PLANT REQUIREMENTS TO SET UP AND OPERATE A COPPER WIRE DRAWING AND INSULATING PLANT

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
COMMUNICATIONS RESOURCES DIVISION
Washington 25, D. C.

FOREWORD

This brochure is one of a series of reports resulting from overseas technical inquiries on factory or commercial establishments, operation, management, and engineering. The report is designed to provide only a general picture of the factors that must be considered in establishing and operating a factory of this type. In most cases, plans for actual installations will require expert engineering and financial advice in order to meet specific local conditions.

Mention of the name of any firm, product, or process in this report is not to be considered a recommendation or an endorsement by the Agency for International Development, but merely as a citation that is typical in its field.

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The original report was prepared by Morris and Van Wormer, New York, New York, for the technical aids program through the facilities of the Office of Technical Services, U. S. Department of Commerce.

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This report has been revised and rewritten by Vitro Engineering Company, a Division of Vitro Corporation of America, Washington Branch, 1025 Connecticut Avenue N. W., Washington 6, D. C.

For further information and assistance, contact should be made with the local Productivity Center, Industrial Institute, Servicio, or United States Aid Missions.

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CONTENTS

	Page
Introduction	1
General Assumptions	2
Product Specifications	3
Production Capacity	4
Manufacturing Unit	5
Manufacturing Operations	5
Plant Site	8
Building	10
Power	10
Water	10
Fuel	10
Plant Layout and Workflow	11
Direct Labor	12
Indirect Labor	13
Direct Materials	14
Supplies	14
Production Tools and Equipment	15
Other Tools and Equipment	15
Furniture and Fixtures	16
Depreciation	17
Manufacturing Overhead	17
Manufacturing Cost	18
Fixed Assets	18
Working Capital	19
Capital Requirements	19
Sales Revenue	19
Recapitulation of Costs, Sales, and Profits	20
Budget Control	21
Purchase Requisition Form	23
Voucher Check	24
Engineers	25
Training	26
Safety	27
Summary	28
Other Considerations	29
Materials and Supplies	29
Market Factors	29
Export Markets	30
Marketing Problems	30
Financial Factors	31
Financial Requirements of the Project	31
Short-term Bank Credits	31
Financial Plan	31
Economic Factors	32
Personnel	32
Laws and Regulations	32
Bibliography	33

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Union Carbide Corporation
Wyatt Building, Washington, D. C.

Arcal Chemicals Incorporated
2320 - 86th Avenue, Seat Pleasant, Md.

Syncro Machine Company
611 Sayre Avenue
Perth Amboy, New Jersey

John Royle and Sons
10 Essex Street
Paterson 3, New Jersey

The manuscript for this report was reviewed by Mr. G. L. Morris, Vice President of the Syncro Machine Company, and his comments and suggestions were of great value in its preparation.

COPPER WIRE DRAWING AND INSULATING

INTRODUCTION

The purpose of this report is to present basic information relative to the establishment of a copper wire drawing and insulating facility in a foreign country. This plant will be equipped to produce both bare and insulated copper wire from copper rods.

This plant requires a considerable capital investment but a relatively small number of skilled workers. However, if the facility is to be located in a country somewhat underdeveloped economically, it is essential that both an adequate source of raw materials and a very substantial local market for the finished products either exist or be capable of development, if this is to be a profitable undertaking. If the plant must import the copper rods, or be forced into keen competition with imports from more industrially advanced countries, it is possible that the profit to be realized from local production may not be sufficient to justify the required capital outlay. To offset this, combining the wire drawing plant with a plant producing copper tubing might increase the chances for profitable operation since copper tube extruders can also extrude the copper rods from which the wire is fabricated.

Since the equipment to be used in this plant is largely automatic, and is capable of more than twice the designed production rate, production should be increased as rapidly as the market will permit. Future production might be diversified to include tinned and enameled wires, an increased range of wire sizes, and the manufacture of twisted insulated wires or small cables.

GENERAL ASSUMPTIONS

In order to make realistic cost estimates, the following assumptions must be made:

1. The costs of the building and general facilities are based on United States prices.

2. Material and equipment costs are based on sizes and specifications current in the United States.

3. Labor costs are based on the average for the industry as recently published by the United States Bureau of Labor Statistics.

4. Adequate power and water are available at the plant site.

5. Adequate transportation facilities are available at the plant site.

6. This plant operates eight hours a day, five days a week, and fifty weeks a year.

7. No special provision is made for the training of new personnel. It is assumed that learners' rates will be paid in such cases.

8. The following items cannot be estimated realistically:

   a. Land value
   b. Distribution and selling costs
   c. In-freight and out-freight
   d. Administrative costs
   e. Taxes

   Although approximate estimates are made for each of these items, for the purpose of completing cost estimates, adjustments should be made in accordance with actual local costs.

9. Columns are provided in the tables included in this report to facilitate the conversion of cost figures to conform with local costs.

PRODUCT SPECIFICATIONS

All information and figures contained in this report are based on the production of solid, round, bare, annealed copper wire, and polyvinyl chloride insulated copper wire, in American Wire Gage (AWG) sizes 8, 10, 12, and 14. All wires are manufactured from 5/16 inch coiled, hot-rolled copper rod.

Polyvinyl chloride insulation (usually referred to as PVC) belongs to a group of insulating compounds whose basic ingredient is either polyvinyl chloride or its copolymer with vinyl acetate, in combination with appropriate plasticizers, stabilizers, fillers, and pigments. These materials can be compounded to provide a wide variety of physical properties, such as resistance to moisture, cold, heat, flame, oils, solvents, chemicals, ozone, etc. Electrical properties are suitable for low-voltage power applications, such as building wires, series street lighting cable, machine tool wiring, hook-up and appliance wiring, overhead line wire, and others.

The cost figures for insulation given in this report are based on a Union Carbide Corporation Compound, Type VFD 9033 G.P. The code letters and numbers indicate the following:

V	=	vinyl chloride acetate compound
F	=	extrusion non-rigid
D	=	diced or pellet
9033	=	company number
G.P.	=	general purpose

This compound is available in the following colors - black #85, black #855, and ivory #385, and discount prices are available in large quantities.

The American Standards Association (ASA), in conjunction with the American Society for Testing Materials (ASTM), provide the following applicable specifications:

ASA C7.1-1957	Soft or Annealed Copper Wire, Specifications for (ASTM B3-56)
ASA C7.7-1953	Hot-Rolled Copper Rods, for Electrical Purposes, Specifications for (ASTM B49-52)
ASA C7.36-1958	Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires used as Electrical Conductors, Specifications for (ASTM B258-57)
ASA C8.30-1954	Insulated Wire and Cable: Vinyl Chloride Plastic Insulating Compound, Tentative Specifications for (ASTM D 734-50T)
ASA C8.22-1960	Rubber and Thermoplastic Insulated Wire and Cable, Methods of Testing (ASTM D470-59T)

PRODUCTION CAPACITY

This plant is designed to produce 20,000 pounds (10 tons) of copper electrical wire (both bare and insulated) per eight hour day, giving an annual production capacity of 2,500 tons.

This rate of production represents about 50% of rated capacity and is considered to be the minimum for efficient and economical use of the equipment. Production should be increased as soon as the market will permit since the present labor force, without augmentation, could double the production rate, thus increasing the profit possible from this operation.

MANUFACTURING UNIT

The manufacturing unit used in the manufacture of copper wire is the pound.

MANUFACTURING OPERATIONS

The basic material for a copper wire drawing plant is 5/16 inch, hot-rolled copper rod. This rod is obtained from a rolling or extruding mill which has fabricated it into the proper size rod from bars or ingots of electrolytic copper.

Pickling - As received, the coiled rod is always dirty and coated with surface oxides which must be removed. Cleaning and oxide removal is accomplished by a dilute sulfuric acid treatment called "pickling". After pickling, the rod is removed, water-washed, and dried. The pickling tanks are usually made of, or lined with, stainless steel, lead, ceramics, glass, or rubber; and the racks or baskets are made of stainless steel, monel metal, or nichrome to provide acid resistance.

Pointing and Stringing - The leading end of the cleaned coil must be pointed to facilitate starting it through the drawing dies (a maximum of 13 to produce the smallest diameter 14 gage wire) on the initial wire string-up for the wire drawing machine. This is accomplished by inserting the end of the rod into a series of gradually diminishing spiral grooves mounted on the side of a power-operated pointing and stringing machine (see figure 1). This machine, essentially a slow-speed drawing machine, draws the pointed rod down to the required size for stringing the drawing dies in preparation for the wire drawing operation.

Wire Drawing, Annealing, and Coiling - The wire drawing machine is operated in series with a continuous electric resistance annealer and a continuous takeup spooler. The rod is fed into one end, drawn down to the required gage size (depending on the number of dies strung), annealed to the proper softness, and wound on reels in the continuous takeup. The takeup unit contains two reels, of either 500 or 1,000 pounds capacity, mounted side by side. The first reel, when filled, automatically transfers the wire to the second reel without interrupting the drawing or annealing operations. For continuous runs, the leading ends of additional coils of rod are welded to the trailing end of the previous coil. This installation (see figure 2) operates at almost 100% efficiency because there is a minimum of scrap loss due to stopping the operation or to temperature changes.

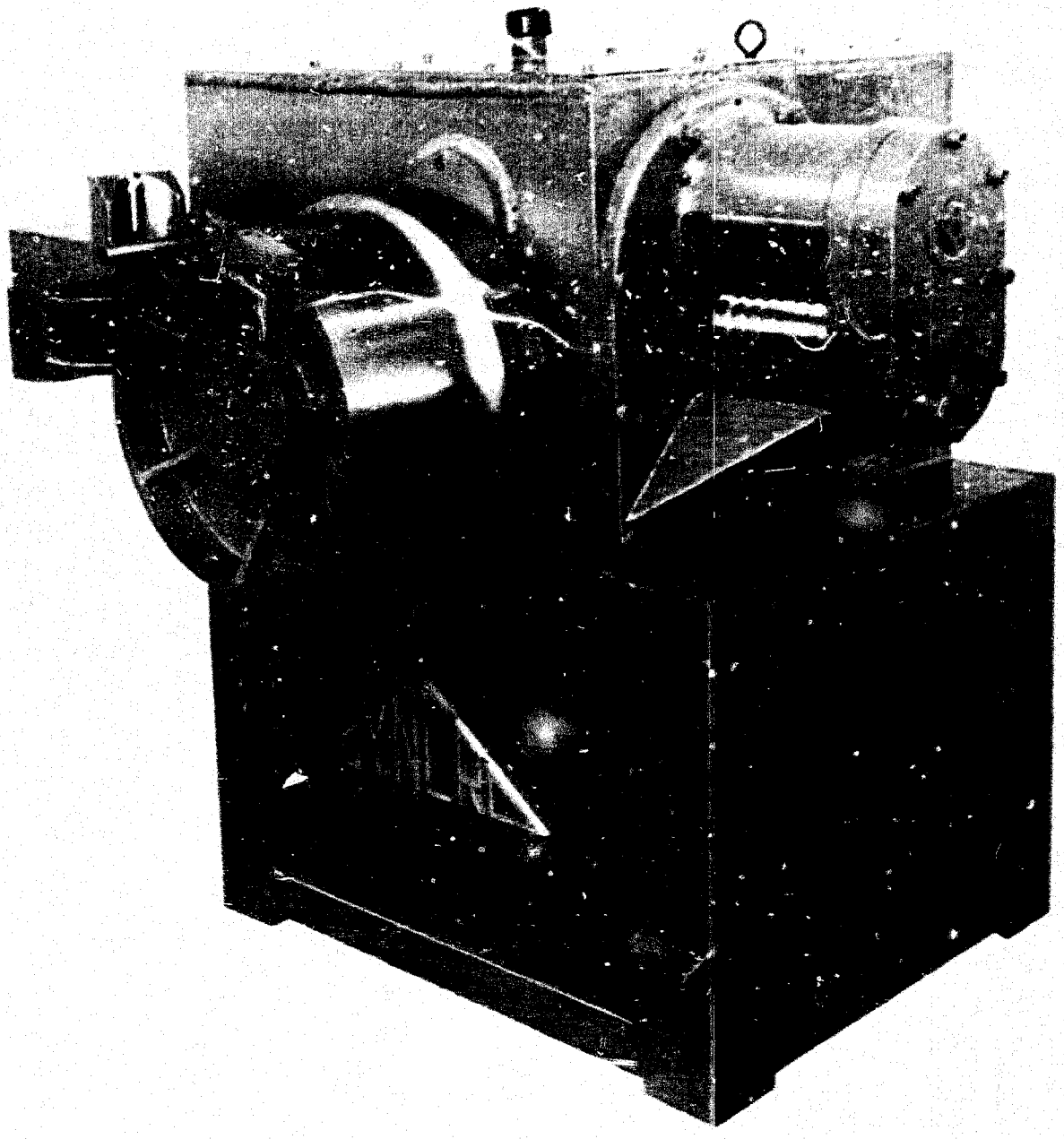

Figure 1. Power-Operated Pointing and Stringing Machine

Figure 2. Typical Manufacturing Unit Consisting of a Wire Drawing Machine at the Left, a Continuous Resistance Annealer in the Center, and a Continuous Takeup Spooler at the Right.

The wire drawing machine and associated motors, transformers, controls, spoolers, annealer, and takeup unit are available as a complete package at price savings to fit the particular needs of the plant.

If bare wire is to be furnished, the coil is placed on a rewinder for transfer to smaller spools which are either shipped or placed in stock. If insulated wire is to be furnished, the coil is either placed in semi-finished stock or immediately sent through the insulating process.

Insulating - In the insulating process, the coil of bare wire from the spooler is placed on a take-off spool and the end centered through the head of the insulation extruder. As the wire is drawn through the head at a preset speed, the insulating material flows through a die or nozzle and forms a continuous concentric coating around the wire. The insulated wire is then air-cooled and wound on a spooler which maintains an even tension as the wire is drawn through the extruder head. Figure 3 shows a typical insulation extruder suitable for applying polyvinyl chloride insulation to copper wire. The coil of the insulated wire is taken from the spooler and placed on the take-off spindle of a rewinder where it is wound on appropriately-sized spools for shipment in commercial lengths.

Quality control is essential in the manufacture of copper wire to be used for electrical purposes. Samples of the bare and insulated wire should be submitted to visual and dimensional inspection, as well as to various electrical tests, to determine its conformance with physical and electrical requirements. The insulated wire normally will be submitted to a spark test, a dielectric test, and an insulation resistance test. In a plant such as this, the inspection and testing is usually performed by the foreman.

PLANT SITE

An area of approximately 1/3 to 1/2 acre will be required to accomodate the building and to allow for normal future expansion. It should be located as advantageously as possible with respect to transportation, power, water, fuel, sources of labor, and a substantial market for its finished products. The cost of the land is estimated at $1,000.

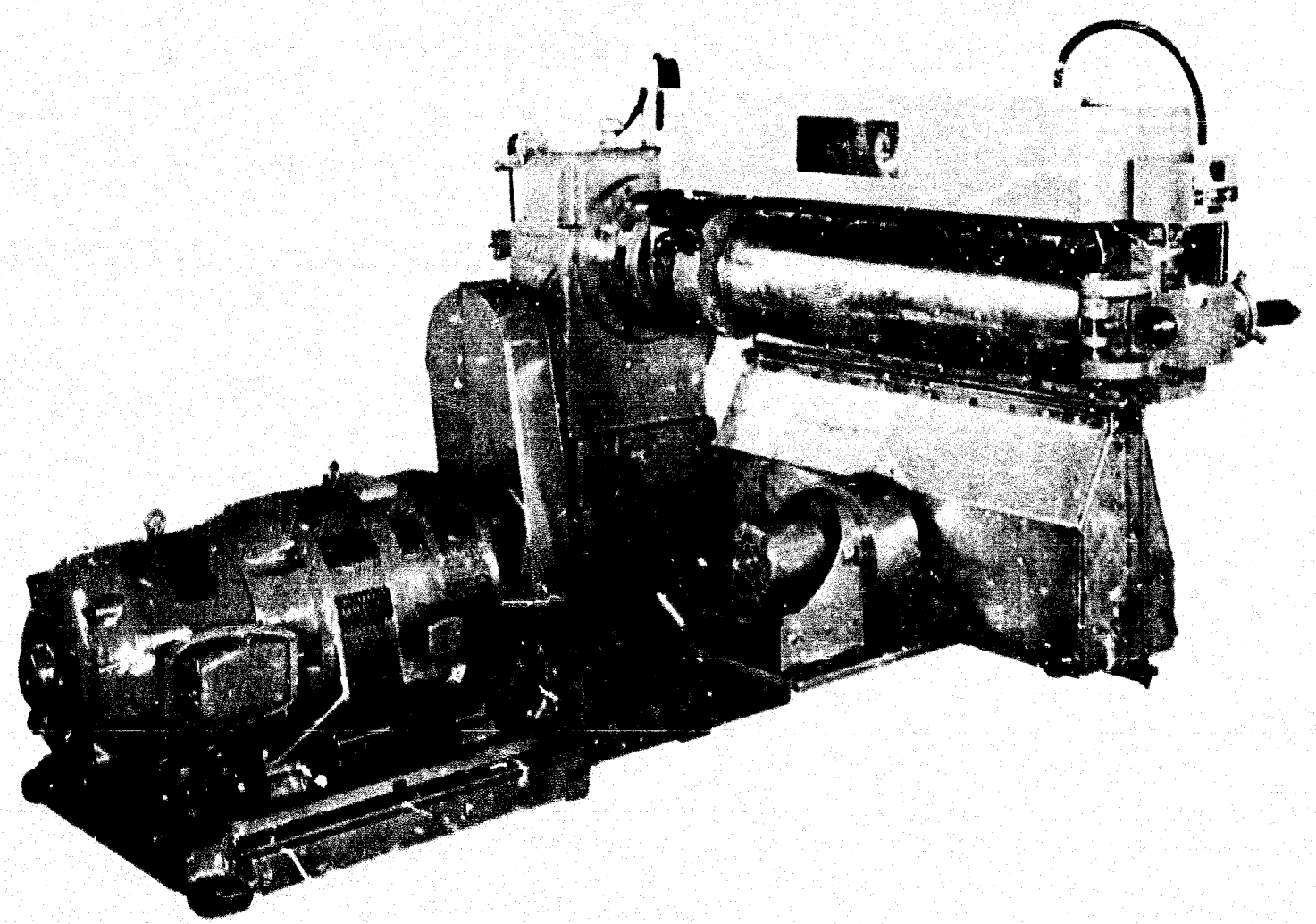

Figure 3. Typical Insulation Extruder

BUILDING

A one story building, constructed of any suitable fire-proof material and containing about 4,000 square feet of floor space, will be satisfactory to house this operation. Suggested dimensions would be 40 feet wide by 100 feet long. The cost of the building, including all utilities, is estimated at $17,000. A proposed plant layout, indicating the location of equipment and the work flow, is shown in figure 4.

POWER

The total connected power requirements for this plant are approximately 500 kilowatts per hour. The annual power cost is estimated at $13,500 based on 1.3 cents per kilowatt hour. Even in the United States, power costs vary widely with locality.

WATER

The annual water requirements for production, sanitation, and fire protection are approximately 2 million gallons. On this basis, the annual water cost is estimated at $600.

FUEL

The annual fuel requirement for heating is estimated at $1,000.

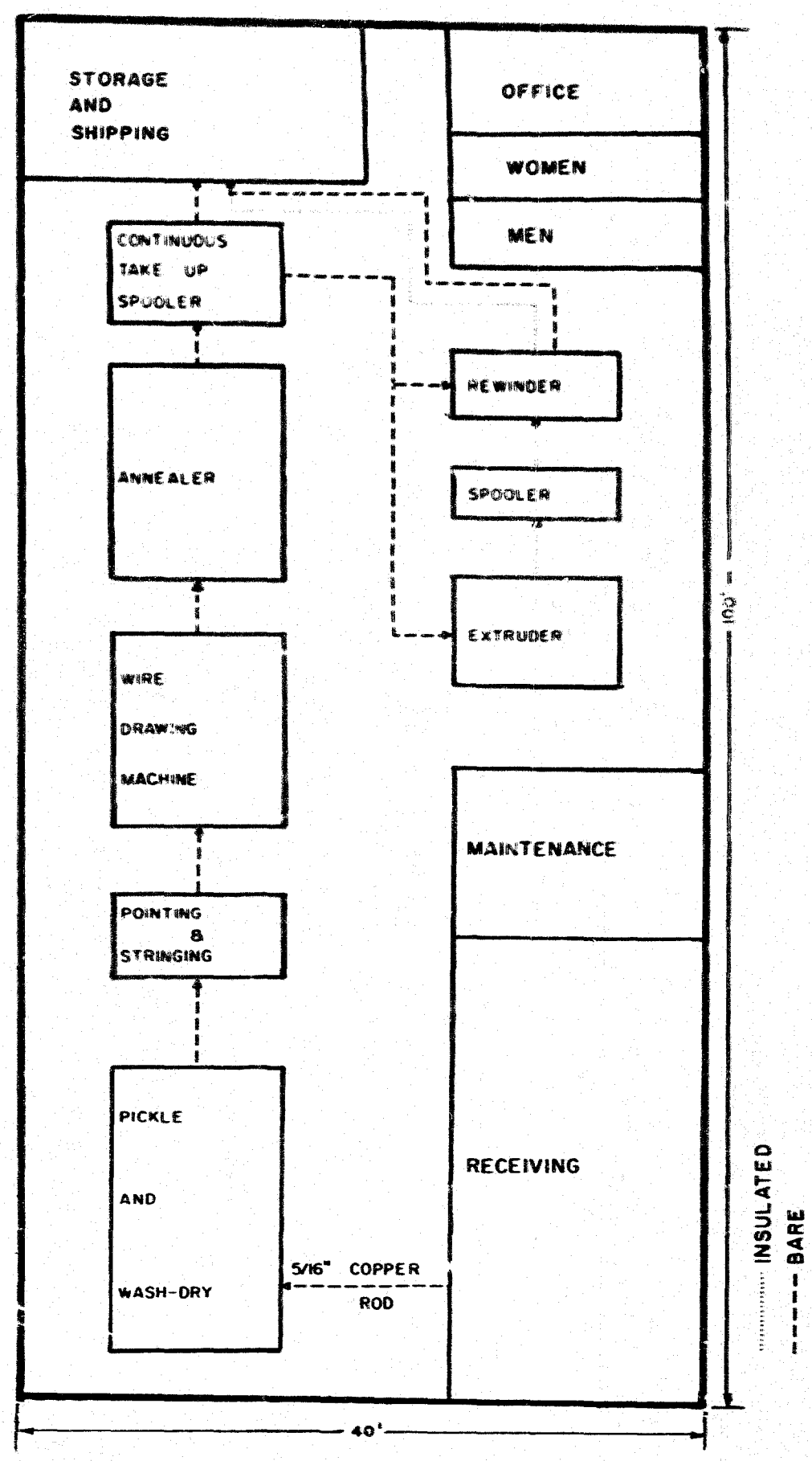

Figure 4. Plan View of Proposed Wire Drawing and Insulating Plant with Work Flow Indicated.

DIRECT LABOR

Two skilled workmen, as listed in the following table, are necessary to operate the manufacturing equipment. One operator would be responsible for the pointing and stringing, wire drawing and annealing, and the continuous takeup spooler. The other would be responsible for all the insulating operations in connection with the plastic extruder and its associated equipment. In addition, at least two laborers, or unskilled helpers, will be required to handle the pickle and wash-dry process, the rewinding operations, and the necessary moving and handling of the rod and wire coils.

Occupation	Number Required	Hourly Rate	Annual Cost Estimated	Annual Cost Actual
Wire drawing and annealing operator	1	$2.50	$ 5,200	
Extruding operator	1	2.50	5,200	
Unskilled helpers	2	1.75	7,280	
Total	4		$ 17,680	

INDIRECT LABOR

Four people, as listed in the following table, are sufficient for the indirect labor force; a manager who also handles the bookkeeping; a foreman who schedules the manufacturing processes for optimum production, and performs quality control duties; a maintenance engineer to maintain and repair the equipment; and a stock clerk for normal receiving, billing, and shipping duties.

Occupation	Number Required	Hourly Rate	Annual Cost Estimated	Annual Cost Actual
Manager	1		$12,000	
Foreman	1	$ 3.00	6,240	
Maintenance Engineer	1	2.50	5,200	
Stock Clerk	1	1.70	3,536	
Total	4		$26,976	

DIRECT MATERIALS

Item	Unit	No. of Units	Unit Cost	Annual Cost Estimated	Annual Cost Actual
5/16" diameter hot-rolled copper rod	Ton	2,400	$920	$2,208,000	
Polyvinyl choloride (PVC)	Pound	126,000	0.28	35,300	
Total				$2,243,300	

SUPPLIES

Item	Annual Cost Estimated	Annual Cost Actual
Sulphuric Acid - 10,000 pounds	$ 500	
Spools - 240,000	24,000	
Wire Dies - 12	420	
Lubricants and hand tools	120	
Office Supplies	200	
Total	$25,240	

PRODUCTION TOOLS AND EQUIPMENT

Description	Number Required	Estimated Cost Unit	Estimated Cost Total	Actual Cost
Pickle tank and auxiliary equipment	1	$ 3,000	$ 3,000	
Pointing and stringing machine	1	6,000	6,000	
Wire drawing and annealing equipment*	1	90,000	90,000	
Extruder**	1	36,000	36,000	
Total			$135,000	

* Wire drawing machine complete with control panel and motors, continuous resistance annealer with transformer, and continuous takeup spooler.

** 3-1/2 inch bore plastic insulating machine complete with control cubicle, auxiliary feed hopper, payoff stand, 30 foot cooling trough, dual-wheel high-speed capstan, spark tester, semi-automatic dual-reel takeup, and tandem motor drives.

OTHER TOOLS AND EQUIPMENT

Description	Number Required	Estimated Cost Unit	Estimated Cost Total	Actual Cost
Rewinder	1	$2,000	$2,000	
Hydraulic lift truck	1	600	600	
Skids	2	500	1,000	
Maintenance Shop (Bench lathe, grinder, test equipment, etc.)			2,000	
Total			$5,600	

FURNITURE AND FIXTURES

Description	Number Required	Unit Cost	Cost Estimated	Cost Actual
Manager's desk and chair	1	$125	$125	
Clerk's desk and chair	1	100	100	
Typewriter and table	1	110	110	
File cabinets	2	50	100	
Adding machine	1	103	103	
Extra chairs	2	15	30	
Coat rack	1	9	9	
Lamps	2	9	18	
Miscellaneous	---	---	5	
Total			$600	

DEPRECIATION

Description	Estimated Cost	Years Life	Annual Estimated	Annual Actual
Building	$ 17,000	20	$ 850	
Production tools and equipment	135,000	10	13,500	
Other tools and equipment	5,600	10	560	
Furniture and fixtures	600	10	60	
Total			$14,970	

MANUFACTURING OVERHEAD

Item	Annual Estimated	Annual Actual
Depreciation	$14,970	
Indirect labor	26,976	
Power	13,500	
Water	600	
Fuel	1,000	
Supplies	25,240	
Total	$82,286	

MANUFACTURING COST

Item	Annual Estimated	Annual Actual
Direct materials	$2,243,300	
Direct labor	17,680	
Manufacturing overhead	82,286	
Total	$2,343,266	

FIXED ASSETS

Item	Estimated	Actual
Land	$ 1,000	
Building	17,000	
Production tools and equipment	135,000	
Other tools and equipment	5,600	
Furniture and fixtures	600	
Total	$159,200	

WORKING CAPITAL

Item	Estimated	Actual
Direct materials, 30 days	$187,000	
Direct labor, 30 days	1,470	
Manufacturing overhead, 30 days	6,860	
Reserve for sales collections, 30 days	2,585	
Total	$197,915	

CAPITAL REQUIREMENTS

Item	Estimated	Actual
Fixed assets	$159,200	
Working capital	197,915	
Total	$357,115	

SALES REVENUE

The production capacity of this plant is rated at 5,000,000 pounds of wire per year. Half of this consists of bare wire and half of insulated wire or 2,500,000 pounds per year of each type. Based on an average wholesale selling price of $0.62 per pound for bare wire, and $0.65 per pound for insulated wire, the total annual gross sales are $3,154,100, yielding a gross profit before taxes of 25%.

RECAPITULATION OF COSTS, SALES, AND PROFITS

ITEM	ANNUAL COSTS ESTIMATED Bare	Insulated	Total	ACTUAL
Direct Materials	$1,104,000	$1,139,300	$2,243,300	
Direct Labor	6,240	11,440	17,680	
Manufacturing Overhead	32,940	49,360	82,300	
Total Manufacturing Costs	$1,143,180	$1,200,100	$2,343,280	
Interest on Loans	10,000	10,000	20,000	
Insurance	1,000	1,000	2,000	
Legal Fees	4,000	4,000	8,000	
Auditing	5,000	5,000	10,000	
Unforeseen Expenses (Bad Debts, Etc.)	10,000	10,000	20,000	
Total Administrative Costs	$ 30,000	$ 30,000	$ 60,000	
Total Sales Costs*	60,000	60,000	120,000	
Total Business Costs	$1,233,180	$1,290,100	$2,523,280	
Profit Before Taxes	308,300	322,520	630,820	
Total Annual Gross Sales	$1,541,480	$1,612,620	$3,154,100	

* Includes Commissions, Travel, Freight-out, Discounts, Etc.

BUDGET CONTROL

A requisition form designed to provide accurate records of procurement and indicate the purpose of procurement with the least amount of time and effort is shown on page 23.

This form has an account number for each type of the various expenditures which the manager will review in detail, monthly or oftener, in order to control his expenses. Some items, such as power and water, are usually under contract and are easily checked by reference to monthly bills. For simplification, items (marked with an asterisk in the table on page 22) are omitted from the purchase requisition. Variations in the labor costs are easily reviewed by examination of the payroll vouchers. The simplified type of control thus provided makes certain that the manager can control expenditures promptly.

In addition to the requisition form, a sample voucher check is shown on page 24. Voucher checks should be used for the payment of all expenditures and the appropriate book account number placed on each voucher.

At the end of each month the manager will receive a statement of all expenditures broken down by budget accounts, as shown on page 22. If the expenditures exceed the budgeted monthly allowances of any of the accounts, the bookkeeper will furnish the manager with a breakdown of all expenditures relative to the budgeted accounts exceeded. All these supporting data can be secured by reference to the purchase requisitions and the check vouchers. This reference will enable the manager to determine what caused the over-expenditure and take corrective action.

If at any time during each month it becomes apparent that expenditures will exceed any of the budget accounts, the bookkeeper will bring this to the attention of the manager for his information and action.

BUDGET CONTROL ACCOUNTS

Account Number	Monthly Expense	Monthly Budget	Annual Budget	Actual
10 Administrative		$ 3,330	$ 40,000	
20 Sales		10,000	120,000	
30 Direct Materials		187,000	2,243,300	
40 Supplies		2,100	25,240	
51 Power*		1,130	13,500	
52 Water*		50	600	
53 Fuel		80	1,000	
60 Unforeseen Expense (Reserve Account)		1,650	20,000	
71 Direct Labor*		1,450	17,680	
72 Indirect Labor*		2,230	26,980	
80 Depreciation (Reserve Account)		1,250	14,970	
Total		$210,270	$2,523,270	

PURCHASE REQUISITION	COMPANY NAME	DATE

- ☐ 10 ADMINISTRATION
- ☐ 20 SALES
- ☐ 30 MATERIALS
- ☐ 40 SUPPLIES
- ☐ 50 UTILITIES
- ☐ 60 UNFORESEEN EXPENSE

INDICATE BELOW THE USE OF MATERIALS

- ☐ DIRECT MATERIALS
- ☐ MAINTENANCE MATERIALS
- ☐ MAINTENANCE SERVICES
- ☐ OPERATING SUPPLIES

	PLEASE ORDER THESE MATERIALS OR SERVICES	DELIVERY WANTED	
QUANTITY	DESCRIPTION	UNIT	TOTAL

QUOTES FROM		REQUISITIONED BY	
QUOTES FROM		APPROVED BY	
QUOTES FROM		ORDER NO.	ORDER DATE

R. W. MITCHELL MANUFACTURING COMPANY

1422 BOSWORTH STREET, S. E.

65-22
514

ANYWHERE, U. S. A._____19____ No. 10000

PAY _____ DOLLARS $ _____

TO THE ORDER OF

R. W. MITCHELL MANUFACTURING COMPANY

TO FIRST NATIONAL BANK
ANYWHERE, U. S. A.

BY SAMPLE CHECK

VICE PRESIDENT

ACCOUNT NUMBER

Sample voucher check to be used for the payment of all expenditures in connection with Budget Control.

R. W. MITCHELL MANUFACTURING COMPANY

ENGINEERS

The services of professional engineers are desirable in the design of this plant, even though the proposed plant is small.

A correct design is one which provides the greatest economy in the investment of funds and establishes the basis of operation that will be most profitable in the beginning and will also be capable of expansion without expensive alteration.

The addresses of professional engineers who specialize in industrial design, some of whom may be willing to undertake such work on low cost projects overseas, can be secured by reference to the published cards in various engineering magazines. They may also be reached through their national organizations, one of which is the

National Society of Professional Engineers
2029 K Street, Northwest,
Washington 6, D.C.

Manufacturers of industrial equipment employ engineers familiar with the design and installation of their specialized products. These manufacturers are usually willing to give prospective customers the benefit of technical advice by those engineers in determining the suitability of their equipment in any proposed project.

The equipment manufacturers also know, and can recommend, professional engineers in private practice who are willing and able to provide appropriate consulting services.

TRAINING

Manufacturing an inferior quality of product during the training period could create sales resistance that might be difficult to cope with later. To avoid such possibilities, the quality of the product should be maintained at all times, including the training period.

In some areas skilled operators may be available locally. In other areas all the operators may have to be trained.

If skilled operators are not available, adequate training would be assured by using one or more of the following methods:

A. If the plant is designed and installed by a competent engineering firm, the contract should be negotiated, if possible, on a turn-key basis. On this basis the contractor agrees to operate the plant and produce the quality and quantity of the product stated in the contract for an agreed period of time. Such a contract would assure adequate personnel training, since full quantity and quality could not be produced with an untrained organization.

B. The engineering firm that designs and installs the plant can usually make training arrangements to have key personnel placed, for training purposes, in a foreign industry that produces the same type of product. This would provide training for the key personnel while the plant is being installed.

C. If neither of the above methods is possible, then qualified and experienced individuals should be employed for the key positions, either permanently or temporarily, to perform the key operations and assist in training the organization, even if they must be secured outside the country.

D. The manager should have years of successful experience in this type of business and be fully qualified in all phases of management, including the training of employees.

SAFETY

There is always danger of accident and injury in any industrial plant. Because of this, the manager should take specific action to bring to the attention of each employee the importance of safety precautions and intelligent first aid.

Practically all machines have safety appliances, and the manager should see that these are in good working condition and that the operators are making full use of them.

In addition to constant watchfulness to make sure that all practicable safety precautions are taken, first aid supplies should be readily available. One complete first aid kit should be maintained near the manager's office, and others at appropriate places throughout the plant. Some of the employees should be trained to provide first aid service.

The use of accident posters in the plant have proved to be of value in reducing accidents. It is recommended that such posters be used, and that some direct special action be taken by the manager, at least once each month, to bring to the attention of all personnel the importance of safety precautions.

A fire brigade should be established and each member trained as to his responsibility in case of fire. Fire drills should be conducted periodically.

It is recommended that the employees be encouraged to offer suggestions or recommendations relative to prevention of accidents, removal of fire hazards and maintaining general interest in all safety factors.

SUMMARY

A small plant, built and operated according to the assumptions made in this report would be a profitable undertaking.

Provision is made for inserting local cost in connection with all cost figures shown in this report. A careful analysis should be made of all cost figures to determine the local potential profits in any location where such a plant is being considered.

There are some determinations, however, that should be made before a decision is reached to build and operate such a plant.

For example, what are the possibilities of future expansion within the country for this industry?

What other products could be manufactured with the machinery and equipment specified in this report?

Is there a market for such additional products?

How does this industry compare with other industries that may be needed in the country relative to the following factors:

1. The economic value to the country.

2. The needs of the majority of the people.

3. The amount of investment capital required.

Consideration should also be given to such factors as :

The amount of power required and the availability of a dependable supply. If an adequate supply is not available the installation of power equipment may be required.

The water requirements for all purposes including fire protection and potable water for drinking purposes.

The fuel requirements and availability. If local fuel can be used the boiler should be adaptable to such fuel.

The transportation facilities to and from the plant. If they are not adequate an investment in trucks may be required.

OTHER CONSIDERATIONS

There are other important subjects, shown below, that should be fully investigated and considered. Information on these subjects is usually available from such sources as banks, government agencies, exporters and importers, wholesalers, retailers, transportation companies and manufacturers.

MATERIALS AND SUPPLIES

1. Are all materials and supplies available locally?
2. Is the local material market competitive?
3. Is satisfactory delivery of local materials assured at reasonable prices?
4. What materials and supplies must be imported?
5. Are they available in world markets at competitive prices?
6. Would prompt delivery of imported materials and supplies be assured so that large inventories would not be required?

MARKET FACTORS

1. Is there already a demand for the product?
   - A. Who are the principal consumers?
   - B. Who are possible new consumers?

2. How is demand for the product now satisfied?
   - A. By local production? If so, what is the volume of annual production?
   - B. What percentage of consumption is filled by local production?
   - C. By imports? If so, what is the volume of annual imports?
   - D. What percentage of consumption is met by imports?
   - E. From what areas are imports derived?

3. What is the estimated annual increase in local consumption over the next five years?
   - A. How were such estimates made?
   - B. By reference to official figures on population growth, family budgets, imports, etc.?
   - C. By consultation with trade or industry, ministries, associations, bankers, commercial houses, wholesalers, retailers, industrial consumers, etc.?

4. If the product is already being manufactured, can the existing and estimated future local market absorb production of the new plant without price-cutting or other dislocations?

5. Would the estimated sales price and quality of the new product make it competitive with an imported equivalent?
   A. After adjusting cost to local conditions, is the estimated sales price of the product so high that tariff protection is necessary to protect it from imports?

EXPORT MARKETS

1. Could the product compete in export markets on the basis of price, quality and dependability of supply?
2. Can export markets for the product be developed?
3. If so, in what areas and in what annual volume?
4. What procedures would be necessary to develop export markets?
5. What would it cost?

MARKETING PROBLEMS

1. In calculating costs of the product, has adequate allowance been made for the expense of a sales department, advertising and promotion that might be required?

2. Do consumer prejudices against locally manufactured products exist?
   A. If so, why?
   B. Would they apply to the new product?
   C. If so, how could they be overcome and what would it cost to do so?

3. Do marketing and distribution facilities for the product exist?
   A. If not, can they be set up?
   B. What would it cost to do so?

4. Will the product be sold to:
   A. Wholesalers?
   B. Retailers?
   C. Direct to consumer?
   D. Other industries?
   E. Government?

FINANCIAL FACTORS

1. Technical advice on selection of machinery and equipment.
   A. In selecting the machinery and equipment for the new plant, have reputable and competent engineers and technicians been consulted?
   B. Have they been asked for advice on the most suitable types of machinery and equipment for the process and locality?
   C. Have they carefully compared costs of various suppliers?
   D. Credit terms offered purchasers?

FINANCIAL REQUIREMENTS OF THE PROJECT

1. In estimating the cost of the project, has careful consideration been given to:
   A. The effect on costs of delays in construction schedules?
   B. In delivery and installation of machinery and equipment?
   C. In import of essential raw materials and supplies?

2. In calculating cash flow and working capital requirements, has careful consideration been given to:
   A. Maintaining adequate inventories of raw materials?
   B. Supplies and spare parts?
   C. Seasonal fluctuations in the business?
   D. The time required to liquidate credit sales to customers and bad debts?
   E. The period necessary to get the plant into production?
   F. Cash required to amortize its principle loans?

3. If the economy is in a period of inflation, has full allowance been made for the influence of rising prices and wages on the cost of the project and on working capital requirements?

SHORT TERM BANK CREDITS

1. Has it been possible to make arrangements with local banks to finance short-time working capital requirements of the business?

FINANCIAL PLAN

1. Has a definite plan to finance the project been worked out?
   A. Is sufficient capital available locally?
   B. If not, what is the plan to obtain the required capital?

ECONOMIC FACTORS

1. How much foreign exchange (and in what currency) is required to import machinery, equipment and supplies:
    - A. How much foreign exchange (and in what currency) is required for annual interest payments and amortization of any loans contracted to import machinery and equipment, or for payment of royalties and technical services?
    - B. How much foreign exchange (and in what currency) is required for annual import of raw materials and supplies?
    - C. What are estimated annual foreign exchange earnings and in what currencies?
    - D. Has careful consideration been given to the possibility of depreciation in the foreign exchange value of the local currency?
    - E. Has careful consideration been given to the possibility of import controls, or restrictions on availabilities of foreign exchange necessary to operate the business?
    - F. What benefits would the new business bring to the economy in the use of local raw materials: in employment and in technology?
    - G. Do dependable facilities exist for transportation, power, fuel, water and sewage?
        - (1) If not, can existing deficiencies be eliminated satisfactorily?
        - (2) What would be the cost to do so?

PERSONNEL

1. Is there an adequate labor supply near the plant location?
    - A. If not, how can the problem be solved?

2. Can the problem of training competent management and supervisory personnel be solved?
    - A. Also, the training of skilled labor?
    - B. Is technical advice available in the locality?
    - C. If not, where can it be obtained and what will it cost?

LAWS AND REGULATIONS

1. Do existing labor laws, government regulations, laws and taxes favor establishment of new business?
    - A. If not, can existing obstacles be removed?
    - B. If so, how and when?

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TECHNICAL AND TRADE ASSOCIATIONS

Wire Association, 453 Main Street, Stamford, Connecticut

Copper & Brass Research Association, 420 Lexington Avenue, New York 17, New York

American Standards Association, Inc., 10 East 40th Street, New York 16, New York

American Society for Testing Materials, 1916 Race Street, Philadelphia, Pennsylvania