

SANDO SAN-JET SINGER

OPERATIONAL MANUAL



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<u>SUMMARY</u>	<u>PAGE</u>
1. Necessity of Singeing	1 - 5
Types of Singeing Machines	
Sando's Patented Singeing System	
Advantages of Using Cooling Water Rollers	
Features and Construction of Machine	
2. Positioning of Burners.	5 & 6
3. Cooling System.	7
4. Adjustment of Gas/Air Mix System.	7 & 8
5. Notes on Operation.	8 - 10
6. Maintenance Work.	10 & 11
7. Figure 1 - Nozzle Plates.	12
Figure 2 - Sectional View of Burner	13
Figure 3 - Fire Bricks.	14
Figure 4 - Gas/Air System (Singer).	15
Figure 5 - Burner Positioning	16
Figure 6 - Burner Clearance Adjustment.	17
Figure 7 - Face & Back or Face Singeing	18
Figure 8 - Water Cooling System	19
8. Troubleshooting	20 & 21
9. Gas Comparison Table (Appendix 1)	22
10. Gases Used For Singeing (Appendix 2).	23
11. Singer Setting For Various Fabrics (Appendix 3)	24

A) Necessity of Singeing

Singeing is a finishing process which removes (burns off) protruding fibers or fuzz from fabric by passing the fabric over gas flames to enable a neat and smooth surface in appearance and to the touch.

Fabrics made of synthetic filaments yarn need no singeing, in the manner described above.

Most synthetic fibers, however, are used in staple form like cotton, wool, etc. The fabrics made of spun yarns (natural and synthetic) cannot avoid such protruding fibers or fuzz which produce a fuzzy fabric surface.

Accordingly, the singeing process is required for fabrics made of spun yarns (natural and synthetic) to burn off protruding fibers and fuzz on both sides of the fabric.

- a) Singeing gives fabric a high quality surface and the singed goods allows de-sizing, scouring and bleaching agents to easily penetrate into the fabric.
- b) Washing effect is increased for the same reason.
- c) Dyeing effect is increased thanks to high affinity of singed fabric for dyes.
- d) When singeing dyed synthetic fabrics, it can provide a beautiful gloss (luster) to them and ensure an increased color effect.

It is understood that the singeing process, the first process for fabric finishing, has a vitally important effect on the following finishing processes. Unless the singeing process is executed well, particularly the working condition of the burners, then all the subsequent processes will be greatly affected, finally preventing high quality fabrics and high production efficiency.

B) Types of Singeing Machines

Two types of singeing machines are available, choice depending upon the object of their use, namely for woven fabrics or knitted fabrics. The machines for knit goods are further subclassified into those for circular knit goods and those usable for both circular knit goods and open-width of plain knitted fabrics. Sando's San-Jet Singer is adequate for all these applications.

C) Sando's Patented Singeing System

Sando's patented singeing system is a combination of cooling water rollers and the Sanjet burners between which fabric is passed to burn off projecting fibers and fuzz. (Figures 5, 6, and 7).

1) Advantages of using cooling water rollers .

- a) Since fabric can be singed without increasing its temperature, thanks to the cooling water rollers, the fabric hand and appearance are not reduced.
- b) Singeing can be carried out at the full width of fabric, free from cloth flapping, due to the support of the cooling rolls.
- c) Singeing can be executed at even places without any creases on the fabric surface.
- d) It is possible to do singeing without any fear of flame passing through the fabric.
- e) Since the water cooling rollers are circular, the fabric passing over them is curved along the rollers, so that the protruding fibers and fuzz at the curved places can be singed effectively.
- f) Thin fabrics, such as laces and lawn fabrics, can be singed without any fear of damages since burner flames are erupted in a tangent contact line as illustrated in Figure 5, so that all the fuzz on the fabric surface and inside the fabric can be burnt off to provide a smooth fabric surface.

2) Advantages of Sanjet burners by Sando.

- a) Since fabric is singed with an even and perfect combustion flame, there is no risk of unsinged fuzz or uneven singeing.
- b) All the fuzz can be burnt off at their root and flown out, there is no fear of pilling or that carbons will be adhered.

Features and Construction of the Machine

Sanjet Burners

1) Features

There has been a rapid progress in the development of synthetic fibers over the last few years, and keeping in step with it, dyeing and finishing machines to process them have been improved or developed. As a matter of fact, there has been increasing demand for high performance of improved singeing machines used as the first of the finishing processes which has a vitally important effect on the succeeding processes, as well as after dyeing.

The existing ribbon type burners can be used with almost no problems to singe cotton fabrics. But synthetic fiber fabrics are very susceptible to heat. Such ribbon type burners may cause uneven flame resulting in uneven singeing, streaks, etc.

In case of singeing synthetic fabrics by the ribbon type burners, there is a risk that fabric temperature may rise excessively and great temperature differences are caused in the flames, resulting in quality degradation, color deterioration, uneven dyeing and pilling, poor singeing.

To solve these problems, the Sanjet burners have been developed through our extensive research into the technology of singeing.

- 1) Even flames are ensured along the full working width.
- 2) Since fuzz are burnt off at their root and singed fuzz are flown out, the possibility of pilling will be reduced and no adhesion of carbons of burnt-off fuzz will remain on the fabric surface.
- 3) Perfect combustion gas temperatures can be adjusted at will according to the characteristics of the fabric being processed. The most suitable gas flame temperature can be ensured within the range of 300 - 1,100 degrees Celsius which are temperatures deemed suitable for synthetic fabrics.
- 4) High performance can be maintained with less gas consumption than the conventional burners, very economical.
- 5) All the fuzz can be singed without increasing cloth temperature.
- 6) As the fabric passing over the burners is not flapped and there are no creases along the full cloth width, completely even singeing will be ensured from side to side.

2. Construction

Sanjet burners are constructed as illustrated in Figures 1 to 3. Each burner consists of a main body and a nozzle. The burner is retained by the journals and bearings. A bracket for moving burner in and out of position is provided with its pneumatic cylinder. (See Figure 5)

Burner Nozzle

The nozzle part of each burner is built up of thousands of precision-shaped steel plates of 0.8mm in thickness as illustrated in Figure 1. These steel plates are manufactured in two different shapes allowing a staggered opening in each plate, and are assembled alternately. After being assembled, they are tightened by bolts and made smooth by the use of a planer and further polished and finished.

The nozzle is fitted in the burner's main body as illustrated in Figures 1 to 2. The construction of the nozzle, with the staggered opening on each of the plates, forms two rows of flame eruption outlets on the surface of the nozzle, now fitted in the burner. This is particularly featured by the Sanjet burner nozzles.

3. Burner's Main Body

Two rows of fire-bricks are mounted on the nozzle to provide a combustion chamber and a flame eruption slit (See Figure 2 and 3 Cross-sectional view of a burner).

Since the flame in the combustion chamber is blown against both inside walls of the fire bricks in a short time, the bricks are heated to ensure a 100% perfect combustion.

Two cooling water paths in the burner prevent deformation of the main body itself, due to the heating of the fire bricks, and avoid troubles due to the increased temperature of mixed gas and the change of the combustion condition due to temperature variations.

The capacity of the cooling water paths is 5 - 15 ℓ /min and the water temperature at their drain side shall be adjusted to 30 degrees Celsius to 40 degrees Celsius.

4. Fire Bricks

Fire bricks mounted on the nozzle are made of special fire proof material. This material has been selected rigidly from among a good many different fire-proof furnace materials after actual use testings for a few years.

a) Fire bricks are arranged in such a way that the joining of two bricks on one side corresponds to the center of a brick on the opposite side. (As illustrated in Figure 3.) Slit space (clearance) between the right and left rows of fire bricks shall be checked by the use of a slit gauge and then fitted.

b) Fitting bolts for fire bricks shall be tightened under a constant pressure, and their tightening should stop immediately before pressure washer is completely flat. This is to avoid fire bricks to become cracked or damaged.

c) Fill fire proof mortar in the space M between fire bricks connected as illustrated in Figure 6. However, be sure never to fill the material in the space A at the slit side of the fire bricks. (Inside Flame).

d) Check the fire bricks before starting daily operation of the machine. If there is anything wrong with their alignment as illustrated in Figure 3, correct it or replace the problem fire brick with a new one. Always locate new brick at the end of burner, moving all the used bricks towards the center.

e) Cleaning of the fire bricks shall be made by the use of a compressor (more than 5kg/cm²). This time, air is blown against the fire bricks at an angle of 45 degrees with the maximum air pressure of the mixers, keeping the singer turboblower running, avoiding particles to fall inside of burner.

f) Water shall by no means be used for cleaning the fire bricks. This is because there is a risk that the hot fire bricks are damaged due to their heat swelling.

g) Whenever fire bricks are fitted, replaced or adjusted, you must be most careful so that they may not be damaged at their joints and angular edges.

h) About three months after your operation of the machine, you can get a sense of assessing the condition of gas flame. If there is anything wrong with the gas flame, you shall hasten to check and take a proper counter-measure to correct it.

i) After the use of the machine, you may find out there are openings between bricks, but it is free from care. Because the openings will be lost after the fire bricks are re-heated. But if the openings are too wide after reheating and the flame is affected, then the bricks shall be adjusted.

j) Even if the openings take place at the joints, never use mortar to refill it. This is because there is a risk that the mortar will filter to the inside of the fire bricks at the slit sides. The angular edges of the bricks will be damaged due to their swelling and produce an imperfect flame.

Mortar For Fire Bricks - See Figure 3.

- a. The mortar shall be made after mixing fire brick powder and water at ratio of 3:1.
- b. The mortar shall be painted to get a smooth surface.
- c. The painted mortar is left as it is for several hours (Approx. 5-6 hours) until it is dried up. Do not heat the burners for that period.
- d. When it is urgent to use the machine, the powder may be mixed with slightly less water.

Optional Brush Box

- a. The following are available as optional equipment:
 - 6-brush roller brush box ... 150 ϕ x 6 rollers
 - 4-brush roller brush box ... 200 ϕ x 4 rollers
- b. A brush box which allows these brush rollers to be position-adjusted by one handle is also available as optional equipment.

Positioning of Burners - See Figure 5

- a. Air pressure for burners position shall be 3.0 - 4.0 kg/cm². (Air source: 3/8 BGP, air pressure 5kg/cm²)
- b. Position angle shall be adjusted by changing angle pieces as illustrated in Figure 5. The angle pieces shall be changed according to the type of fabric being processed. Refer to Figures 5, 6 and 7).

- c. Burners are positioned from the ignition position to the singeing position automatically when the cloth speed has reached about 50m/min. (The position timing can be adjusted by altering a timer in the panel box or a running relay)
- d. The speed controller shall be adjusted so that the burners may not hit on the stoppers strongly when positioned.
- e. The change to the ignition position is carried out quickly after exhausting the air through the quick exhaustion valve.
- f. If it is required to test electro-magnetic valves (or the burners position test), the top bolts shall be removed and the head buttons of the valves be pressed to let the valves work. Release the finger touch and they will return.

Singeings on the same surface of the fabric with the two burners

A stationary lower roll and an upper roll are introduced. The upper roll uses the burner shaft as its support. The upper roll is raised to the specified position as illustrated in Figure 7 and then fixed by set screws.

When the upper roller is not in use, it must be lowered near to the burner return pipe. This is because there is a risk that the remnant heat of the secondary burner flame is mixed with the increasing heat of the first burner flame to cause the upper roller to be curved due to heating, resulting in roller mal-centering.

Pre-heating Cylinder (When coming from Japan)

- a. The operating steam pressure of the pre-heating cylinder is 2kg/cm² in maximum. It shall not be exceeded.
- b. Before using the pre-heating cylinder, be sure to exhaust the drain and then charge steam into the cylinder.
- c. Since the safety valve is adjusted to 1.9kg/cm², check whether the safety valve is working by referring to the pressure gauge.
- d. Check whether the steam trap is working by referring to the tester.
- e. If the supplied steam pressure is too high, use a reducing valve to make the pressure less than 2kg/cm².
- f. Be sure never to run the machine without steam. This is because there is a risk that the carbon part of the rotary joint will be worn out earlier and the steam will be leaked.

Cooling Water Supply for Burners and Cooling Rolls

- a. Before operating the machine, be sure to open the water supply valve and adjust the drain volume by the use of the drain valve. If the drain volume is not proper, adjust it by the valve.
- b. The opening degrees of respective valves and water volumes are listed below. (Hydraulic pressure is recommended to be 2kg/cm².)

Section	Open Rate of valve	Volume of water	Temperature of drain
Cooling water roller	1/4 turn	2-4 ℓ/min (0.53-1.06 gal/min)	50-55°C (122-131°F)
Gas Burner	1-2 turns	10-20ℓ/min (2.64-5.28 gal/min)	35-45°C (95-113°F)
Cooling Cylinder	1/2-1 turn	6-10ℓ/min (1.59-2.64 gal/min)	less than 30°C (86°F)

Temperature of water to the cooling water roller shall be adjusted by a water flowmeter. (For Knits, 60-70°C) (140-158°F). (See Figure 8)

- c. If the cooling water roller is cooled excessively, there will be dew drops which, in the case of thin fabrics, will cause remnant fuzz due to wetted selvages.
- d. If there are dew drops, then cotton dust and carbons will be prone to remain in fabric. It can also stain the goods.

Adjustment of Gas/Air Mix System

The whole system is designed so that the flame is automatically adjusted by changing air settings only.

The components of the system are:

1. Gas Train
2. Turboblower for air with butterfly valve.
3. Main gas and air piping with manual micrometers, gauges and mixer. (See Figure No. 4)
4. Pilots and flame detectors.

A. Establishing A Flame

In order to establish a sound flame, the following conditions must exist:

1. Gas pressure on gas gauge prior to the micrometers must be at 280 mm/AQ (for natural gas). This pressure is obtained by adjusting the reducing valve of the gas train.

2. Burners should be in the ignition position.
3. When burners are in an ignition position, air pressure shown on gauges prior to micrometers should be at 60 or 80 mm/AQ. This pressure is obtained by adjusting the butterfly valve of the turboblower.
4. Set gas micrometer until flame adopts an open fan shape (✓). Once flame holds this shape without any flame movement, it is a good flame.
5. Once the burner is moved from an ignition position into a singeing position, you can adjust the air by means of the air micrometers, to the desired flame.

Notes on Operation

- 1) When you are doubtful of your singeing results, you can stop the machine temporarily and check the results. Then re-run the cloth.
- 2) While the machine is temporarily stopped, the flames will not be shut-off with the burners in the ignition position, so that you can re-start under the same setting conditions previously set in the unit.
- 3) If the machine is stopped with an emergency stop, burners will automatically move to an ignition position and the flames will be extinguished. The fire bricks must be cooled, which means that it is necessary to keep the water for cooling the burner and those on the cooling rollers running, as well as the air turboblower, allowing the bricks to cool down gradually.
- 4) When the machine is temporarily stopped the cloth stops accordingly. If the brush rollers continue to run, there is a risk that the cloth will be damaged. Switch off the main motor and the brush rollers will be stopped.
- 5) If you are required to thread up the unit, or add a piece to the cloth being processed, it shall be sewn together, not tying knots which will damage the bricks when passing between cooling roller and burner.
- 6) The most important feature of the Sanjet burners is that even if the gas amount is decreased, the flames are not extinguished, keeping heated air or a semi-heated air to singe the fuzz. So, the flame eruption is strong enough to get into the air layer covering the running cloth, and all the fuzz in and on the fabric can be singed.
- 7) When synthetic fiber fabrics are processed by the Sanjet burners, singeing tests shall be carried out and then, based on the data obtained, actual singeing shall be made, reminding yourself of the feature of Sanjet burners stated in item 6.

- 8) In the Singeing tests, at least three sorts of singeing should be tested, "light", "medium", and "heavy singeing". The data shall be prepared by checking the upper and lower limits of flame power in case of various types of air pressures, cloth speeds and fabrics. It will save considerable amount of time if you use the blanket type of trial, where different types of fabrics are sewn together in a continuous strand.
- 9) Bearing in mind the upper and lower limits of flame power for each type of cloth, the running-in operation shall be made for the period of 3 to 4 months with weak flame near the lower limit of the flames strength (power). If the machine is operated with strong flames with insufficient running-in period, there is a risk of burn damages of the machine components.
- 10) The temperature of the drain water for cooling burners and cooling rollers must be measured and adjusted from time to time by using a thermometer. (See Figure 8)
 - a) Knit Singer:
570mm ϕ (22.4" ϕ) water cooling cylinders for singeing: 2 cylinders 60-70°C (140°-158°F)
 - b) Woven Singer:
150mm ϕ (5.9" ϕ) Water cooling rollers 50-55°C (120°-131°F)
 - c) Knit or Woven Singers:
Sanjet burners 35-45°C (95°-113°F)
- 11) If the cooling rollers are excessively cool dew drops will generate. This also applies to the burners. There is a risk that these dew drops fall on the running cloth and soil it.
- 12) On the contrary, if the water for burners or cooling rollers is excessively hot, the water within the burners and the rollers will be turned into steam. The steam pressure is higher than the pressure for water supply, pushing back the supply water and the units will be heated gradually and force to bend or warp. To prevent this trouble, be sure to adjust the supplied water amount and measure the temperature of drained water.
- 13) After stopping the singer, to cool the fire bricks and burners, the turboblower should stay on and water supply should continue for 10-15 minutes.
- 14) Be sure never to sprinkle water over the fire bricks.
- 15) In case of singeing wide cloth, full length of flame is given along the full length of each burner. In case of medium wide cloth, adjust the flame width by the cut manual valves under the burner, leaving the flame slightly wider than the actual width of cloth.

- 16) If you find flame irregularities along the burner working width, or flame lifting(s) at the end(s) of the working width, adjust the cut valves by loosening or tightening them a little bit.
- 17) A cut valve cuts 125mm of the flame width and the right and left cut valves cut 250mm. There are several types in terms of number of cut valves, for example

Full opening of cut valve	(Full Burner)mm
One cut valve at each side, total 2	1,300 mm
Two at each side, total 4	1,500 mm
Three at each side, total 6	1,650 mm
Four at each side, total 8	1,800 mm
Five at each side, total 10	2,000 mm

- 18) If the flame working width is narrowed by the cut valves, the working nozzle area will be reduced by the cut width. The eruption speed of mixed gas from the nozzle will be sped up and become stronger. In this event, there is a risk of over singeing or burning of the cloth. It is necessary to reduce the air pressure. In this case, reduce the air pressure by the reduced percentage of the nozzle width, a singeing test should be carried out to obtain a suitable data for actual singeing and new setting of air pressure.
- 19) Though singeing tests were briefly explained in item 7 and 8, it is suggested that different types of cloths be cut by 0.5 linear meter in length and sewn together to form a continuous strand. Make a few continuous strands with identical fabrics to run singeing tests on these samples under different conditions, to enable the data for each type of cloth to be obtained quicker. The singeing tests are by all means necessary.
20. Leader cloth and a new cloth shall not be knotted together. Since the clearance between cooling water roller and the burner is set to about 10mm, the fire bricks will be damaged. Be sure to seam together by using a sewing machine.
- 21) A vinyl sheet soft head is provided (See Figure 4) to prevent the burner flame from backfiring. Since the vinyl sheet will be hardened after a long use, be sure to check it at the time of each monthly machine check up. Even if condition of vinyl sheet is not bad, replace it every year.

Maintenance Work

As routine work after the day's final operation of the machine, follow these check points:

- 1) Check whether all the switches are turned off.
- 2) Check whether the gas cock is stopped.
- 3) Check whether gas source is stopped.
- 4) Clean the fire extinguishing trough and mangles.
- 5) Clean the carbon contaminated cooling water rollers.

- 6) Clean the brush rollers and brushing box.
- 7) Clean each part of the machine and its surroundings.
- 8) Check whether water source valve is stopped.
- 9) Prepare the fabrics being processed in the following day.

Every week-end Checking List:

- 1) Execute every week-end checking and adjustment.
- 2) Check the fire bricks arrangement of each burner.
- 3) Replenish oil to each part excluding the ball bearing parts.
(Particularly, burner shafts)
- 4) Clean all the parts of machine.

Every Month's Fine Checking and Adjustment

- 1) Check whether there is anything wrong with any component of the machine. If there is any trouble, adjust it completely.
- 2) Check and adjust the fire bricks and make remedy for the mortar part.
- 3) Supply oil to the burner bearing parts, reversing device and other parts.
- 4) Give grease to the periphery of the ball bearing part.
- 5) Clean outside and inside of the machine on a large scale.

FIGURE 1

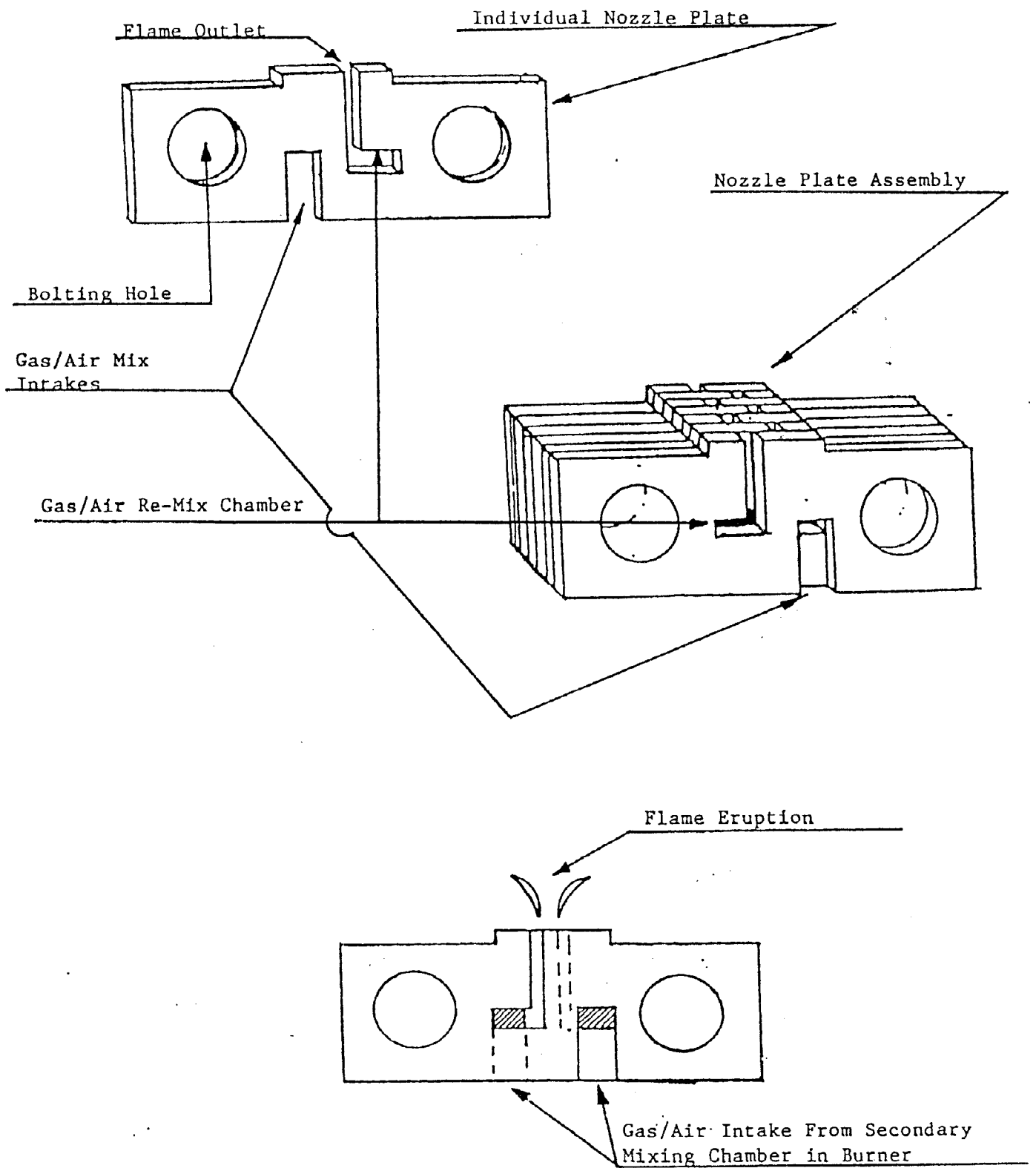


FIGURE 2.

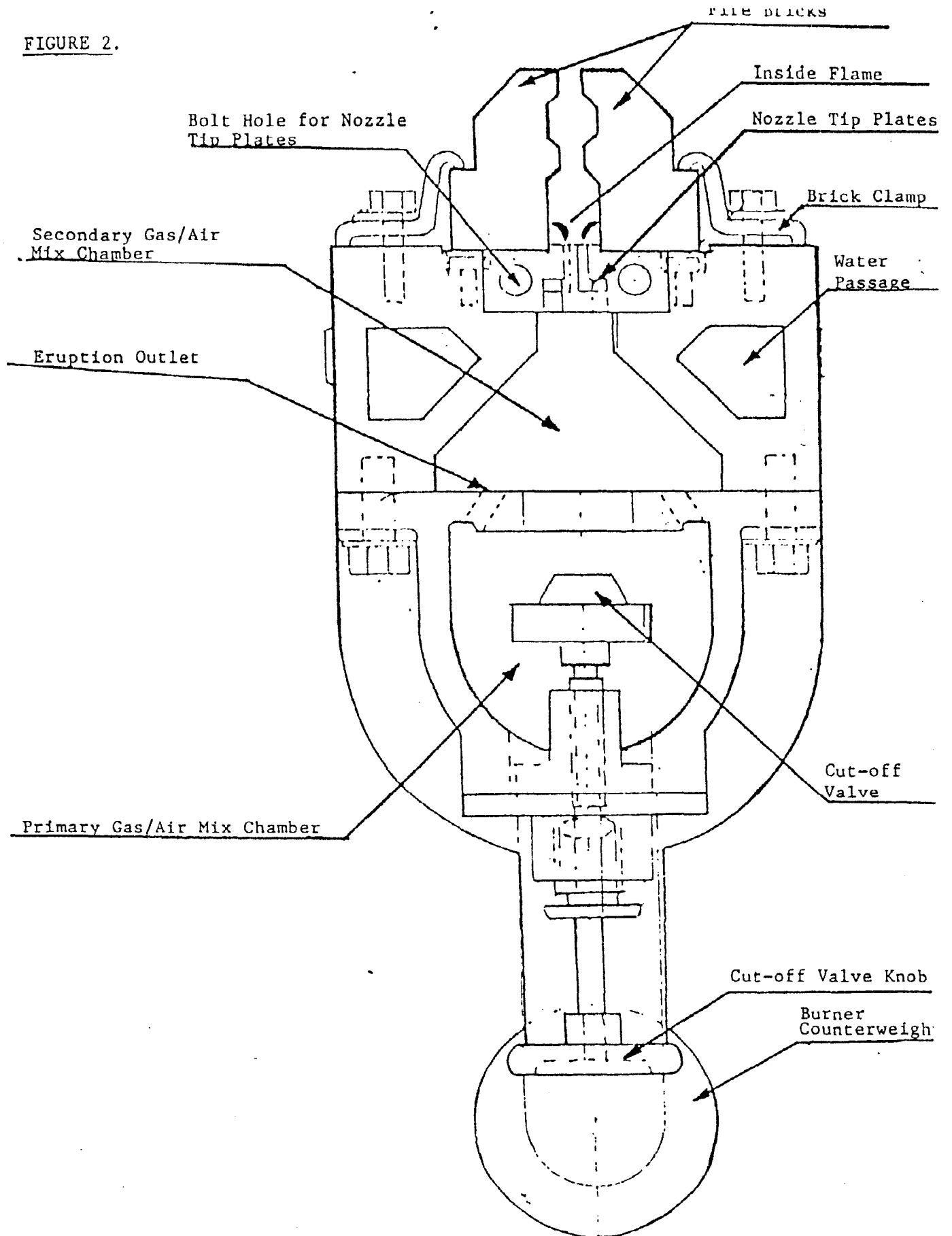


FIGURE 3

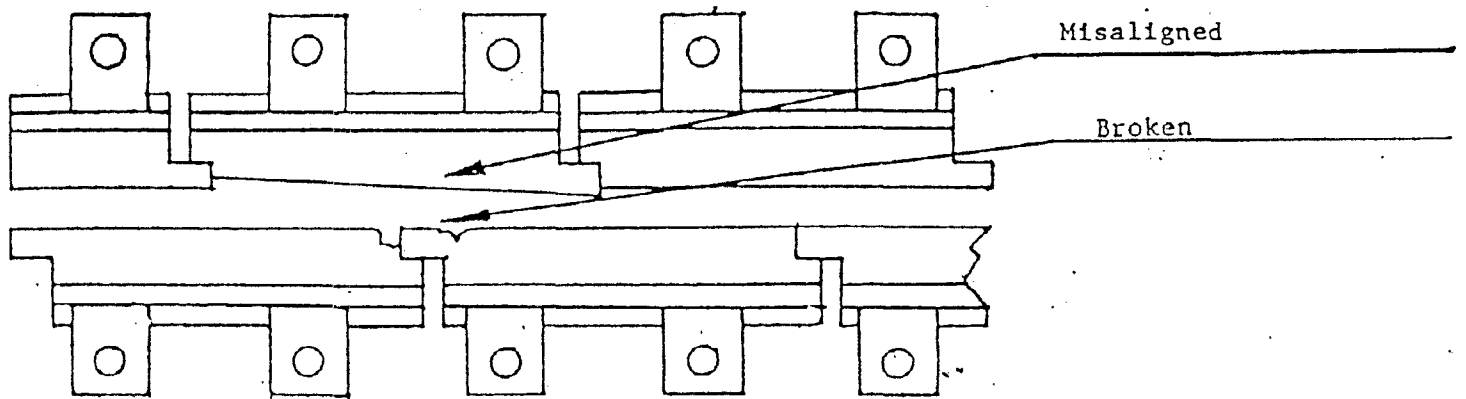
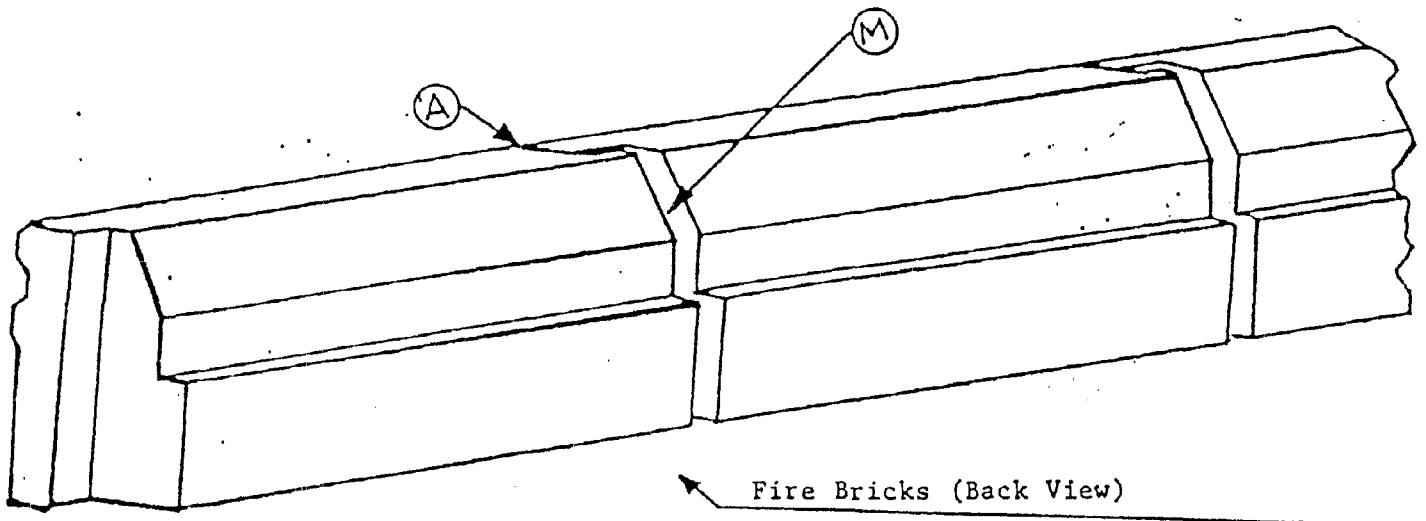
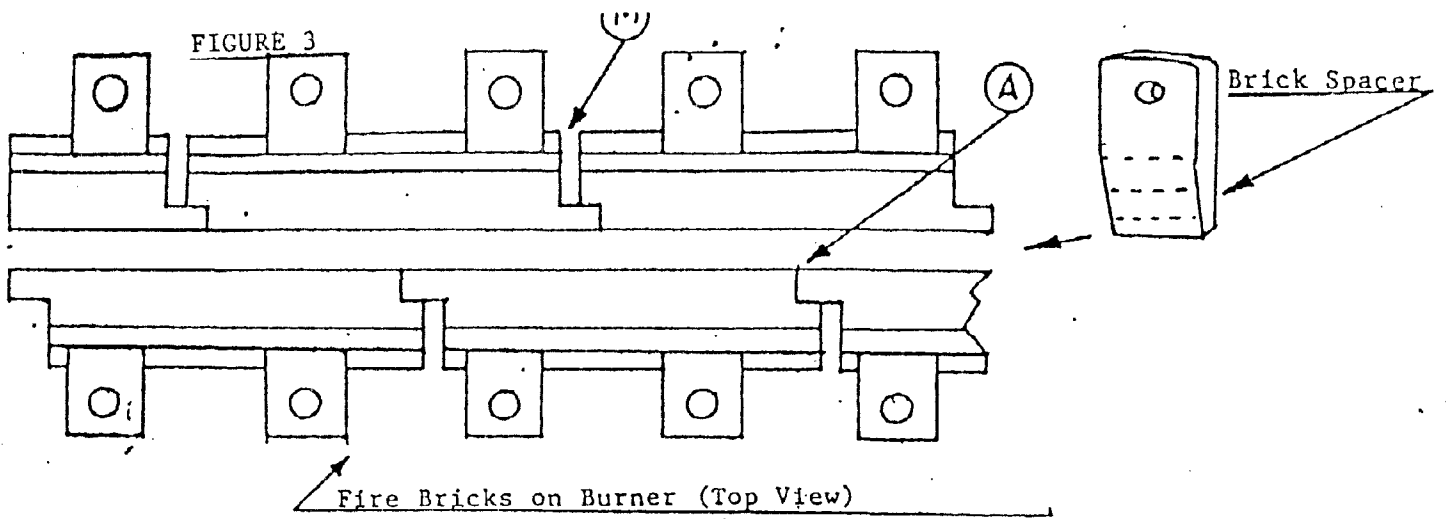


FIGURE 4.

SANDO'S SAN-JET SINGER - GAS/AIR SYSTEM

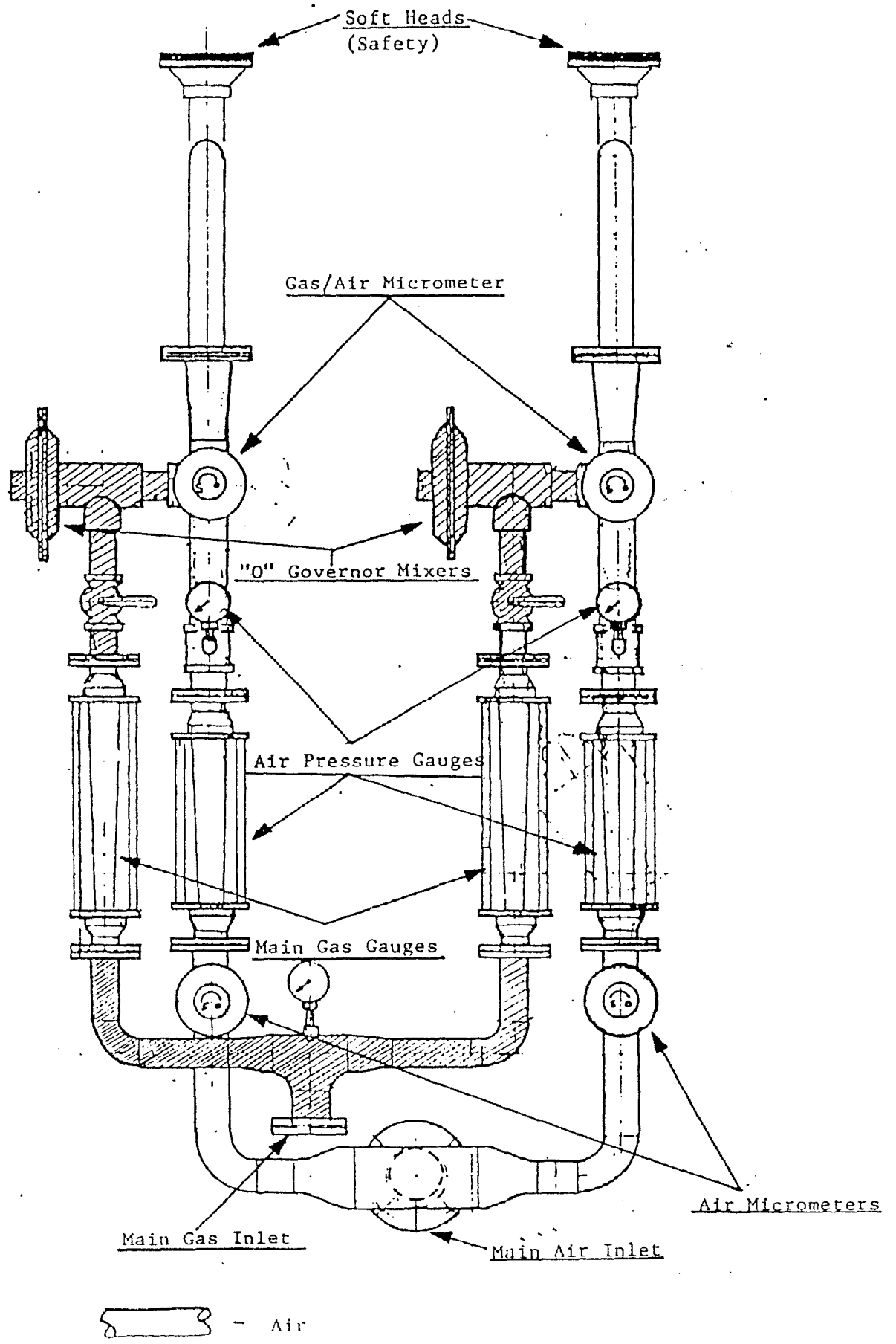


FIGURE 5.

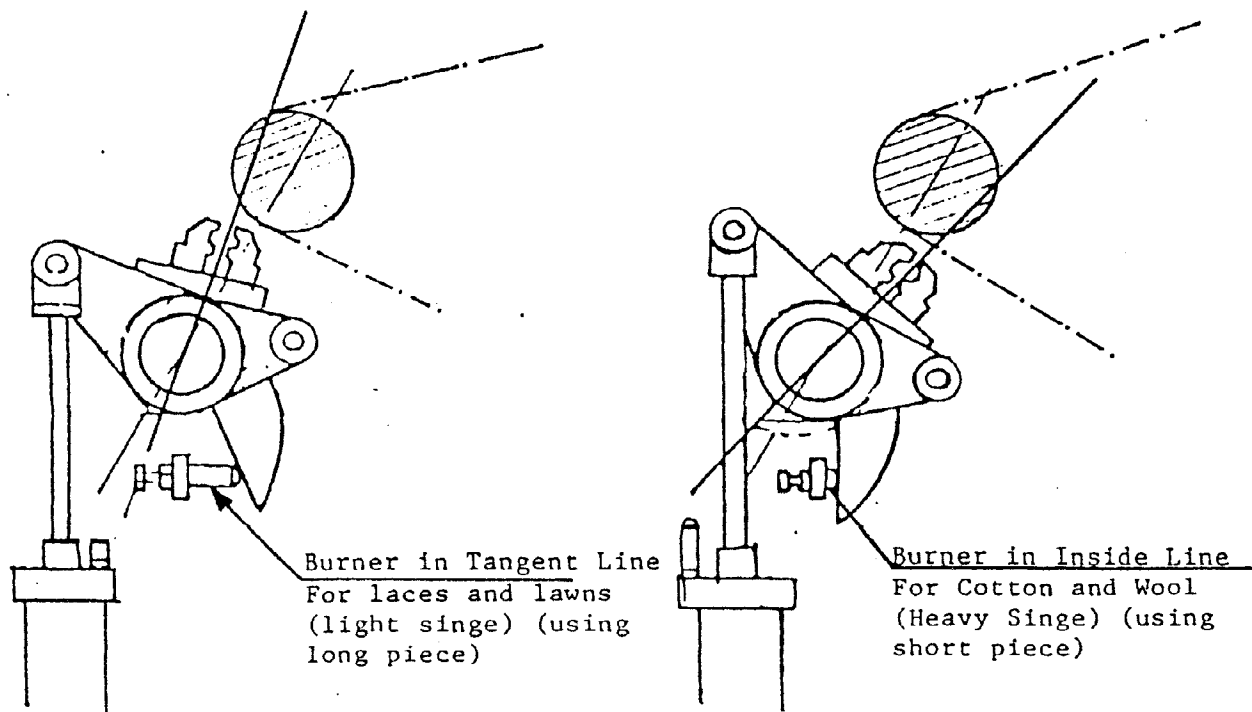
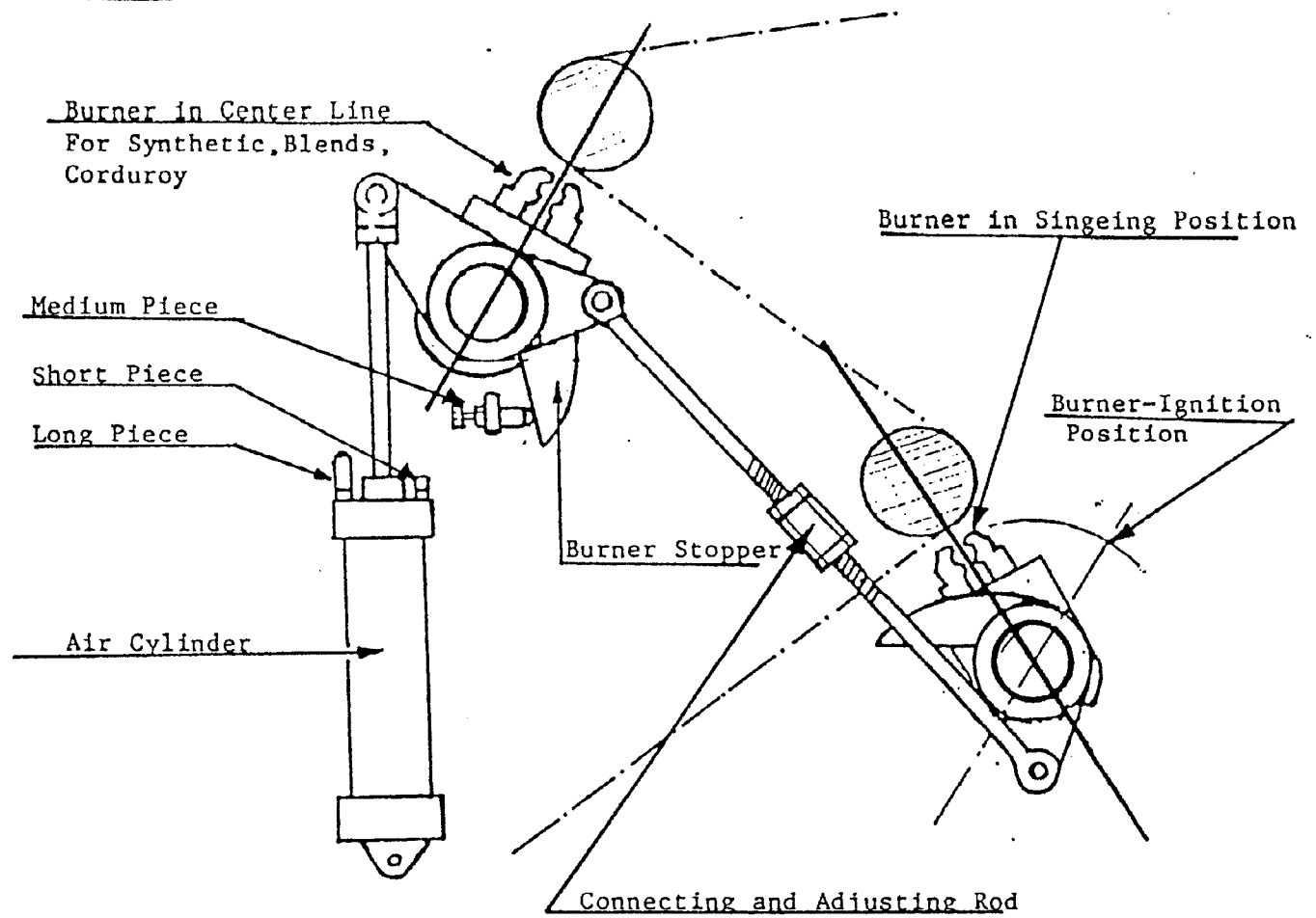


FIGURE 6.

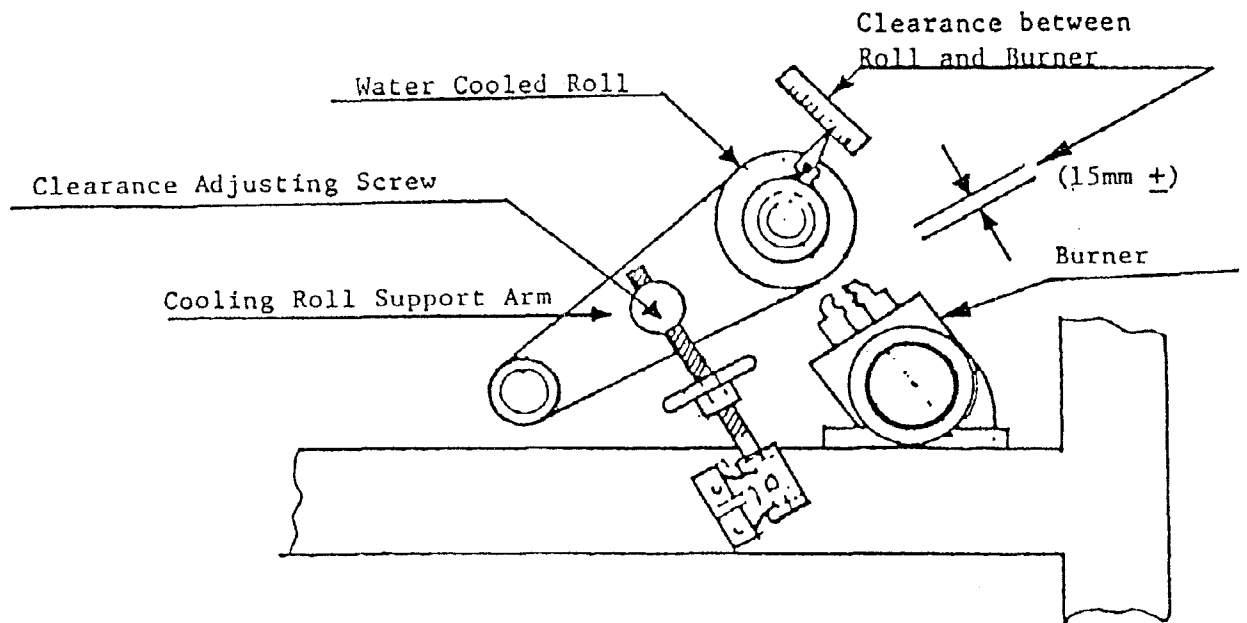
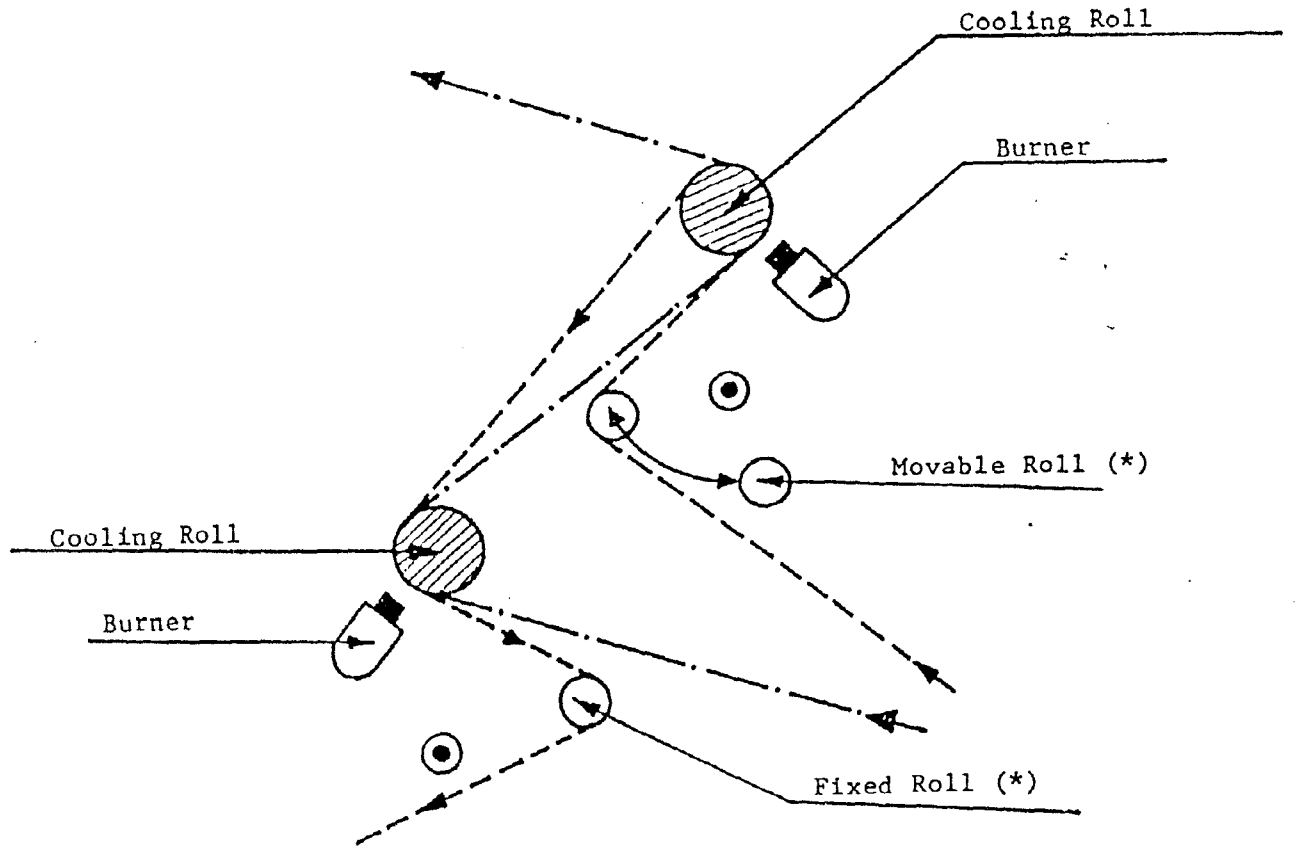


FIGURE 7.

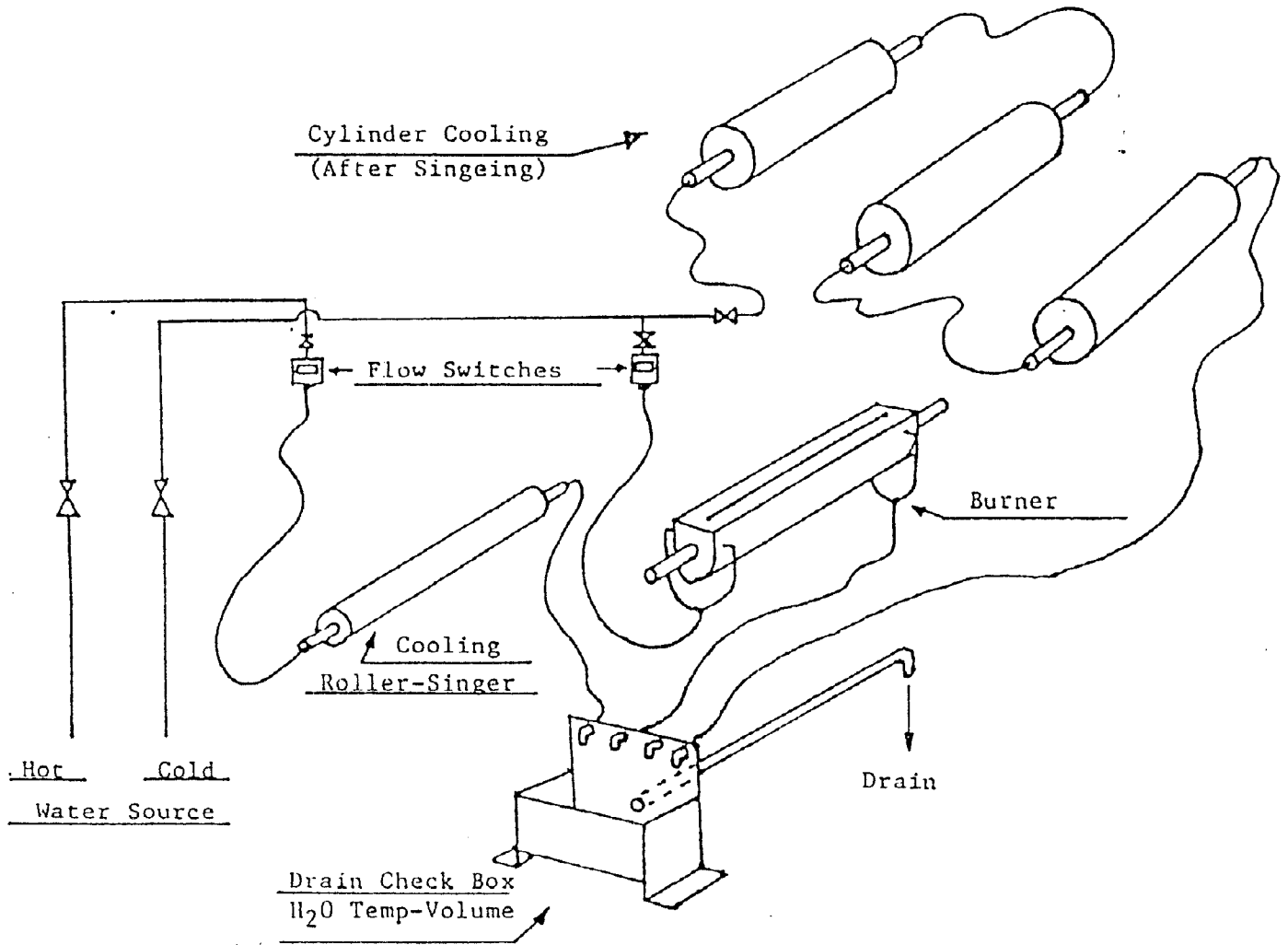


-.-.-. = Standard Face and Back Singeing

----- = Face Singeing only (corduroy)

(*) Rolls Required For Face Singeing Only (Corduroy)

FIGURE 8.



GAS SINGEING MACHINE

Trouble	Possible Cause	Countermeasures
Burner Flame	Fire Brick	Check For Misaligned Bricks Check The Slit Width of Fire Brick and Adjust it Replace the Aged or Damaged Fire Bricks Inspect the Cement Connection of Fire Bricks
	Nozzle	Clean the Clogging of Nozzle Plates, as shown in operational manual Inspect and Re-tighten the Fitting Bolt
	Mal-adjustment of Gas Mixer	Check pressure in Gas Line Inspect and re-adjust gas mixer in reference to the specification of model GM-LP326 given in gas mixer catalogue Adjust the air cock and gas adjusting dial, as specified in Operational Manual
Failure In Igniting Gas Burner	1) Ignition Plug	Clean the carbon deposits or other foreign matters sticking to the plug Inspect Wiring Verify amount of air being blown at time of ignition, check butterfly valve on turboblower Inspect and adjust the plug in reference to the specification of Model TL-60 given in Ignition-transformer Catalogue
	2) Abnormal Feed Of Gas To Pilot Burner	Check the Piping Clean or replace the electromagnetic valve Replace electromagnetic coil Check opening or closing of the inlet valve

GAS SINGEING MACHINE

Trouble	Possible Cause	Countermeasures
Failure In Igniting Gas Burner	3) Abnormal Supply of Gas to the Main Burner	Inspect electric wiring Clean or replace electromagnetic valve Replace electromagnetic coil Adjust LPG decompression valve
Positioning of the Burner	1) Air Cylinder	Replace worn out or damaged parts Feed lubricating oil at bearing part and clean it
	2) Insufficient supply of Air to Air Cylinder	Re-tighten the piping parts, etc. Check Packings Inspect other pneumatic apparatus
	3) Mal-function of electromagnetic valve for Air Cylinder	Check Wiring Clean or replace electromagnetic valve Replace electromagnetic coil
Feeding Of Cloth	1) Abnormal Rotation Of Driving Motor	Check Wiring
	2) Abnormal Rotation or adjustment of speed of driving roll	Defficient or excessive tension of driving belt Check wearing of driving belt Check key for fitting of drive pulley.

Gas Comparison Table

No.	Type of Comparison	Description	Propane gas	Butane gas	Town gas
1	Analysis	Molecular formula	C_3H_8	C_4H_{10}	$CO.H_2N_2CH_3$ $CO_2O_2C_nH_n$
2		Composition %	H:18.3 C:81.7	H:17.3 C:82.7	CO:5 to 8 H ₂ :35 to 50 N ₂ :12 to 22 CH ₄ :15 to 25 CO ₂ :2 to 3 C _n H _n :3 to 8
3		Specific gravity	1.52	2.0	0.45 to 0.65
4	Burning Characteristics	Firing temp.	490-550°C	480-540°C	
5		Max. flame temperature	1925°C	1895°C	
6		Burning speed	4 m/sec	3 m/sec	5.5 m/sec
7	Total Caloric Values	kcal/kg	12,200	11,850	
8		kg/m ³	1.83	2.46	
9		kcal/m ³	22,240	29,150	4,500
10	Usage	Supply air volume	24 times	31 times	5 times
11		Total mix gas volume	25/m ³	32/m ³	6/m ³
12		Mix gas, kcal/m ³	980	910	750

Appendix 2

List of Gases Used for Singeing Various Fabrics

Working width: 1,800 mm; two burners used.

<u>Fabric</u>	<u>Speed</u>	<u>Measure</u>	<u>Propane gas</u>	<u>Butane gas</u>	<u>Town gas</u>
Polyester, other synthetic fibers, 80 to 100 g/m ²	150 m/min	kcal/h	70,000 to 90,000	70,000 to 90,000	70,000 to 90,000
		kg ₃ or m ³ /h	5.8-7.4 kg 3.1-4.2 m ³	5.9-7.6 kg 2.4-3.1 m ³	15.5-20 m ³
Poly/Cotton Poly/Rayon 100 to 120 g/m ²	130 m/min	kcal/h	100,000 to 120,000	100,000 to 120,000	100,000 to 120,000
		kg ₃ or m ³ /h	8.2-9.8 kg 4.5-5.3 m ³	8.5-10.1 kg 3.5-4.2 m ³	22-27 m ³
Poly/Cotton Poly/Wool 120 to 150 g/m ²	130 m/min	kcal/h	130,000 to 150,000	130,000 to 150,000	130,000 to 150,000
		kg ₃ or m ³ /h	9.9-12.2 kg 5.8-6.7 m ³	11-12.6 kg 4.5-5.2 m ³	29-33 m ³
Cotton/Wool 150 to 200 g/m ²	120 m/min	kcal/h	160,000 to 180,000	160,000 to 180,000	160,000 to 180,000
		kg ₃ or m ³ /h	13.1-14.7 kg 7.1-8.0 m ³	13.5-15.2 kg 5.5-6.2 m ³	36-40 m ³
Cotton/Satin singeing twice, Wool-Mohair singeing twice 250 to 300 g/m ²	100 m/min	kcal/h	200,000 to 240,000	200,000 to 240,000	200,000 to 240,000
		kg ₃ or m ³ /h	16.4-19.5kg 8.9-10.7m ³	16.8-20.1kg 6.9-8.2m ³	4.5-53m ³