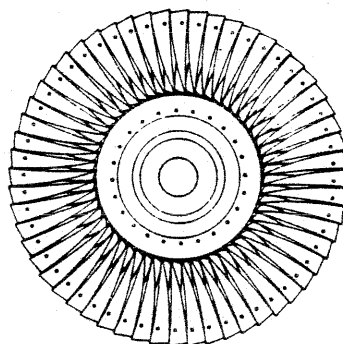
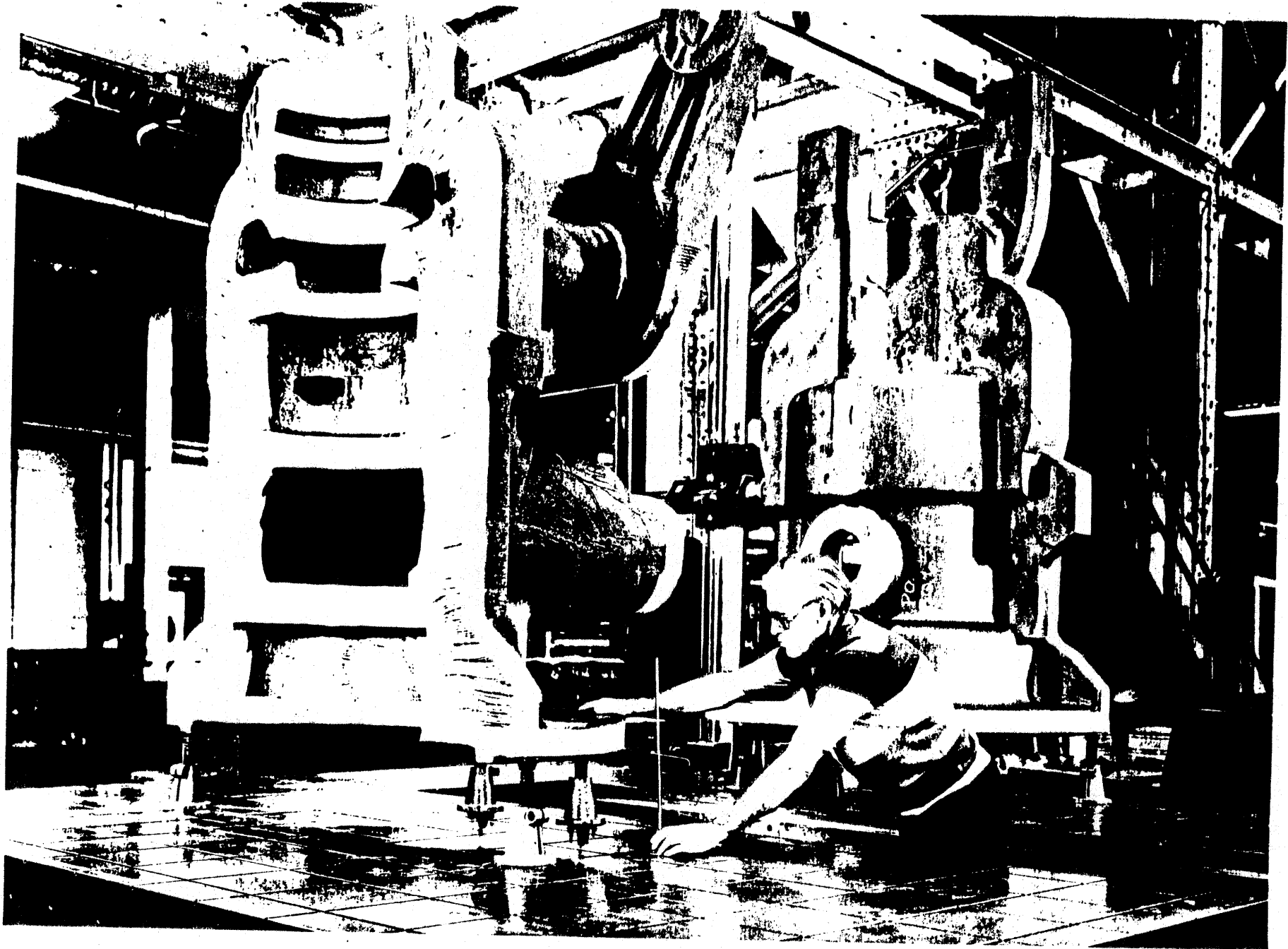


Reprint 132A
MARCH 1976

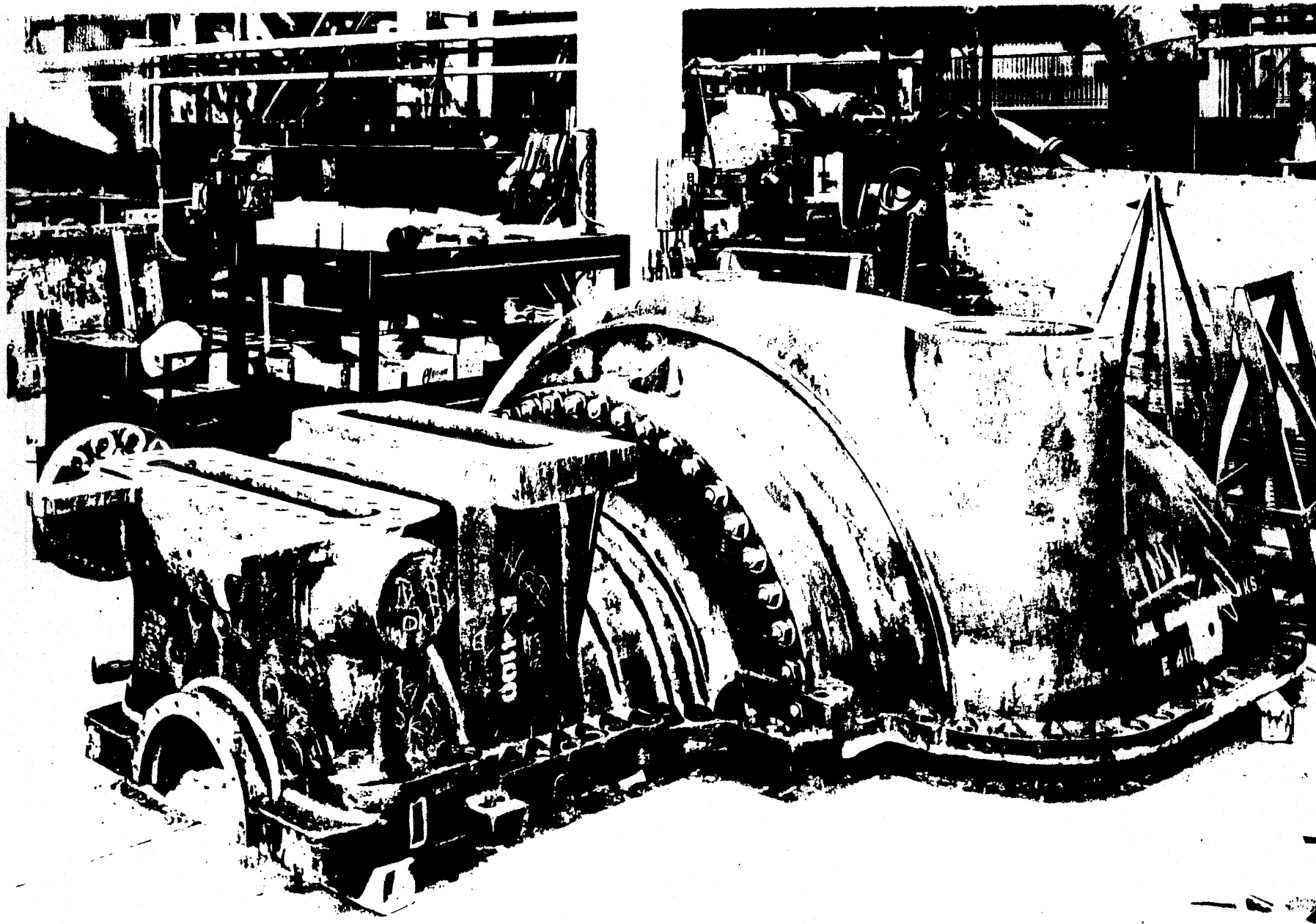
Components



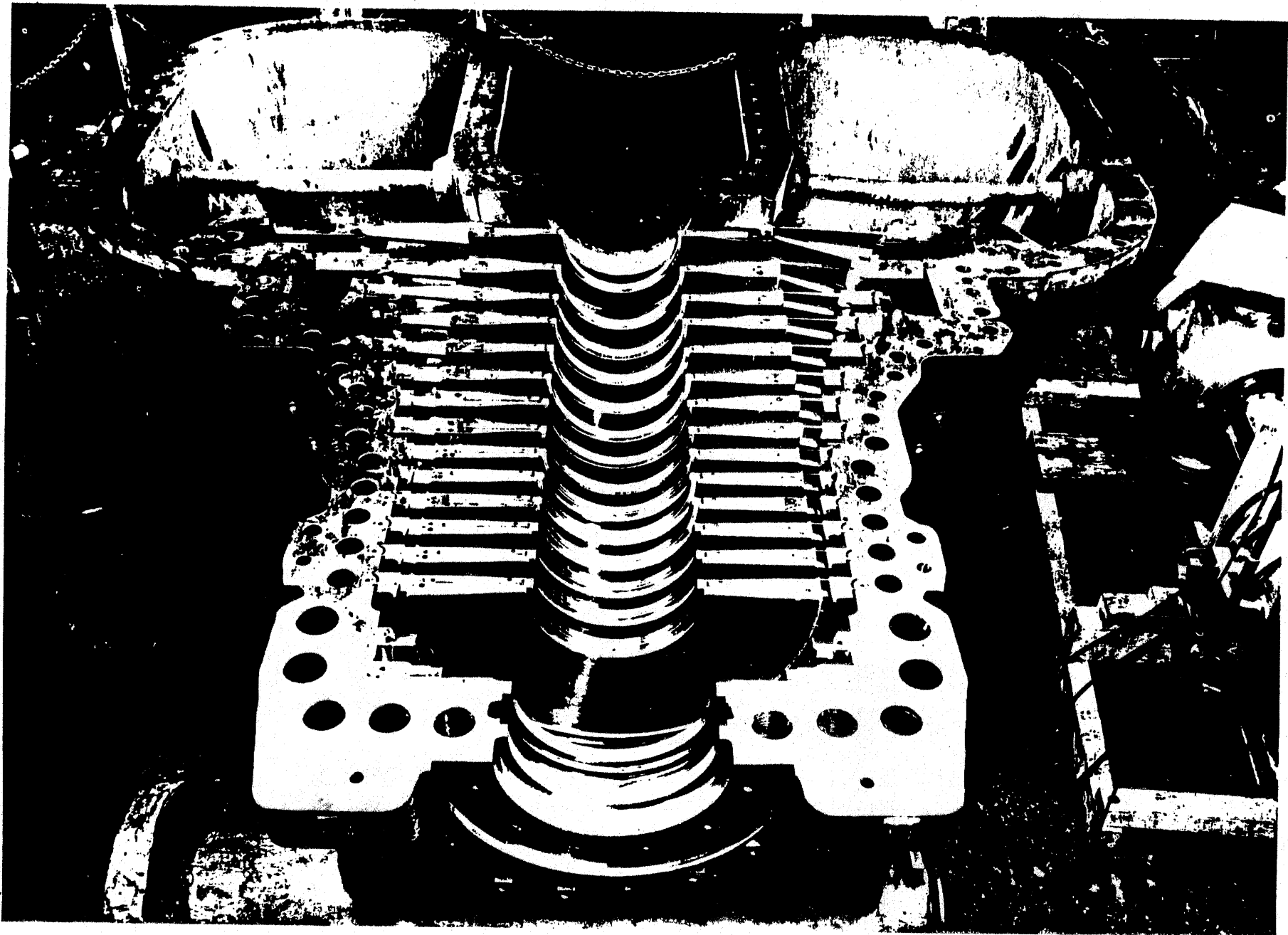
***Elliott
Multistage
Steam
Turbines***



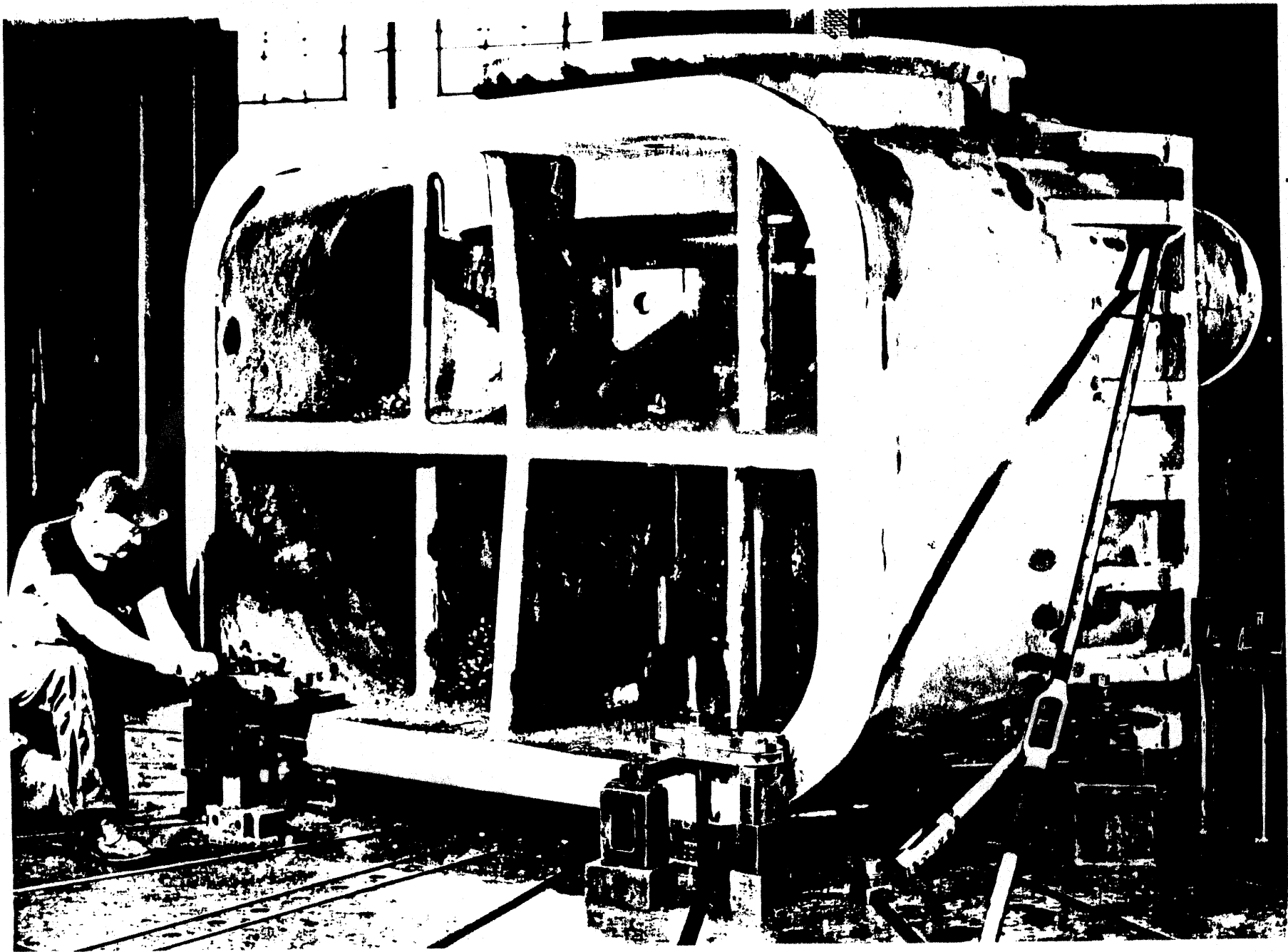
Steam end castings for 2000 psig (138 bar) extraction-condensing turbine on layout table.



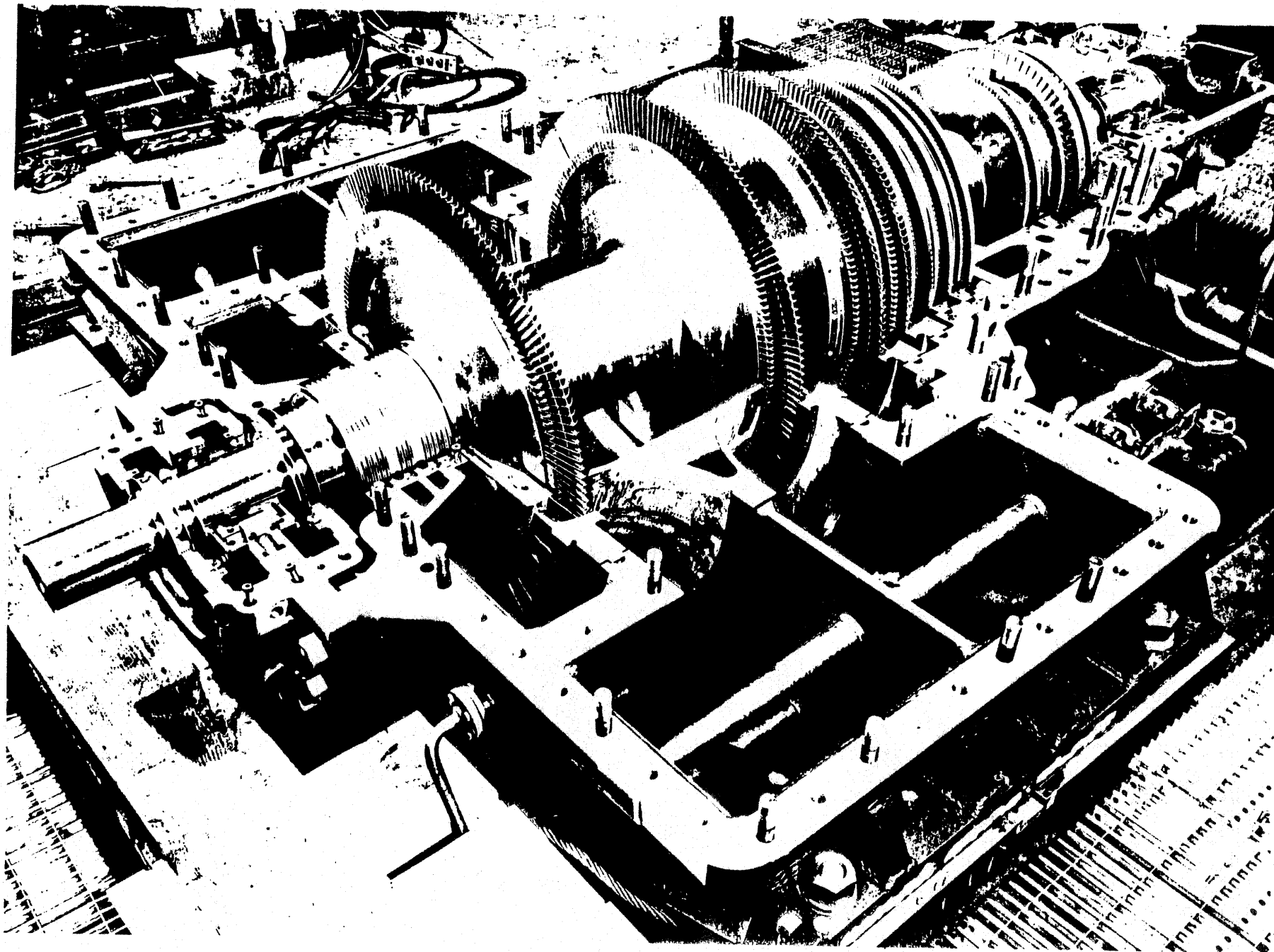
Top half of 900 psig (62 bar) induction-condensing unit showing both steam chests, barrel section and exhaust end.



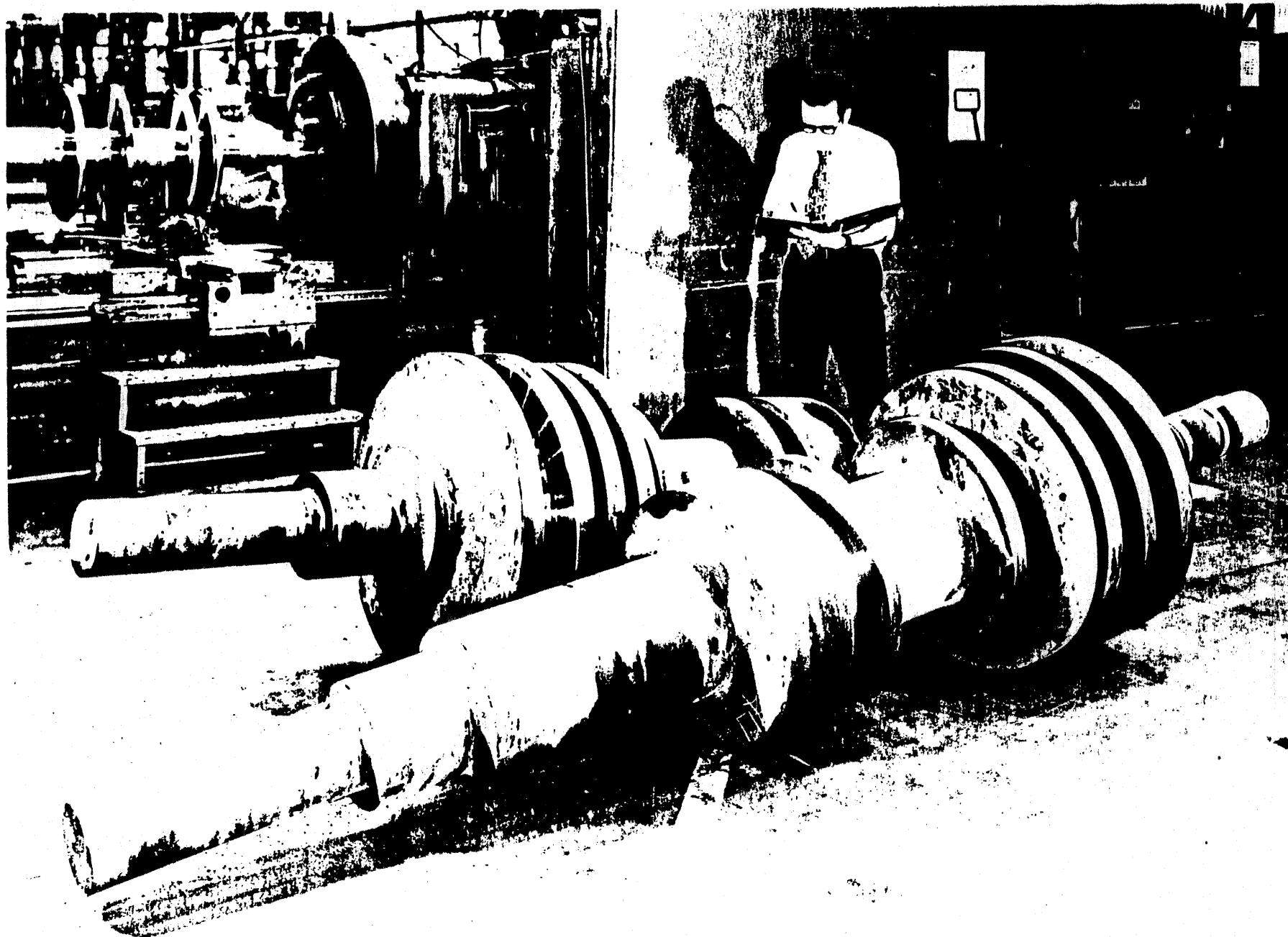
Inverted top half casing of 2NC-14 condensing unit showing both fabricated and cast diaframs and 88" (2235mm) exhaust casing.



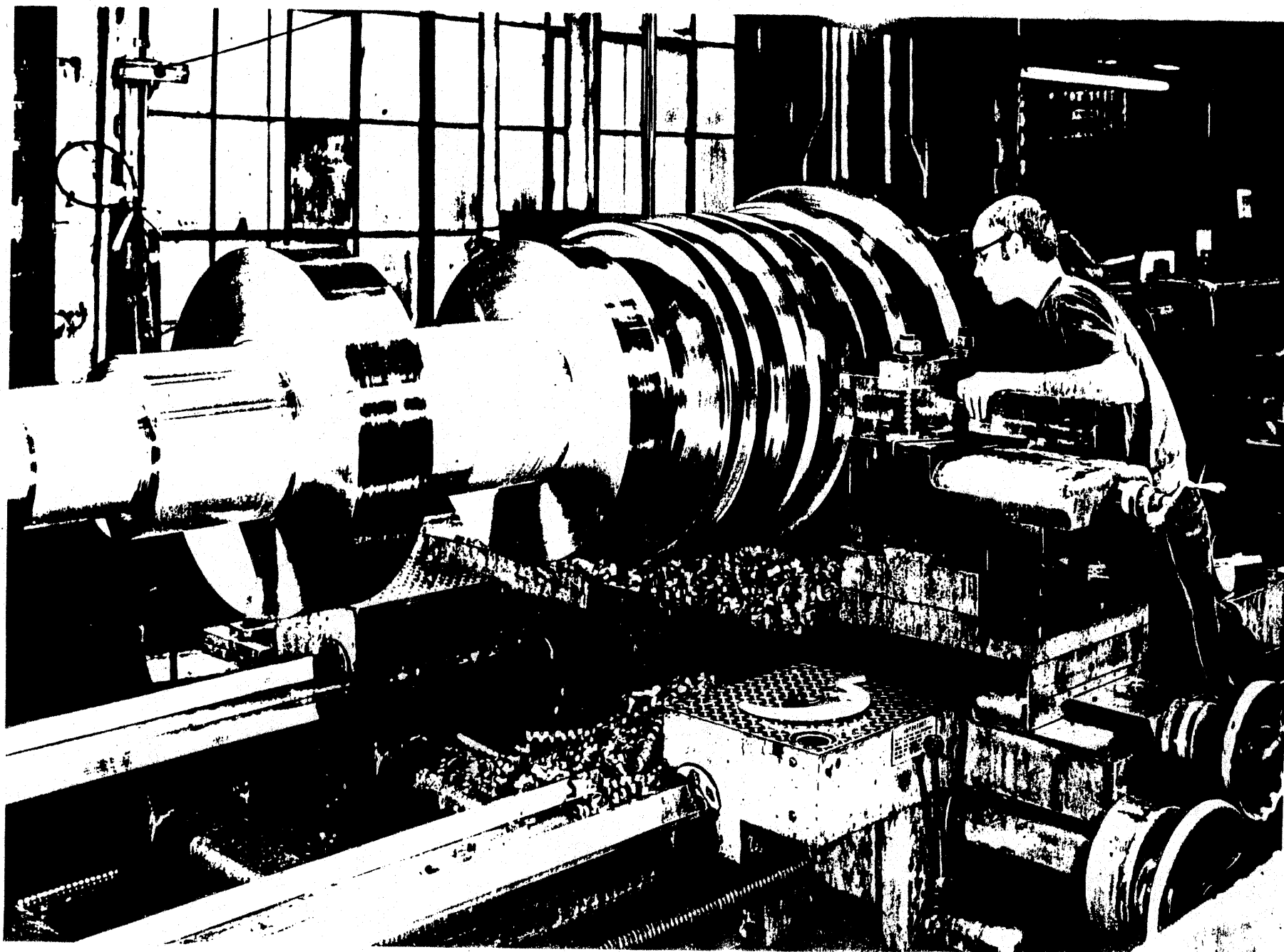
Nozzle of 88" (2235mm) exhaust casing.



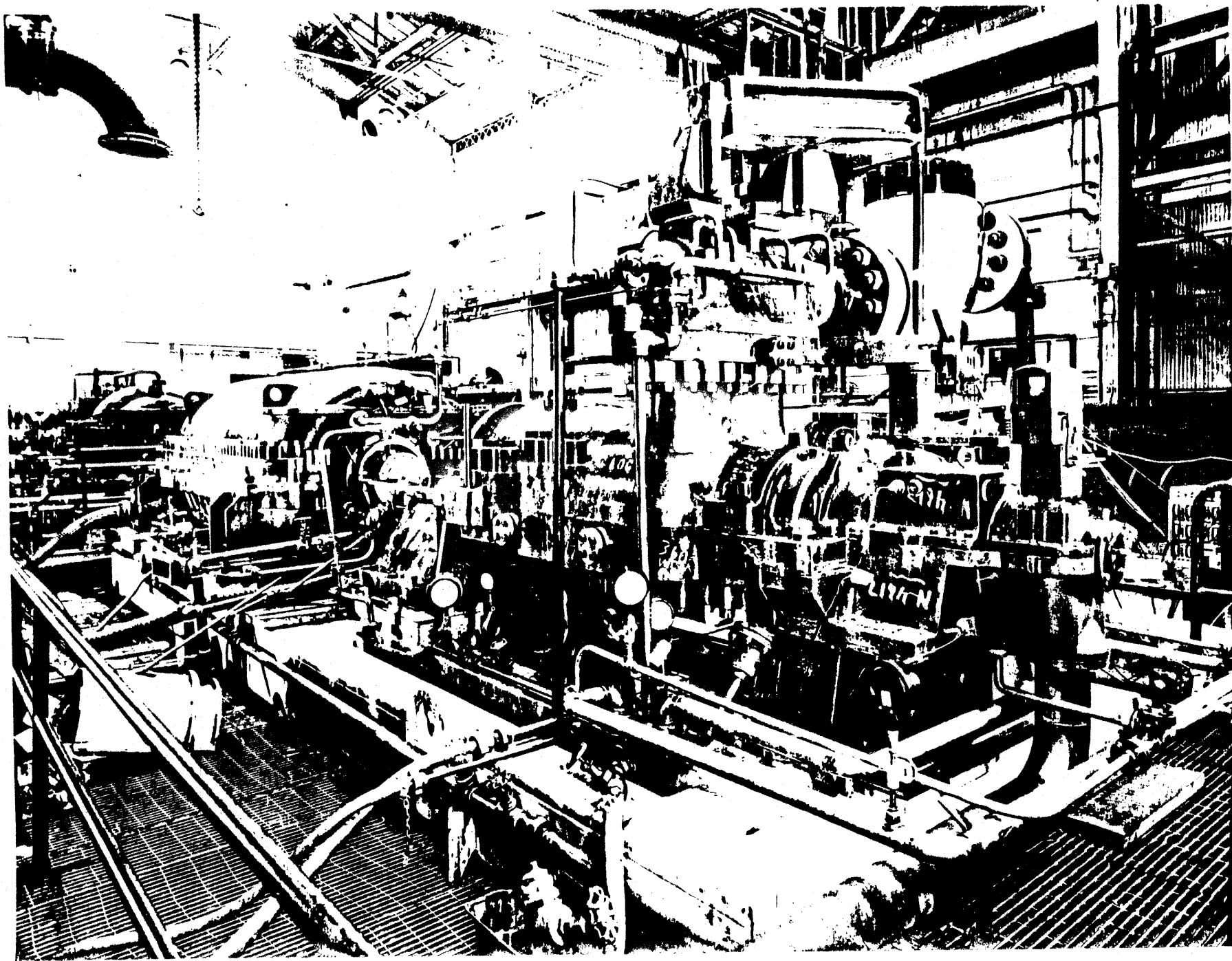
2SQNV7-DF Lower half casing with integral rotor in place, fabricated exhaust end and induction/extraction section after the second sta



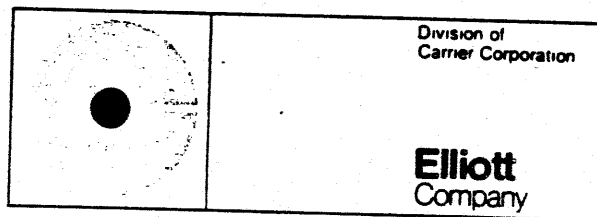
Large integral rotor forgings as received from forge shop.



Machining the integral rotor of a 41,500 HP (30,500 kW) extraction-condensing turbine.



2NV-5 back-pressure unit develops 31,750 HP (23 700 kW) and is designed for 2000 psig (138 bar) steam.



- Mechanical Drive Turbines
- Air and Gas Compressors
- Turbochargers
- Tube Cleaners
- Tube Expanders
- Roller Burnishers

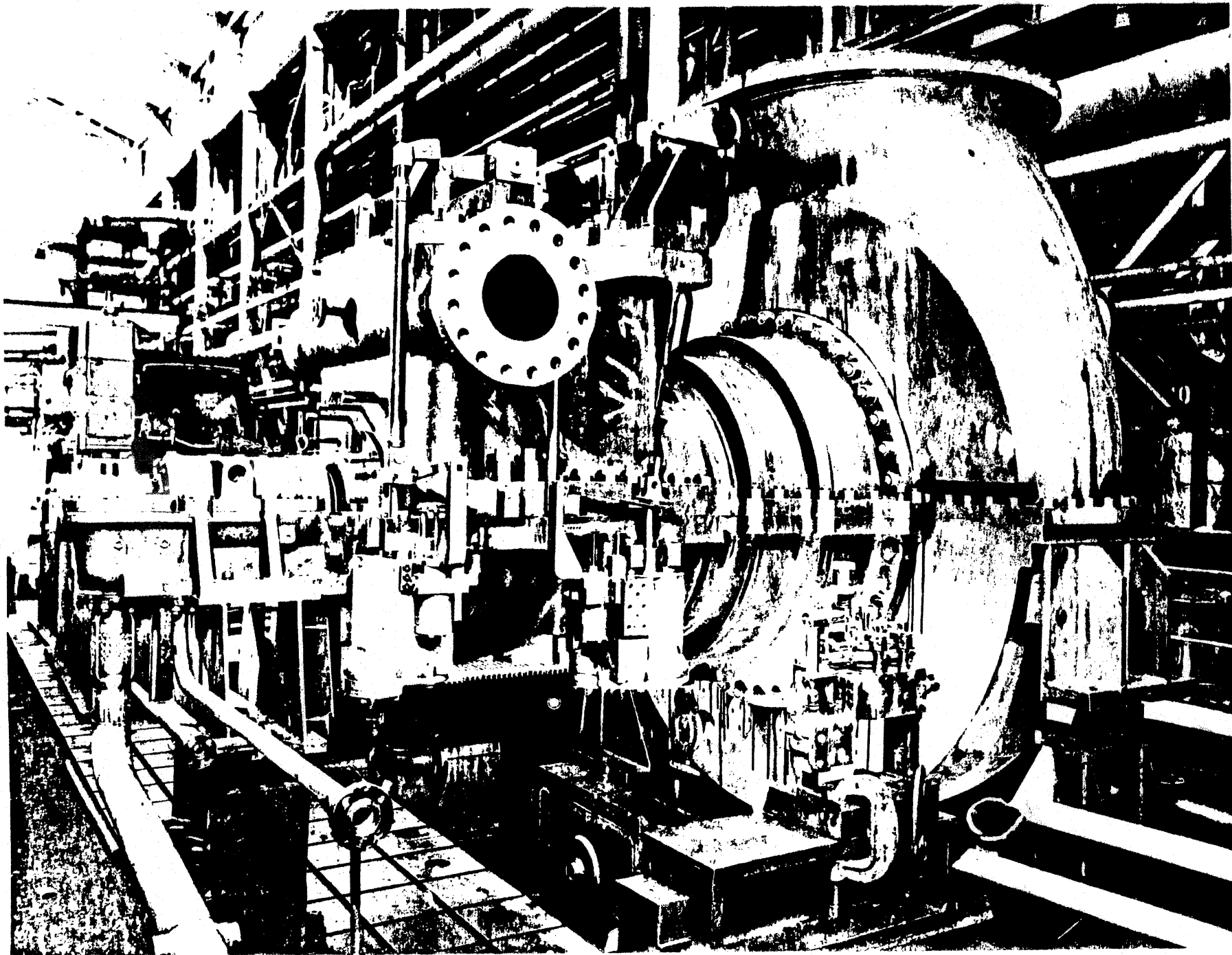
Elliott Company General Offices:
 Jeannette, Pennsylvania 15644
 Other plants at Dayton and Springfield, Ohio;
 Isle of Wight, England

Canada: Elliott Industrial Equipment Company
 24 Queen St. East, Brampton, Ontario

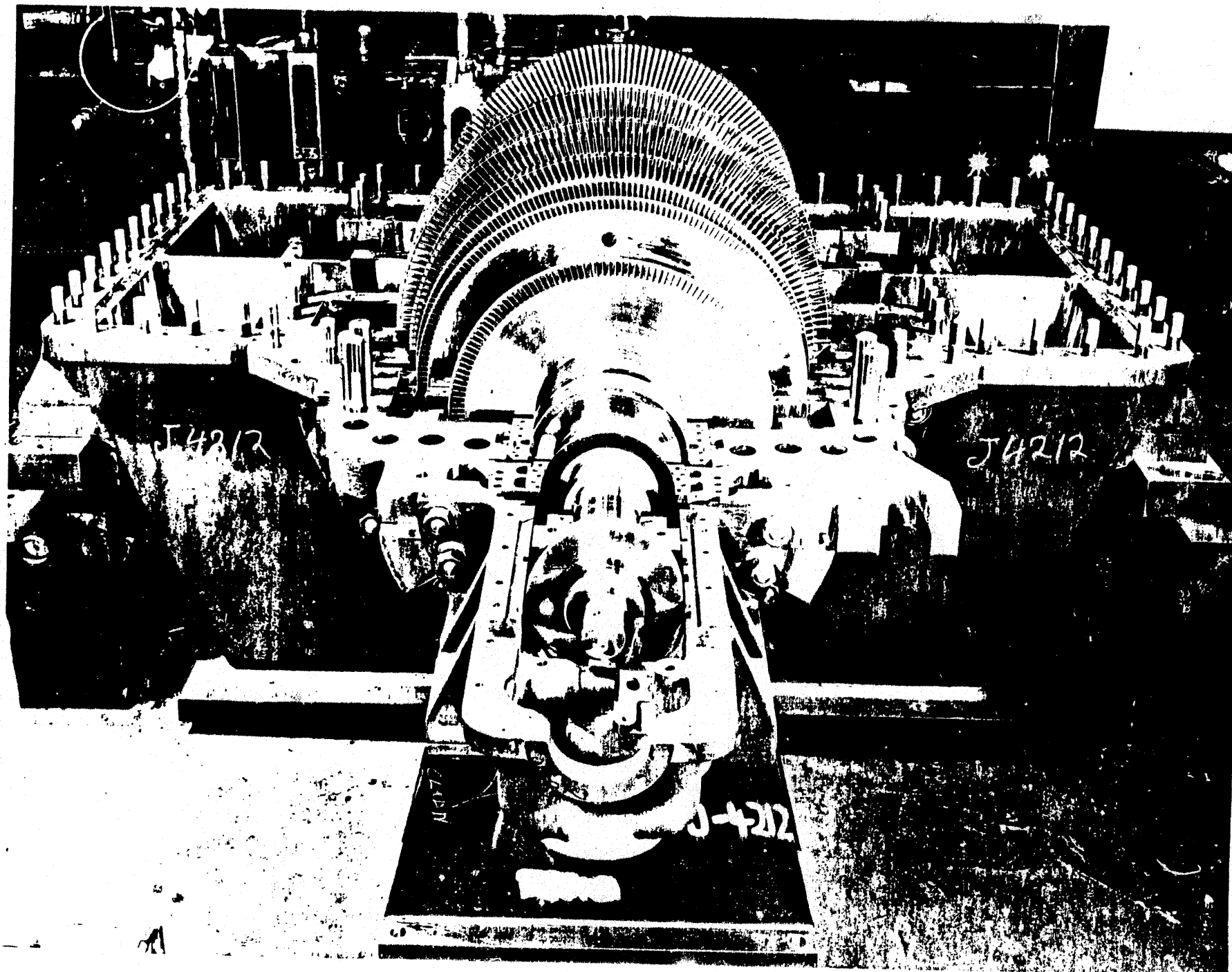
Europe, Middle East, Africa:
 Elliott Turbomachinery Ltd.
 197 Knightsbridge, London, England

Latin America: Elliott Overseas Company
 1570 Madruga Avenue
 Coral Gables, Florida 33146

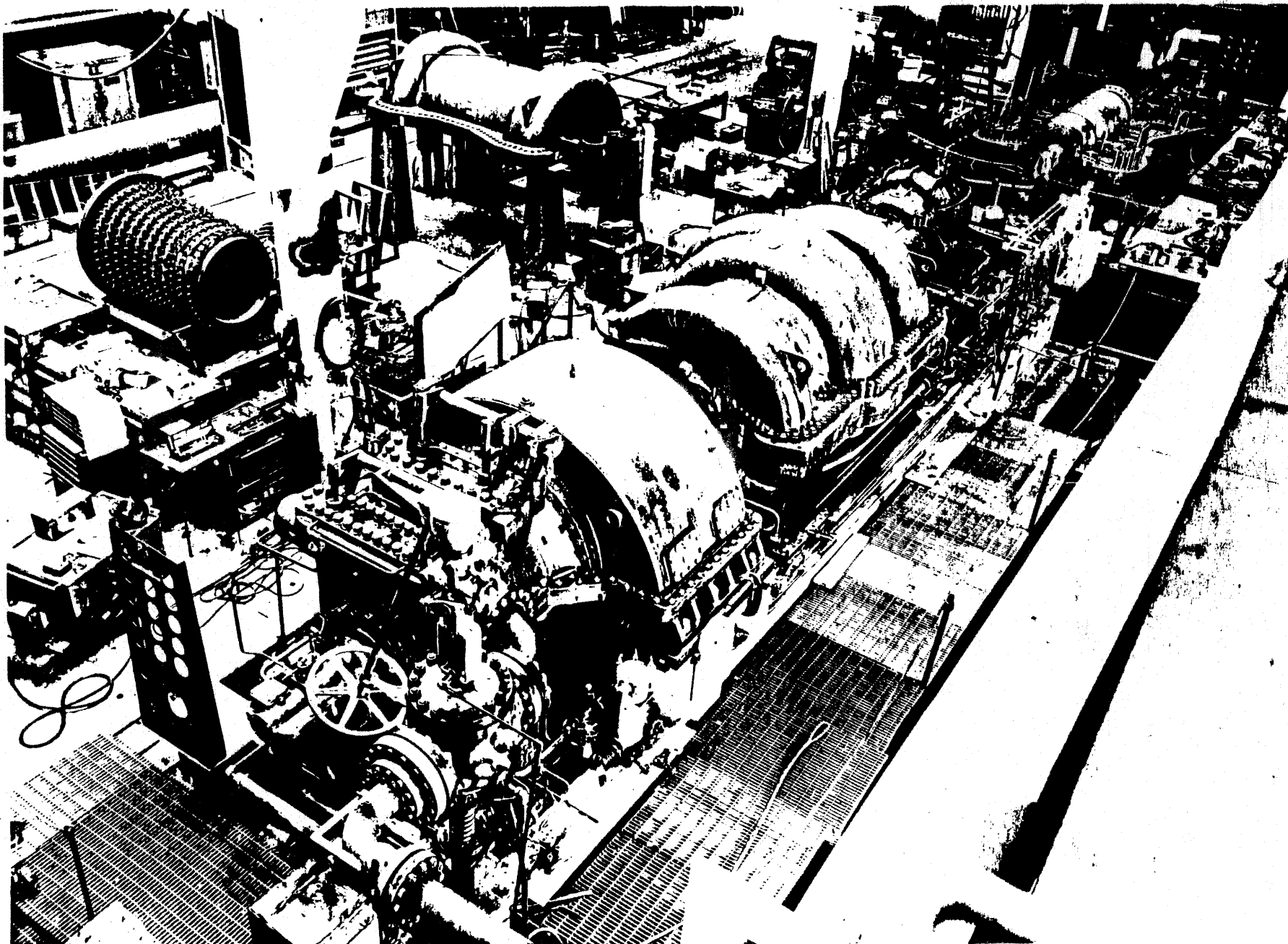
Far East: Elliott Overseas Company
 P.O. Box 1112, City of Industry, California 91749



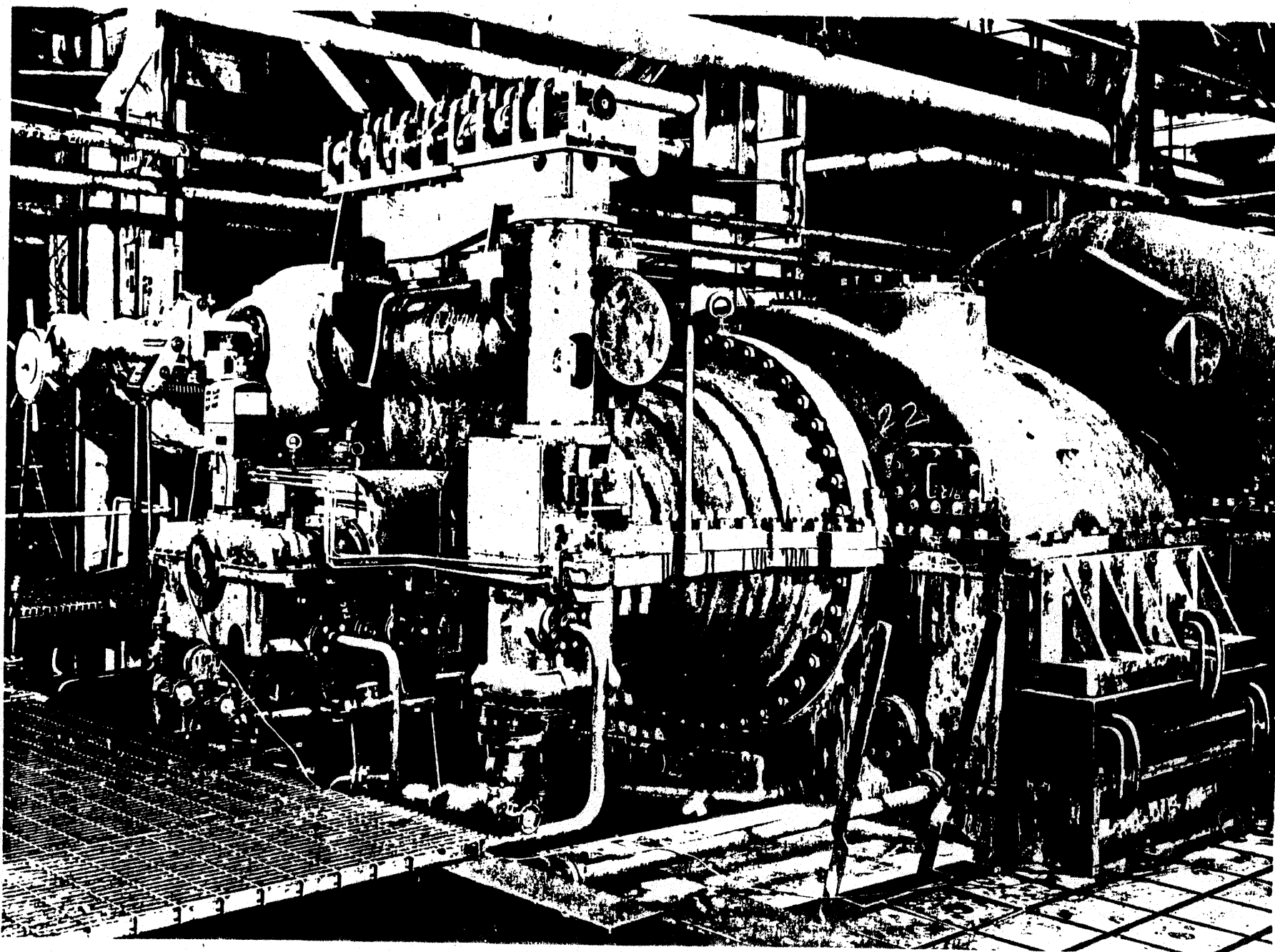
2NV-8 condensing-extraction turbine showing both steam chests, servo motors and pressure regulator.



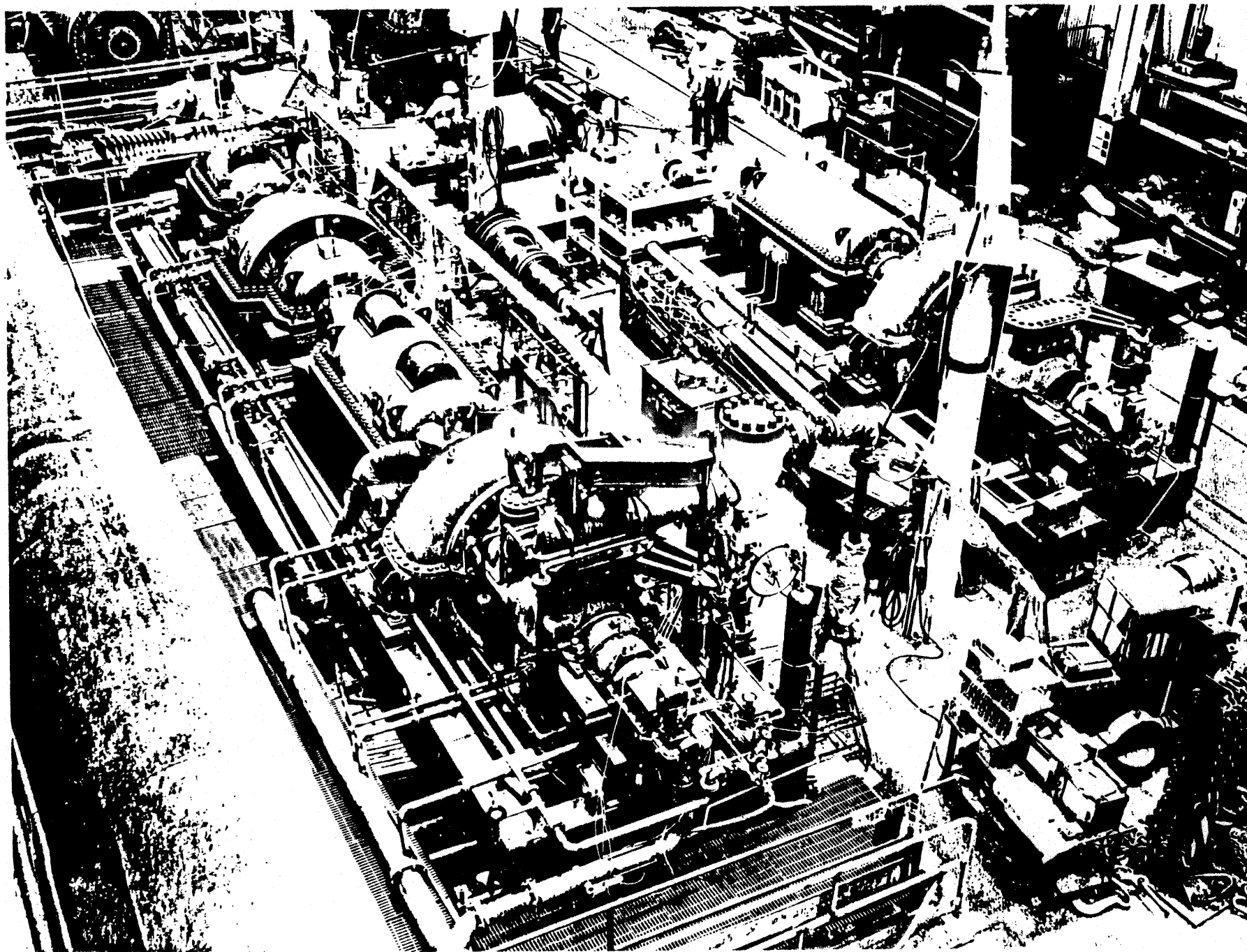
SNV6-DF cooling turbine.



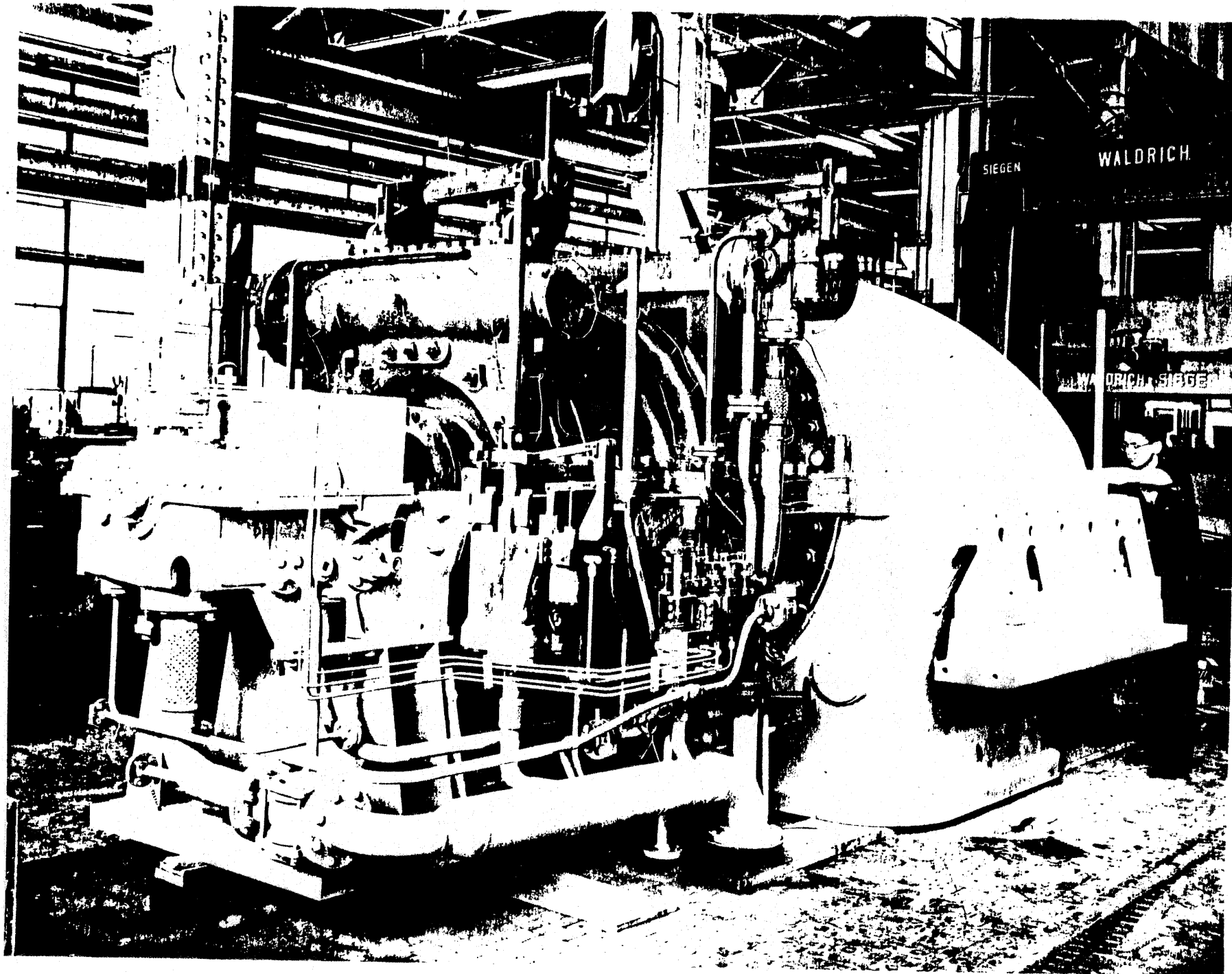
2NV7-DF double-flow, condensing-extraction turbine driving an Elliott process gas compressor string.



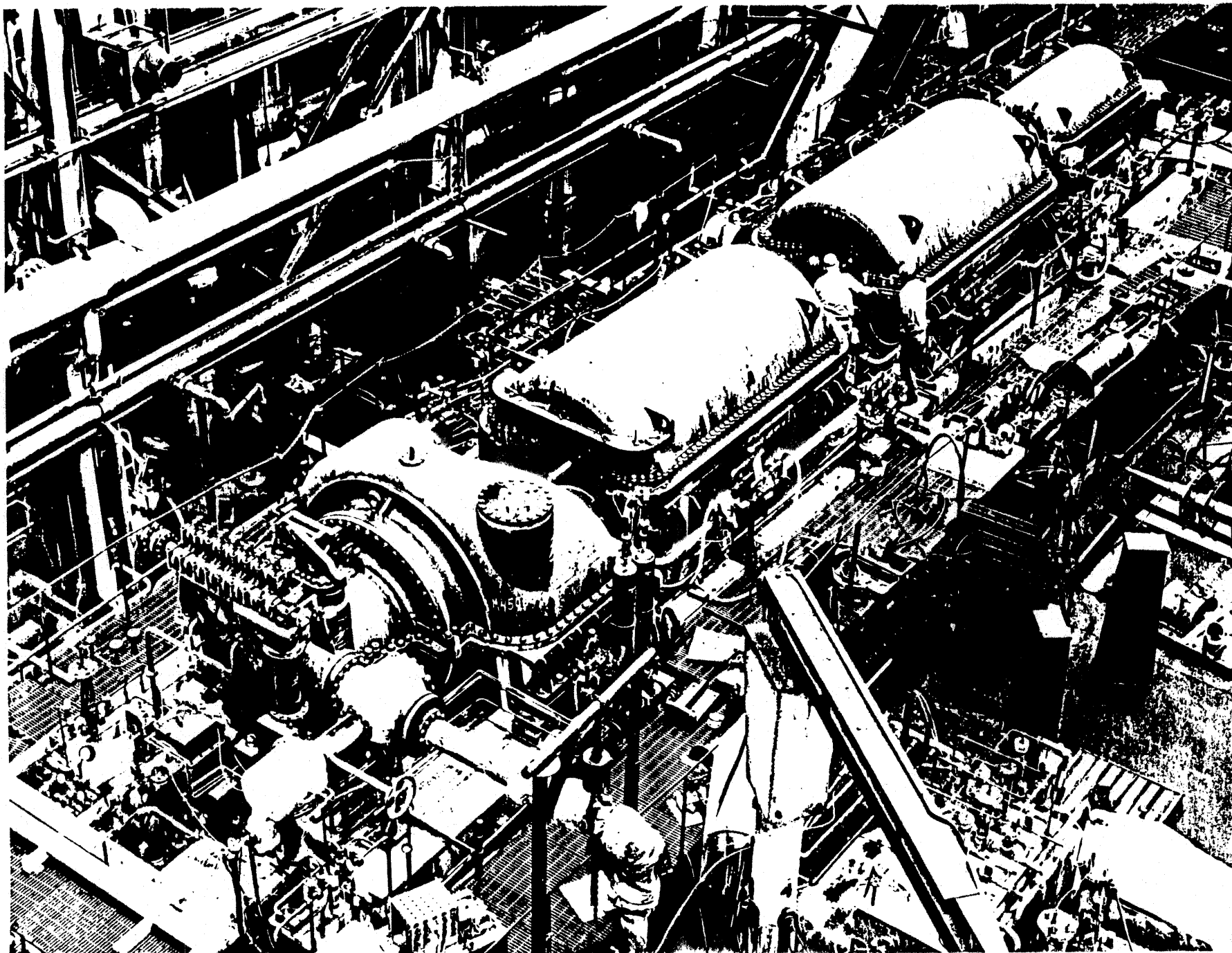
2NC-10 condensing turbine driving an Elliott 110M blast furnace compressor.



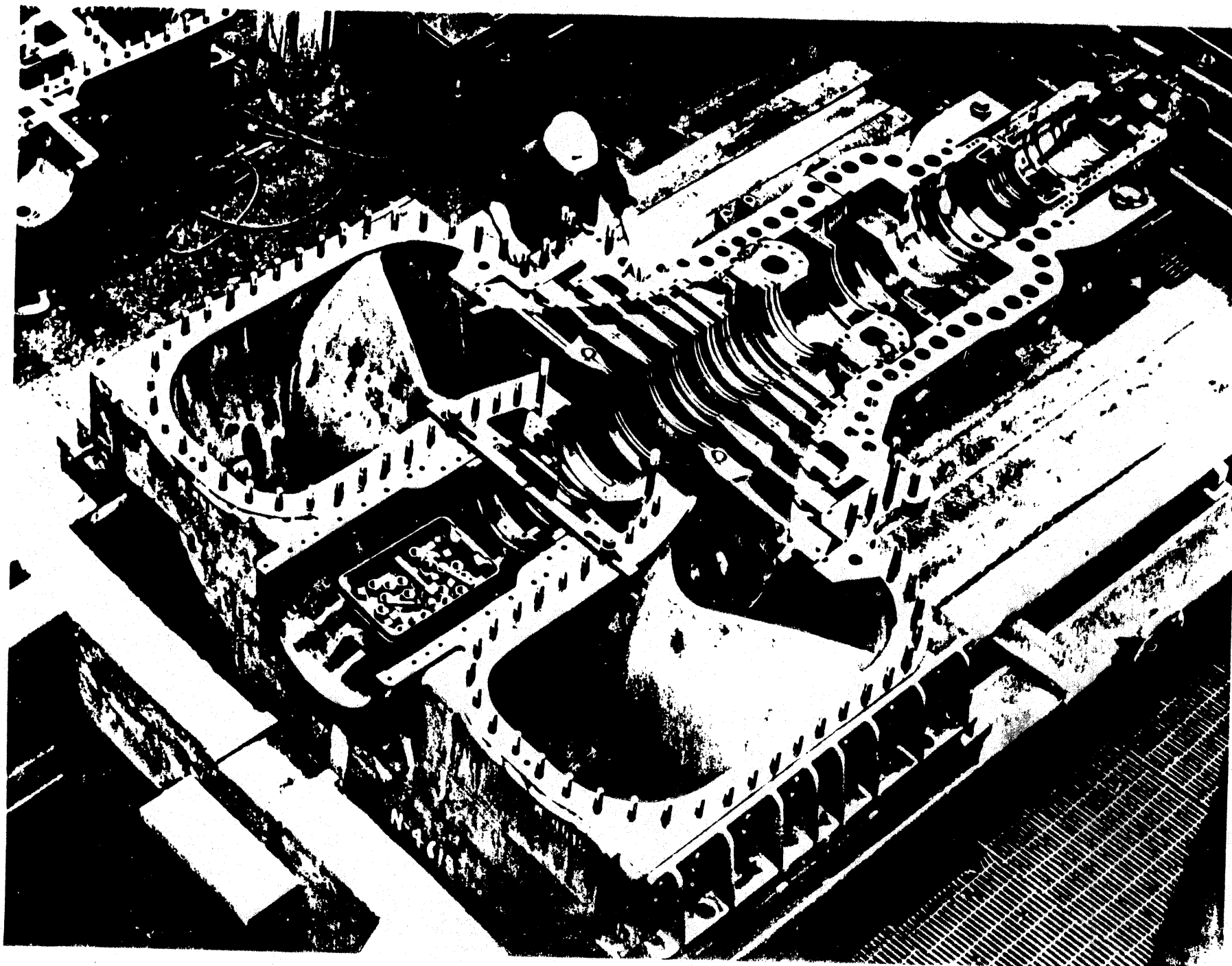
Two 2SNV-6 condensing-extraction units designed for 2000 psig (138 bar) steam pressure.



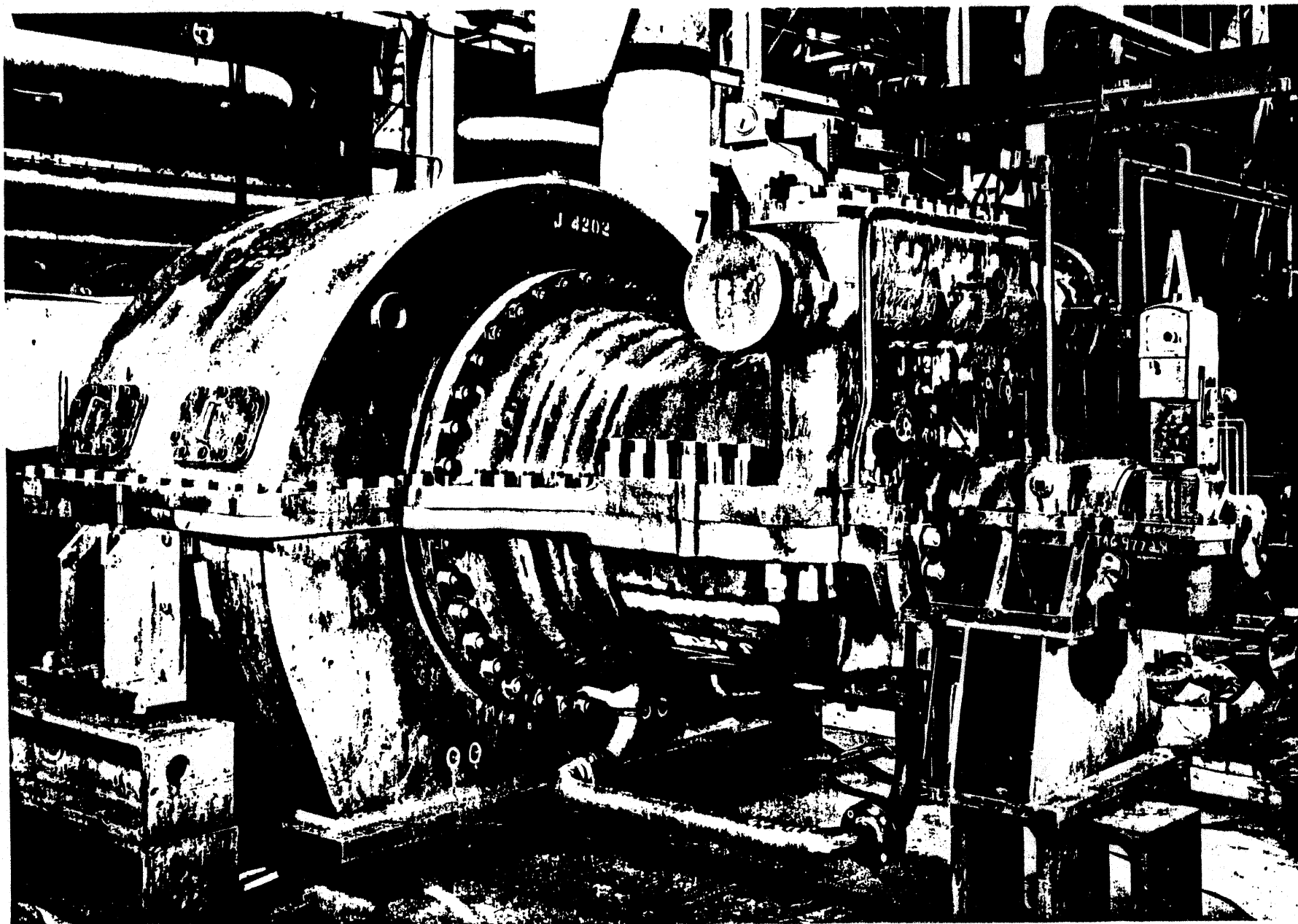
2NV-9 condensing-industrial turbine ready for shipment.



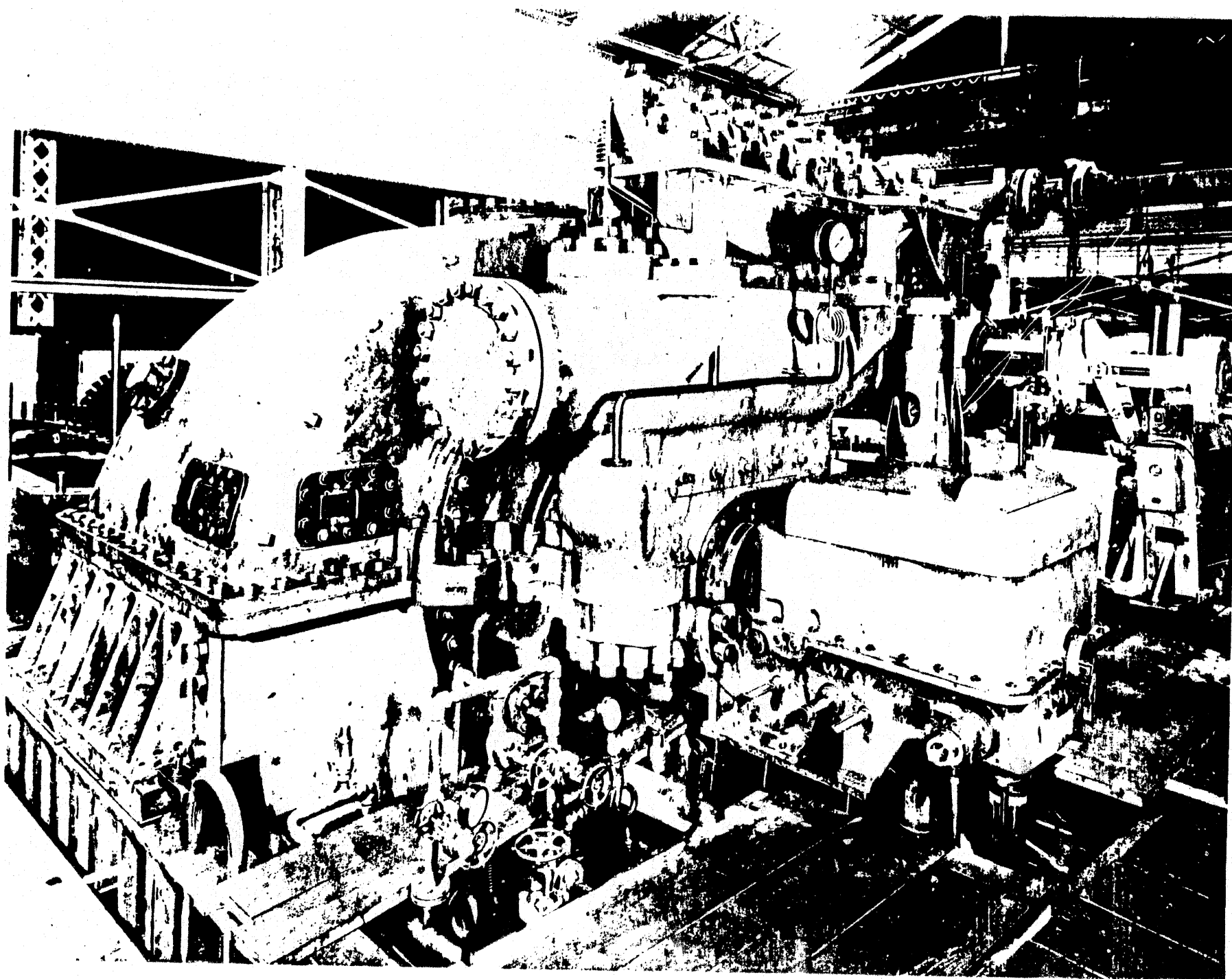
2SNC-9 condensing-extraction turbine rated 41,500 HP (30 970 kW) at 4305 r/min for ethylene plant service.



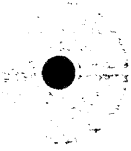
2SNV-8 condensing-extraction turbine rated 54,300 HP (40 520 kW) 4490 r/min and designed for 2000 psig (138 bar) steam pressure



2NV9-DF double-flow condensing turbine.

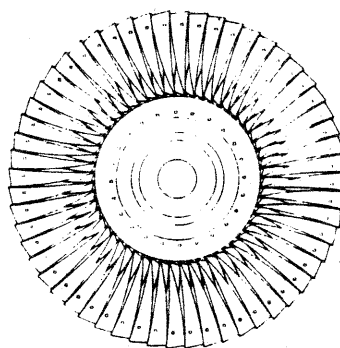


2SNC-7 single flow condensing turbine. Exhaust flow of 104 000 HP (17 910 kW), 4200 r/min unit is 64,000,000 CFH.

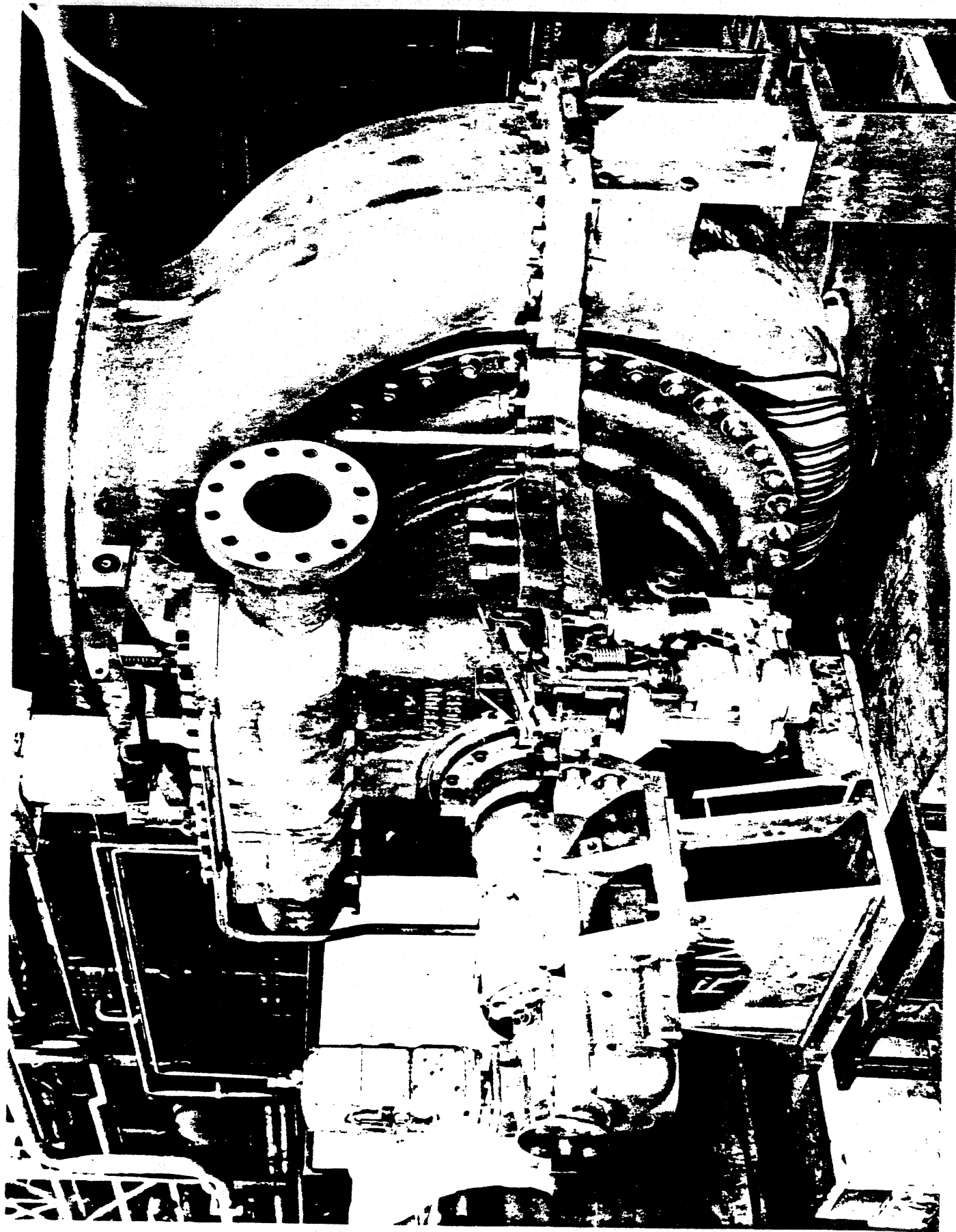


Reprint 131
March 1976

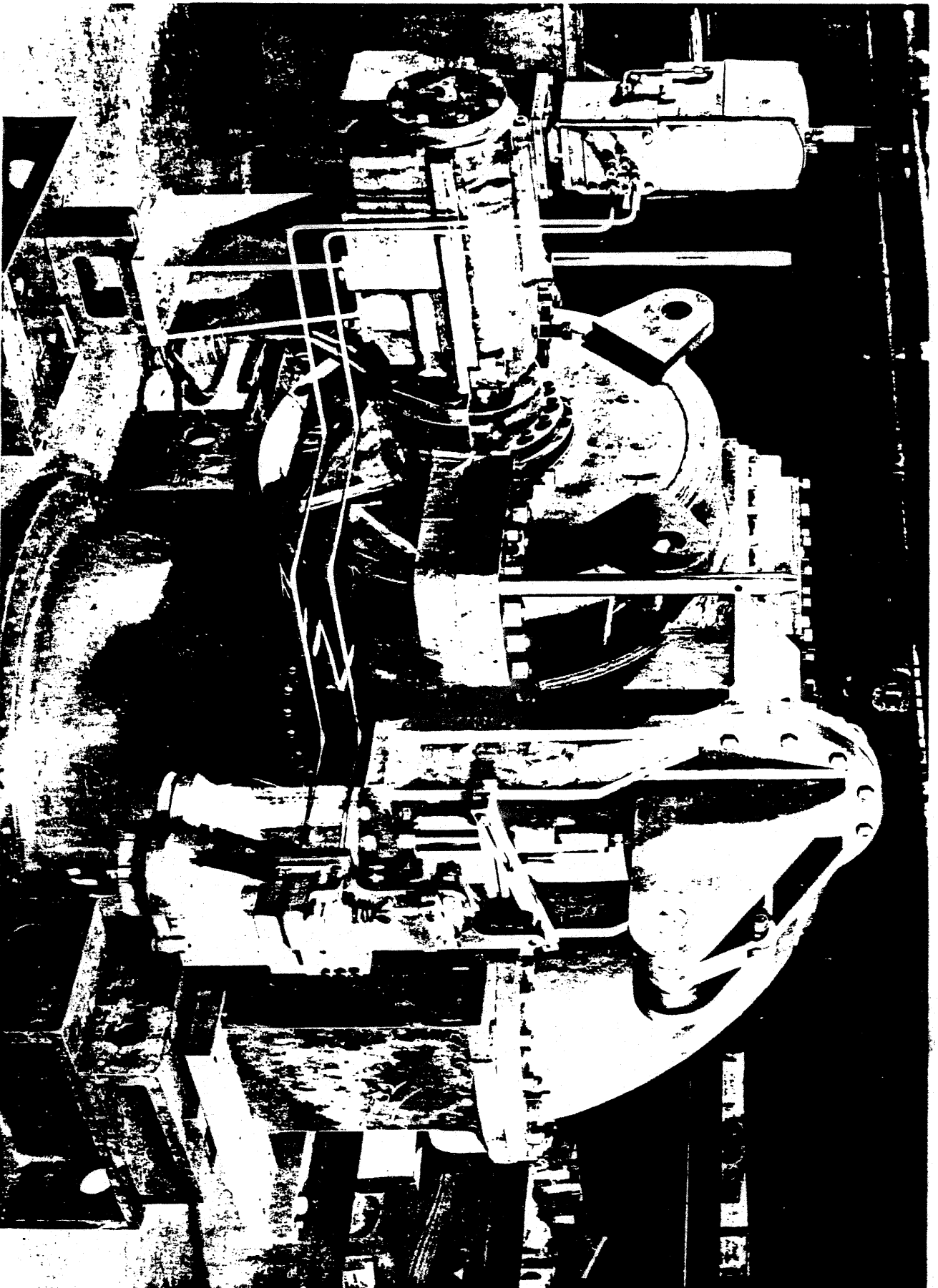
Type N Multivalve Turbines



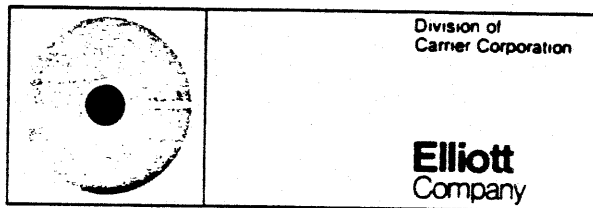
*Elliott
Multistage
Steam
Turbines*



2NV-6 single-fir condensing turbine.



SO-3 Condensing turbine for low-pressure steam showing fabricated steam end and grid valve-servo motor linkage.



- Mechanical Drive Turbines
- Air and Gas Compressors
- Turbochargers
- Tube Cleaners
- Tube Expanders
- Roller Burnishers

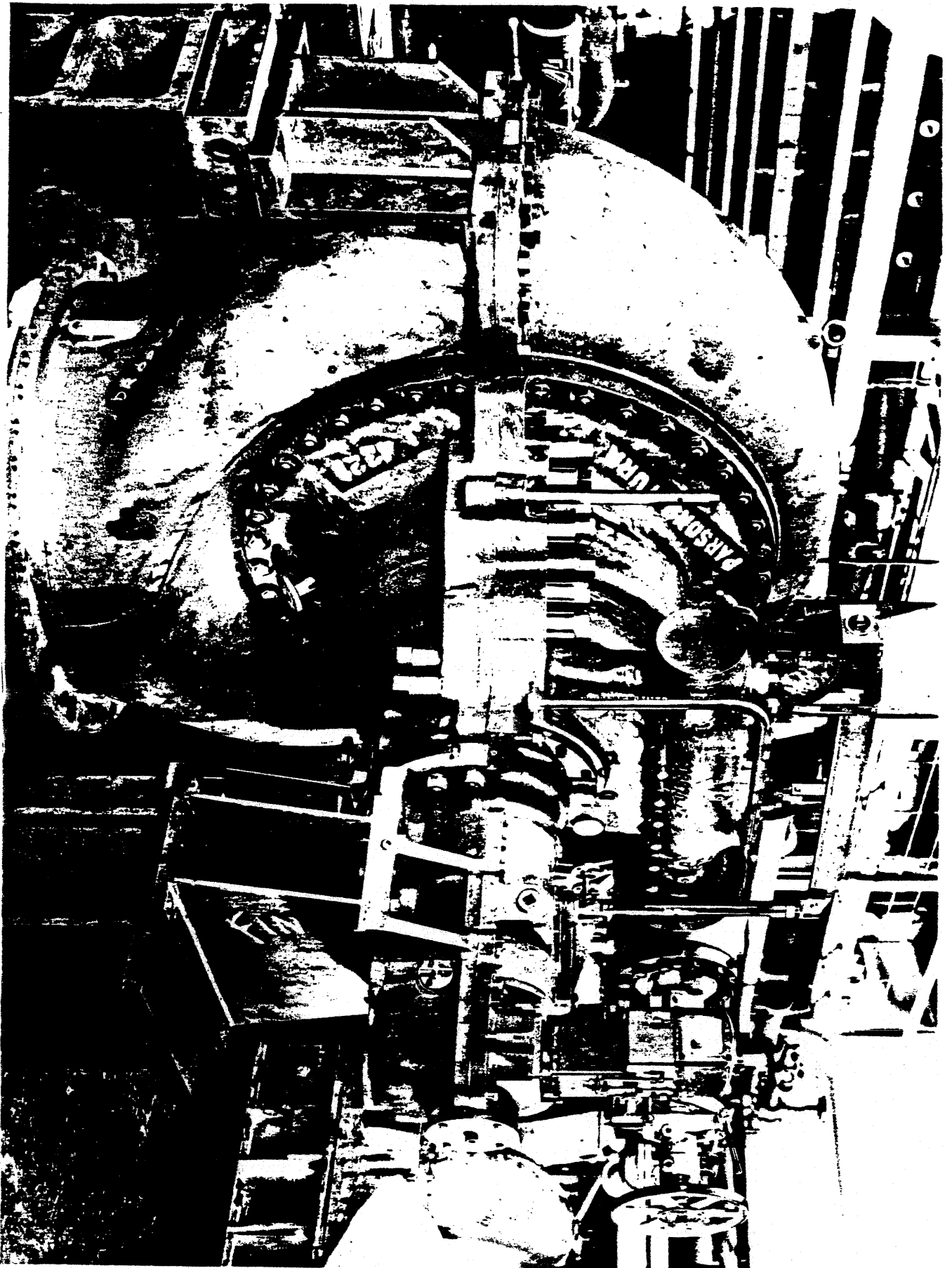
Elliott Company General Offices:
Jeannette, Pennsylvania 15644
Other plants at Dayton and Springfield, Ohio;
Isle of Wight, England

Canada: Elliott Industrial Equipment Company
24 Queen St. East, Brampton, Ontario

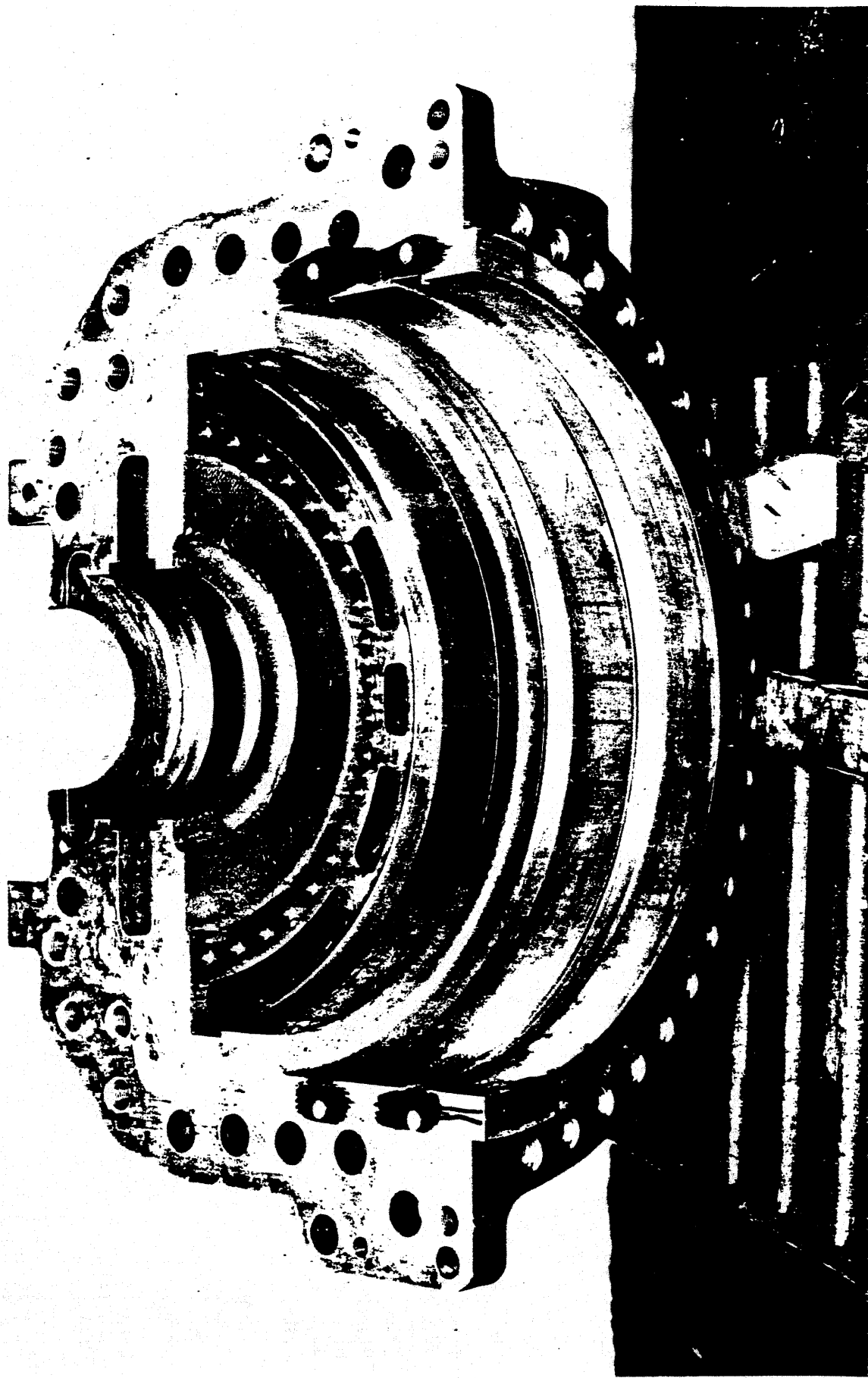
Europe, Middle East, Africa:
Elliott Turbomachinery Ltd.
197 Knightsbridge, London, England

Latin America: Elliott Overseas Company
1570 Madruga Avenue
Coral Gables, Florida 33146

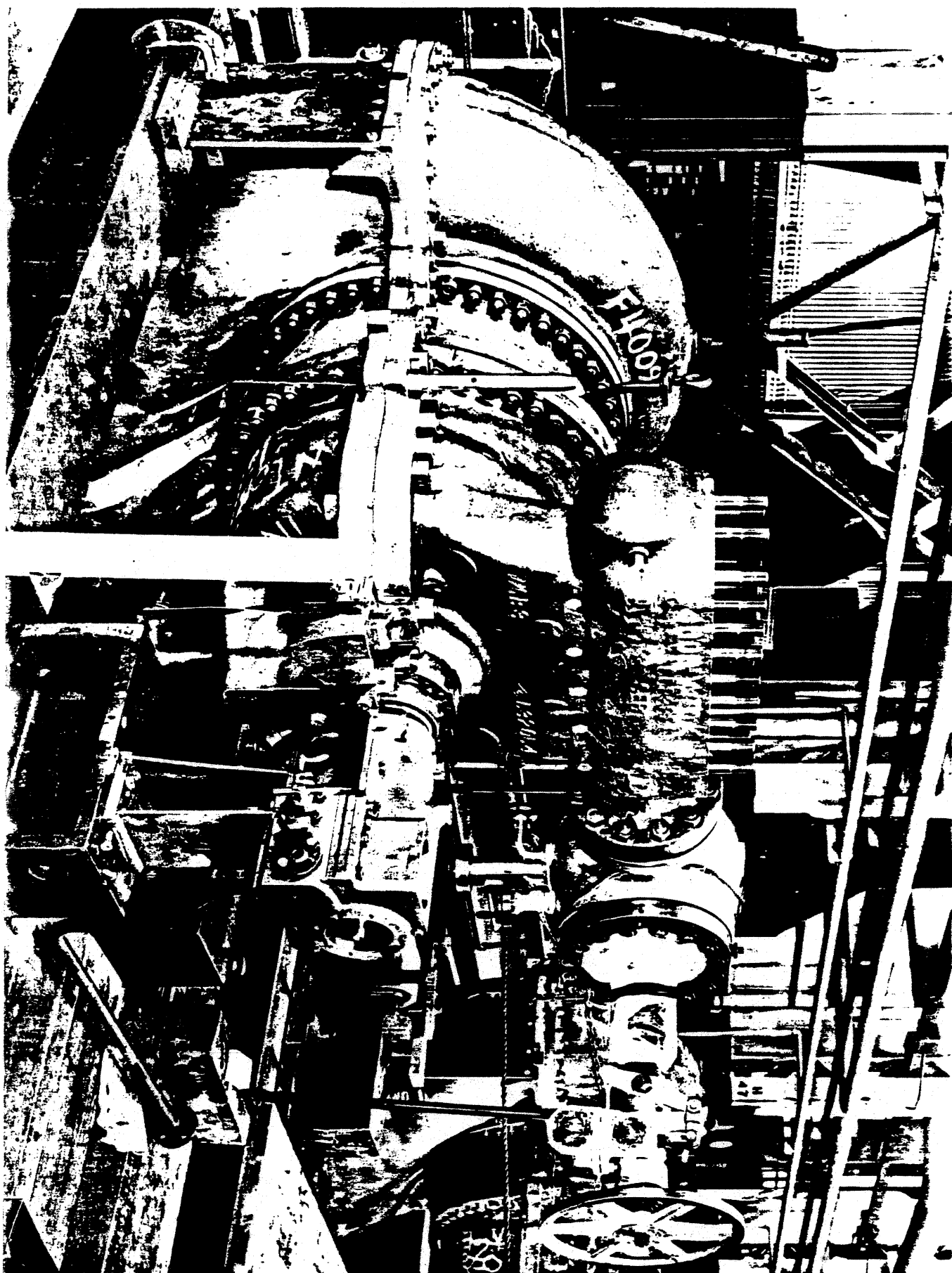
Far East: Elliott Overseas Company
P.O. Box 1112, City of Industry, California 91749

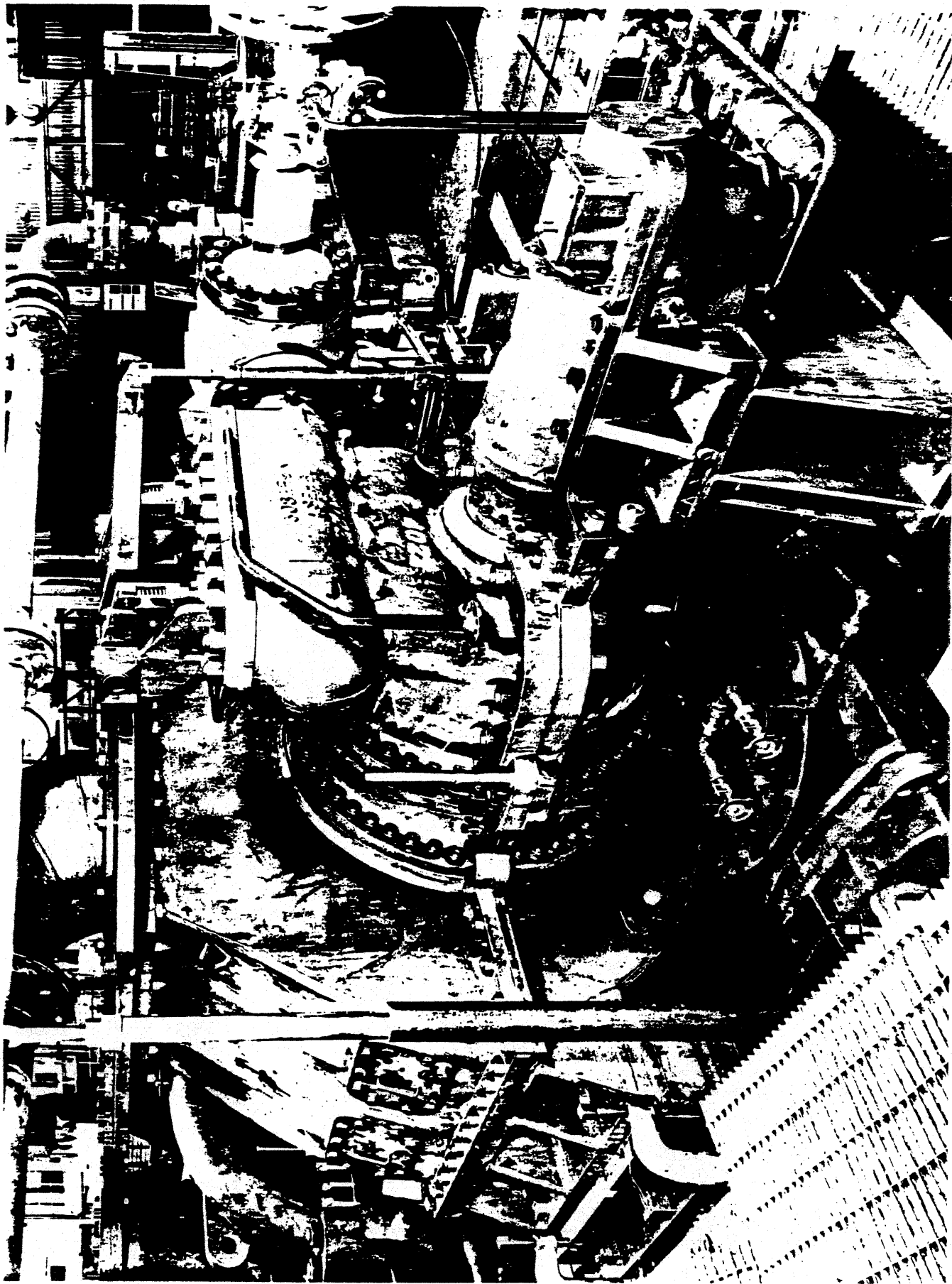


2QNV-6 Condensing turbine.



SQV-8DF Condensing turbine showing internal casing and double flow exhaust with up nozzle.

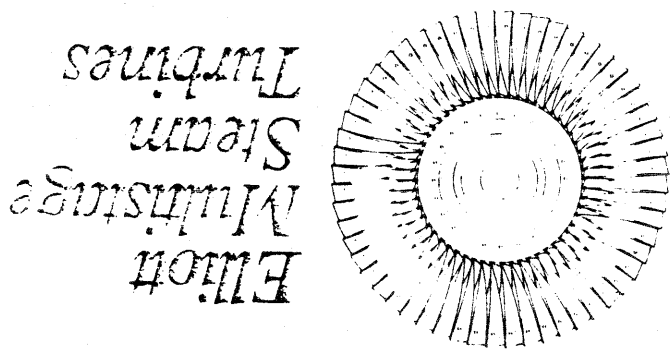
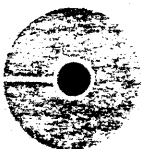


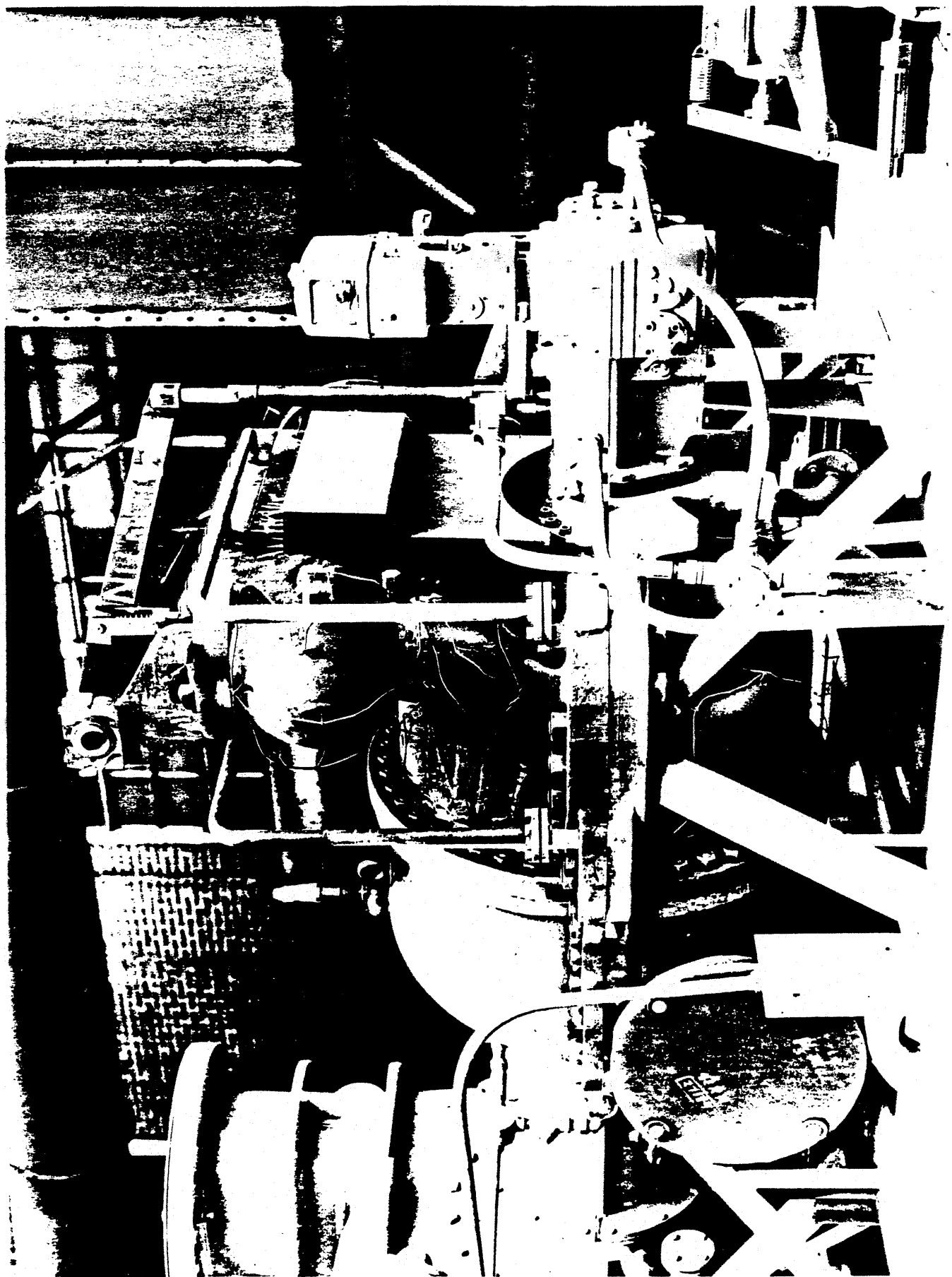


SQV-8DF Condensing turbine inverted upper-half casing showing the five nozzle banks.

Type Q Multivalve Turbines

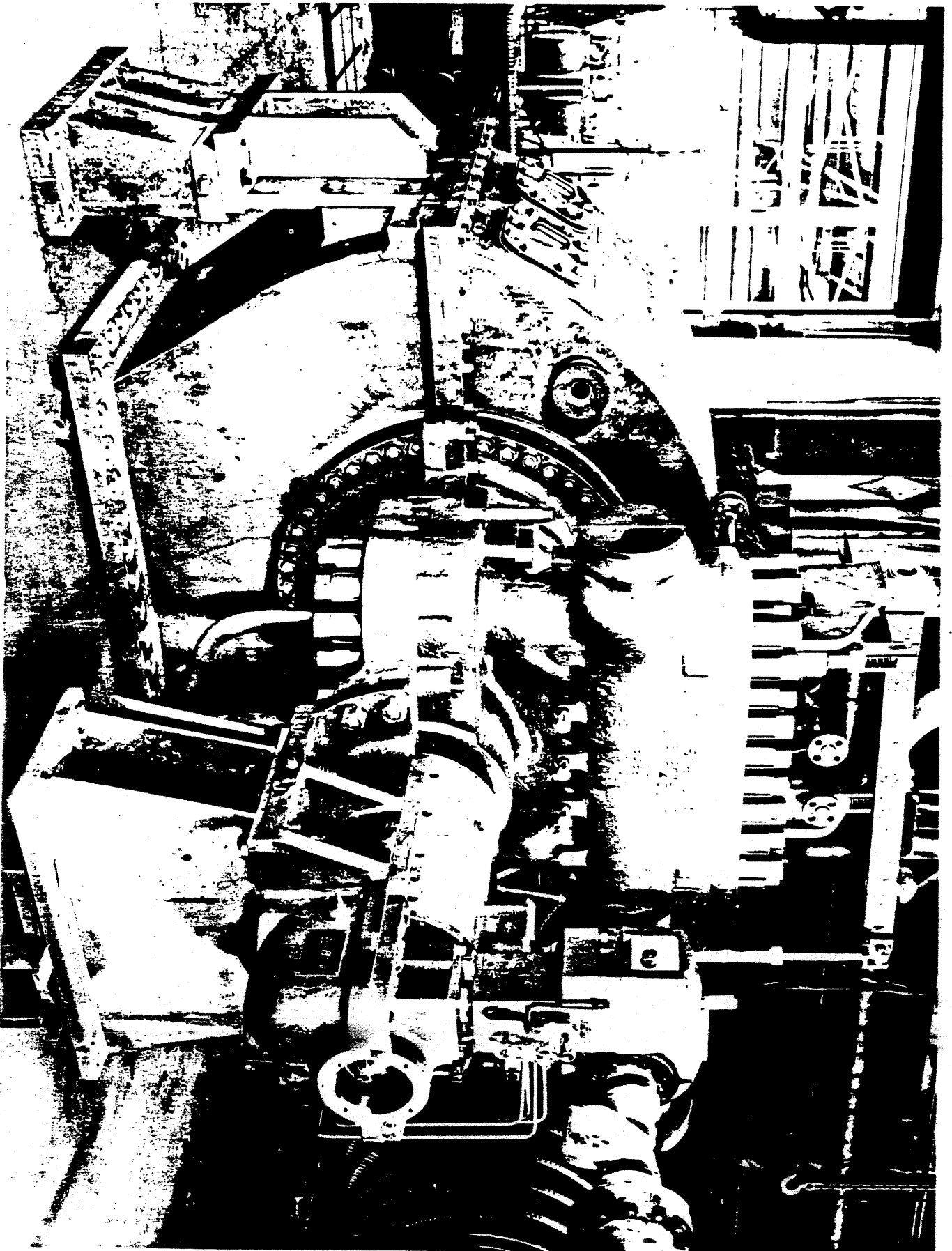
Reprint 130A
March 1976

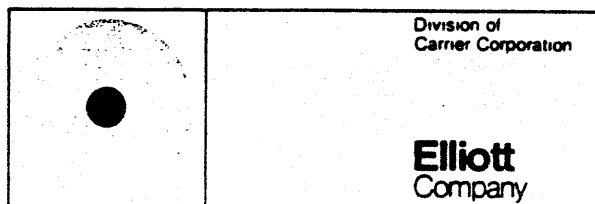




2QV-5 Back-pressure turbine showing 14" E-line exhaust.

SRV8-DF Condensing turbine showing double-flow exhaust (900 psig design)





- Mechanical Drive Turbines
- Air and Gas Compressors
- Turbochargers
- Tube Cleaners
- Tube Expanders
- Roller Burnishers

Elliott Company General Offices:

Jeannette, Pennsylvania 15644

Other plants at Dayton and Springfield, Ohio;
Isle of Wight, England

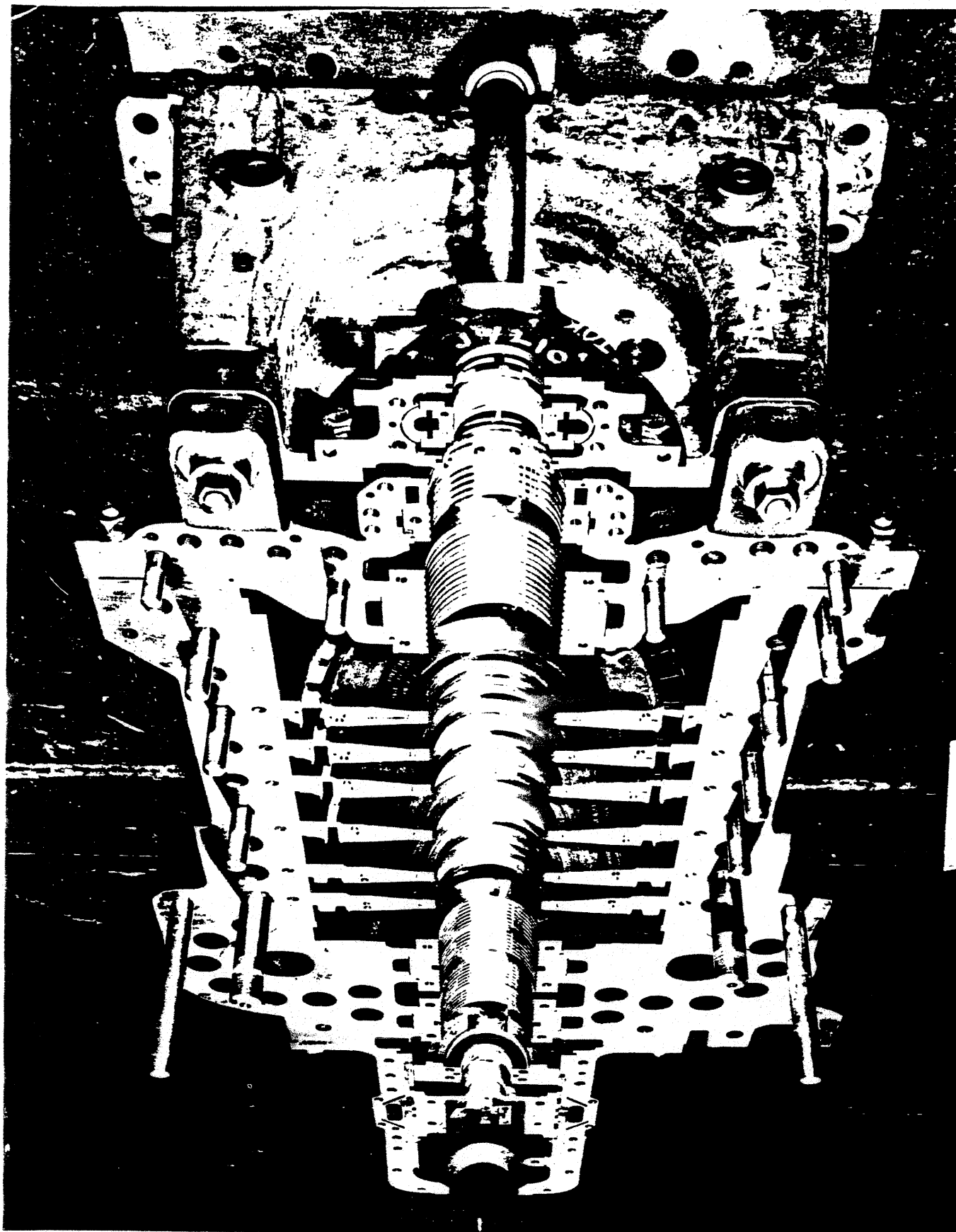
Canada: Elliott Industrial Equipment Company
24 Queen St. East, Brampton, Ontario

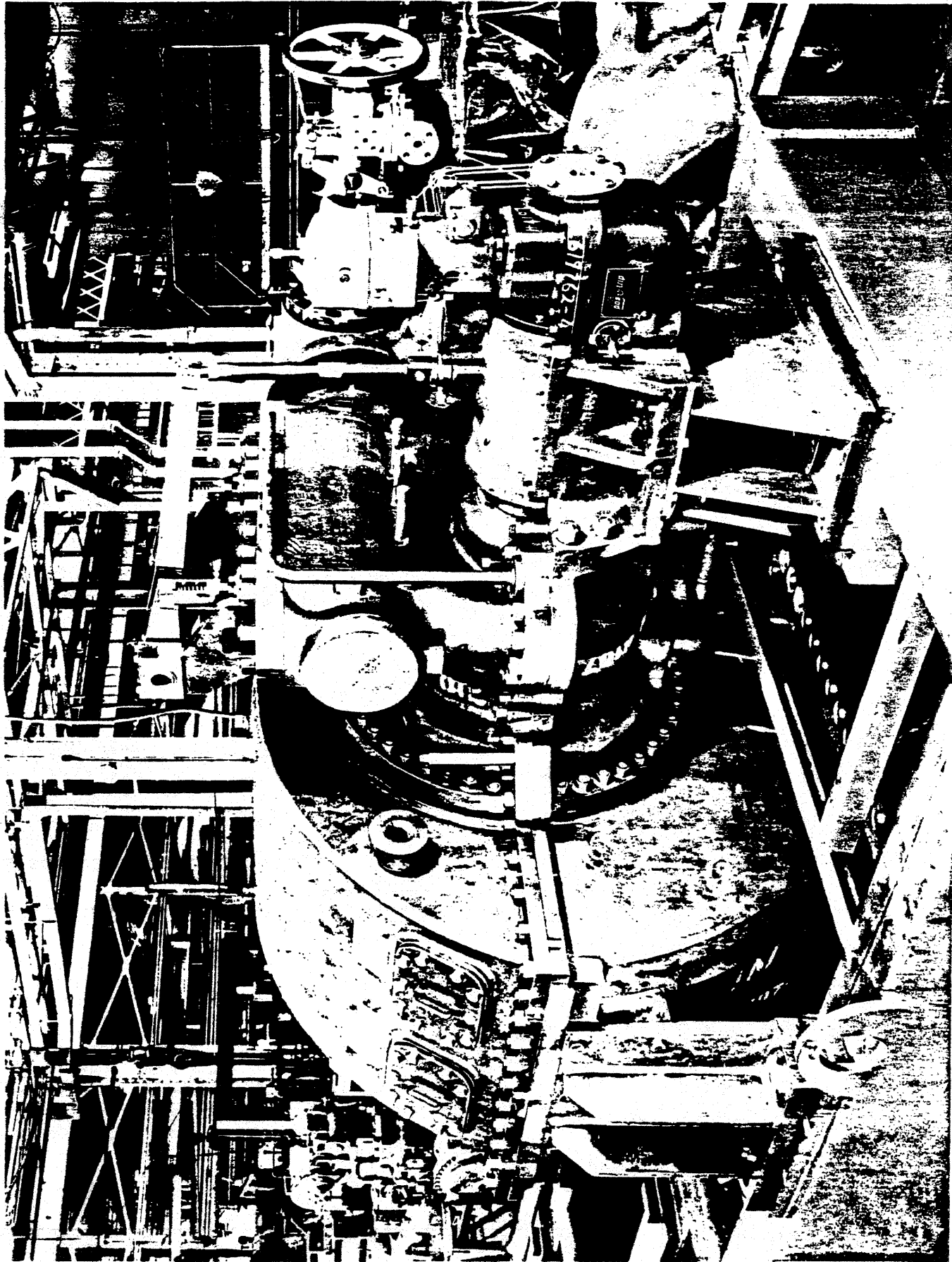
Europe, Middle East, Africa:
Elliott Turbomachinery Ltd.
197 Knightsbridge, London, England

Latin America: Elliott Overseas Company
1570 Madruga Avenue
Coral Gables, Florida 33146

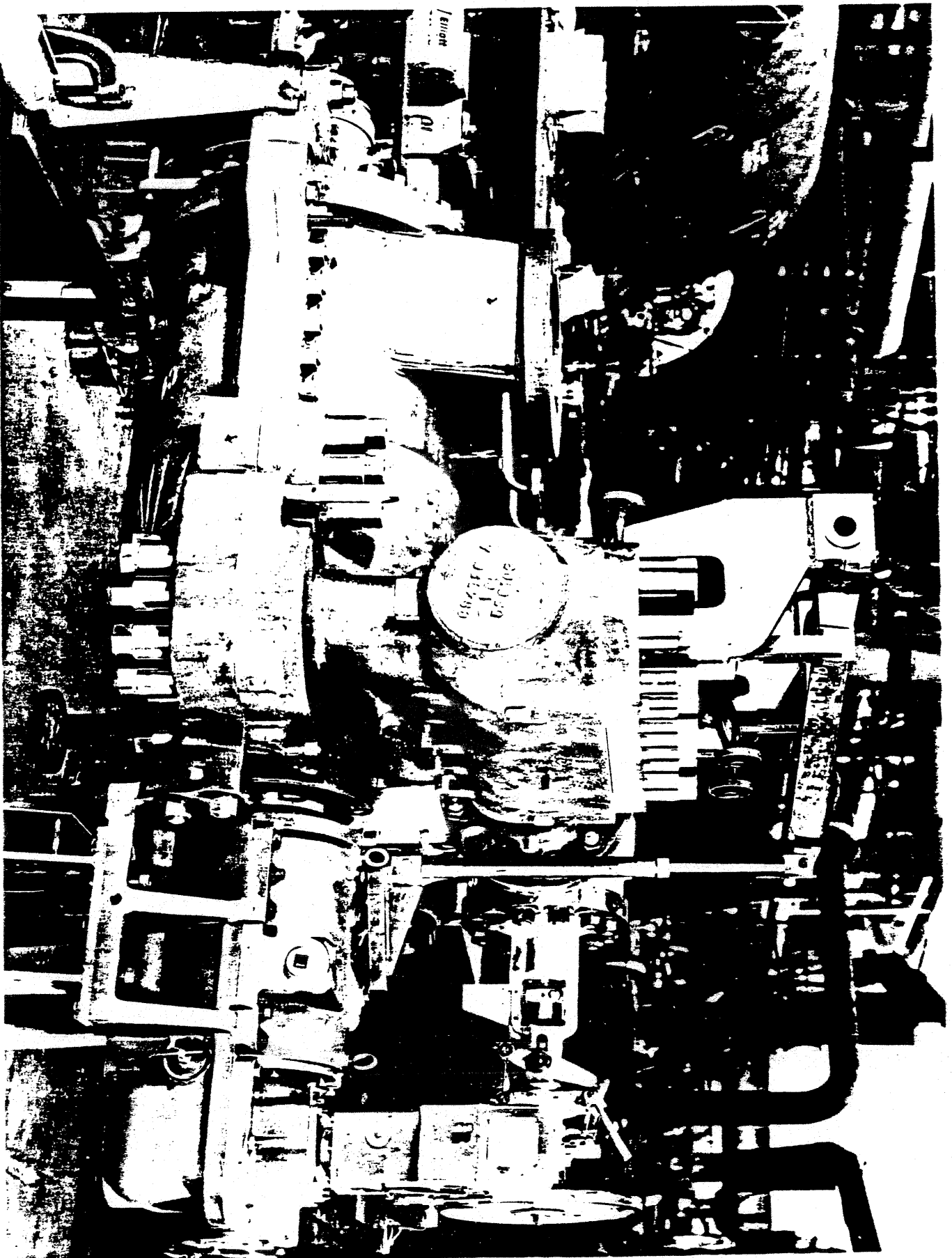
Far East: Elliott Overseas Company
P.O. Box 1112, City of Industry, California 91749

SRV-7 Back-pressure turbine lower-half casing showing all fabricated diaphragms, labyrinth seal

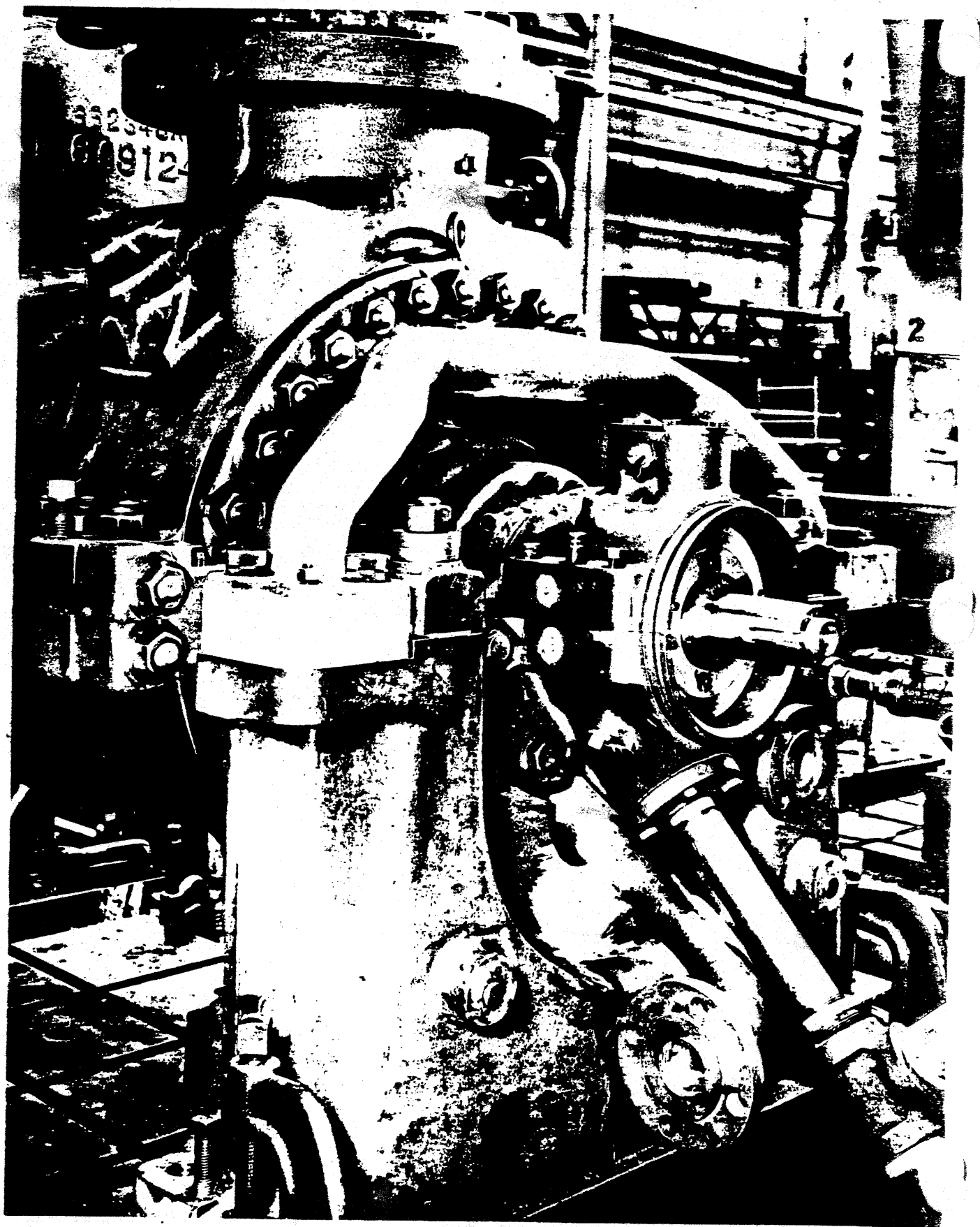




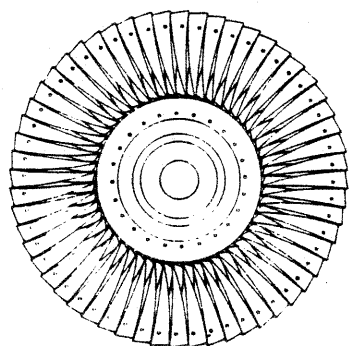
SRV6-DF Condensing turbine showing left-flow exhaust (650 psig design)



SRV-7 Back-pressure turbine. (900 psig design)



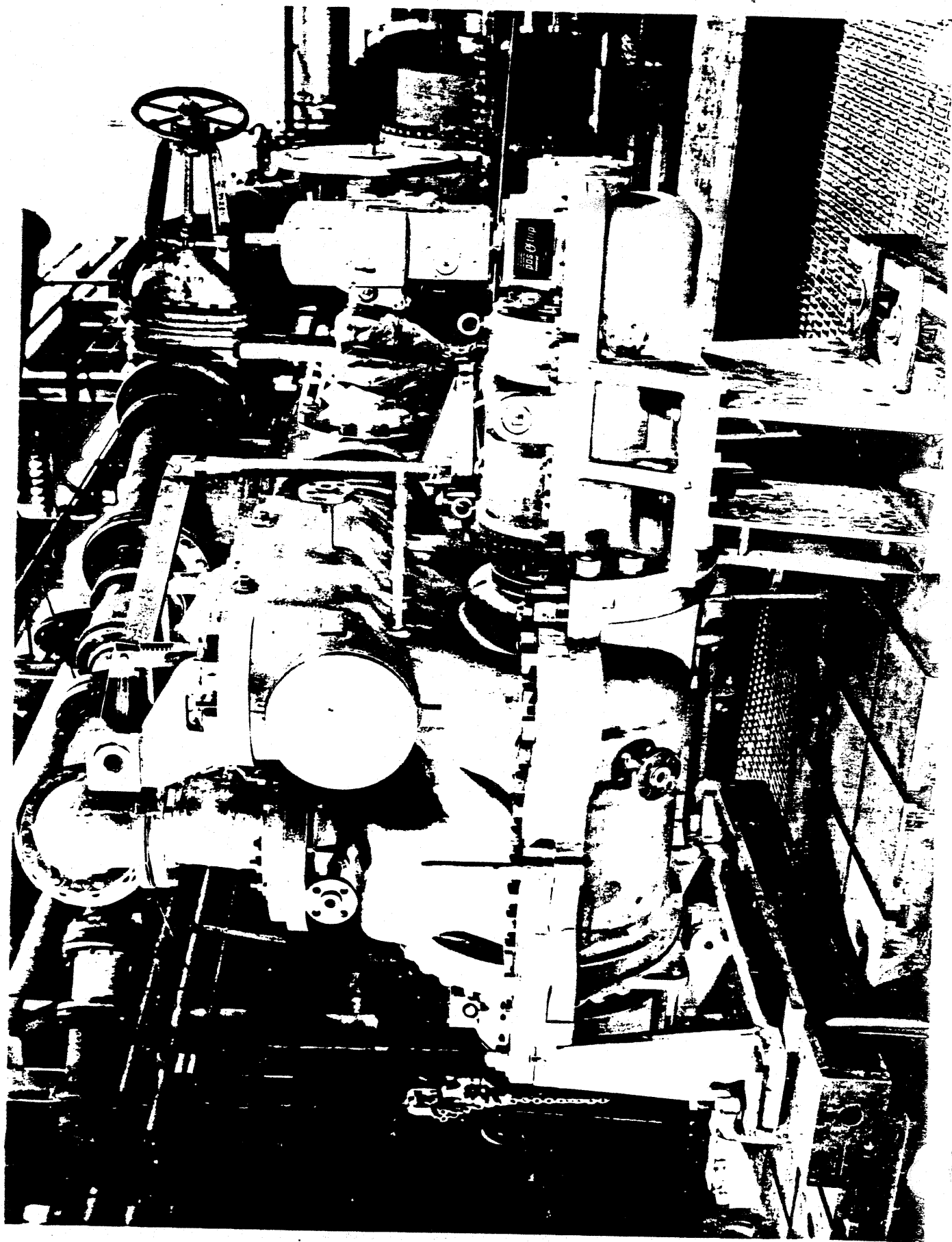
Type R Multivalve Turbines

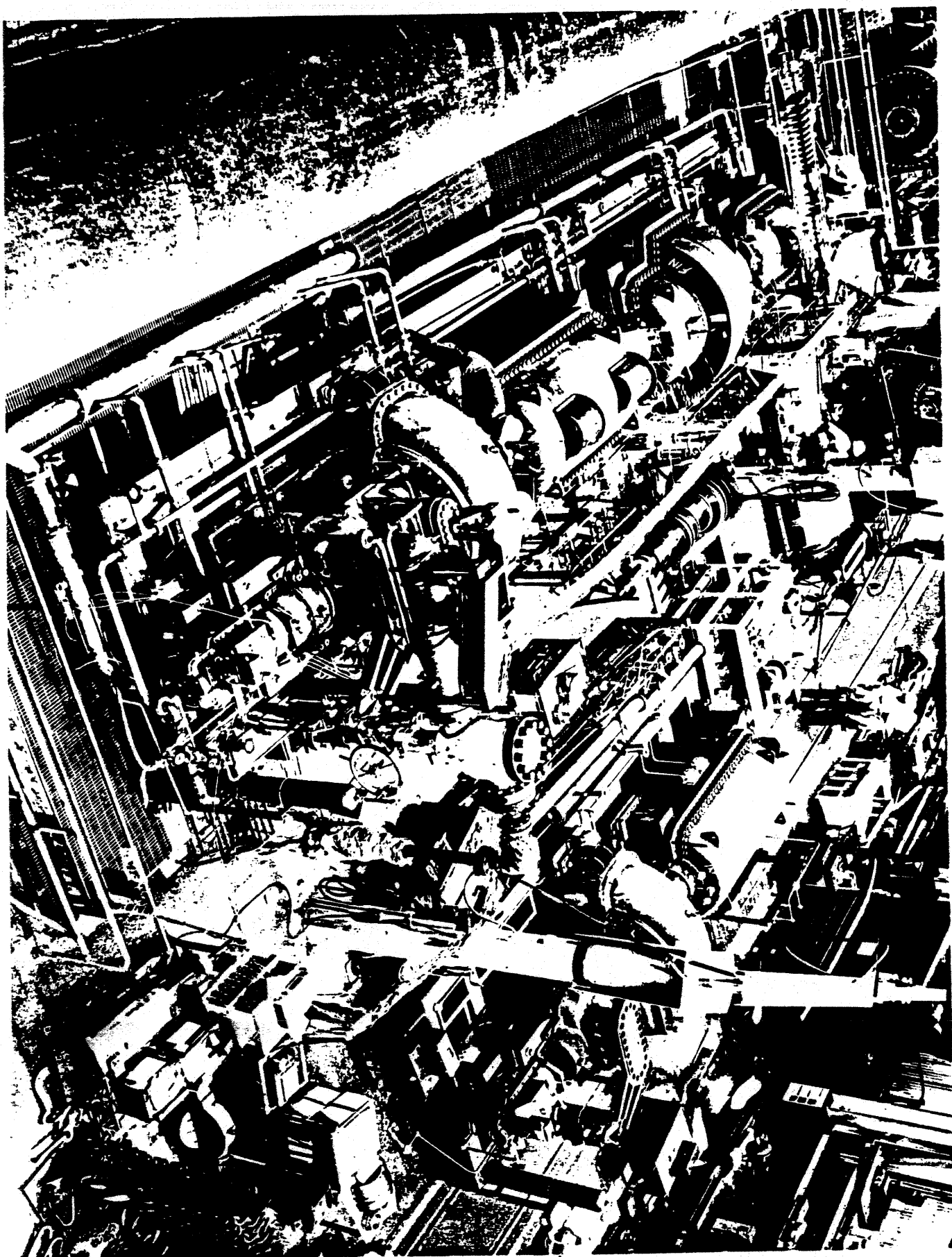


*Elliott
Multistage
Steam
Turbines*

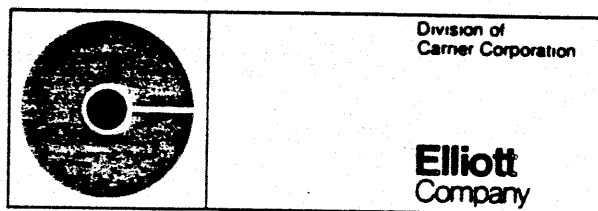
Reprint 129A
March 1976







Two 2SNV-6 turbines being readied for operation on Elliott's test floor.



- Mechanical Drive Turbines
- Air and Gas Compressors
- Turbochargers
- Tube Cleaners
- Tube Expanders
- Roller Burnishers

Elliott Company General Offices:

Jeannette, Pennsylvania 15644

Other plants at Dayton and Springfield, Ohio;
Isle of Wight, England

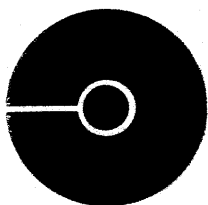
Canada: Elliott Industrial Equipment Company
24 Queen St. East, Brampton, Ontario

Europe, Middle East, Africa:

Elliott Turbomachinery Ltd.
197 Knightsbridge, London, England

Latin America: Elliott Overseas Company
1570 Madruga Avenue
Coral Gables, Florida 33146

Far East: Elliott Overseas Company
P.O. Box 1112, City of Industry, California 91749



SPECIFICATIONS

CRITICAL SPEED POLICY—Process Compressors and Turbines

The availability of new analytical tools and techniques for rotor dynamics studies has in some cases led to misunderstandings regarding critical speed analyses. In order to prevent such misunderstandings, the following company policy is presented. It will pertain to all contracts involving process type compressors and multistage turbines, unless amended by mutually satisfactory agreement.

I. Lateral Critical Speed

A. It is Elliott Company policy to design machinery in accordance with API 617 criteria, unless otherwise stated. First critical speed will be at least 20% over maximum continuous speed for "stiff shaft" machines and at least 15% below minimum operating speed for "flex. shaft" machines. Second critical speed will be at least 20% over maximum continuous speed.

B. On variable speed machines, it will be assumed that minimum operating speed will be at least 75% of maximum continuous, unless otherwise stated or unless a specified operating point requires a lower speed.

C. Nameplate critical speeds will be calculated values in all cases except first critical on a "flex. shaft" machine. The latter value will be that measured on the test floor.

D. Method of critical speed prediction will be at the discretion of Elliott Company, and will normally be "Prohl" method, depressed for support system characteristics.

E. If an unbalance response analysis is specified, Elliott Company will comply, including a report. If data submittal for independent analysis is specified, it will be furnished. In either case, a fee for this service is required.

II. Torsional Critical Speeds

A. It is Elliott Company's policy to perform a torsional analysis on all multistage compressors and multistage turbines, unless amended by mutually satisfactory agreement.

pressors strings containing speed reduction or speed increasing gears. An analysis is also performed for all synchronous motor driven systems.

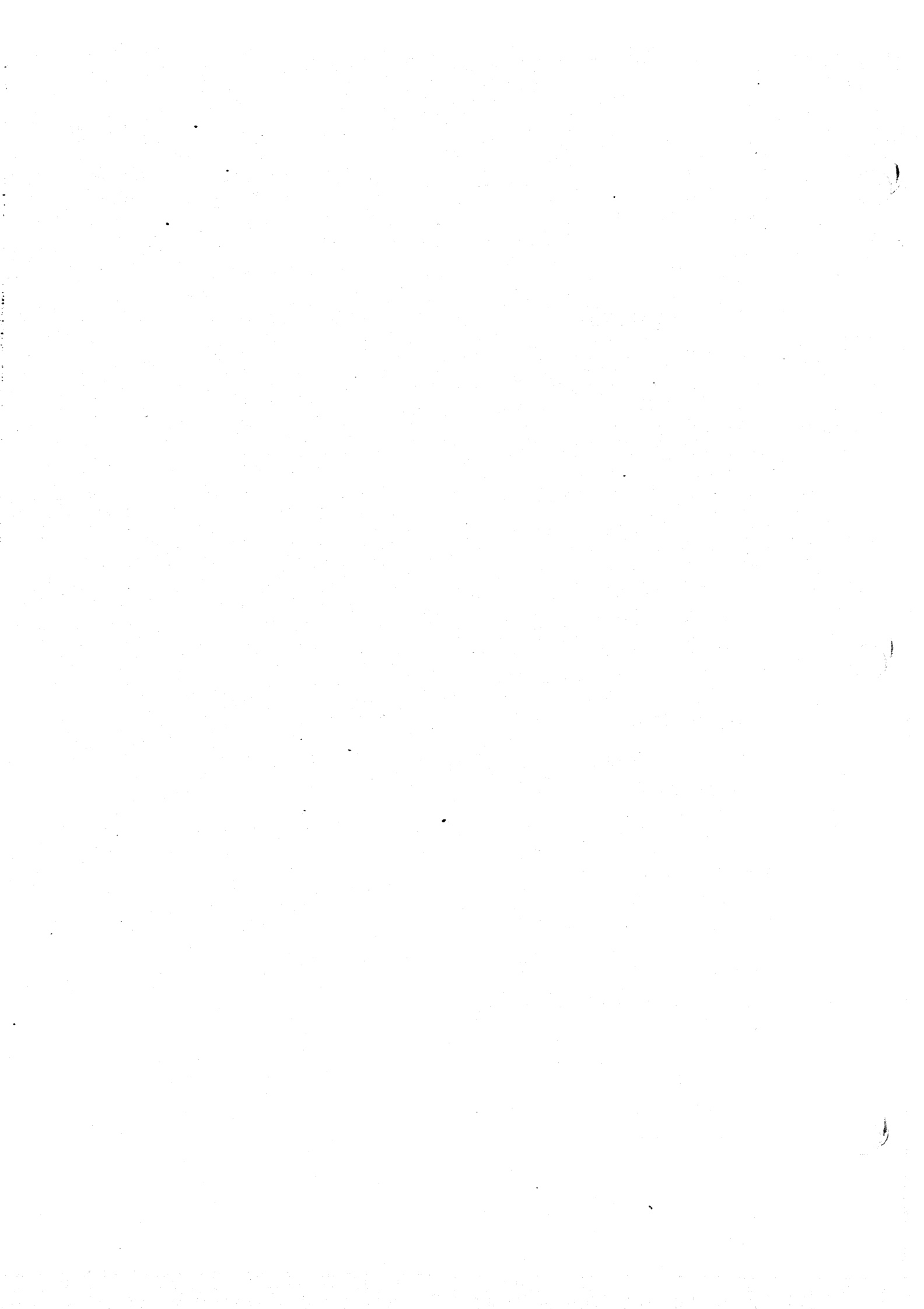
B. Unless specified, non-gear steam turbine driven strings are normally not analyzed because torsional response of such systems in resonance results in stresses that are well below allowable values.

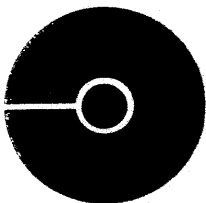
C. Calculated torsional critical speed will be at least 10% removed from first order speed range and gear tooth passing frequency. If a margin of 10% is not physically possible, analysis of shaft and coupling stresses is made to achieve acceptable levels when running in or near resonance. If specified, a torsional report will be issued. If data submittal for independent analysis is specified, it will be furnished. In either case, a fee for this service is required.

III. Policy

A. As stated above, unbalance response and/or torsional reports will be provided when specified. If data are requested for the purpose of independent unbalance response and/or torsional analyses, such data will be furnished.

B. In either case above, it is understood that differences in methods, empirical factors, and interpretation may occasionally lead to different conclusions. In such cases Elliott Company will make reasonable efforts to resolve the differences. If this proves impossible, further expense and time lost must be borne by others. If physical changes mandated by others are considered detrimental by Elliott Company, the right of warranty qualification is reserved.





SPECIFICATIONS

API 615 (1/73) — SOUND CONTROL ELLIOTT POLICY FOR COMPRESSORS AND TURBINES

I. Scope

Elliott Company recognizes the need for sound level control, and the fact that rotating equipment is a major source of sound. Therefore, the object of this policy is to present the expected sound levels from the company's equipment, describe the environment and method of measurement upon which these levels are based, and discuss methods of sound control. The policy will pertain to all contracts involving process-type centrifugal compressors and multistage turbines, unless amended by a mutually-satisfactory agreement.

II. Installation

A. Environment Acoustical performance is based on a sound pressure level which is dependent on acoustical characteristics of the space in which the unit operates. All measured sound levels are assumed to be in a hemispherical free field or semi-reverberant field which has a room constant large enough so as to not significantly affect sound pressure levels at the measuring point.

B. Background Sound The background sound level is that of the environment measured when the equipment is not running. Levels of ambient sound must be determined so that their influence can be separated from the measured sound levels to obtain the equipment's true sound level. If the difference between the measured sound level and the background sound level is less than 3 dB in a given octave band, a valid equipment sound level in that band cannot be determined. When the difference is greater, the following correction factor should be subtracted from the measured sound level:

Correction-dB	3	2	1	0
(Measured-Background) dB	3	4.5	6.9	10 & Over

The equipment sound levels listed on the other side do not include oil consoles, and the above

III. Sound Measurement

A. Equipment Operation Any meaningful sound level measurement must take place on site while the equipment is operating at rated speed, power and pressure. The object should be to determine equipment sound level that is representative of the normal operating performance and conditions.

B. Associated Sound The effect of the sound produced from the components associated with the system must be eliminated to arrive at a true representation of the equipment sound level. In order to achieve this, the inlet and exhaust steam piping and the inlet and discharge gas piping must be suitably insulated. Compressor accessories, particularly intercoolers and their interconnecting piping, must also be insulated, and inlet silencers must be installed on air compressors. It is the purchaser's responsibility to control the associated sound from the system and other sources to the extent that it does not affect accurate sound level readings of the Elliott equipment.

C. Measurement Locations Microphone locations should be set up in accordance with ANSI S5.1, with all points one metre from a major surface of the equipment and at a height of 1.5 metres above the floor. Additional measurement locations for the process and steam piping as described in API 615 are considered measurements of piping sound level rather than equipment sound level.

(continued on other side)

IV. Equipment Sound Levels

The following table lists the maximum sound pressure levels expected and guaranteed for normal design construction of the company's rotating equipment, based upon the above qualifications of the installation and sound measurement procedures.

TYPE OF EQUIPMENT	QUANTITY OF CASINGS	SOUND PRESSURE LEVEL, dBA (1) NORMAL DESIGN	
		Estimated Range	Guaranteed
Compressor	Each	88-96	98
Steam Turbine	Each	85-95	97
Complete Train: (2)	2	91-99	101
	3	93-101	103
	4	94-102	104
	5	95-103	105

(1) Reference 0.0002 microbars.

(2) Total of all compressor and steam turbine casings.

To reflect any motors or gears in the train of equipment, first determine the sound level difference between the company's equipment and the gear. Increase the higher of the two values by the amount shown in the following table for a total train sound level. Then repeat this correction to the new total if a motor is also included.

	dBA Difference			
	0-1	2-3	4-8	9 & Over
dBA Addition	3	2	1	0

V. Special Sound Control

A. Acoustical Treatment If the purchaser's requirements for sound pressure levels are less than those tabulated above, acoustical treatment can be purchased for the equipment to comply with the current OSHA requirement of 90 dBA for an 8 hour duration. This will usually be accomplished with a house-type enclosure over the equipment.

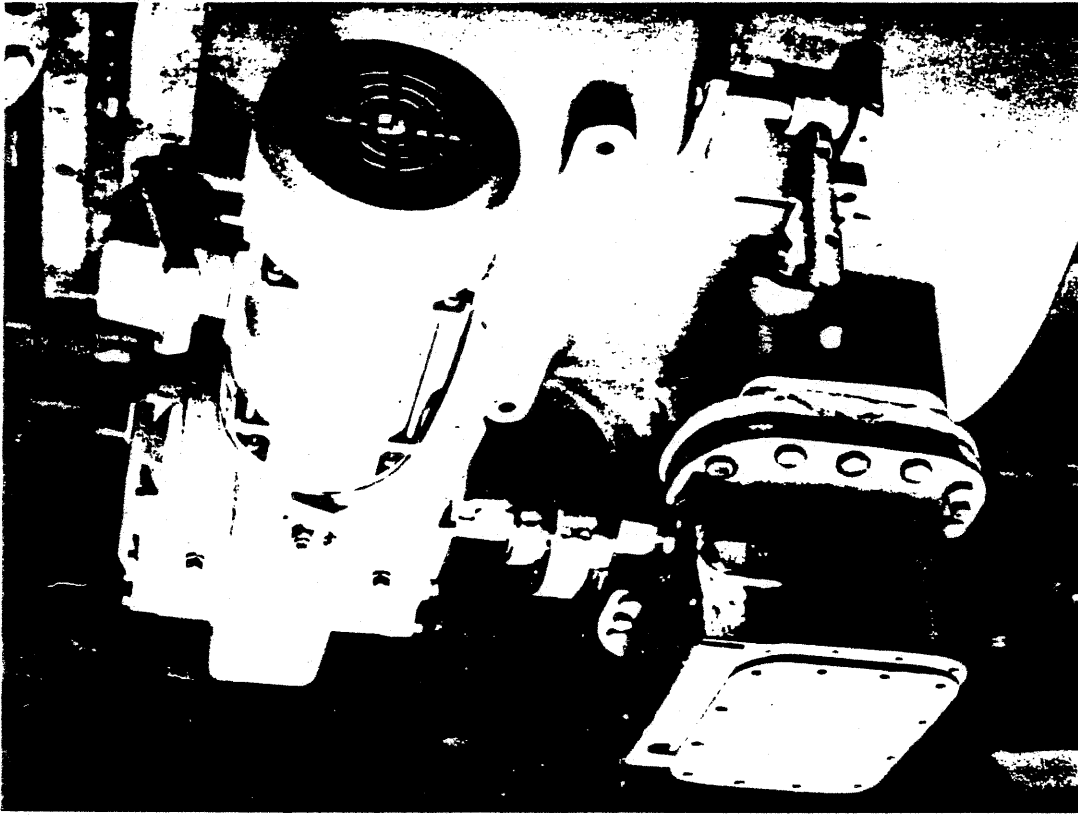
Necessary ventilation and accessibility can be designed into the enclosure as required. Effective sound level reduction is highly dependent on good field installation that eliminates leakage paths.

B. Special Design Due to the nature of sound generation inside centrifugal compressors and steam turbines, it is economically impractical to significantly reduce sound levels through special designs. Therefore, only standard and proven design equipment will be offered, and sound control will be limited to external acoustical treatment as discussed above.

VI. Policy

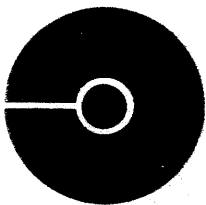
A. Liability Realizing that the control of sound is a function of the installation's environment and the system, as well as the company's equipment, Elliott Company will cooperate fully with the purchaser in attempting to meet his requirements. However, since many of the determinate factors of the sound level are beyond the design and control of Elliott, the company's liability shall be limited to the supply of external acoustical treatment only for the equipment the company has supplied, and only for claims made during the normal warranty period.

B. Sound Level Tests If desired, sound measurements can be taken during normal equipment shop testing with the understanding that nothing special will be incorporated into the test stand arrangement in an effort to reduce sound levels. However, the results from the measurement of sound levels on the company's test stand during shop testing of the equipment cannot be considered accurate or meaningful due to the impossibility of simulating design conditions and installation configuration of the equipment, and also due to the inherent nature of the environment of the test stand. Also, these measurements will not be a factor in the consideration of compliance with any guarantees.



MOTOR-DRIVEN TURNING GEAR

SPECIFICATIONS



electric motor (about 3 HP/2.2 kW) and reduction gearing to connect the motor to the turbine shaft. When operating, the turning gear rotates the turbine shaft at 5-10 r/min, thus preventing the shaft from taking a "set" in one position. Electrical interlocks are provided in the motor starting circuit to prevent starting the turning gear without sufficient oil pressure at the turbine bearings.

Other safety features provide for automatic disengagement of the turning gear if steam is inadvertently admitted to the turbine while the turning gear is engaged. When this occurs the motor is automatically turned off and the turning gear locked out of the way to prevent damage.

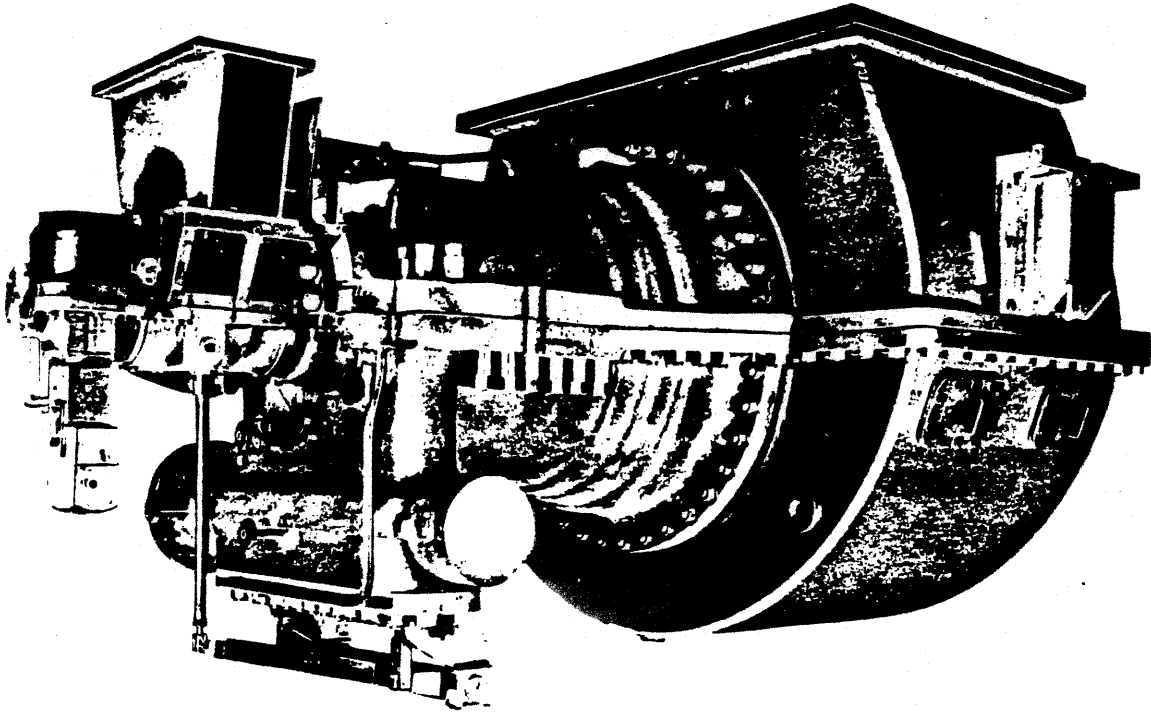
During startup and shutdown of high-temperature turbines, when large temperature changes are taking place within the casing, it is desirable to rotate the turbine rotor at slow speed so as to minimize thermal distortion of the shaft.

Unequal heating or cooling can result in the rotor taking a "set" and the shaft becoming bowed—which can delay startup while waiting for the shaft to straighten.

A motor-driven turning gear provides the power to slowly turn the rotor at these times and can also be used to roll the rotor to any desired position for inspection checks.

The turning gear is generally mounted at the exhaust end of the turbine and consists of a small

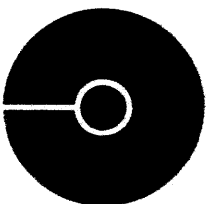
Typical Double-Flow Condensing Steam Turbine



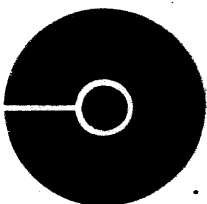
Turbine staging generally consists of a two-row impulse pressure (Curtis) stage followed by one or more single-row impulse pressure (Rateau) stages as required for the design and for the operating steam conditions. Steam flow is regulated through nozzles to the first stage blades. Further expansion of the steam in each stage as it expands to lower pressures converts the heat energy of the steam into velocity energy, which, in turn, is absorbed by the moving blades and delivered to the shaft. When the specified heat drop is relatively small, or for some noncondensing designs requiring optimum efficiency at a selected load point, the first stage may be a single-row impulse type rather than two-row.

Each Elliott turbine is designed for the particular conditions of the specific application, thus assuring continued high efficiency and reliability. Elliott turbines are of the horizontally-split, impulse type featuring the inherent advantages of large running clearances and low end thrust. Coordinated design, assembly and test of the turbine with its accessories assures dependable, economic operation. Component design, applied engineering, manufacturing processes and field experience have developed from a wide and varied experience with both turbine-generator and mechanical drive units. Background knowledge of all of these necessary functions plus a continuing program of research and development produces a unit incorporating the latest state-of-the-art advances.

MULTI-VALVE TURBINE CONSTRUCTION AND ARRANGEMENT



SPECIFICATIONS



SPECIFICATIONS

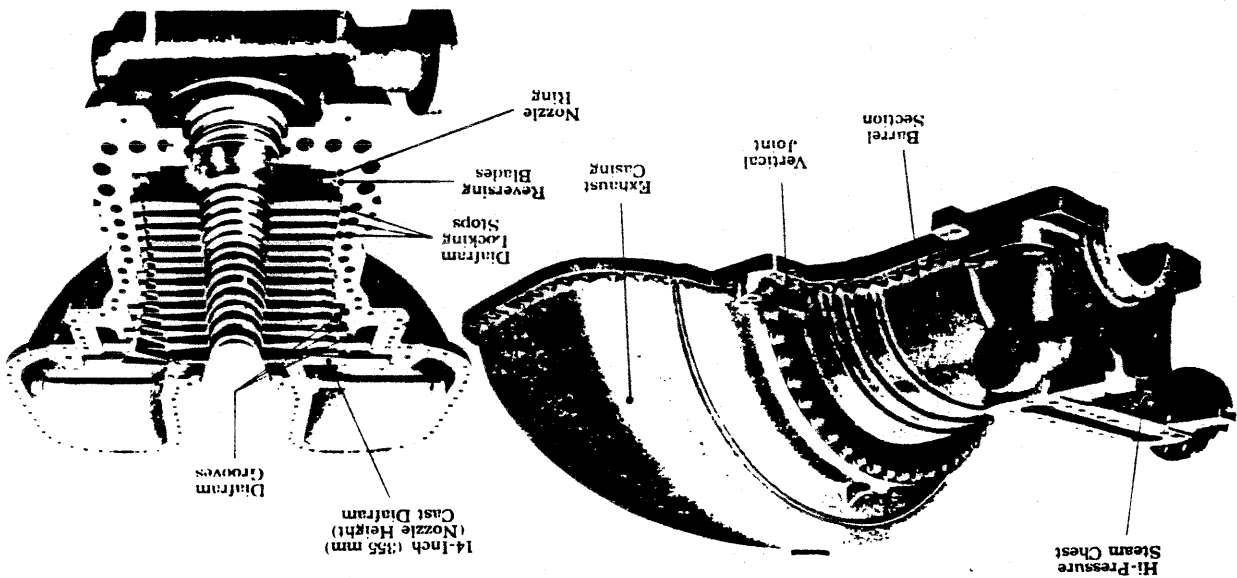
MULTIVALVE TURBINE CASING

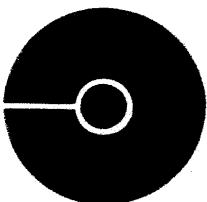
The high-pressure end of the turbine is supported by the steam end bearing housing which is flexibly mounted to allow for axial expansion caused by temperature changes. The exhaust casing is centerline supported on pedestals that maintain perfect unit alignment while permitting lateral expansion. Covers on both the steam end and exhaust end bearing housings and seal housings may be lifted independently of the main casing to provide ready access to such items as the bearings, control components and seals.

Additionally, all Elliott steam end designs avoid excessive metal concentrations as a precaution against large temperature gradients between inside and outside skin temperatures. This provides for rapid temperature equalization during start-up and thus minimizes the required warm-up period at reduced speed. This also protects against nozzle partition cracking, assuring a long casting life for turbines assigned to frequent start-stop service.

The typical casing for an Elliott turbine consists of a cast high-pressure steam chest, intermediate barrel section, and separate exhaust casing. The barrel section is generally integral with the steam chest so that the vertical bolting joint is at one of the latter stages where internal pressures are very much reduced. The steam end, exhaust casing, nozzle ring, reversing blades and diaphragms are all split on the horizontal center line. Eyebolts, lifting lugs and guide rods are provided so the entire upper half of the turbine can easily be lifted to permit internal inspection.

The nozzle ring and diaphragms are machined on the outside diameter and assembled into grooves accurately machined in the casing. Cap screws, secured by locking, fasten the nozzle ring to the steam chest, while diaphragm halves are locked in position by stops located at the horizontal split of the casing. Steam chest passages, nozzle block partitions and valve opening sequence are all carefully designed to insure even and rapid heating of the





SPECIFICATIONS

MULTIVALVE TURBINE ROTOR ASSEMBLY

The turbine rotor consists of the shaft, seals, thrust collar, overspeed trip, governor drive, half coupling and discs complete with blades.

For units operating at moderate temperatures and speeds, all discs are shrunk and keyed on the shaft, the hubs being designed to minimize bore stresses. Replaceable sleeves are always used between the discs to protect the main shaft in case of rubs caused by abnormal operation. Individual discs are always statically balanced. The components are always statically balanced.

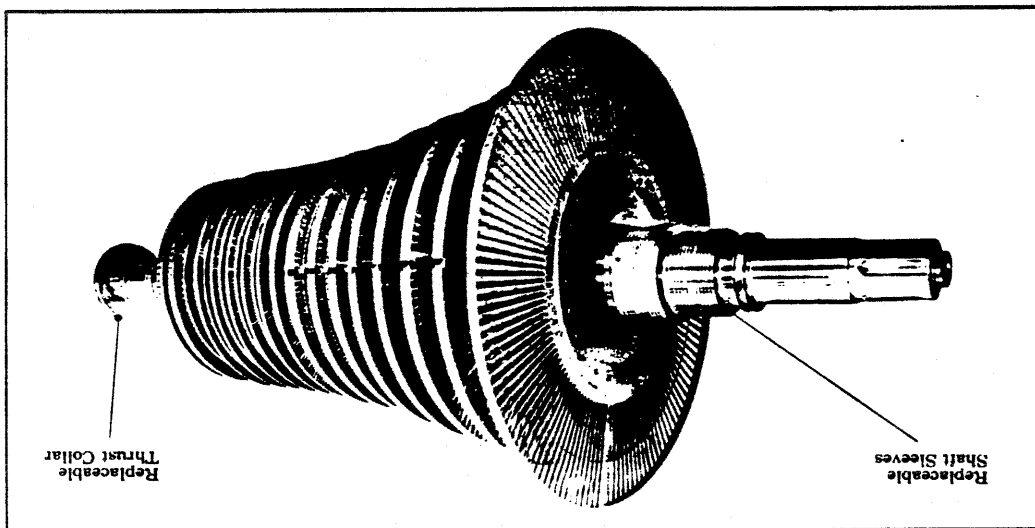
For units operating at high temperatures and/or high speeds, the first few, and sometimes all discs are forged integrally with the shaft.

With either type construction, the shaft forging and disc materials are selected to match the exact speed and temperature conditions of the application and the shaft is proportioned to insure any critical speeds are safely outside the operating speed range.

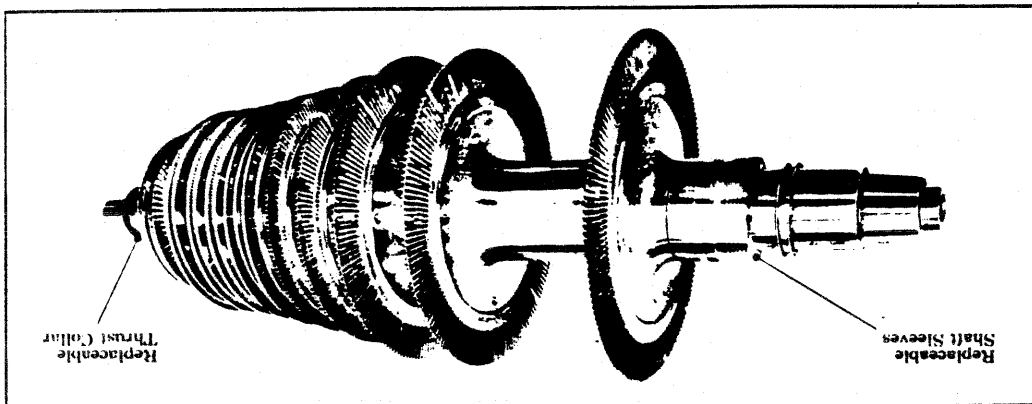
pleated rotor assembly is then dynamically balanced to insure smooth operation.

For units operating at high temperatures and/or high speeds, the first few, and sometimes all discs are forged integrally with the shaft.

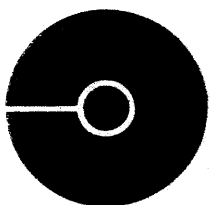
With either type construction, the shaft forging and disc materials are selected to match the exact speed and temperature conditions of the application and the shaft is proportioned to insure any critical speeds are safely outside the operating speed range.



Typical built-up single-flow rotor with 14-inch (355 mm) last stage blades



Typical integral rotor with double-flow last stage



SPECIFICATIONS

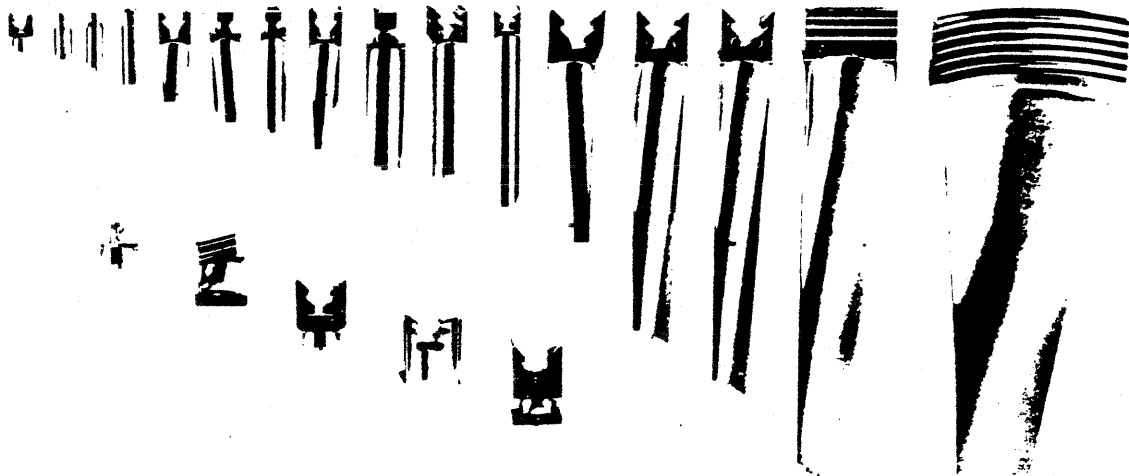
TURBINE BLADES

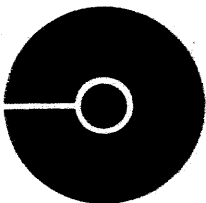
and twisted vortex blading is used in low pressure stages.

All blades are produced on the most modern of machine tools from a chromium stainless steel alloy specially selected for its strength, erosion/corrosion resistance and damping qualities. These modern tools, plus a strict quality control program, consistently produce blades to the exacting tolerances required to assure a tight fit on the discs.

For each turbine application, blade selection is determined with utmost care before a proposal is presented. Each selection is made considering both thermodynamic performance and mechanical reliability. For every stage the blade frequencies and stresses are analyzed (centrifugal and steam loading) using the design aids mentioned above. Further, other blade-related considerations are analyzed including such important features as thrust size and loading, stage pressures, pressure drop per stage, blade trip-speed limits, disc speed limits, and resonant conditions.

Because the blades are the most vital part of a modern steam turbine, Elliott devotes considerable time and effort to their design and manufacture. Many years of experience have resulted in an unusually wide selection of blades. Elliott's superb record of blade reliability is the result of a conservative design philosophy and the extensive use of modern design aids such as Goodman, Interference (Campbell), and Elliott Diagrams™ which are based on actual testing of complete rotors to determine natural blade frequencies. This extensive testing program and the resulting Elliott Diagrams™ mean all blades in your turbine are assured of a long trouble-free life. The photo below illustrates some of the designs available to meet any conditions of power, speed and steam conditions. Notice the various root types available as well as shroud and/or lashing wire combinations. The blades are spaced and shaped for optimum strength and resistance to vibration, as well as to derive the maximum aerodynamic lift (push) from the steam with minimum energy loss. Tapered





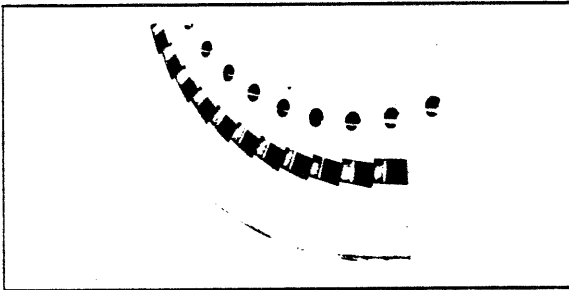
SPECIFICATIONS

MULTIVALVE TURBINE NOZZLES AND DIAFRAMS

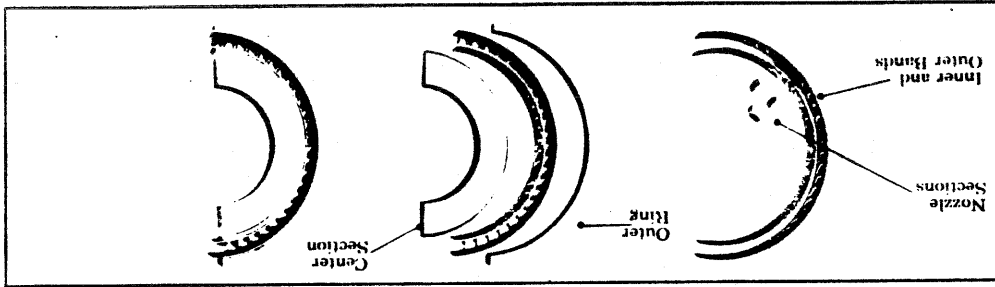
The nozzles used in the first stage nozzle ring are cut from stainless steel. Steam passages are then accurately milled in these nozzle blocks before they are welded together to form the nozzle ring. Nozzles for intermediate-pressure diaframs are formed from profiled stainless steel sections welded into stainless steel inner and outer bands. These nozzle sections are then welded to a circular center section and to an outer ring then accurately machined to form the completed diafram.



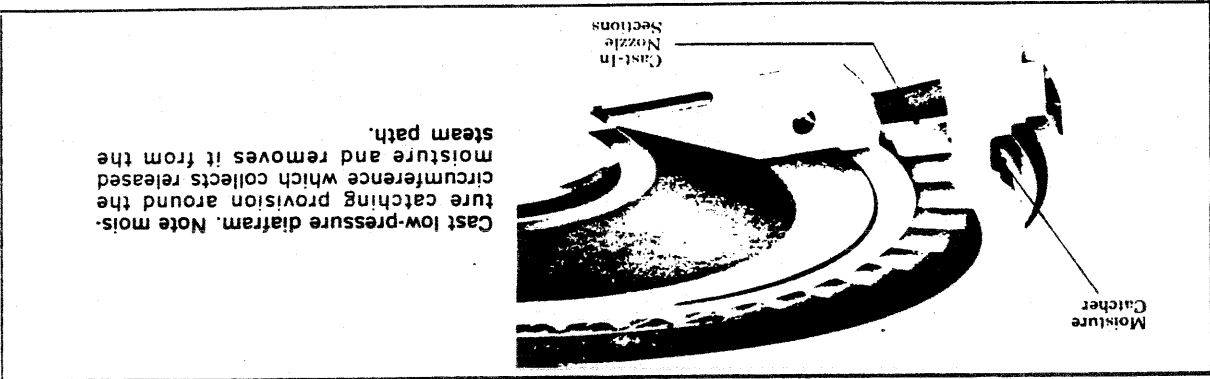
Milled nozzle blocks which form the first stage nozzle ring.



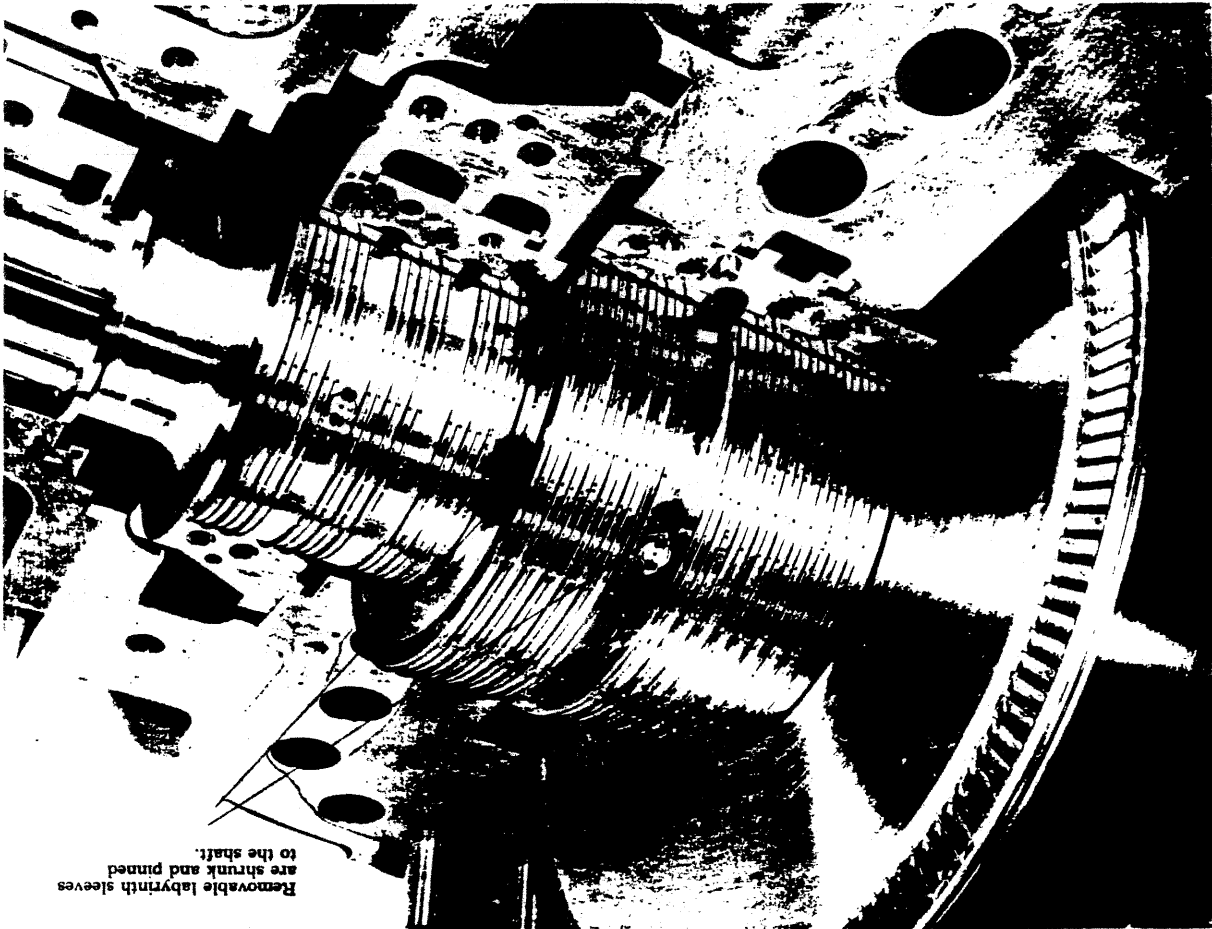
Section of completed first stage nozzle ring.



Intermediate stage diafram in three stages of assembly, left to right.



Cast low-pressure diafram. Note moisture catcher which collects released moisture and removes it from the steam path.

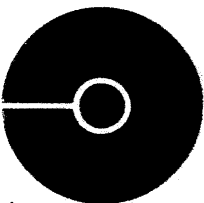


Removable labyrinth sleeves
are shrunk and pinned
to the shaft.

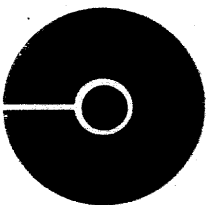
operation, the sealing strips are deformed, clearance is increased, and the resulting heat is conducted away from the shaft. This reduces the possibility of a bowed shaft. Frequently, continued operation is possible with these increased clearances, and replacement of the removable strips and sleeves postponed until convenient. Labyrinth seals are also used where the shaft passes through the diaphragms to prevent leakage between stages.

At each end of the turbine shaft, where it projects through the casing, suitable seals are provided to prevent the outward leakage of steam along the shaft or the in-leakage of air. Segmented carbon rings with replaceable shaft sleeves are available on smaller models. Metallic labyrinth-type seals are available on all models and standard on larger frames. With labyrinth seals, alternate high and low packing strips rotate inside a stationary baffle. In case of a rub caused by abnormal

MULTIVALVE TURBINE SHAFT SEALS



SPECIFICATIONS



SPECIFICATIONS

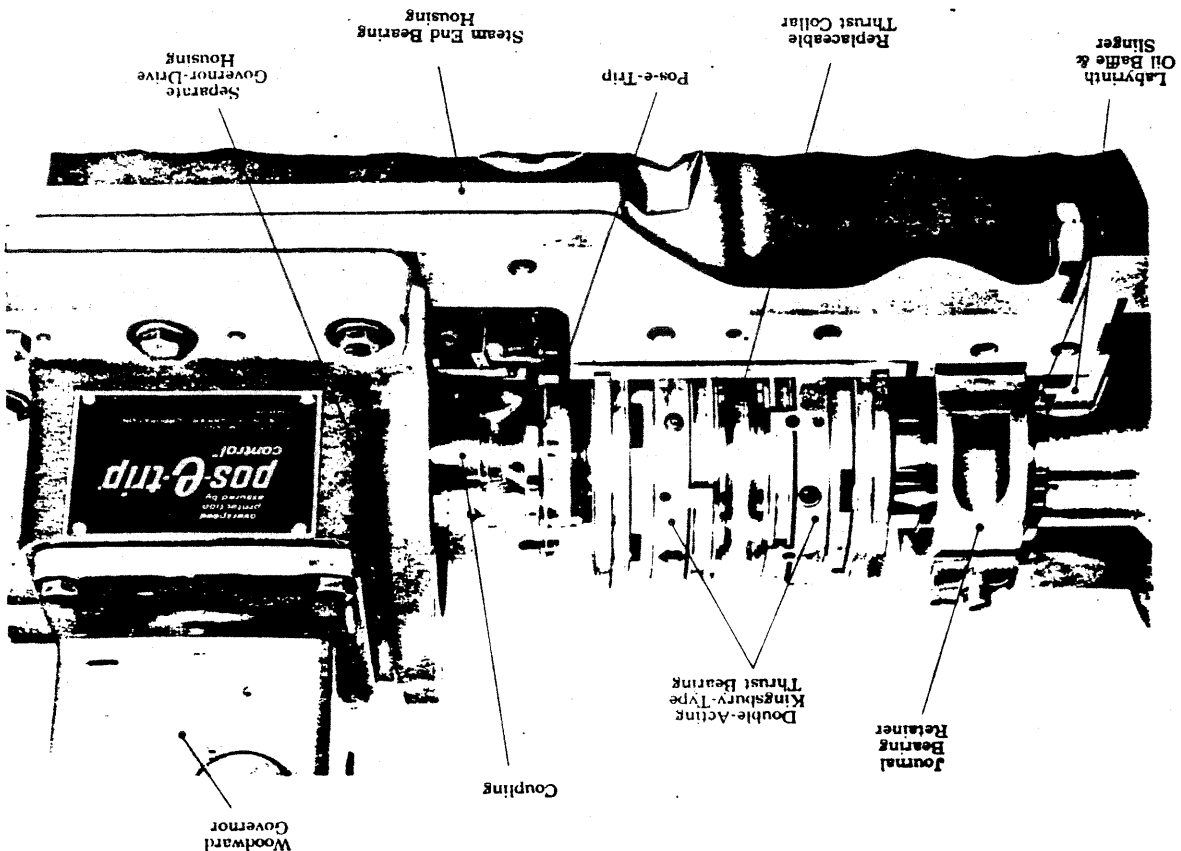
MULTI-VALVE TURBINE BEARINGS

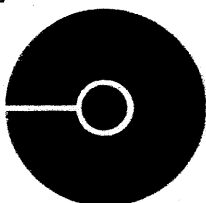
tween the thrust collar and the surface of each shoe, the self-leveling feature assures that the thrust load is evenly distributed among the shoes. The Elliott design provides a convenient means of moving the rotor axially to adjust the stationary-to-rotating clearances. As with the journal bearings, stops at the horizontal split prevent the thrust bearing from rotating with the shaft.

All Elliott thrust bearings are sized to provide thrust capacity well in excess of the thrust created in the turbine.

JOURNAL BEARINGS: The turbine rotor runs in positively-aligned, pressure-lubricated bearings that are horizontally-split and lined with babbit of the highest quality. Anti oil-whip and pressure-dam bearings are used where required to assure bearing stability throughout the speed range. Oil slingers and labyrinth baffles prevent the leakage of oil out of the bearing housings.

THRUST BEARINGS: Proper running clearances are assured by the double-acting, self-leveling, fully-equalized, Kingsbury-type thrust bearing. As the wedge-shaped oil film is formed bearing.





MULTIVALVE TURBINE OVERSPEED TRIP SYSTEM

In addition to the overspeed trip, other safety devices may be incorporated into the hydraulic trip circuit to shut down the turbine. These would include such factors as high bearing temperature, loss of exhaust vacuum, or changes in process conditions.

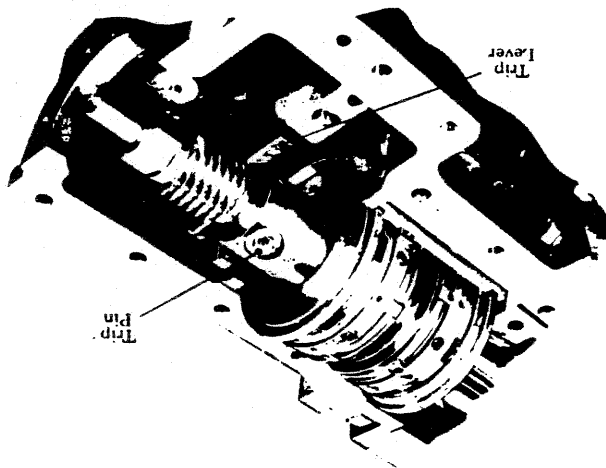
An added safety feature is available that closes the governor valves in addition to the trip-and-throttle valve, when any of the above devices shut down the turbine. This insures the unit will shut down even if the trip-and-throttle valve should stick in the open position due to scale deposits, etc. Each Elliott turbine is also supplied with a manual trip lever conveniently located on the steam-end bearing housing.

The trip-and-throttle valve used on Elliott turbines is constructed of materials selected to match the conditions of each application. It is supplied with a built-in steam strainer and is designed for throttling operation during start-up. This allows all governor valves to remain open to insure rapid and even heating of the steam chest and nozzle chambers. The handwheel and additional trip lever are located for convenient and safe operation.

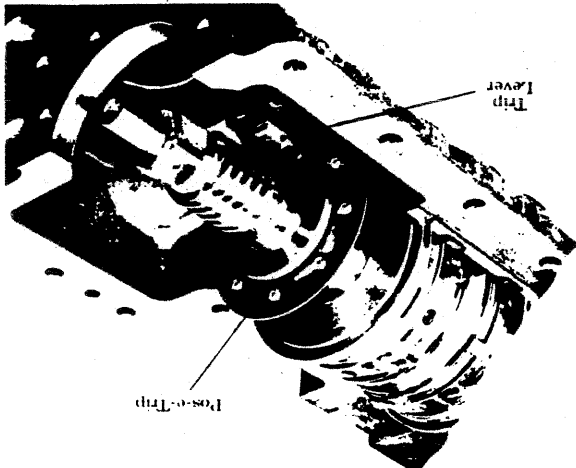
An emergency overspeed trip, entirely separate from the speed governor, is supplied to instantly stop the flow of steam to the turbine if the set speed is exceeded. The trip mechanism may be reset at speed without bringing the turbine to a complete stop.

Units tripping at speeds below 8000 rev/min are fitted with a conventional eccentric trip-pin mounted in the turbine shaft. When trip speed is reached, centrifugal force on the pin causes it to strike an oil release mechanism. This relieves the oil pressure on the trip cylinder of the trip-and-throttle valve, instantly stopping the flow of steam to the turbine.

Units tripping at speeds above 8000 rev/min are fitted with Elliott's exclusive, patented Pos-e-trip® control which will consistently and repetitively trip within 1/10 of 1 per cent of the set speed. Each Pos-e-trip is calibrated at the factory and no further adjustment is ever required—either at startup or during the normal life of the turbine. Proper calibration cannot be tampered with by operators, assuring that your turbine is being operated within safe speed limits. Tripped or untripped, the Pos-e-trip is inherently in dynamic balance.



Trip System below 8000 rev/min



Trip System above 8000 rev/min

