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**PLANT REQUIREMENTS  
FOR MANUFACTURE OF  
TWO-BURNER GAS PLATES**



**FOREIGN OPERATIONS  
ADMINISTRATION  
Washington, D. C.**



## FOREWORD

The purpose of this report is to present basic information for establishing and operating a small plant to manufacture two-burner gas plates in a country with a tropical or semi-tropical climate. The information includes general manufacturing methods, plant layout, and costs of materials, equipment and labor based on the assumptions contained in this report.

The plant described is considered to be the economic minimum in size which utilizes suitable equipment and methods. The product is simple in order that costs may be kept to a minimum.

As an essential preliminary, potential plant operators must determine whether or not there is a market for the two-burner gas plates. Naturally, they must be willing to assume the risks inherent in any business. The profits shown in the profit and loss statement are illustrative and depend upon market conditions, good management, and local factors.

For further information and assistance, readers should contact their local Productivity Center, Industrial Institute, Servicio, or United States Operations Mission.

This report is one of a series prepared for the Office of Industrial Resources of the FOREIGN OPERATIONS ADMINISTRATION by the Wolf Management Engineering Company, Chicago, Illinois.

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# PLANT REQUIREMENTS FOR MANUFACTURE OF TWO-BURNER GAS PLATES

## INTRODUCTION

For several years now there has been a marked change in the equipment used for cooking and other purposes in homes and places of business throughout the world. The fireplaces, stoves and other units used for cooking and which burn wood, coal, peat and other types of fuel are being supplanted by small, inexpensive, easily portable units called, in the United States, two-burner gas plates.

These new units, while they are dependent upon gas supplied by a pipe line or from small tanks of liquefied petroleum products, such as propane or butane, are so much more convenient and time-saving than the units previously used for cooking that the number of these small plates being used is increasing rapidly from year to year.

This sustained widespread increase in the use of these units means that there is a good, continuing market for their production.

The manufacture of these units fortunately requires relatively inexpensive equipment so that the total capital required is quite modest.

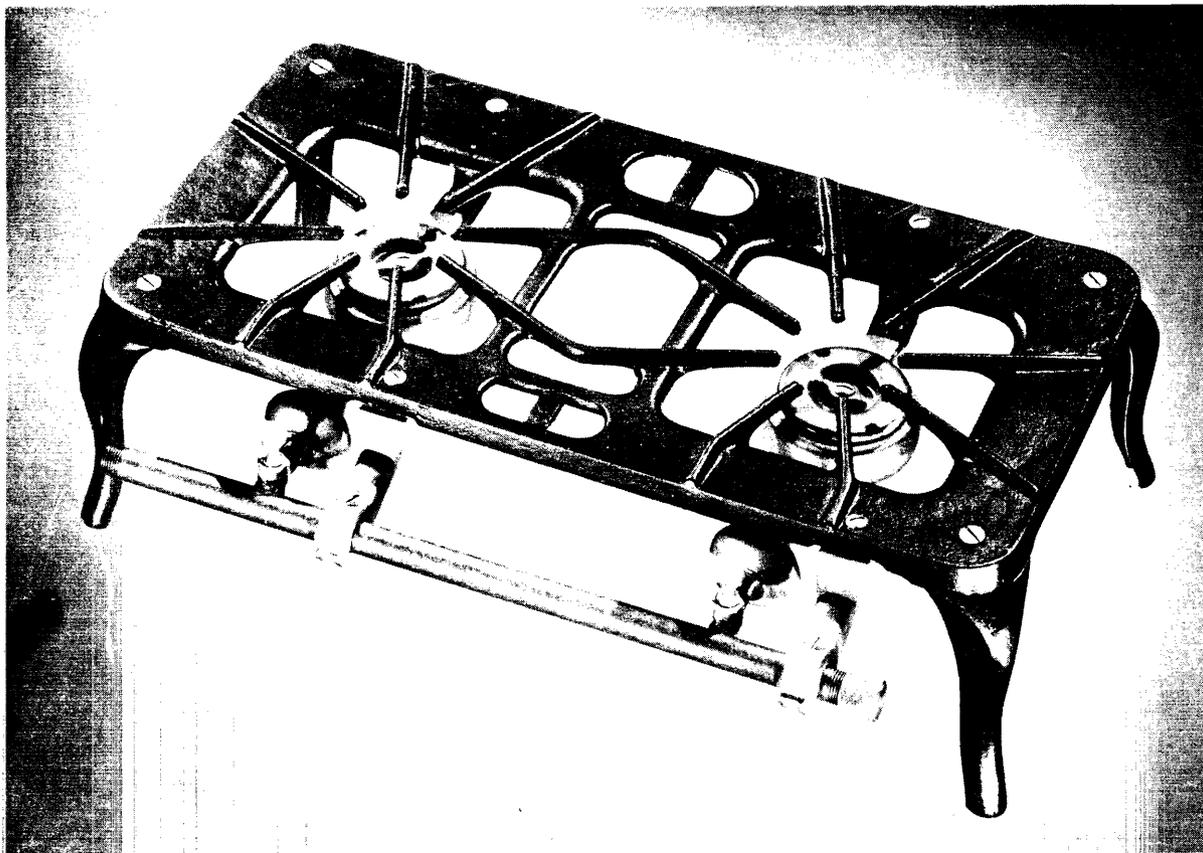


Figure 1 - ASSEMBLED TWO-BURNER PLATE

*BEST AVAILABLE COPY*

## GENERAL ASSUMPTIONS

In order to make realistic estimates, it has been necessary to use certain general assumptions. These are:

1. Costs are based on 1955 prices in the United States. Labor rates were determined by averaging going rates in plants engaged in operations similar to those proposed herein.
2. Adequate and suitable water, sewage, electrical, and transportation facilities are available at the plant site.
3. The plant will operate an average of eight hours per day, twenty-two days per month, or approximately 250 working days per year.
4. Labor saving devices which would increase investment in capital out of proportion to the corresponding reduction of unit costs have not been included in the equipment requirements.
5. The necessary materials are available in suitable quantity, quality, and at suitable prices.
6. The market is available or can be readily developed at reasonable costs.
7. The time for starting the proposed enterprise is favorable.

## THE MANUFACTURING PROCESS

Inasmuch as it is recommended that the parts are all to be purchased and the unit is to be shipped unassembled, the manufacturing process is very simple. The parts required and the work to be done on each piece are tabulated on the following page.

If the castings cannot be purchased in proper quantity, quality and at proper prices, it may be advisable for the manufacturer of the gas plates to also make the castings. In this event, the manufacturer should refer to the report in this series entitled Plant Requirements to Set Up and Operate a Gray Iron Jobbing Foundry.

Parts List  
Two-Burner Gas Plate

Item	Number Required	Dimensions	Material	Operations to be Performed
Plate	1	1/2" x 10" x 20"	Gray iron	Paint
Legs	4	5-1/2" long	" "	"
Back burner brackets	2	-	" "	"
Lower front brackets	2	-	" "	"
Upper front brackets	2	-	" "	"
Burner bases	2	-	" "	Drill & tap two 3/16-inch holes in each.
Burner top plates	2	-	" "	None
Pipe cap	1	-	Steel	None
Pipe	1	3/8" x 16"	Steel	Cut off; thread both ends; drill & tap two 1/8-inch holes.
Air adjustment plates	2	1/16" x 1-1/4" radius (90°)	Steel, galvanized	None
Burner valves, complete	2	1/8"	Brass; ceramic handle	None
Flat head stove bolts & nuts	4	1/4" x 3/4"	Steel	None
Oval head stove bolts & nuts	8	3/16" x 3/4"	"	"
Oval head stove bolts & nuts	2	3/16" x 1"	"	"
Oval head stove screws	2	3/16" x 1/4"	Steel, plated	"

Note: Weight of cast iron parts is approximately 13.5 pounds.

The steps of manufacturing are:

1. Paint bed, legs and brackets
  2. Drill and tap burner bases
  3. Cut, thread, drill and tap pipe
  4. Assemble valves to pipe
  5. Pack parts
1. The castings are to be made from the most inexpensive gray iron, it being necessary only to paint the bed, legs and brackets. This is to be done very simply by dipping a number of the pieces into the paint tank and hanging them on hooks to dry.
  2. The burner bases are each to be drilled and tapped for two 3/16-inch stove bolts (one hole for the top plate and one for the air adjustment plate). This will be done on a drill press which has a tapping attachment.
  3. The pipe is cut into 16-inch lengths on the power band saw, cutting as many at one time as the vise on the saw will hold. After the saw operator has clamped the material for one cut, he does other work until the cut is completed, at which time the saw automatically stops. The pipes are clamped individually in a pipe vise mounted on a post so that both ends may be threaded with a hand stock and die. In the event more units are to be produced than the contemplated 100 per day, it might be advisable to buy power-driven pipe-threading equipment.  
  
The pipes are then put into a fixture in the other drill press, and two holes are drilled for the gas valves. These holes are then tapped by a tapping attachment in the same drill press.
  4. The brass gas valves, which are bought complete with ceramic handles, are then screwed into the threaded holes in the pipe by means of a hand tool made like a speed wrench with a slotted sleeve to hold the valve while it is being attached to the pipe.
  5. The parts are wrapped in paper (old newspapers are used in the United States) in order to protect the painted surfaces, and then packed in individual cartons for storage or shipment. The bolts are grouped as required for each two-burner unit and packed in small paper bags.

#### MATERIAL REQUIREMENTS

The material requirements are very simple, since the castings are designed so as to simplify and minimize operations. The castings are to be made of gray iron, about 13.5 pounds per unit being required. At \$0.15 per pound, the castings cost per unit would be \$2.02. The core patterns and the match plates for molding, while owned by the producer of the gas plates, would be kept by the foundry making the castings.

For the reason that the manufacture of the brass valves requires much high-precision equipment if they are to be made inexpensively and much painstaking skilled labor if they are to be made by hand, it is recommended that they be bought complete. These valves, complete and ready to be attached to the pipe, would cost about \$0.30 each. In ordering them it will be necessary to specify whether they are to be used on liquefied petroleum gas (L. P.) or on artificial or natural gas because of the difference in the diameter of the orifices.

The pipe would be bought in 20-foot lengths and cut into 16-inch lengths, making 15 units with no waste.

The air adjustment plates would cost \$0.02 each. Two are required for each unit. The paint would cost approximately \$0.10 per unit.

The material costs, as tabulated, are:

Item	Cost	Cost Per Unit	Comparative Figures	
			Cost	Per Unit
Castings (13.5 lbs.)	\$0.18/lb.	\$ 2.02	_____	_____
Pipe and cap	-	0.11	_____	_____
Valves	0.30 each	0.60	_____	_____
Air adjustment plate	0.02	0.04	_____	_____
Paint	-	0.10	_____	_____
Bolts and nuts	-	0.05	_____	_____
Total cost of material, one unit:		\$ 2.92	_____	_____

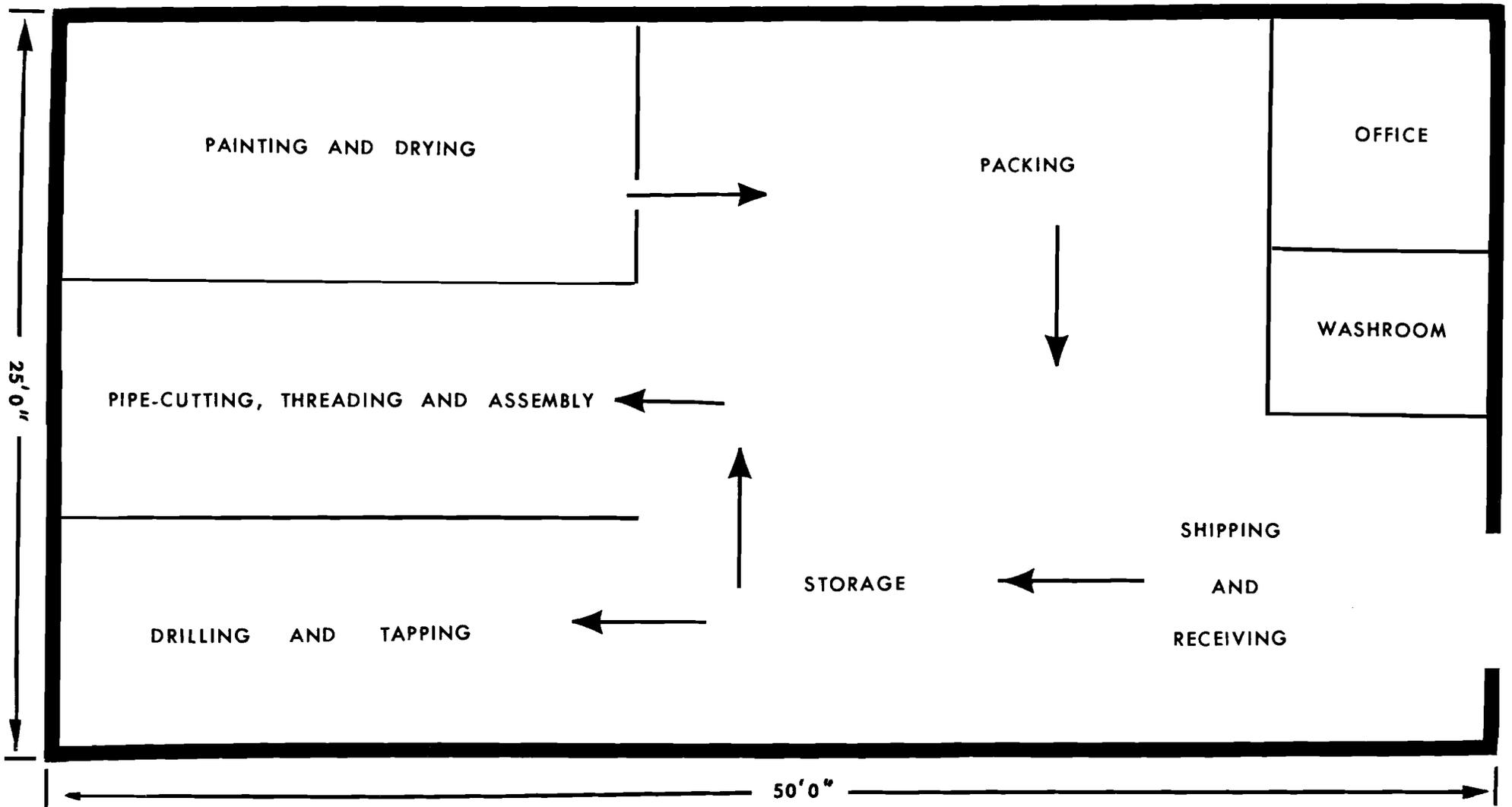
For a daily output of 100 units, the total material cost would be \$292.

### BUILDING REQUIREMENTS

For this enterprise, the building requirements are modest, it being necessary only to protect equipment, cartons and finished goods from the weather.

If the castings, valves, pipe and cartons are to be delivered frequently, and if finished units are to be picked up daily so that the storage area required is at a minimum, it should be possible to produce 100 units per eight-hour shift in a space 25 feet by 50 feet. These dimensions are only suggested. Any practical combination of dimensions would be satisfactory.

It would be advisable, in arranging for the building, to consider more space if large delivery quantities are more economical.



SCHEMATIC FLOW CHART AND LAYOUT FOR TWO-BURNER GAS PLATE PLANT

The paint tank and drying rack should be separated from the other space, at least by a substantial partition, in order to keep the temperature and humidity as uniform as possible and to keep any solvent fumes away from other manufacturing operations. Every precaution must be taken to prevent fire in the area where paint is kept and used.

At \$3.00 per square foot, it is estimated the cost of the building will be 25 feet X 50 feet X \$3.00 = \$3,750.00.

LABOR REQUIREMENTS

The labor requirements are likewise very modest. Only three unskilled workers and a working supervisor are required to produce 100 completed units daily. Each worker will necessarily be required to do a number of different tasks each day in order to keep busy and in order to get out the required production.

The working supervisor will also handle the shipping, payroll, purchasing and other office details, at least at the outset until there is economic justification for a change.

The three unskilled workers would be paid \$10.00 per day, and the supervisor, \$12.50 to \$15.00. Using the higher figure for the supervisor, the daily payroll would be \$45.00.

EQUIPMENT REQUIREMENTS

Item	Function	Cost	
		Estimated	Actual
Match plates and core patterns	For molds and cores (to be kept at foundry)	\$ 3,000	_____
2 Drill presses (bench-type)	To drill and tap burners and 3/8-inch pipe	225	_____
Band saw	To cut pipe to length	265	_____
Dip tank	For painting plate, legs, and brackets	150	_____
Drying rack	To hold painted parts while drying (homemade)	150	_____
3/8-inch stocks and dies	For threading pipe	90	_____

Item	Function	Cost	
		Estimated	Actual
Miscellaneous: drills, taps, vises, hand tools, etc.	For drilling and tapping	420	_____
Office equipment		100	_____
Total Equipment Requirements:		\$ 4,400	_____

OVERHEAD RATE

Item	Depreciation (Assuming no scrap value)			Estimated Yearly Depreciation	Actual Yearly Depreciation
	Estimated Cost	Actual Cost	Life (years)		
Building	\$ 3,750	_____	20	\$ 187.50	_____
Production tools and equipment	4,300	_____	10	430.00	_____
Office equipment	100	_____	10	10.00	_____
Total:	\$ 8,150	_____		\$ 627.50	_____

Overhead Expenses Per Month

	Estimated	Actual
Depreciation	\$ 52.27	_____
Indirect Labor	None	_____
Office Supplies	10.00	_____
Power, Light, Fuel, Water	50.00	_____
Insurance, Interest, Taxes	-	_____
Shipping Supplies, Miscellan- eous	75.00	_____
Total:	\$ 187.27	_____

$$\text{Overhead Rate} = \frac{\text{Monthly Overhead Expense } (\$187.27)}{\text{Monthly Direct Labor Hours } (704)}$$

Estimated Overhead Rate = \$0.266 Per Direct Labor Hour

$$\text{Actual Overhead Rate} = \frac{\text{Monthly Overhead Expense}}{\text{Monthly Direct Labor Hours}}$$

Actual Overhead Rate = \_\_\_\_\_

UNIT COST OF MANUFACTURE

	=	<u>Estimated Cost Per Unit</u>	<u>Actual Cost Per Unit</u>
<u>Direct Labor</u>			
$\frac{\$45 \text{ per day}}{100 \text{ units per day}}$	=	\$ 0.45	_____
<u>Materials</u>			
$\frac{\$292}{100}$	=	2.92	_____
<u>Overhead</u>			
$\frac{\$187.27 \text{ per month}}{100 \text{ units} \times 22 \text{ days}}$	=	$\frac{\$187.27}{2,200} = 0.08$	_____
Total Manufacturing Cost Per Unit:		\$ 3.45	_____

CAPITAL REQUIREMENTS

	<u>Working Capital</u>	<u>Estimated</u>	<u>Actual</u>
<u>Inventory:</u>			
Direct material (one month)		\$ 6,424	_____
Work-in-process (one day)		292	_____
Finished goods (one day)		292	_____
Total Inventory:		\$ 7,008	_____
<u>Operating Expenses for One Month:</u>			
Direct labor		\$ 990	_____
Indirect labor		None	_____
Power, Light, Fuel, Water		50	_____
Office Supplies		10	_____
Miscellaneous supplies		75	_____
Total Operating Expenses:		\$ 1,125	_____
Total Working Capital:		\$ 8,133	_____

Fixed Assets

	<u>Estimated</u>	<u>Actual</u>
Land	-	_____
Building	\$ 3,750	_____
Production tools and equipment	<u>4,400</u>	_____
Total Fixed Assets:	\$ 8,150	_____

Total Capital Requirements

Working capital	\$ 8,133	_____
Fixed assets	8,150	_____
Reserves (organizational expense, surveys, accounts receivable, necessary operating reserves)	<u>3,717</u>	_____
Total:	\$ 20,000	_____
	_____	_____

SALES REVENUE

The two-burner gas plate currently retails in the United States for \$7.00. The normal trade discounts would call for a manufacturer's price of \$5.00 per unit. At 100 units per day, the annual net sales revenue would total \$132,000.00.

PROJECTED PROFIT AND LOSS STATEMENT

	<u>Estimated</u>	<u>Actual</u>
Gross Sales Revenue	\$ 132,000	_____
Less: Returns and Allowances	-	_____
Net Sales:	<u>132,000</u>	_____
Less: Cost of Manufacture		
26,400 x \$3.45	<u>91,080</u>	_____
Gross Profit on Sales:	<u>40,920</u>	_____
Less: Distribution Expenses		
Commissions )		
Advertising ) 10% of		
Out Freight ) Sales		
Other )		
Total Distribution Expense	<u>13,200</u>	_____
Operating Profit:	<u>27,720</u>	_____
Less: Administrative Expenses		
(2% of Sales)	<u>2,640</u>	_____
Net Profit (before taxes, insurance, interest, and other undetermined expenses)	<u>\$ 25,080</u>	_____
	=====	=====

CONCLUSIONS

In any area in which the important factors are significantly similar to those herein presented, it would be quite advisable to establish a plant to manufacture two-burner gas plates.

Inasmuch as no finishing operations are contemplated for the cast iron parts, it would be advantageous to insist that the foundry supply only acceptable parts, in order to maintain satisfactory quality.

\* \* \*

Figure 2 - PARTS OF TWO-BURNER GAS PLATE

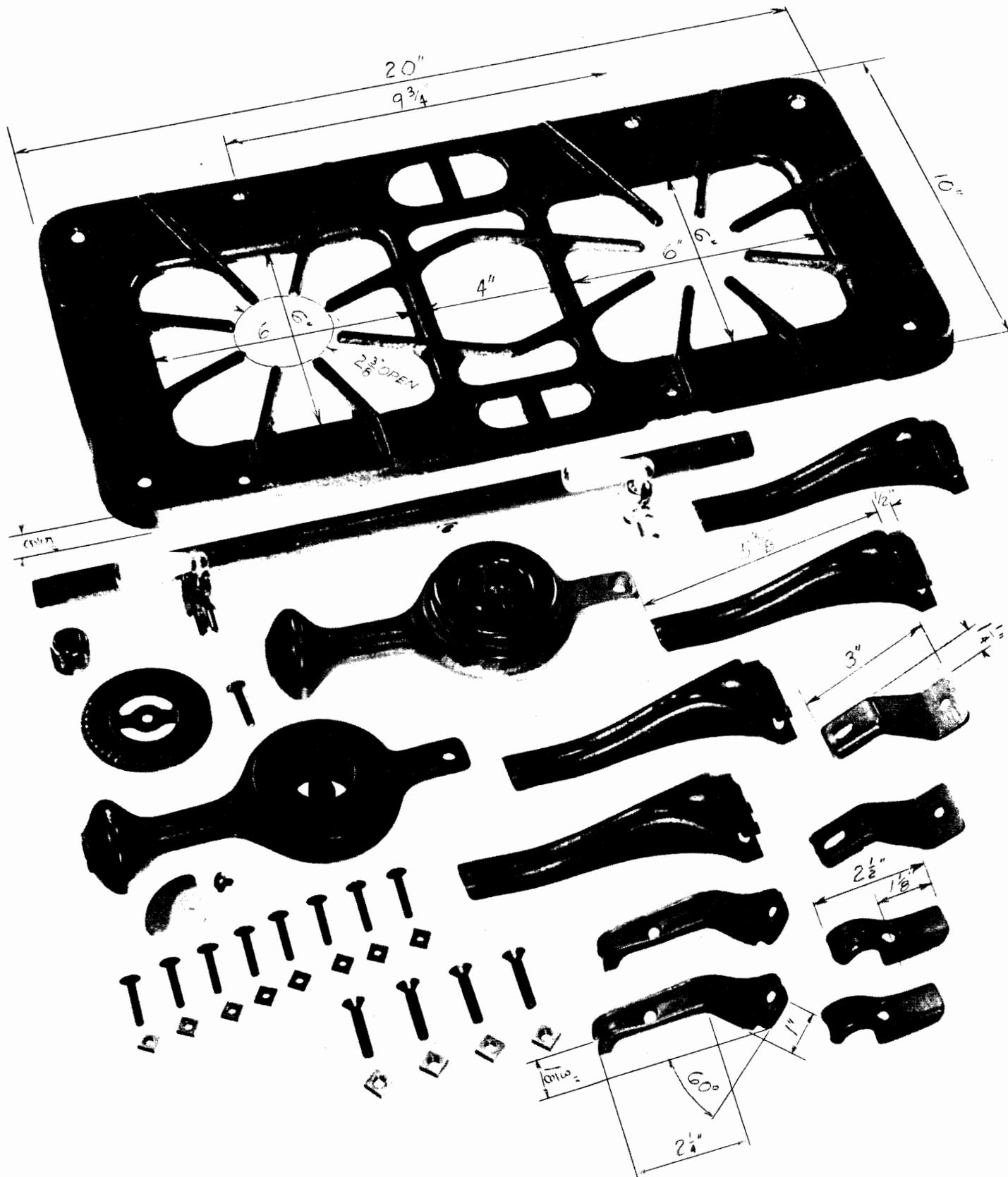


Figure 3 - DETAILS OF BURNER PARTS

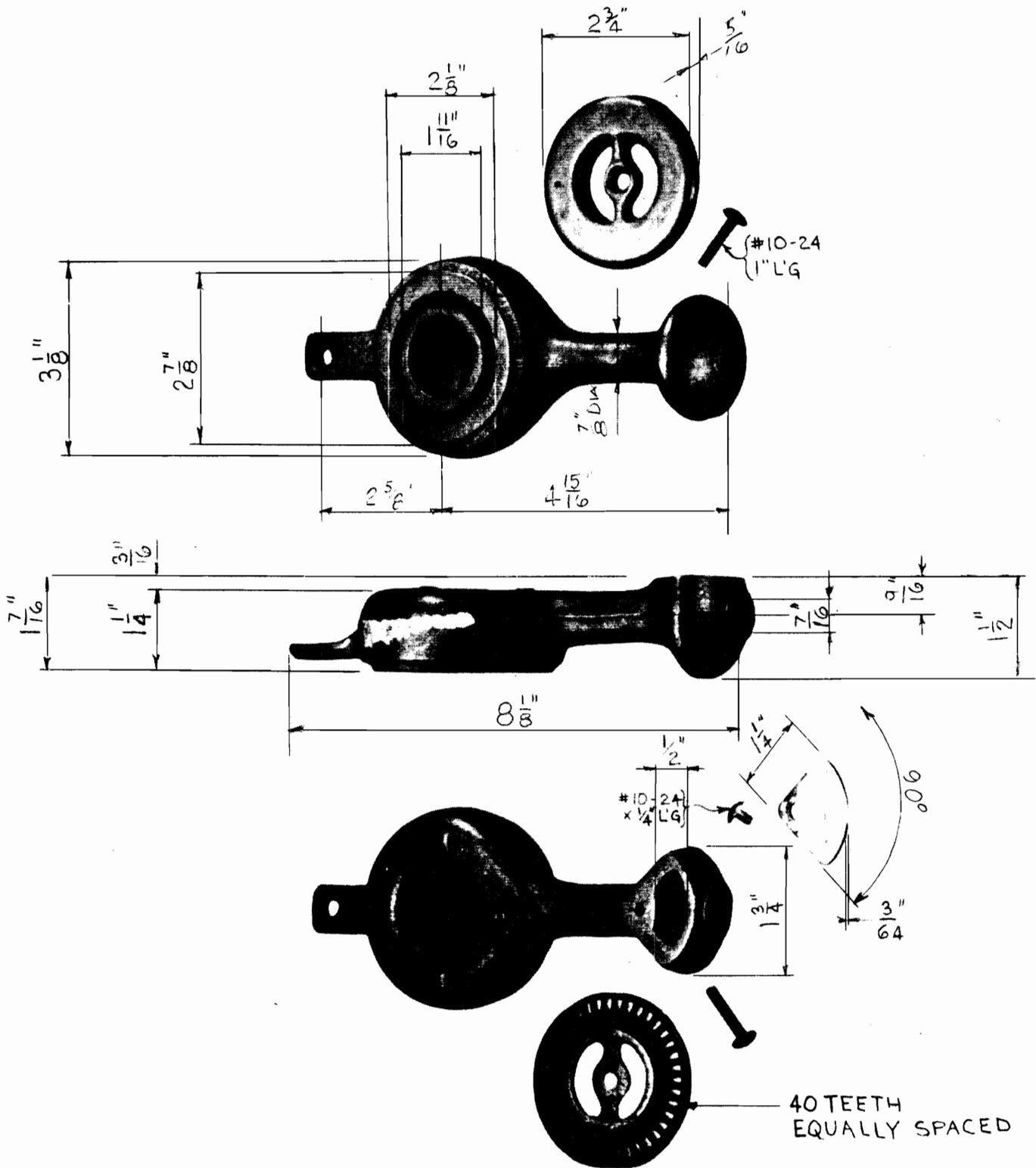
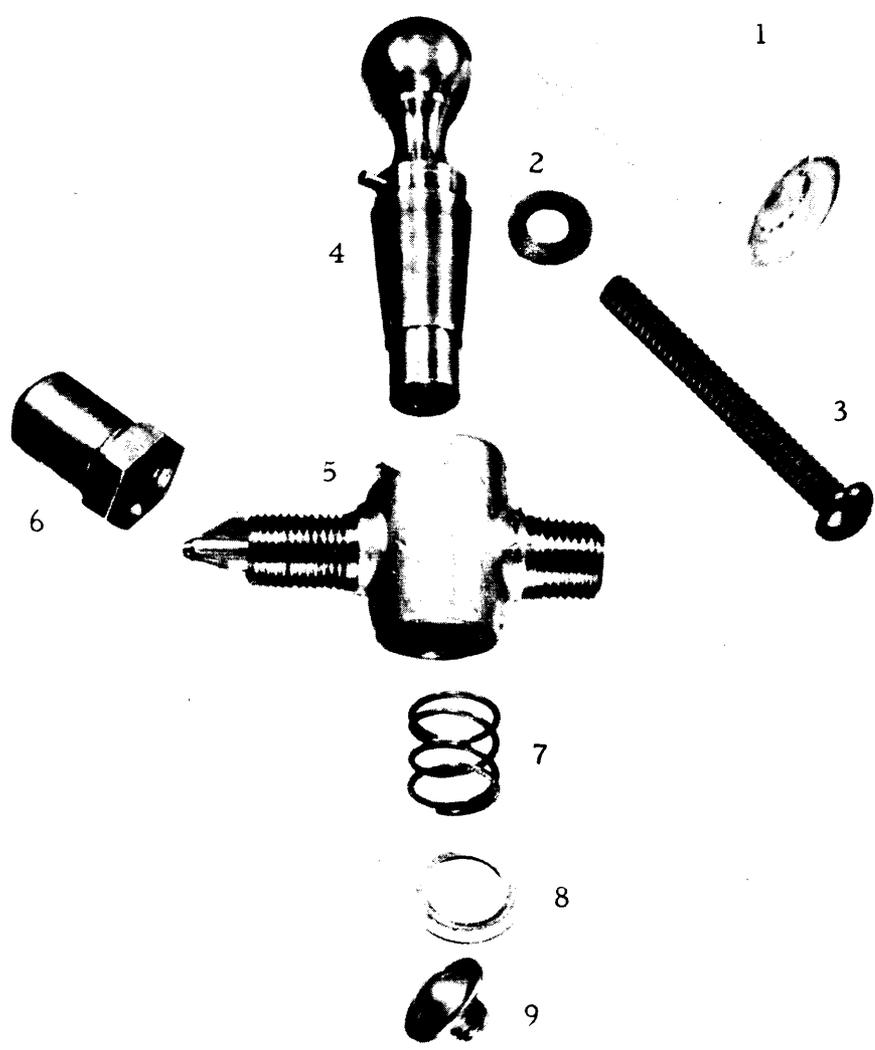


Figure 4 - GAS COCK PARTS



1. Ceramic handle
2. Washer
3. Handle screw (#10/24, 1-11/16 inches long)
4. Stem and stop pin
5. Body
6. Orifice
7. Spring
8. Washer
9. Retaining screw

PLANT REQUIREMENT REPORTS AVAILABLE

\*ABRASIVE WHEELS  
AGRICULTURAL TOOLS  
\*ANIMAL FEED PELLETS  
ASBESTOS - CEMENT SIDING  
BRASS FOUNDRY  
\*BUCKETS, PAILS AND PANS  
\*BUILDING BRICKS  
\*BUILDING HARDWARE  
\*CERAMIC DINNERWARE  
\*COARSE WRAPPING PAPER  
\*CONCRETE BLOCKS & SLABS FOR WALLS  
COOKING UTENSILS  
\*COTTON DRESSES  
COTTONSEED OIL  
\*FARM HAND TOOLS  
\*FERTILIZER MIXING  
FIBRE BOXES  
FINISHED LUMBER MFG. PLANT & TRAINING SCHOOL  
\*FLAT GLASS  
FOOD PRODUCTS (CAN & DEHYDRATE)  
\*GLASS CONTAINERS  
GRAY IRON JOBBING FOUNDRY  
\*JOB MACHINE SHOP  
KITCHEN EARTHENWARE  
LEATHER TANNING  
MEN'S HOSE  
MEN'S UNDERWEAR  
\*PAINT  
PAINT AND VARNISH BRUSHES  
\*PHOSPHATE PROCESSING  
PLASTICS MOLDING  
PUMP & WINDMILL HEAD UNITS  
\*REFINED SUGAR  
\*SANITARY WARE  
\*SHELL BUTTONS  
TERRY CLOTH  
TOILET & LAUNDRY SOAP  
TWO-BURNER GAS PLATES  
\*WALLBOARD  
WOOD TABLES & CHAIRS  
ZINC ALLOY DIE CASTING

*\*Reports soon to be available*