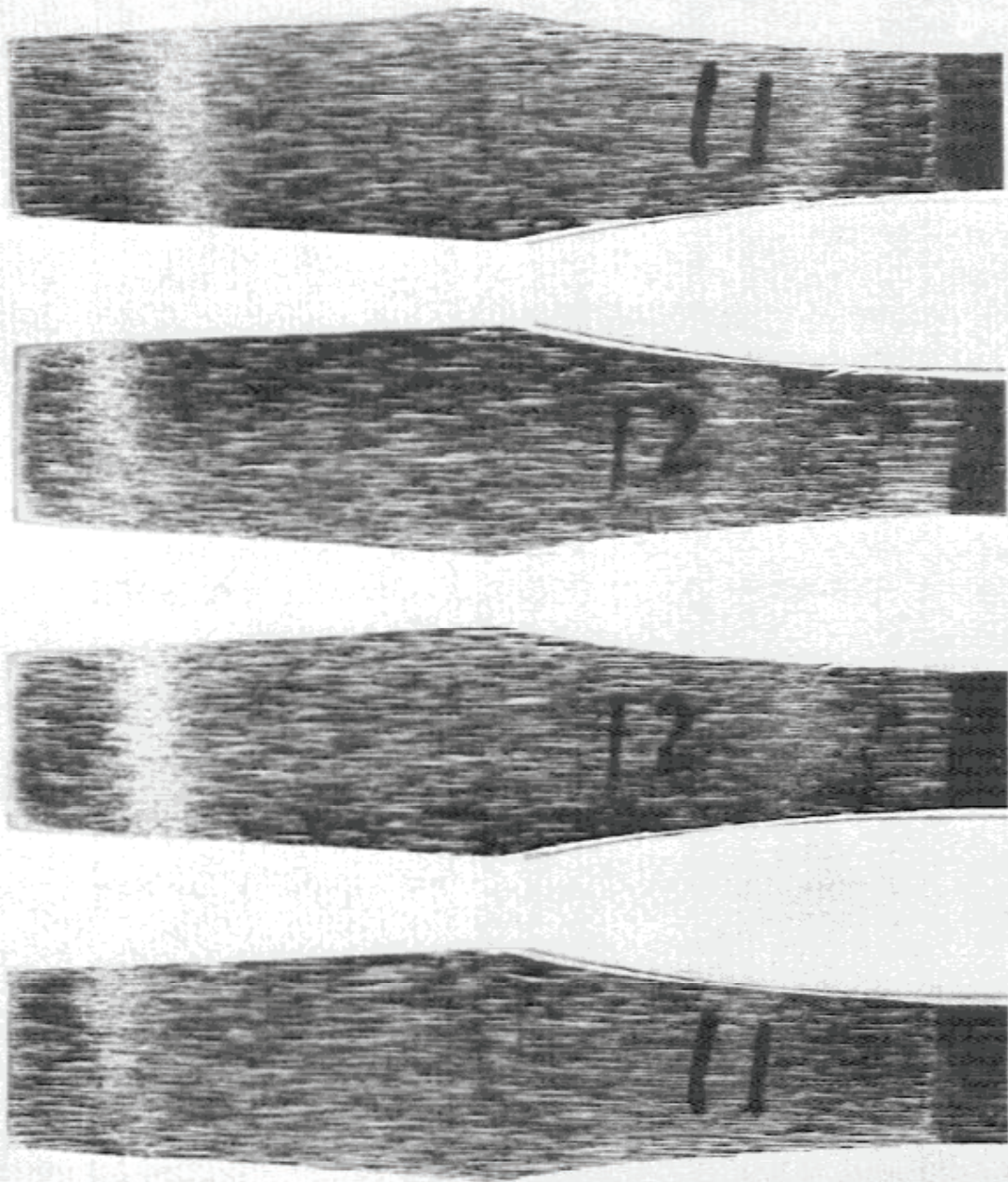
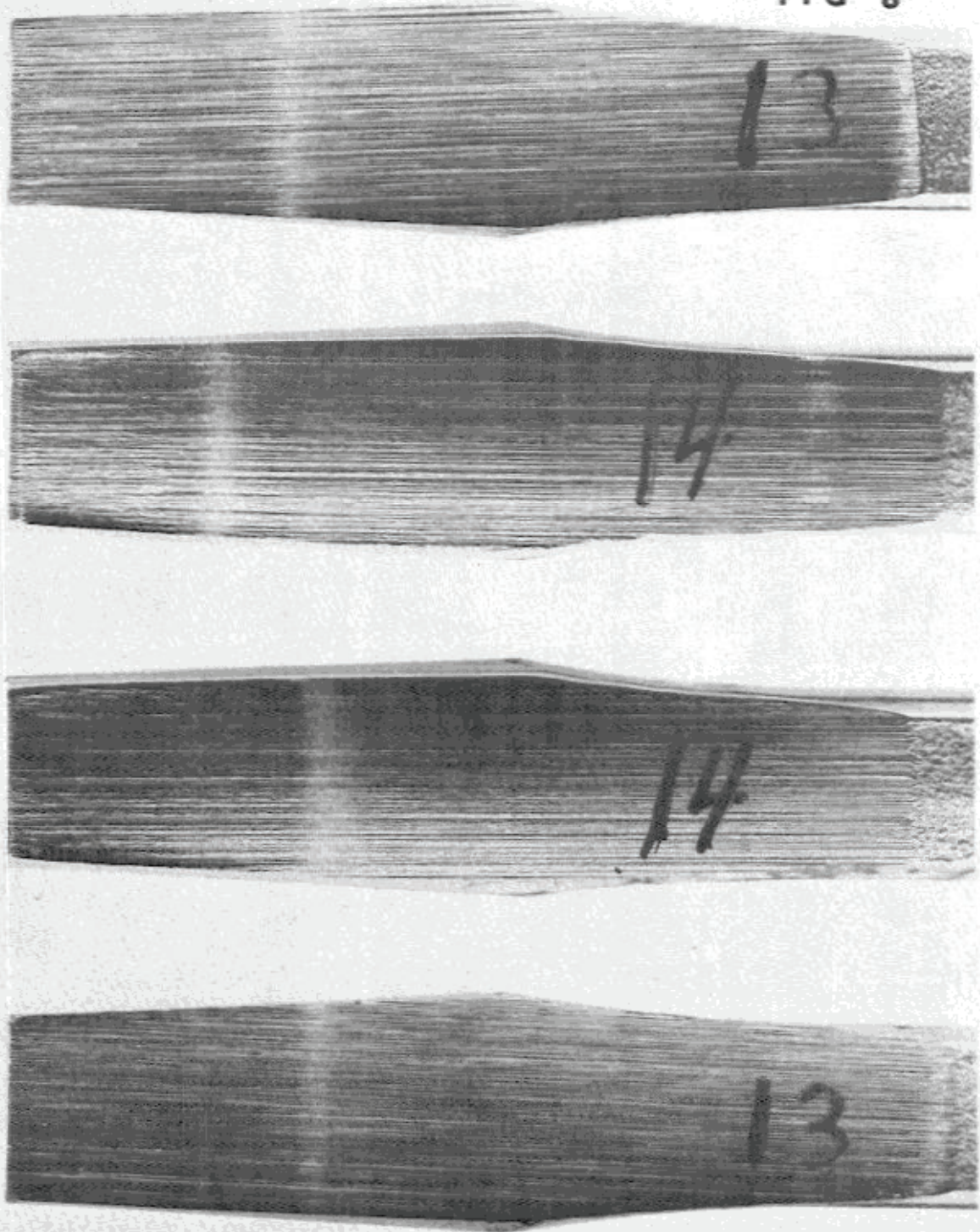


FIG 7



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FIG 8



CM 1 2

FIG 9



CM 1 2

FIG 10

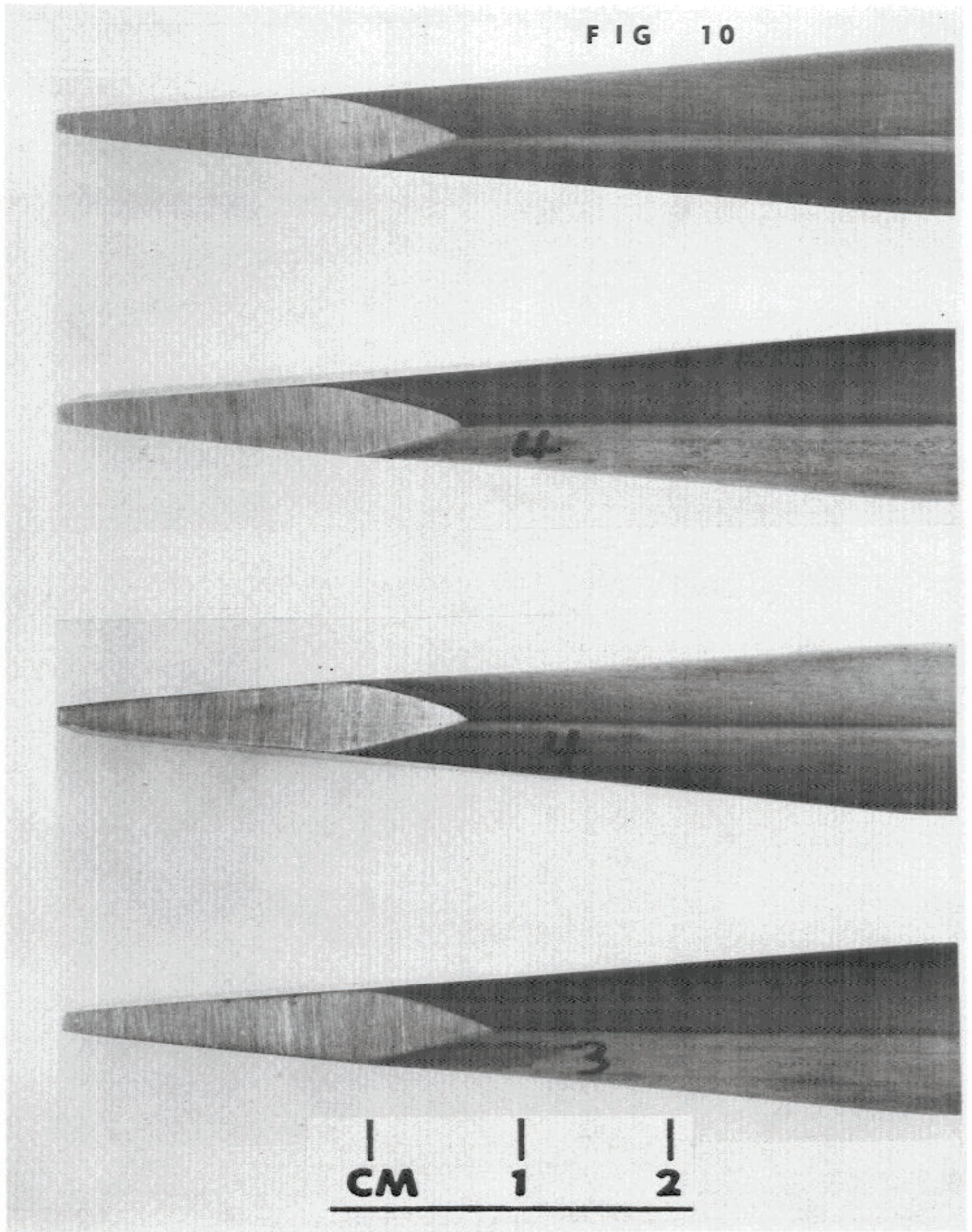
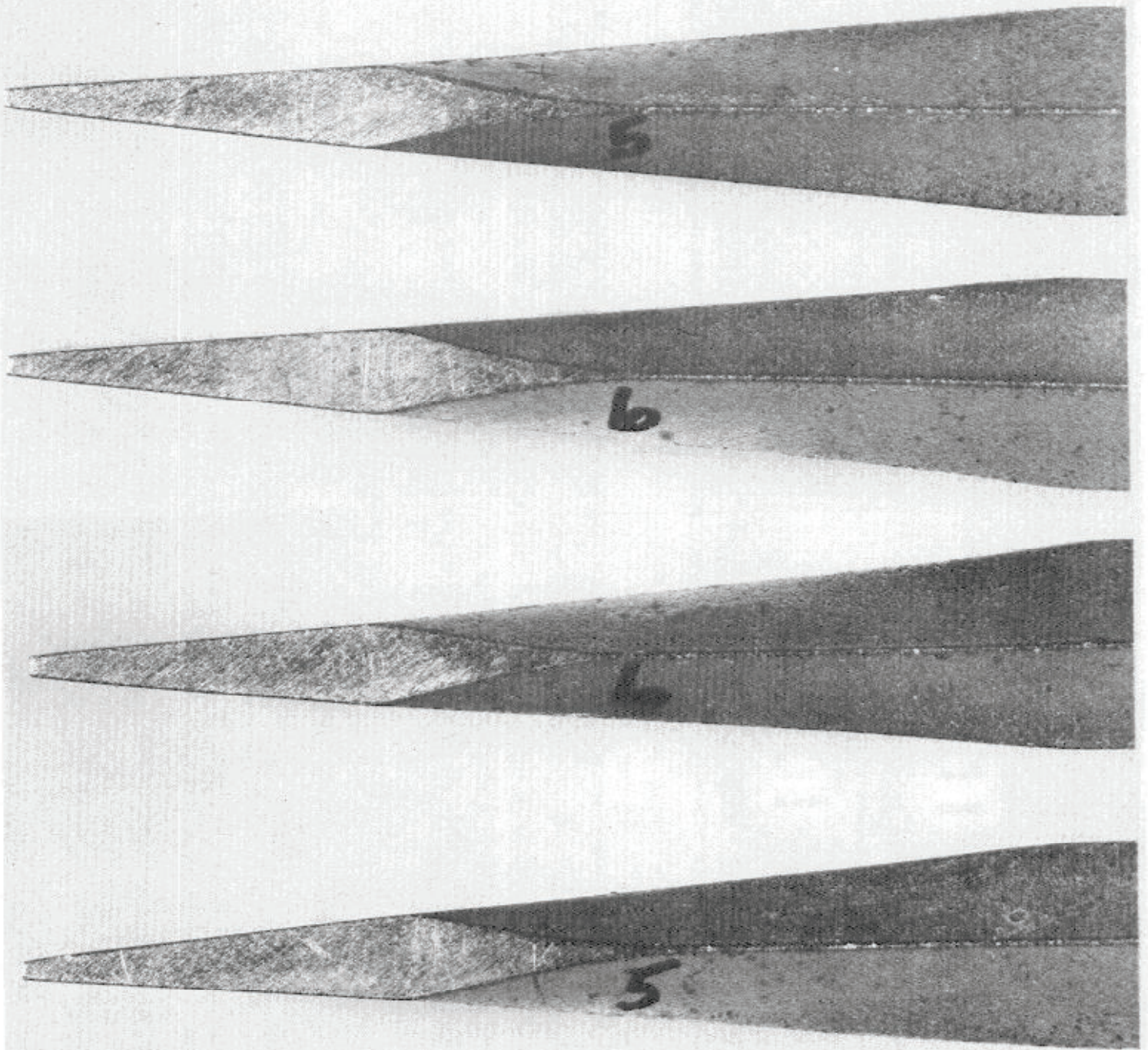
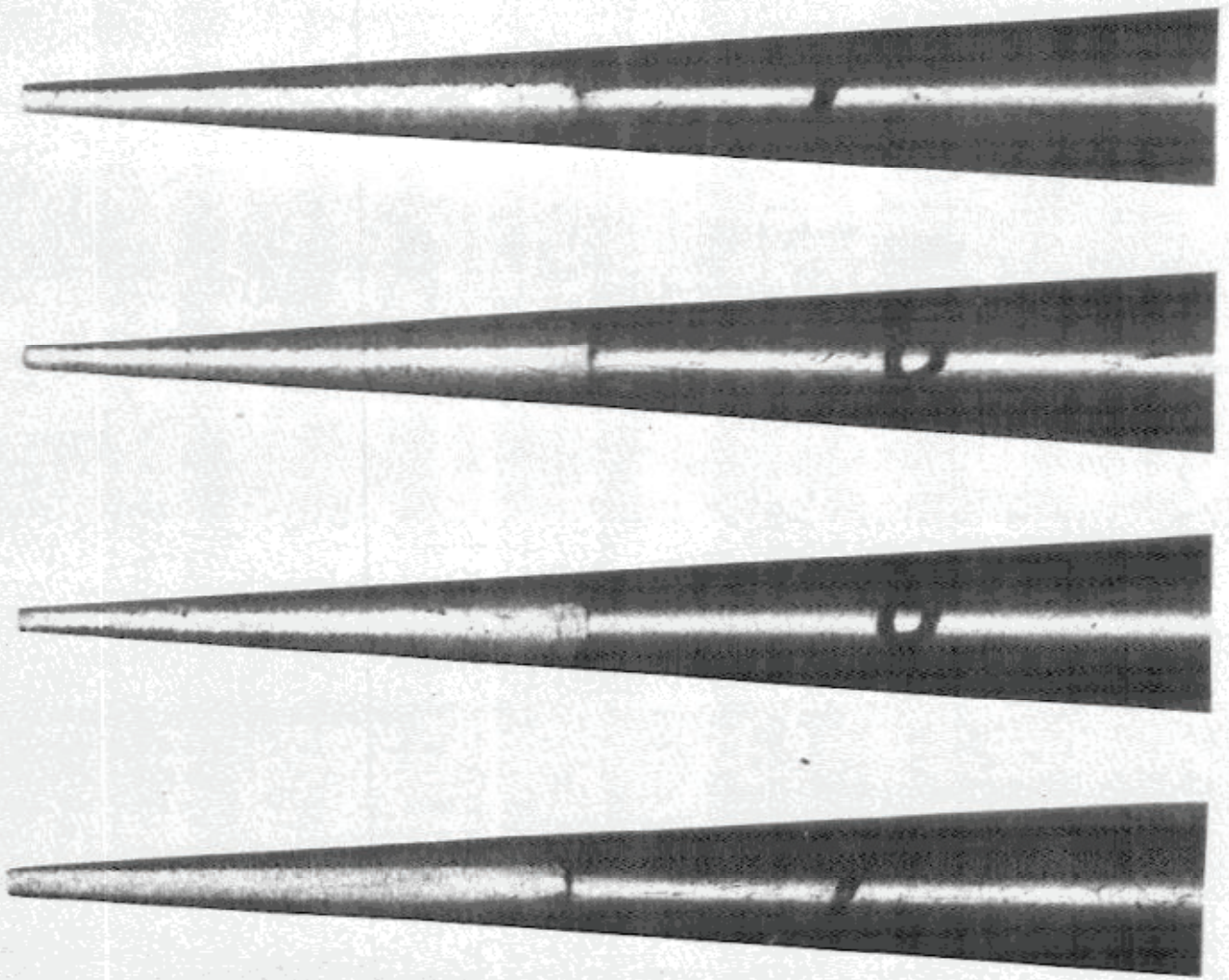


FIG 11



1 CM 1 2

FIG 12



1 CM 1 2

FIG 13

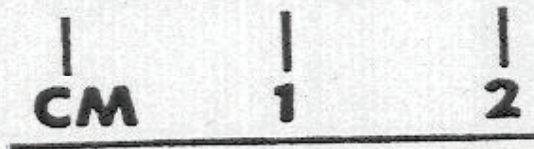
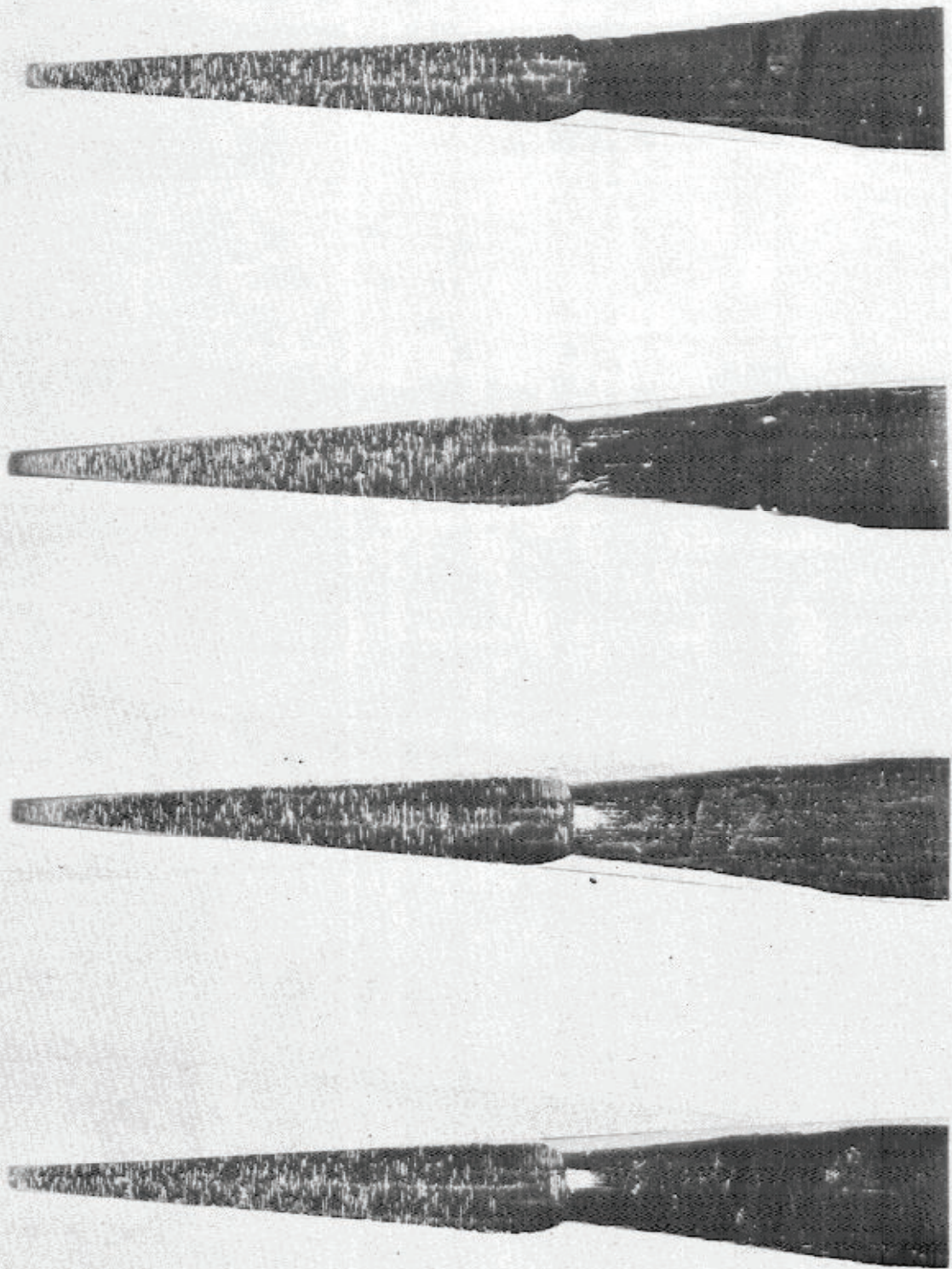
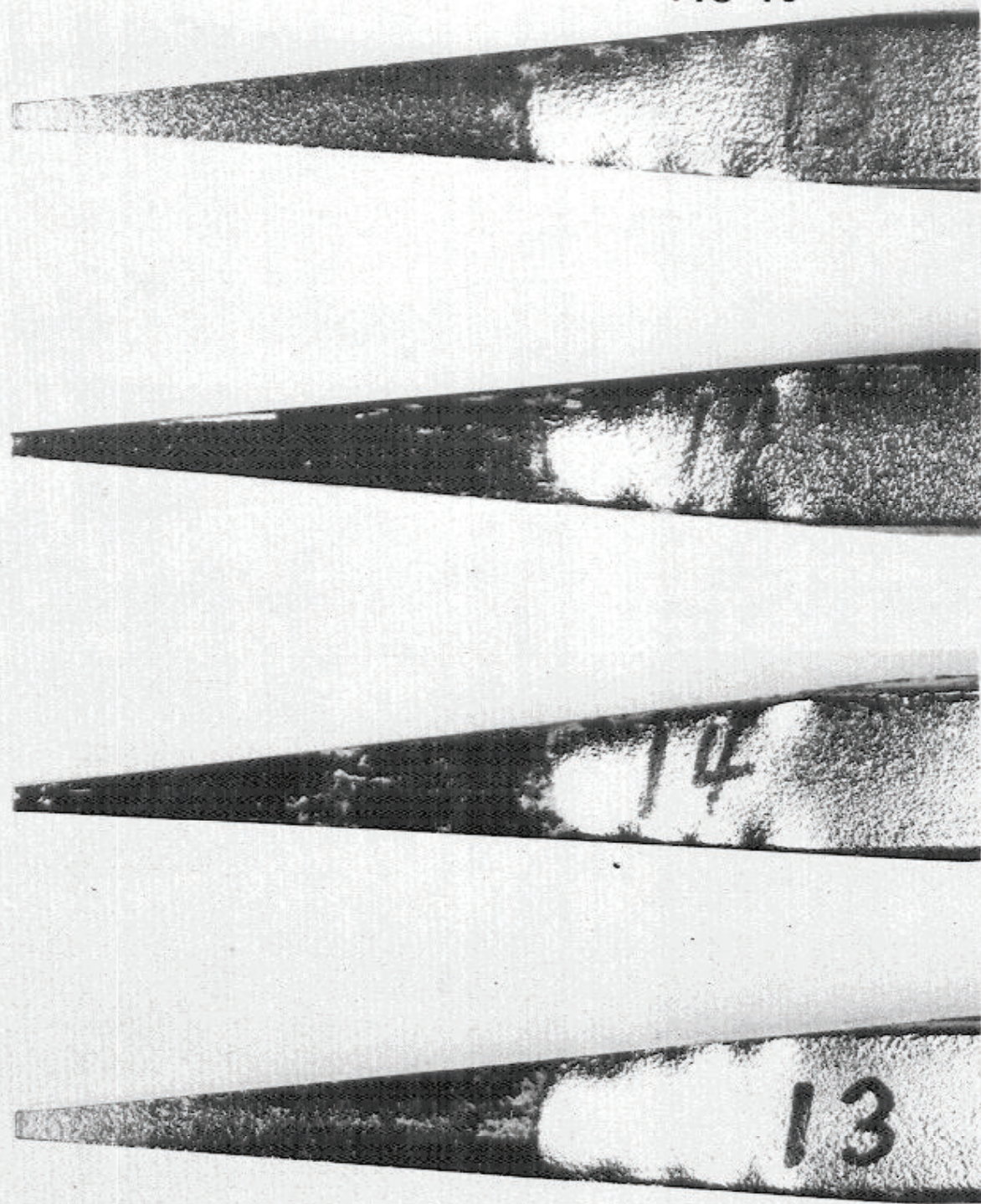


FIG 14



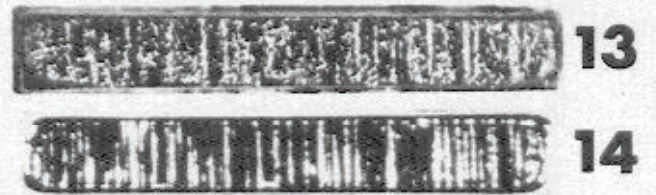
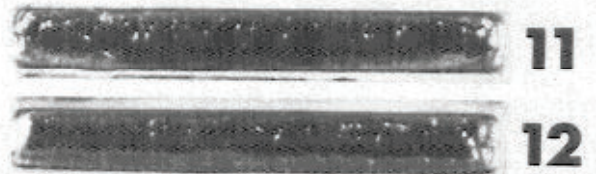
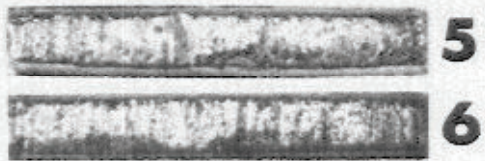
1 CM 1 2

FIG 15



1 CM 1 2

FIG 16



do provide some screwdriver bars to the entire industry from time to time. It is probable that their characteristics are unique enough so that, for instance, a Roxton bar would look the same on a Stanley, or Sears, or any other manufacturer of screwdrivers. However, again, because of the manufacturing processes involved there is a strong probability that no two bars, old or new, look exactly the same; even those produced on highly mechanized processes, since the grinding and forging and other operations are unique to that particular manufacturer...."

2. Rosco Tools:

"These blades are from our top-quality line, and are made of Chrome Vanadium Steel. They are heated at the ends until they are red hot and are forged flat in a progressive die on a punch press, which also trims the edges and the front tip to shape the keystone. As the final step in the die, the blades are again hit on the face to insure flatness.

After heat treating, these blades are ground with abrasive belts on the two faces of the keystone, and the two sides of the deystone. In some cases, where the blades end up too thin, we would also grind the front tip.

After grinding, our blades are dipped in an organic epoxy coating and thoroughly baked to harden the coating surface. In this respect, we are distinctive from the majority of other screwdriver manufacturers."

3. Mephisto Tools:

"Today's market more or less demands a plated blade, and this covers a lot of manufacturing marks that would make your job easier. However, I imagine that the width and thickness of the bite of the driver would vary ever so slightly from one manufacturer to another - other marks would show under microscopic examinations...

We are sending***two 12" blades that were made on a Rotary Forging Swagger - trimmed, ground, hardened, wheel-abraded and plated."

4. Great Neck Saw Mfrs:

"...screwdrivers are made by cutting wire from either bar stock or coils. They are straightened and then flattened and trimmed and punch pressed. Depending upon the quality,

some screwdrivers are heat treated and plated without any further work. The better quality screwdrivers are heat treated and ground. Some are plated for cosmetic purposes after grinding. The bulk of the blades are not plated, but just ground and polished.

As the finishing is usually done by hand, the grinding marks on two screwdrivers in the same batch may not even have the same marks, even though they came off the same grinding wheel."

5. Upson Tools:

"The sequence of manufacturing operations is as follows:

1. Material cut to length from long bars.
2. Blade end hot swaged.
3. Blade is heat treated entire length.
4. Sand tumbled to remove carbon deposits.
5. Tip and face hand ground.
6. Stress relieved at 700°F.
7. Nickel plated."

6. Vaco Products:

"Our method of manufacturing is as follows:

1. Cutoff to length - Shear cut in die.
2. Degrease to remove surface oil.
3. Bevel end which will be inserted into handle.
4. O.D. polish to remove surface defects.
5. Wash and dip in oil.
6. Induction heat and hot flatten screwdriver tip.
7. Edge trim in punch press.
8. Edge grind.
9. Face polish.
10. End trim to tip thickness specification.
11. Mark VACO - CHROME - VANADIUM STEEL
12. Heat treat and temper to 54-56 Rc.
13. Vibratory finish to remove heat treat scale.
14. Straighten as necessary.
15. Nickle Chrome plate."

7. XceLite: No data received

ILLUSTRATIONS

Fig 1

Producers of blades in order of arrangement are:

1 & 2 - Stanley	9 & 10 - Upson
3 & 4 - Rosco	11 & 12 - Vaco
5 & 6 - Mephisto	13 & 14 - XceLite
7 & 8 - Great Neck Saw	(Photo courtesy of AFIP)

Fig 2-8

Two sides of one blade from a company are bracketed by two sides of the second blade from the same company in each illustration. Note the variations in abrasion patterns, types of abrasion, relationship of the blades to shafts, surface texture of blades and shafts, size and shape of blades, both relative to one another and from one company to another. (Photos by AFIP)

Fig 9-15

Same procedure is followed as before, but in relation to the narrow sides of each blade. In addition to the characteristics noted for the broad sides of blades, note the presence of shear marks in some cases. (Photos by AFIP)

Fig 16

Though less apparent, the tips of the blades vary in method of preparation or production and size. (Photo by AFIP)

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ASSISTANCE NEEDED

The Baltimore City Police Department is in need of written exams, quizzes, or any other similar exercise designed to examine firearms examiner candidate qualifications. Any department employing use of such testing materials, please contact:

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