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AKTIESELSKABET

BURMEISTER & WAIN'S MASKIN- OG SKIBSBYGGERI

4, Strandgade, Copenhagen, Denmark

Telephones:

Head Office and Engine Works Asta 2501

Shipyard Asta 1133

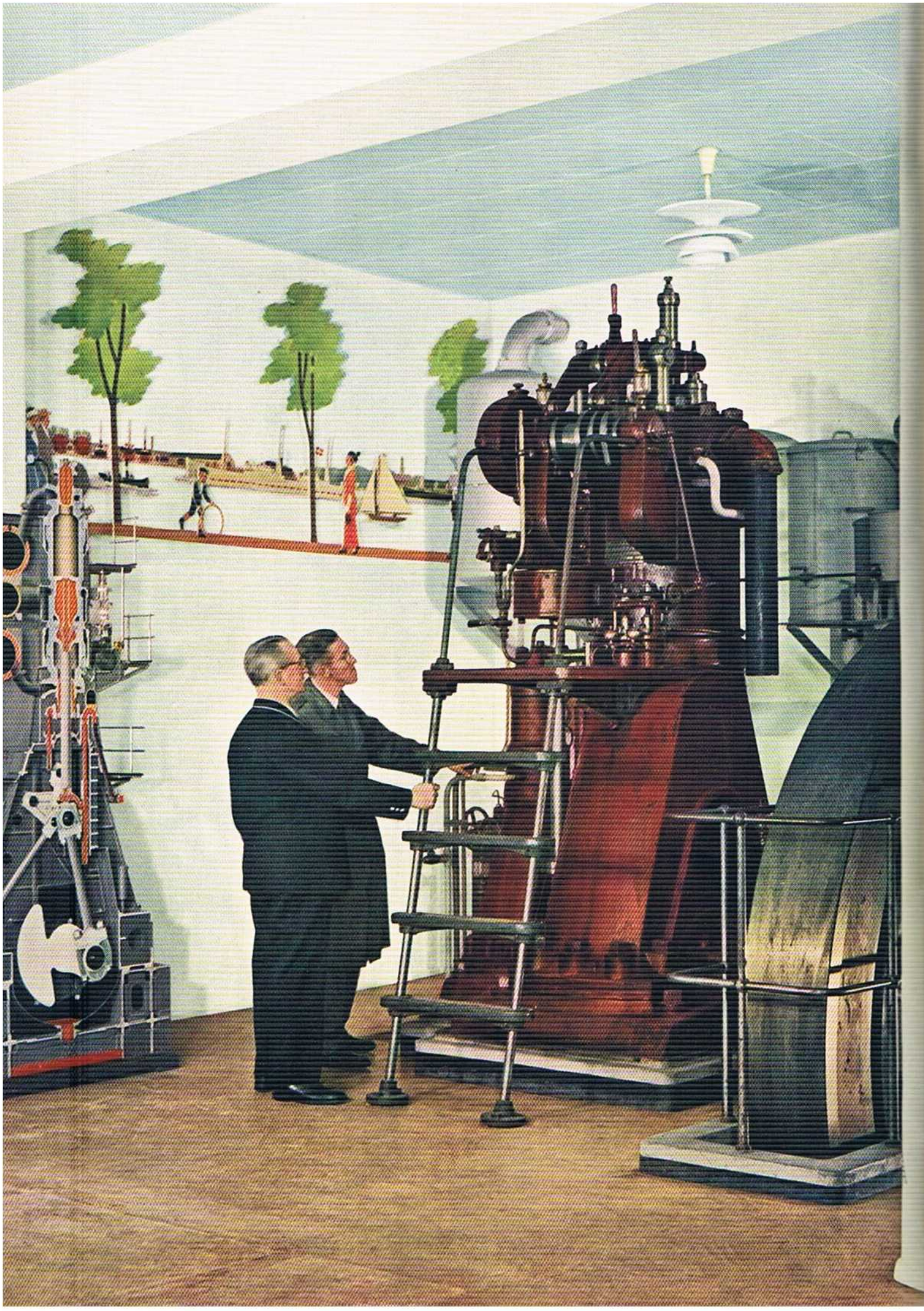
Foundries and Steel Works Central 4365

Cable Address: Burmeisters, Copenhagen

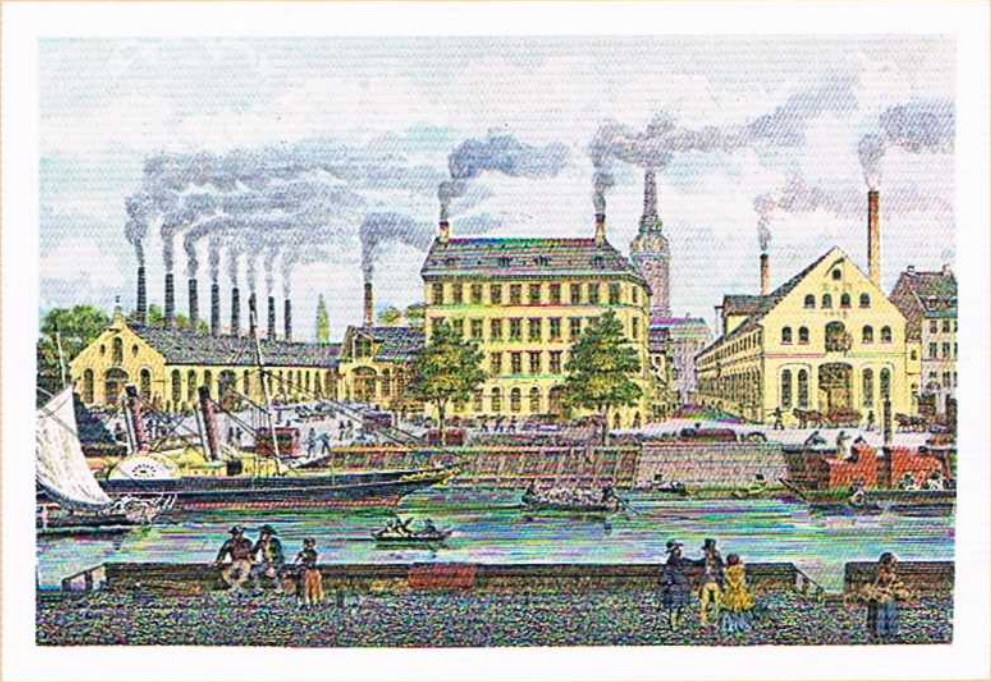
Burmeister & Wain

Engineers and Shipbuilders

Burmeister & Wain's history as engineers and shipbuilders covers more than a century. Since 1904, when B & W marketed its first stationary diesel engines, and especially since 1912, when it built the world's first ocean-going ship powered by direct reversible marine diesel engines, the company has occupied a leading position in the fields of diesel engineering and the building of all types of modern motor ships. In order to strengthen this position, Burmeister & Wain has in recent years extended all its manufacturing resources. The purpose of this brochure is to give you an up-to-date picture of the company's plants and their production.



The Historical Background of Burmeister & Wain's Development



The history of Burmeister & Wain began with the granting of a Royal Warrent to Hans Heinrich Baumgarten on 18th February 1843, giving him the right to establish and operate an engineering workshop in Copenhagen. It was this workshop that, despite its small size and unlikely location - "the second floor back" of a part commercial, part dwelling, house, in the oldest part of Copenhagen - was the first home of what has developed into the world renowned company: Burmeister & Wain.

Three years after starting his business, Baumgarten entered into partnership with C. C. Burmeister and moved the entire firm to the part of Copenhagen called Christianshavn. After building an iron foundry in 1847, the new firm devoted its activities to, among other things, the production of steam engines. The same year saw the delivery of Baumgarten & Burmeister's first steam engine: its output was 16 HP.

In 1852, the company opened Denmark's first shipyard for the building of iron ships; Newbuilding No. 1, the s/s "Hermod", was delivered in 1854. Among the first ships launched from this yard was the little paddle steamer "Hjejlen"; it is still in service as a popular and well patronized summer excursion boat on the beautiful Silkeborg lakes in Jutland.

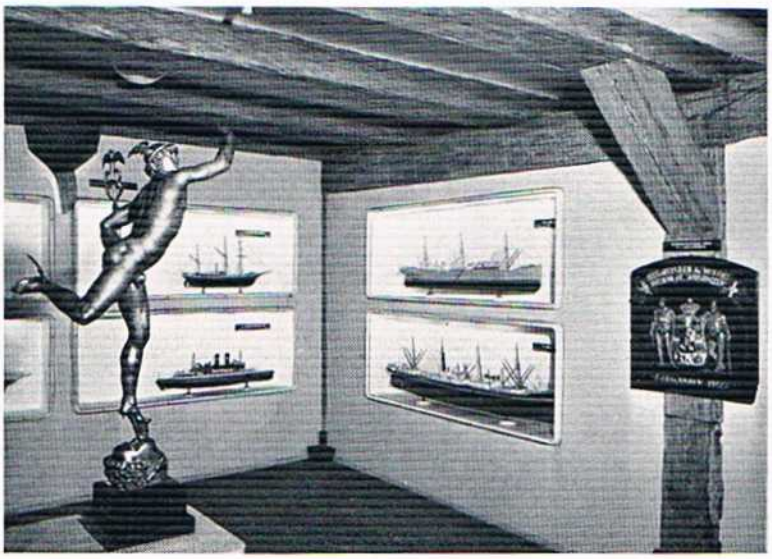
Baumgarten retired in 1863 and was succeeded by an Englishman, William Wain. The limited liability company of Burmeister & Wain was registered in 1872

and at the same time a new shipyard was established on Refshale Island in Copenhagen's outer harbour. The yard though greatly extended, is still on this site. Since 1854, B&W have built almost 800 vessels.

In 1898, B&W reached an agreement with the German inventor, Rudolf Diesel, to take over patent rights in Denmark on his new internal combustion engine. Under the terms of the agreement, Burmeister & Wain had authority to take out their own patents for any improvements to the engine that they might possibly develop themselves. The first B&W experimental diesel engine was built in 1898, but it was not until 1904 that B&W felt able to begin production of stationary diesel engines; they ranged in size and output from 8 to 160 HP.

Developments in the use of electricity created a demand for larger and larger diesel engines. In 1906, B&W built an engine of 180 HP and in 1909, a 4-cylinder, 600 HP unit was delivered to the power station at Aalborg, one of Denmark's largest towns.

During this period Ivar Knudsen, director of Burmeister & Wain, worked on the idea of adapting the diesel engine to marine use as propelling machinery in large ships. Rudolf Diesel described



him as being "the man, who has not only understood my thoughts better than any other, but who has the finest possibilities of carrying them out". With the building of the world's first ocean-going diesel motor ship "Selandia" in 1912, for The East Asiatic Company of Copenhagen, Burmeister & Wain won the great victory that Diesel had dreamed of, but hardly dared hope to realize. In the following years whilst the company itself built marine diesel engines, license agreements were reached with engine works in all parts of the world. Today, B&W engines are built under license in all countries having large scale shipbuilding industries.

B&W TODAY

Marine and stationary diesel engines

Auxiliary diesel engines

Engines for fishing crafts

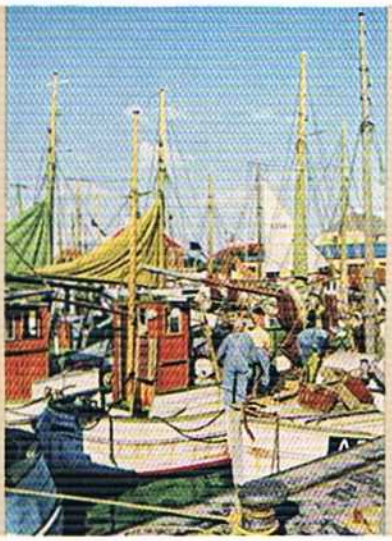
Shipbuilding

Iron and steel castings and forgings

Pattern making

Stationary boiler plants

The Production of Burmeister & Wain



B&W Marine Diesel Engines

The production of diesel engines for all purposes and in all sizes is – concurrently with shipbuilding – the principal field of Burmeister & Wain. The engine works at Christianshavn, with the affiliated technical departments, form a natural centre for this production. The experience gained at B&W's own works, and at the works abroad where B&W engines are built under license, is collated and correlated here.

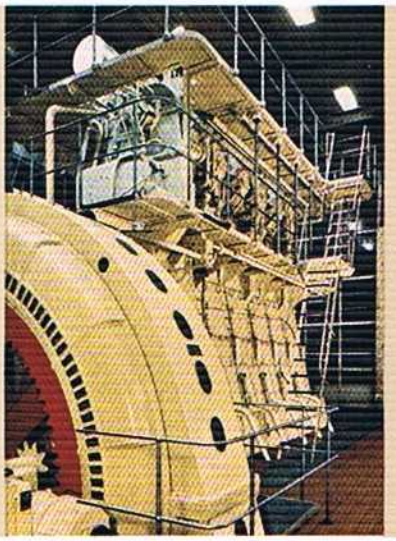
In 1904, Burmeister & Wain put their first stationary diesel engines on the market. The next major task was to make this engine suitable for marine purposes. Here too, B&W's engineers were successful, and in 1912, the world's first large marine plant was installed in m/s "Selandia". On its maiden voyage that same year it proved the outstanding qualities of the diesel engine as a marine propelling engine. So far the peak of this development is reached with the engine type 84-VTBF-180. A 12 cylinder unit of this engine will develop approx. 23,000 IHP, sufficient for a 60,000 tons dw. supertanker with service speed of abt. 16 knots.

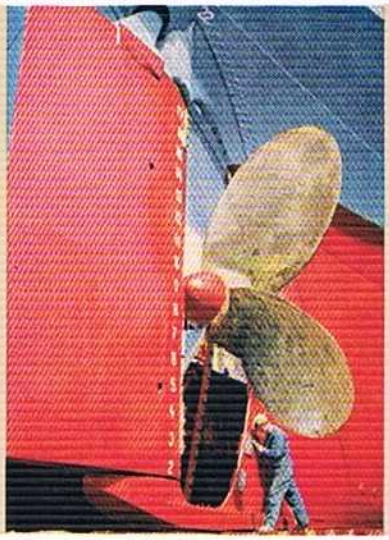
B&W Alpha Marine Diesel Engines

A speciality in Burmeister & Wain's field of production is the building of B&W Alpha marine diesel engines for fishing vessels, small cargo vessels, tugs, and so on. Engines for such purposes must be reliable in service, economical, easy to operate, and sturdy. Combining these principles with their modern design, the 2-stroke valveless B&W Alpha diesel engines are ideal for all types of small ships.

These engines require only an absolute minimum of maintenance. They are supplied in standard design in three main types, designated 340, 400, and 490 - according to their length of stroke in millimetres, and can be delivered with manually or hydraulically operated mechanism for controllable pitch propeller – with reversing gear for fixed propeller – or as direct reversible engines. They range in size from two to eight cylinders, developing from 100 to 1050 BHP. It is thus always possible to find, among the horsepower ranges of the various types and designs, just the B&W Alpha diesel engine that is the best suited to a given purpose.

Comprises





B&W Stationary Diesel Engines

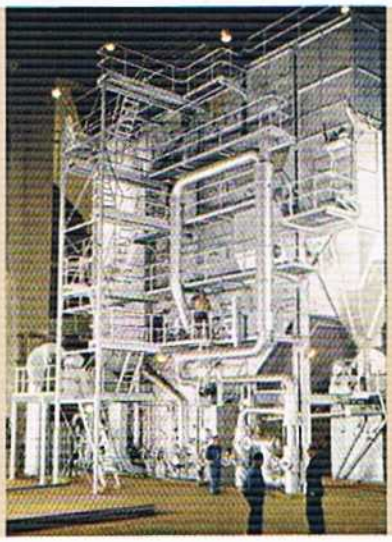
The first stationary B&W diesel engines were built in 1904, based on the experience gained with B&W's first experimental engine, but in many respects of considerably altered design. Their outputs ranged up to 160 BHP, and more than 50 years later they are still in service.

The development of the diesel engine continued, and in 1909, a unit output of 900 BHP was achieved. In 1933 B&W delivered a diesel engine of 22,500 BHP to the H. C. Oersted Power Station in Copenhagen - it is to this day the world's largest. The diesel engine's field of application is still being extended, and all over the world, by virtue of its reliable and economical service, it upholds Denmark's reputation in diesel engine building. The output of B&W's stationary engines ranges from 70 BHP upwards. They may be two- or four-stroke engines with or without turbocharge, the turbocharged engine having the advantage that even when mounted in high-lying regions where the atmosphere is thin, it is normally possible to maintain full horsepower output.

Shipbuilding

The number of ships of all types built by Burmeister &Wain since 1854 is nearing 800, since 1912 almost exclusively diesel motor ships. Ship repairs also constitute an important part of the activities of the yard and, since completion of the new dry dock, ships up to approx. 38,000–40,000 tons dw. can be handled. Among the many famous ships delivered from B&W's yard, special mention may be made of the world's first ocean-going diesel motor ship "Selandia"; the cargo and passenger ships "Transilvania" and "Basarabia"; the whale factory ship "Thorshovdi"; and the m/s "Songkhla", the first ship built specially for the turbocharged, two-stroke B&W diesel engine.

But B&W does not rest on its laurels in the field of shipbuilding: a gigantic extension of the existing yard, scheduled for completion around 1960 and comprising 2,500,000 sq. feet reclaimed land, a building dock for ships up to 70,000 tons dw. together with new workshops to serve it, will enable the company to face future competition.



Casting and Forging

Burmeister & Wain's foundries and forges, situated at Teglholmen on Copenhagen's South Harbour, cover a total area of about 615,000 sq. feet and, like the other B & W divisions, they constitute an effective and up-to-date plant. The main products are iron, steel, and non-ferrous castings as well as heavy forgings.
For this purpose the works are equipped with a number of cupolas as well as electric and oil-fired steel hearths the largest of which has a capacity of 35 tons. The forges have hydraulic forging presses up to 2000 tons.
At Teglholmen the large elements for B & W's diesel engines: bedplates, frames, shafts, etc. are cast and forged, and before being carried to the engine works in large lighters they are rough-machined. In addition to the material utilized by B & W's engine works and shipyard, the foundries supply various forgings and castings to Danish and foreign industrial concerns. Samples are taken of iron and steel castings for careful testing in the modern laboratories. This testing ensures first-class, flawless material.

Stationary Steam Plants

With long experience in the construction of many different types of installation, B & W today are in a position to deal with most problems in this field. B & W plants are chosen for many power stations and by leading industrial concerns, because of their technical, economic and operational superiority.
In addition, accessories and auxiliary equipment are supplied, such as pipe systems, water processing plants, oil burners, separators, and atomizers.
At its disposal in both steam plant and diesel engine production, B & W has a modern welding shop situated at Wilders Plads in Christianshavn.

B & W's manufacturing capacity further includes FABRIKEN GULDBORG, Nykøbing F., which is an iron foundry working in close co-operation with AKTIESELSKABET HOLEBY DIESELMOTOR FABRIK, Holeby, where small stationary diesel engines and marine auxiliary engines are made, and, finally, NORDISK DIESEL A/S, assembly plant for automobiles, tractors and scooters.

B&W Diesel Engines are Built by Licensees all over the World:

Belgium:

SOCIÉTÉ ANONYME COCKERILL-OUGRÉE
SERAING

British Commonwealth and Empire:

HARLAND AND WOLFF LIMITED
BELFAST AND GLASGOW

Sub-Licensees:

JOHN G. KINCAID & CO., LTD.
GREENOCK

HONGKONG & WHAMPOA DOCK COMPANY LIMITED
HONG KONG

Denmark:

ELSINORE SHIPBUILDING & ENGINEERING CO., LTD.
ELSINORE

ROYAL DANISH DOCKYARD
COPENHAGEN

Finland:

VALMET OY
HELSINKI

France:

SOCIÉTÉ DES FORGES ET ATELIERS DU CREUSOT (USINES SCHNEIDER)
LE CREUSOT (S.-&-L.)

CHANTIERS DE L'ATLANTIQUE (PENHOËT-LOIRE)
SAINT-NAZAIRE (LOIRE INF.)

ATELIERS LOUIS THIRIET
LA BAULE (LOIRE INF.)

Germany:

FRIED. KRUPP DIESELMOTOREN G. m. b. H.
ESSEN

Holland:

MACHINEFABRIEK EN SCHEEPSWERF VAN P. SMIT JR., N. V.
ROTTERDAM

Italy:

CANTIERI NAVALI RIUNITI
GENOVA

Japan:

MITSUI SHIPBUILDING & ENGINEERING CO., LTD.
TOKYO

Sub-Licensee:

HITACHI SHIPBUILDING & ENGINEERING CO., LTD.
OSAKA

Norway:

A/s AKERS MEK. VERKSTED
OSLO

Sub-Licensee:

SARPSBORG MEK. VERKSTED A/s
GREÅKER

Spain:

LA MAQUINISTA TERRESTRE Y MARÍTIMA S. A.
BARCELONA

SOCIEDAD ESPAÑOLA DE CONSTRUCCIÓN NAVAL
MADRID

SOCIEDAD ESPAÑOLA DE CONSTRUCCIONES BABCOCK & WILCOX
BILBAO

Sweden:

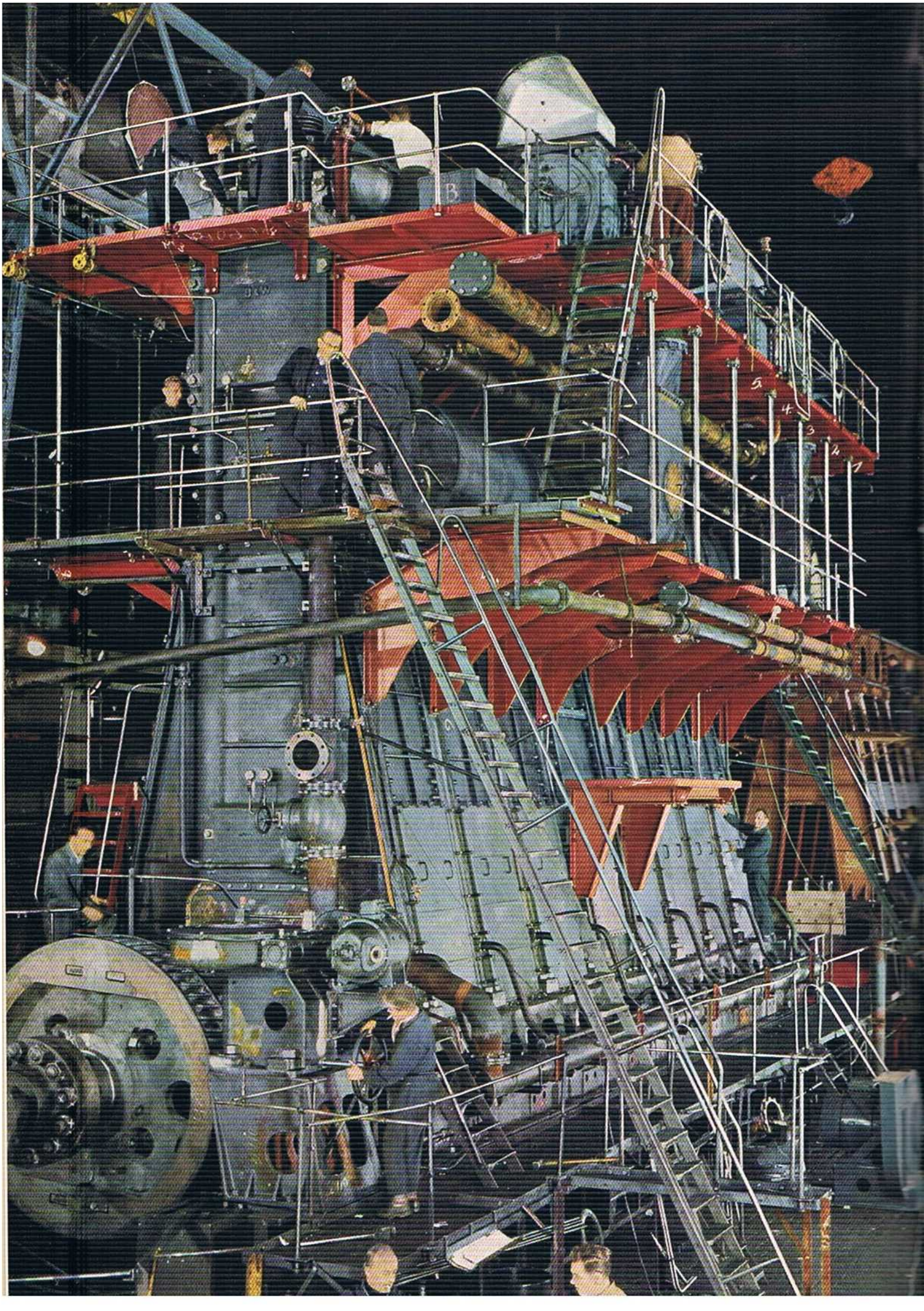
ERIKSBERGS MEK. VERKSTADS AKTIEBOLAG
GOTHENBURG

Union of Soviet Socialist Republics:

V/O MACHINOIMPORT
MOSCOW

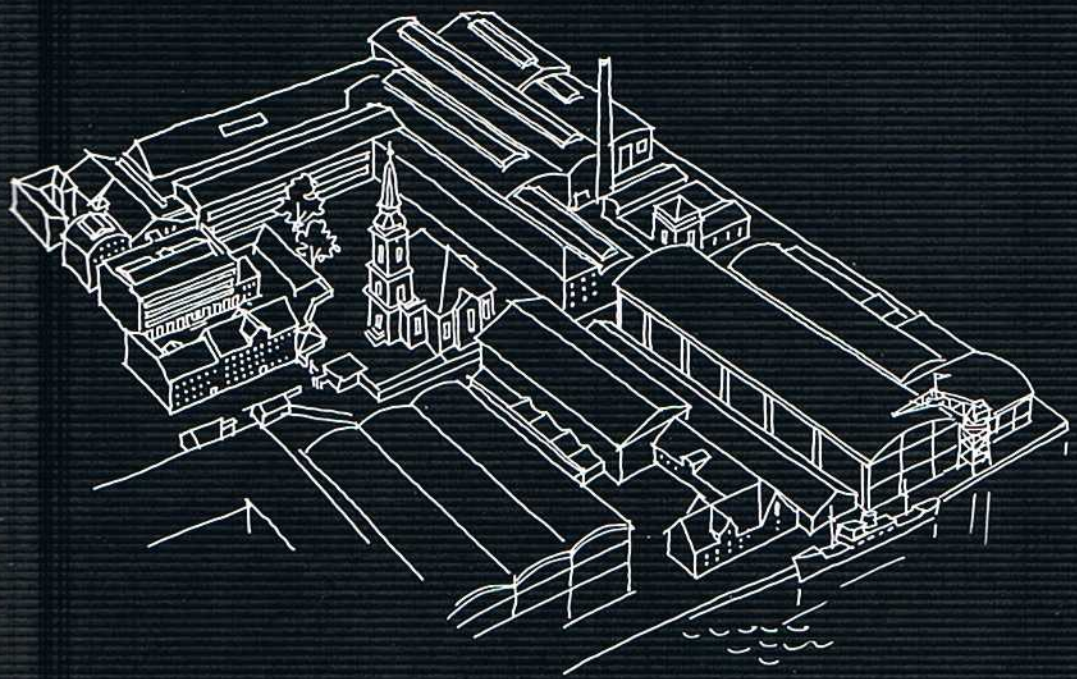
Yugoslavia:

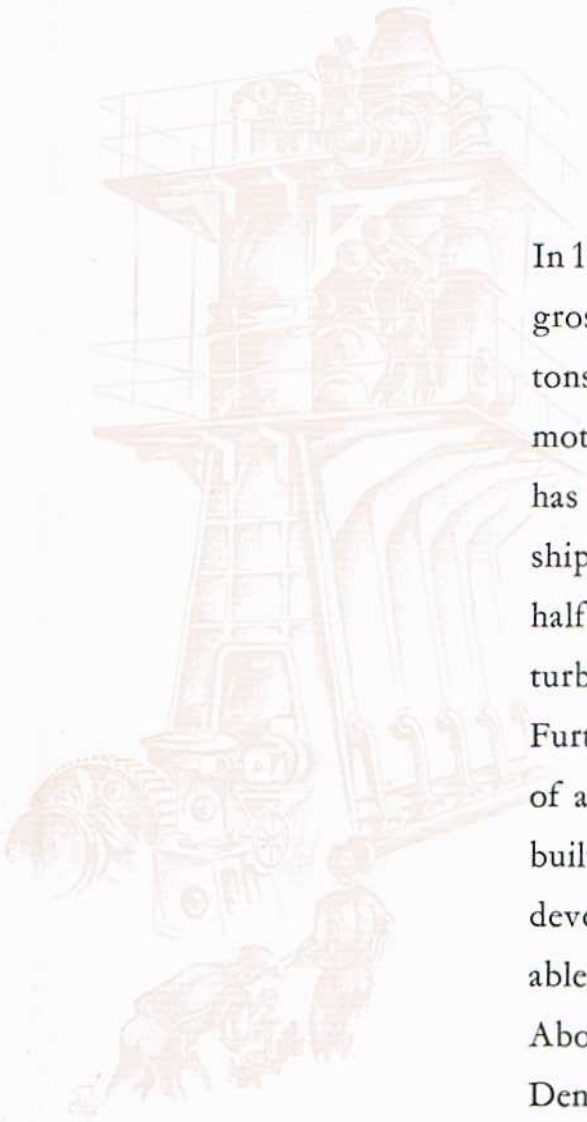
BRODOGRADILIŠTE ULJANIK
PULA



B&W

Diesel Engine Works



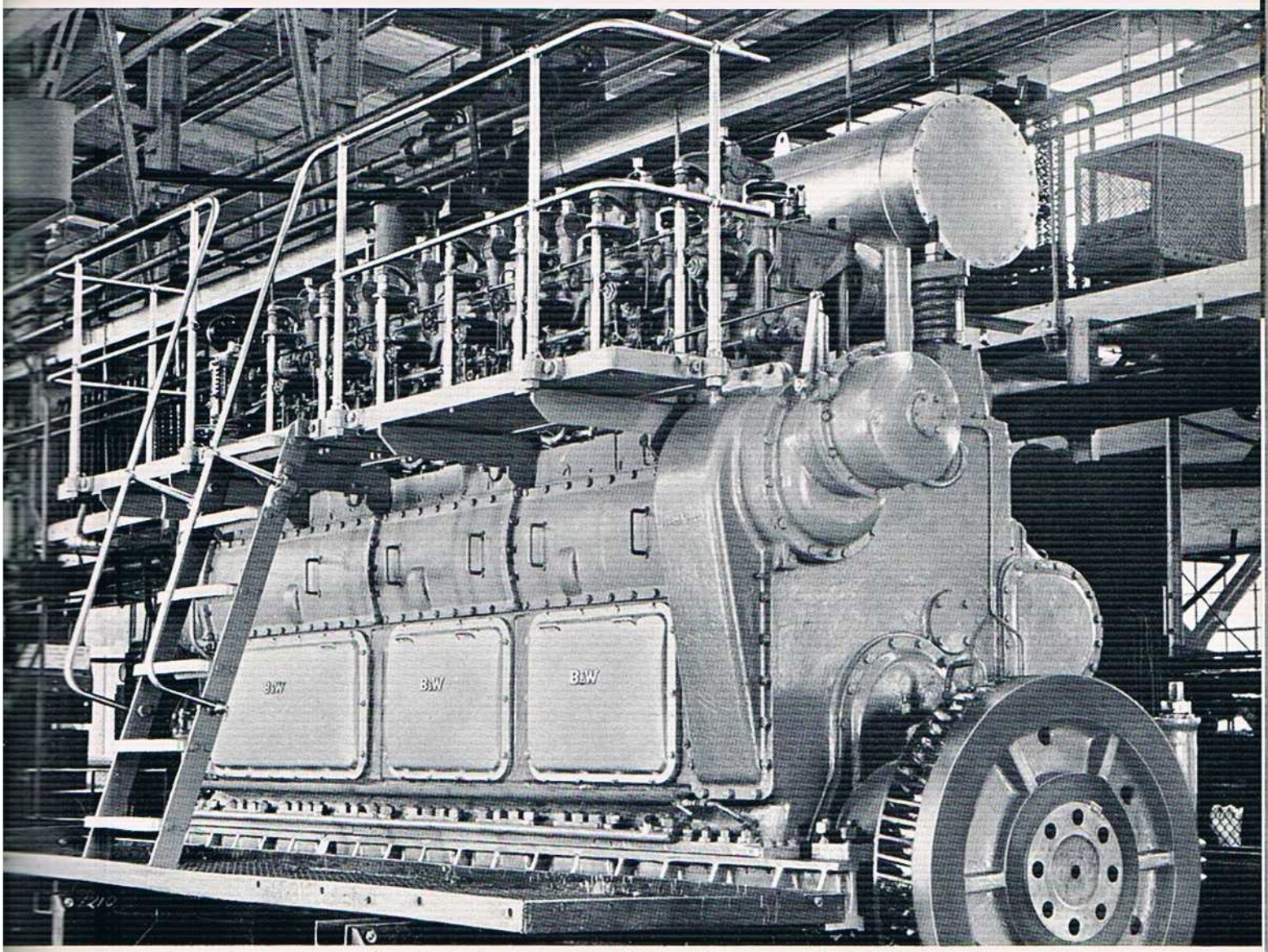


In 1939, the world's merchant fleet amounted to 68,509,432 gross registertons and steamships accounted for 51 million tons of this total; the remaining quarter representing motor ship tonnage. Since the end of World War II, there has been a steady increase in the employment of motor ships, and today diesel engines are propelling just about half of all the world's merchant tonnage, leaving steam turbines and reciprocating steam engines to share the rest. Further, it should be noted that it is not alone a question of an increase in the number of individual motor vessels built, that accounts for this increase. It is also that the development of the marine diesel has meant that it is now able to power much larger vessels than formerly.

About 90 % of the merchant fleets of Sweden, Norway and Denmark consist of motor ships and about half of all Great Britain's merchant fleet is also dependent on the diesel engine.

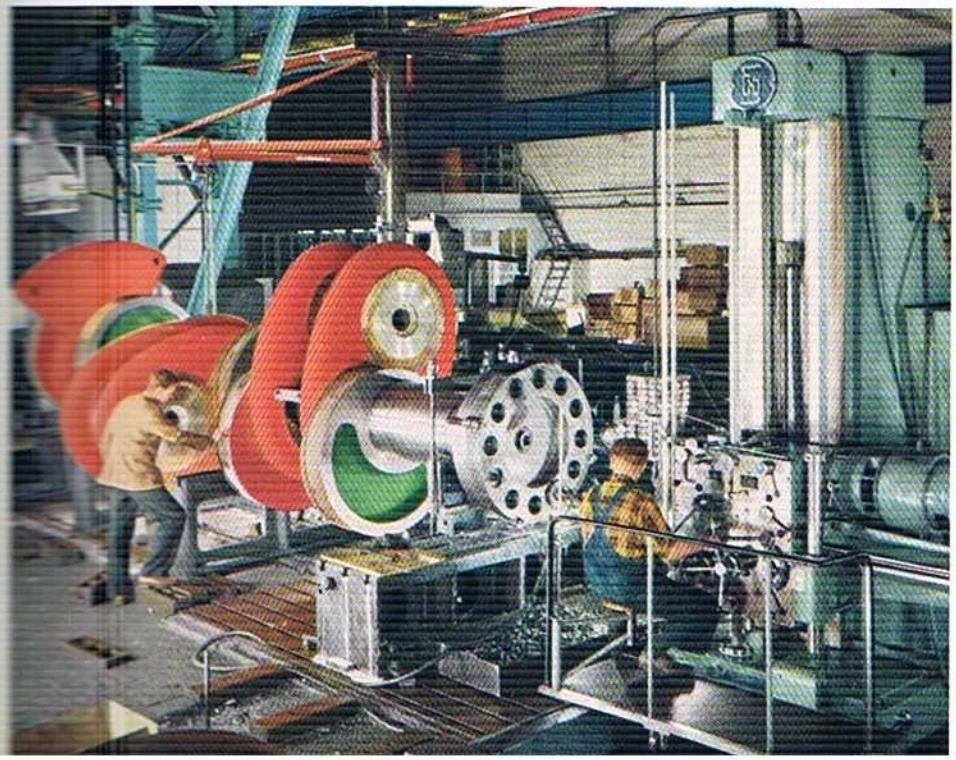
The fact that the marine diesel engine has been able to achieve such extensive popularity is something that reflects a certain amount of glory on Burmeister & Wain in that, right from the very beginning, the company have not only been the leaders in the development of marine diesel power but have uninteruptedly done everything possible to improve it. In 1952, the 16,000-ton motor tanker "Dorthe Maersk" sailed on her maiden voyage powered by a new and epoch making B&W diesel engine. It was with this ship that the turbocharged 2-stroke marine diesel engine made its debut on the world's trade routes. An event that had great influence on the further development of motor shipping.

Marine Diesel Engines

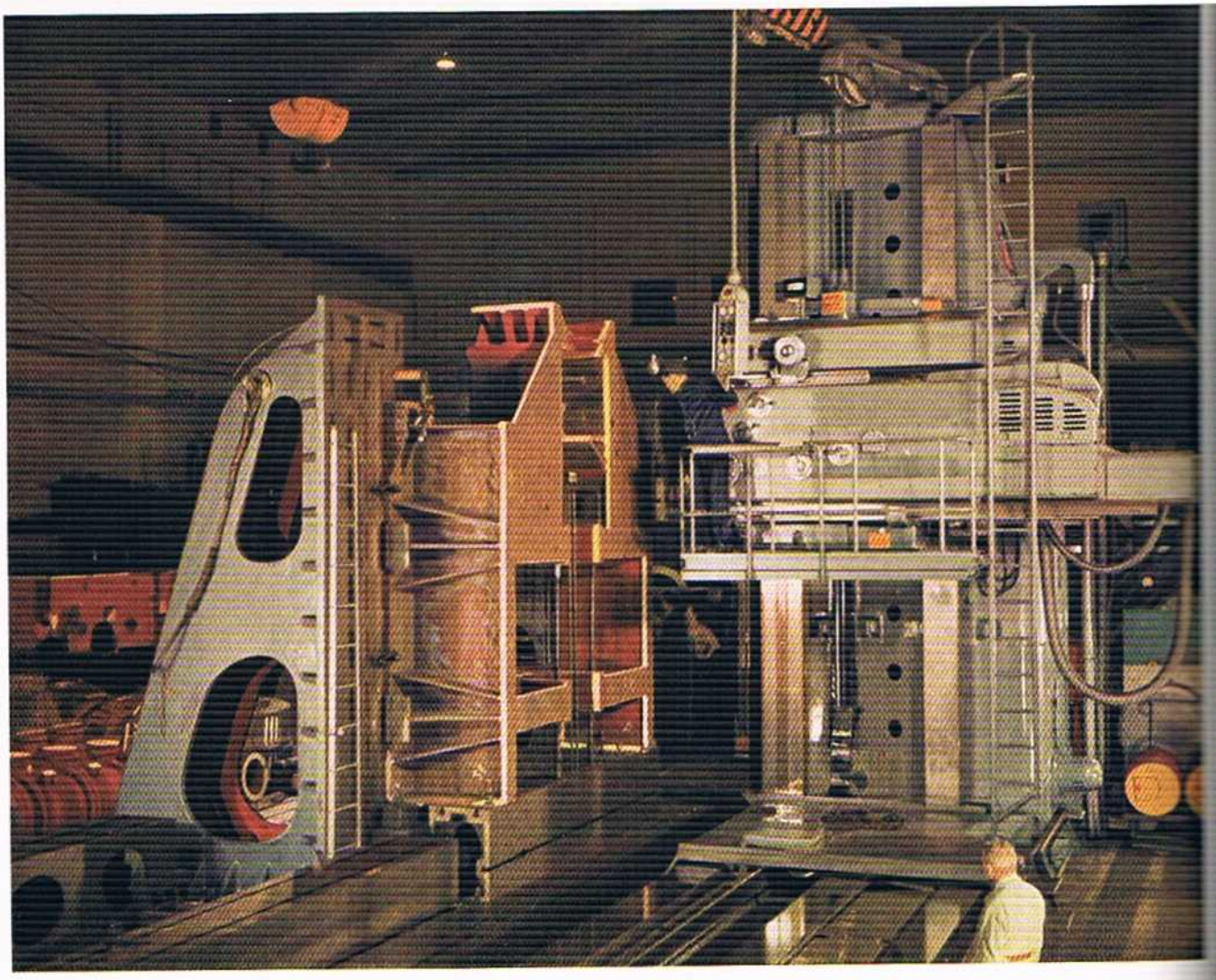


7-cylinder, single-acting, 2-stroke marine diesel engine of the trunk piston type 28-VF-50. Cylinder diameter 280 mm, length of stroke 500 mm. Output in normal continuous operation 1,130 IHP, equivalent to approximately 850 BHP, at 360 rpm.

Embedding a crankshaft for a 10-cylinder B & W diesel engine. Dependent on the size of engine and the number of cylinders, these shafts are made either as semi-, or fully built-up units. B & W's production includes crankshafts up to 14 metres long and up to a maximum weight of almost 200 tons.



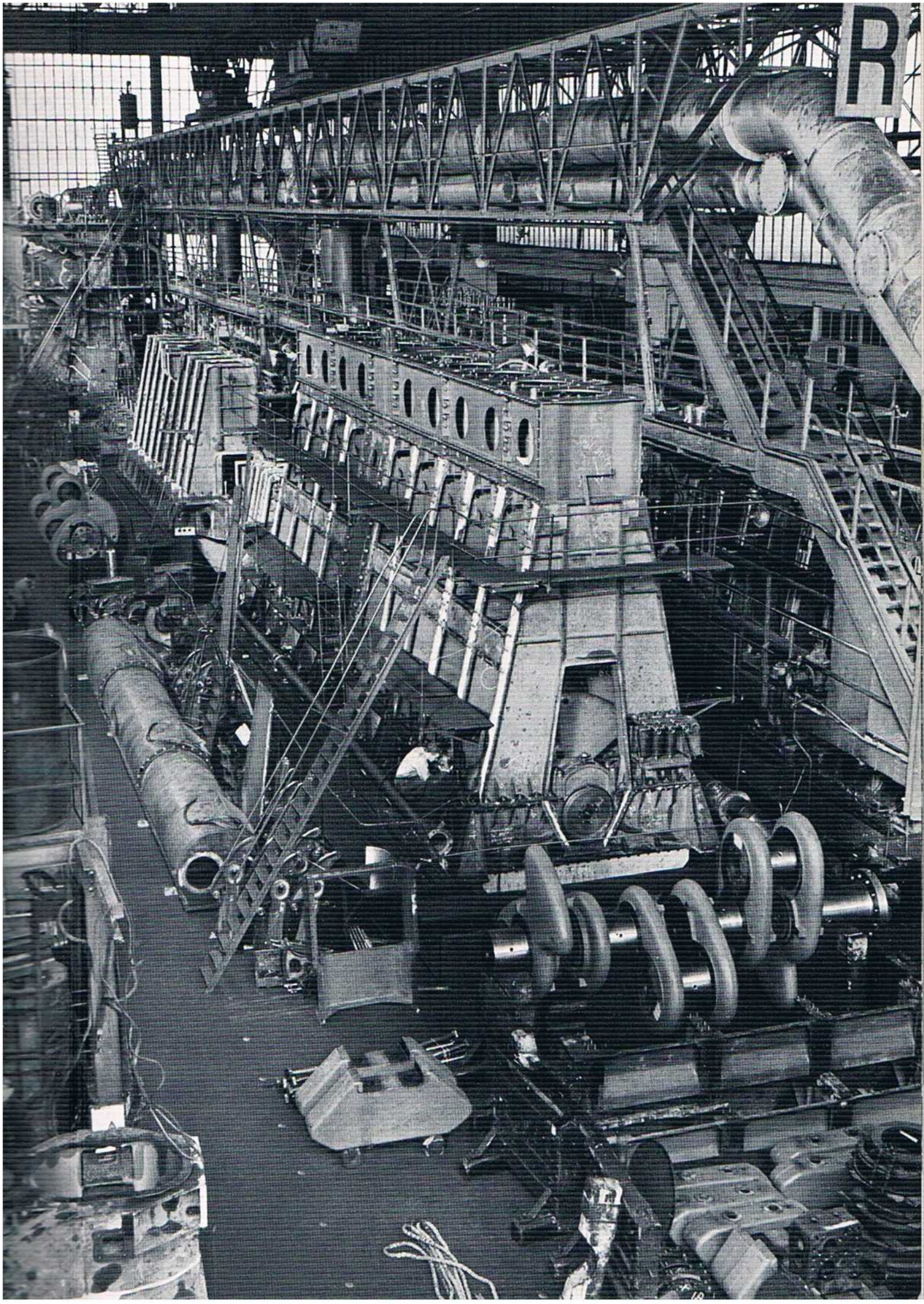
After the elements have been shrunk together, the machining is completed, comprising among other processes a most accurate drilling of the flange connections.



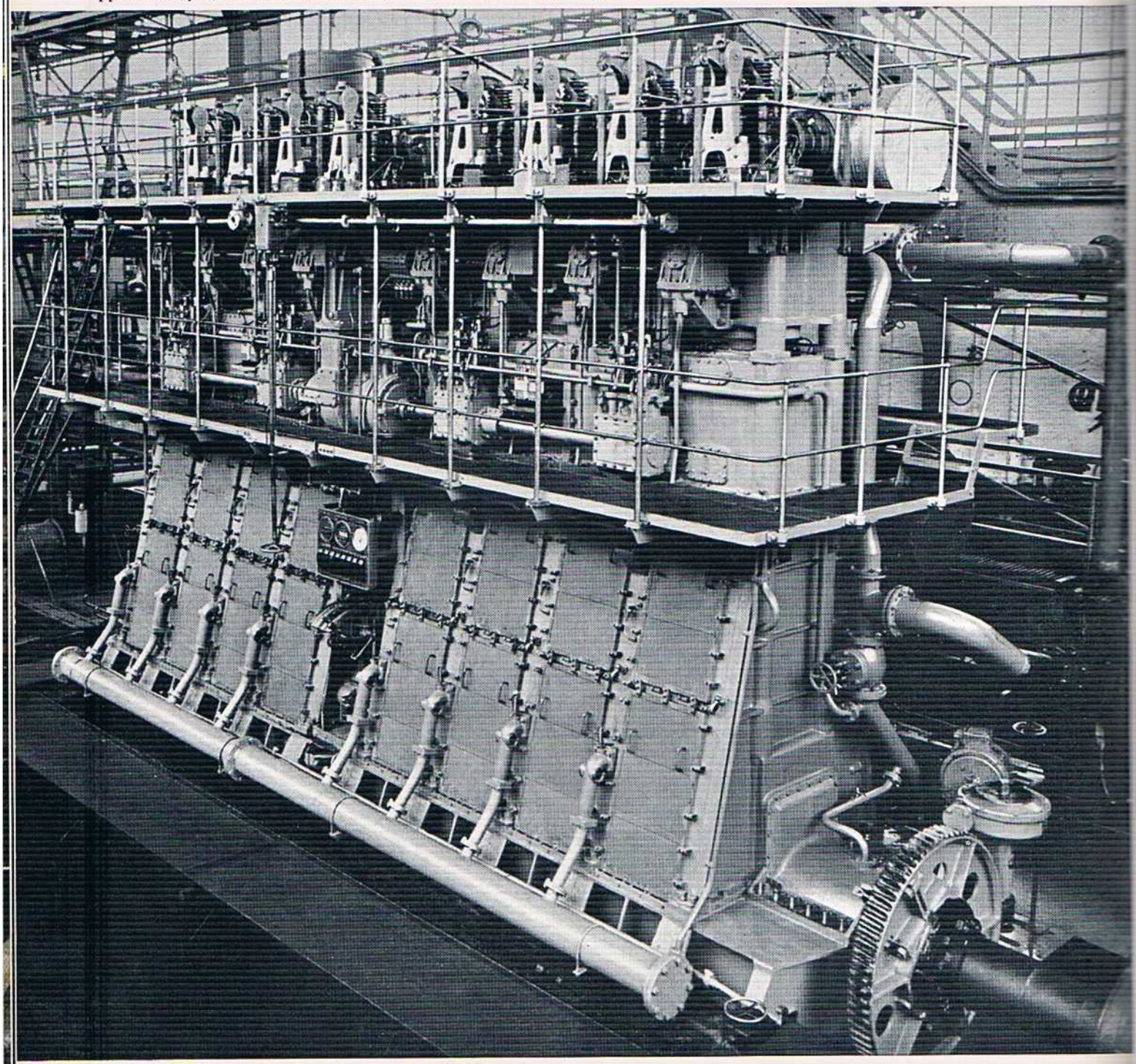
The Burmeister & Wain workshops are equipped with the most modern precision machine-tools that combine to give effective and absolutely accurate machining of individual components.

In the welding shop of the engine works, the large elements for the B&W diesel engines, such as bedplates, frames, etc., are welded on special tables. By means of a pushbutton system, the sections can be placed to permit welding from a convenient angle.

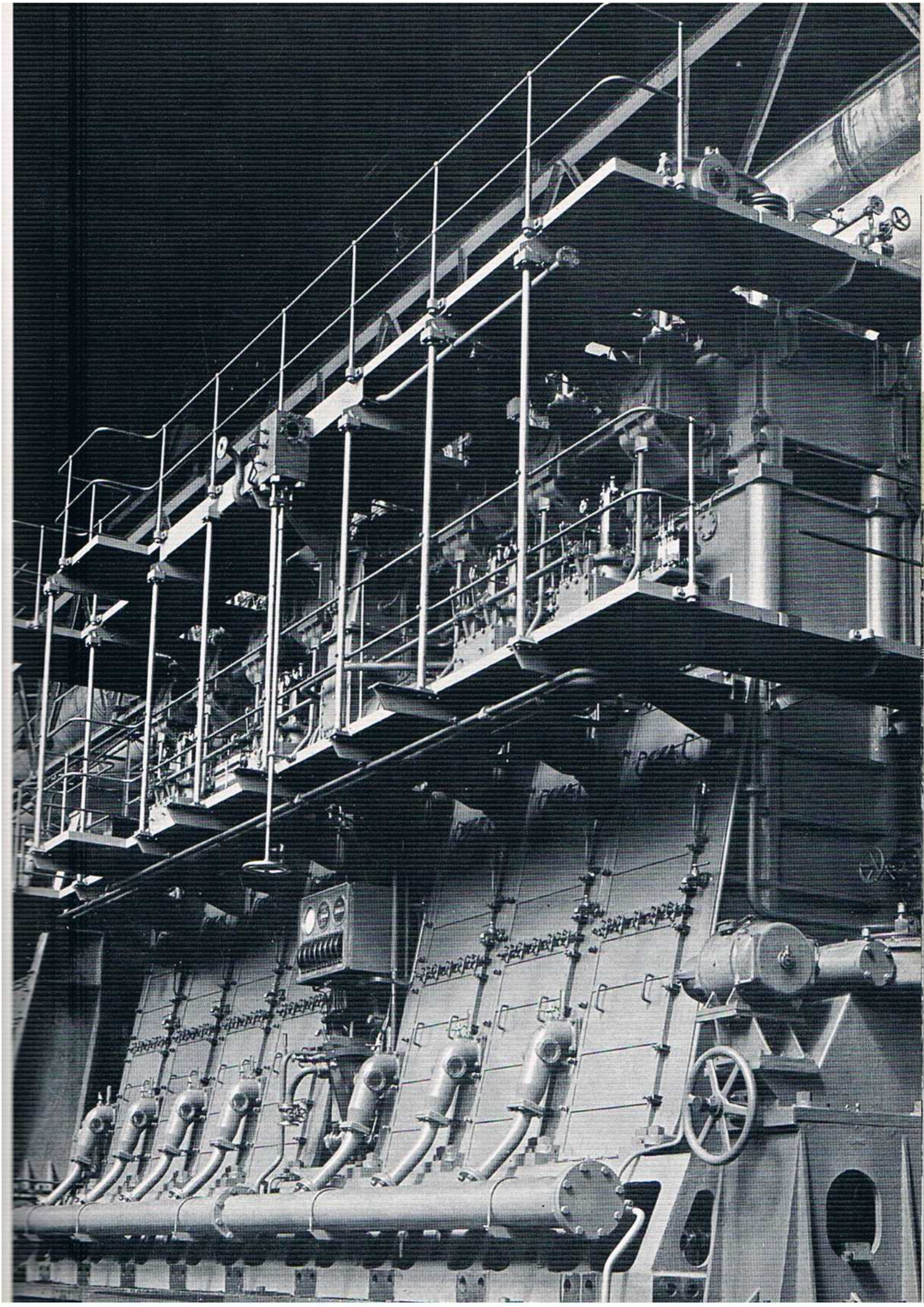
Erection of a large marine diesel engine on test beds in B&W's engine works at Christianshavn.

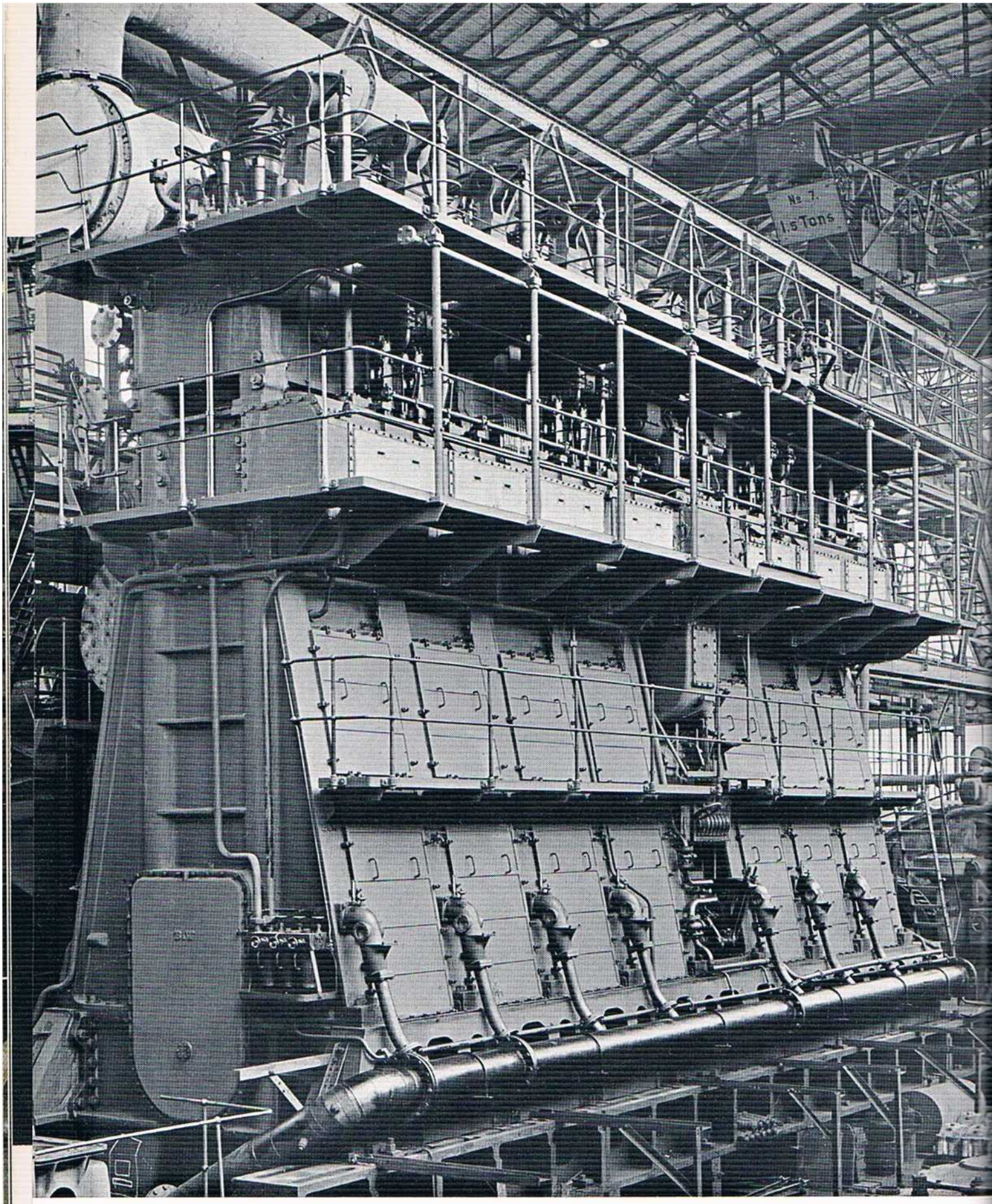


8-cylinder, single-acting, 2-stroke marine diesel engine of the crosshead type 50-VTF-110. Cylinder diameter 500 mm, length of stroke 1,100 mm. Output in normal continuous operation 4,240 IHP, equivalent to approximately 3,360 BHP, at 170 rpm. B&W's crosshead type engines may be arranged to run on heavy oil.



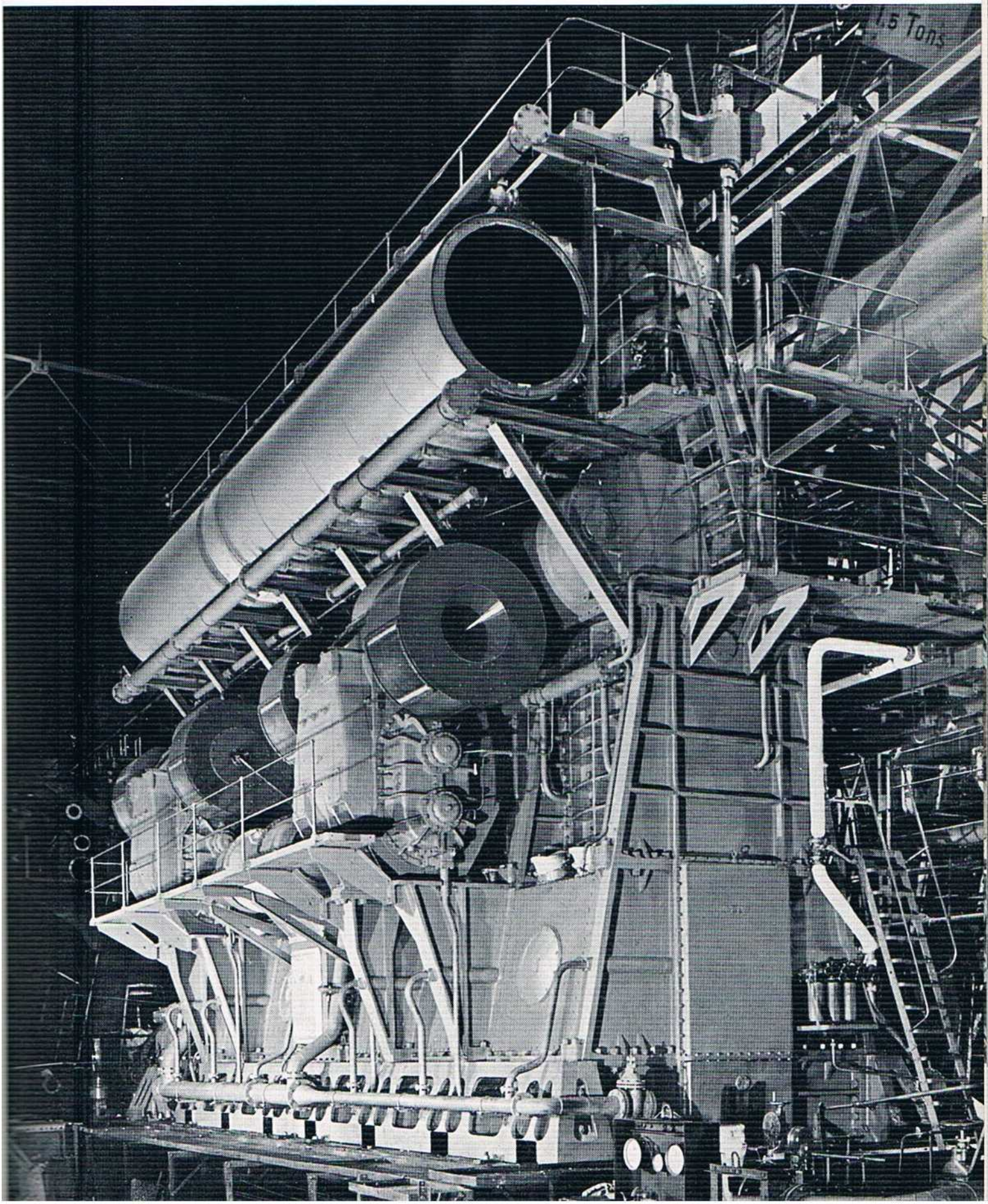
7-cylinder, single-acting, 2-stroke crosshead marine diesel engine of cast design, type 62-VTF-115. Cylinder diameter 620 mm, length of stroke 1,150 mm. Output in normal continuous operation 5,250 IHP, equivalent to approximately 4,200 BHP at 150 rpm.





7-cylinder, single-acting, 2-stroke marine diesel engine of the crosshead type 74-VTF-140. Cylinder diameter 740 mm, length of stroke 1,400 mm. Output in normal continuous operation 7,630 IHP, equivalent to approximately 6,125 BHP, at 125 rpm.

5-cylinder, single-acting, 2-stroke marine diesel engine of the opposed-piston type 75-VTF-170/60. Cylinder diameter 750 mm, main piston stroke 1,700 mm, exhaust piston stroke 600 mm. Output in normal continuous operation 8,000 IHP, equivalent to approximately 6,500 BHP, at 110 rpm.



Turbocharging of 2-stroke marine diesel engines was achieved by Burmeister & Wain as the result of many years of experiments; this gain was regarded as being the greatest advance within the diesel engineering for over 25 years. The engine built for "Dorthe Maersk", having the type reference 74-VTBF-160, was given its trials on the test bed at B & W in the beginning of January 1952. Its bore and lenght of stroke was 740 mm and 1600 mm, respectively. The very first turbocharged diesel engines were equipped with turbochargers of foreign construction but later engines of this type have been fitted with turbochargers designed and built by B & W themselves.

Since the delivery of this first installation, the production of large marine diesel engines has gone over more and more to those of the turbocharged type for the simple reason that this type offers so many advantages: Turbocharging increase the output of a 2-stroke diesel engine by 35 per cent in comparison with a similar engine of the same overall size and rpm, and the mean pressure is increased from 92.5 to 113.8 lbs/sq. inch. At the same time the lubricating oil and the fuel oil consumption is reduced by 25 and 3 per cent, respectively.

The output of the 6-cylinder turbocharged engine is a little greater than that of similar 8-cylinder non-turbocharged engine, developing 7380 BHP at 115 rpm. In the case of the "Dorthe Maersk", the reduction in the number of cylinders from 8 to 6 has lead to a saving of 20 per cent in engine length and 25 per cent in engine weight; the space and weight saved has increased her pay load capacity. Apart from the saving and advantages inherent in reduced engine weight and lenght, as well as reduced fuel and lubricant consumption, all combined with increased output, turbocharging also offers reduced overhauling work and maintenance costs. This is not only an advantage in *normal* installations but also in those special cases where for various reasons it is desirable to employ multiple engined geared or diesel-electric installations.

By introducing the turbocharged 2-stroke marine diesel engine, B & W have made it possible to employ marine diesel engines in large tankers, a field that had, until only a few years ago, been the preserve of the steam turbine. To meet the need for a marine diesel engine able to power the latest supertankers, B & W took a decisive step with the designing of the world's first turbocharged 2-stroke marine diesel engine with a bore of 840 mm and a stroke of 1800 mm, developing a maintained output in sea-going service of 1730 BHP per cylinder at 110 rpm. A considerably greater output than had ever been developed in any earlier type of diesel engine.

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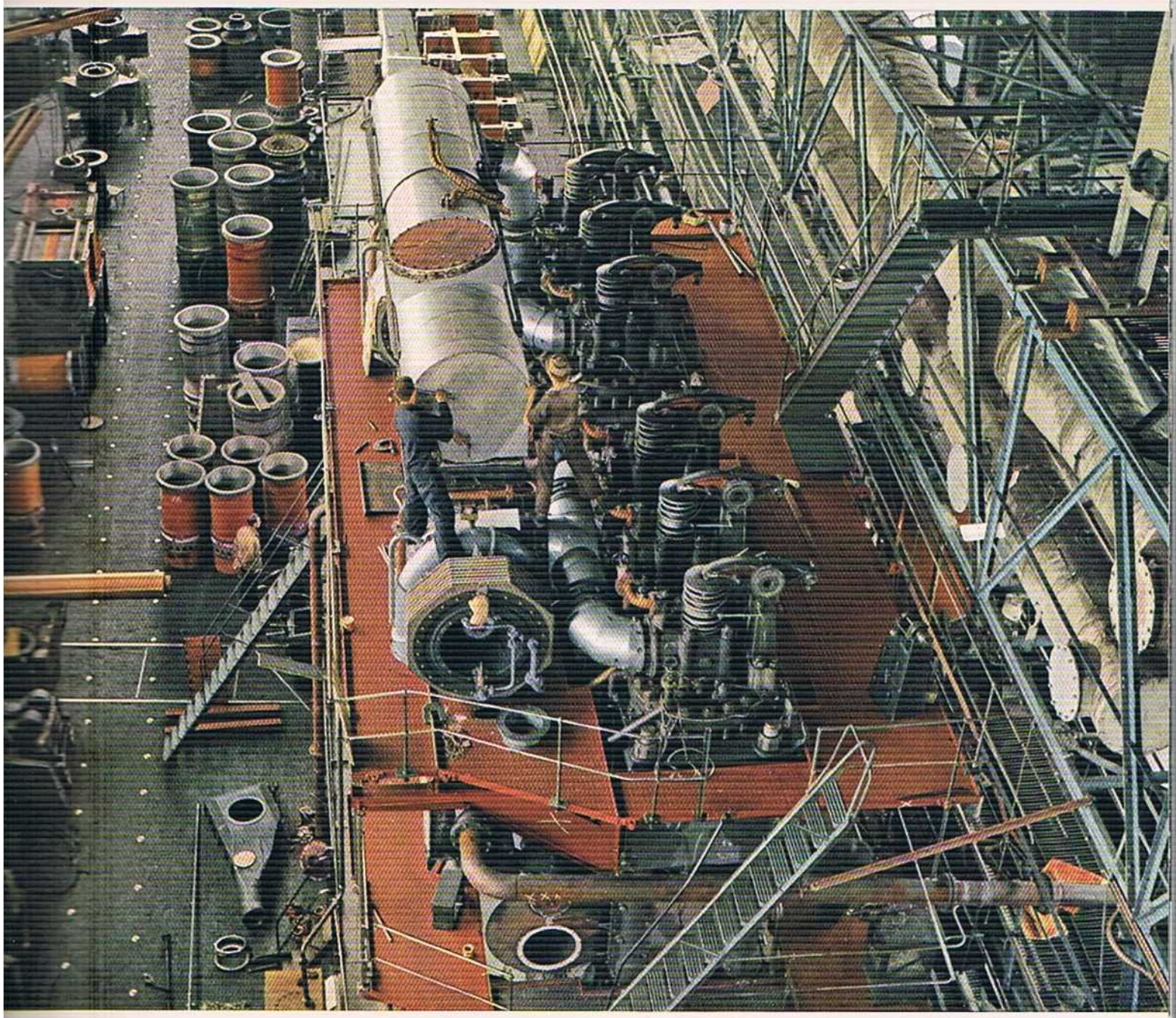
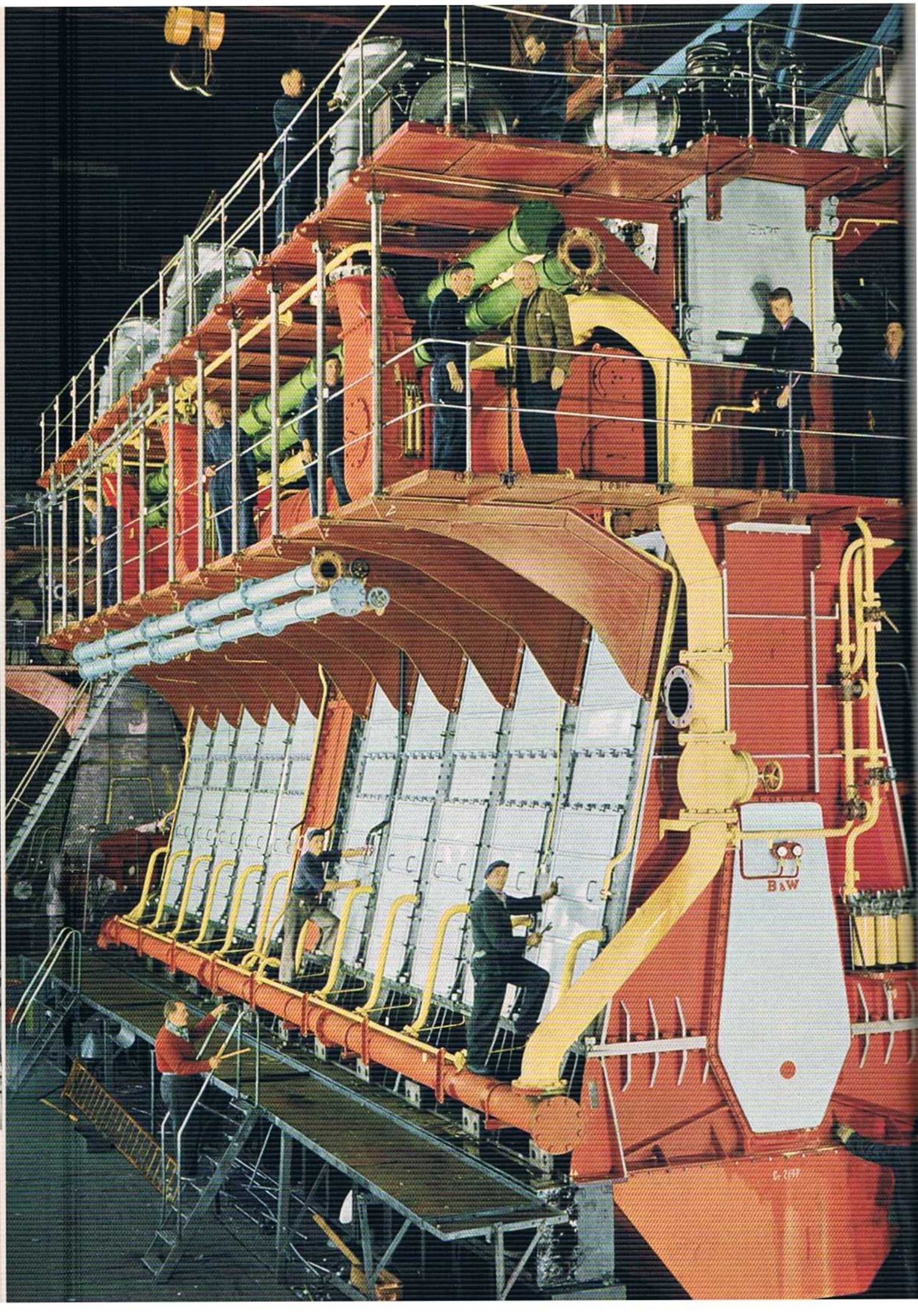
B&W

Turbocharged, 2-Stroke Engines

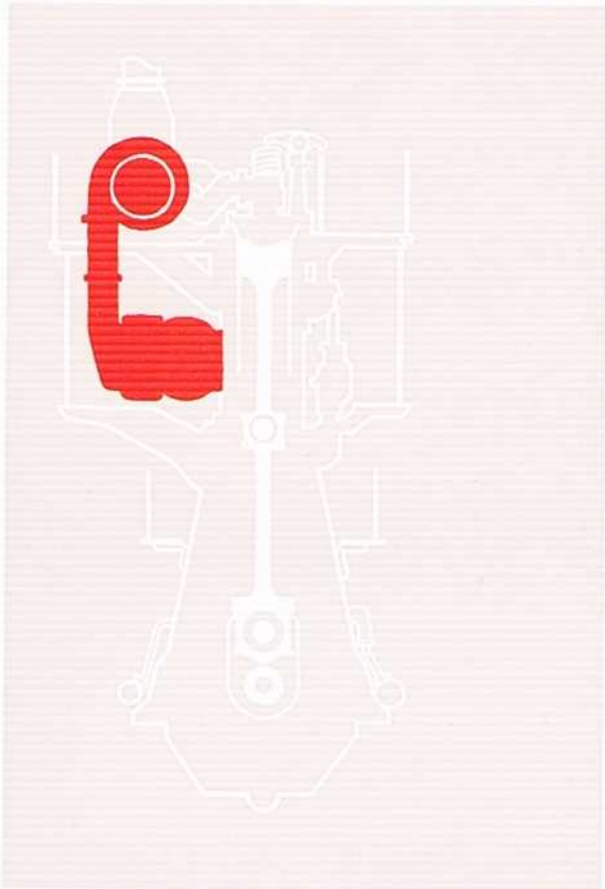


Mounting the turbocharge unit of a 6-cylinder marine diesel engine in B & W's test shop.


B&W

Continued from page 26

The East Asiatic Company in Copenhagen, who had been the first to exploit the advantages of the ocean-going diesel-powered motorship, were once again first in taking advantages of the possibilities inherent in the employment of B&W's new development and ordered a 6-cylinder engine to power a new 18,500 tdw. tanker. This confirmation of the Company's confidence in the new engine led almost immediately to an alteration of an order placed by the Belgian petroleum company PETROFINA with B&W. The original order had contemplated the building in the B&W yard of a 34,000 tdw. tanker; this was changed to a vessel of 45,000 tdw. equipped with a 12-cylinder engine of the new type. Since the appearance of this type, several units have been ordered at B&W.

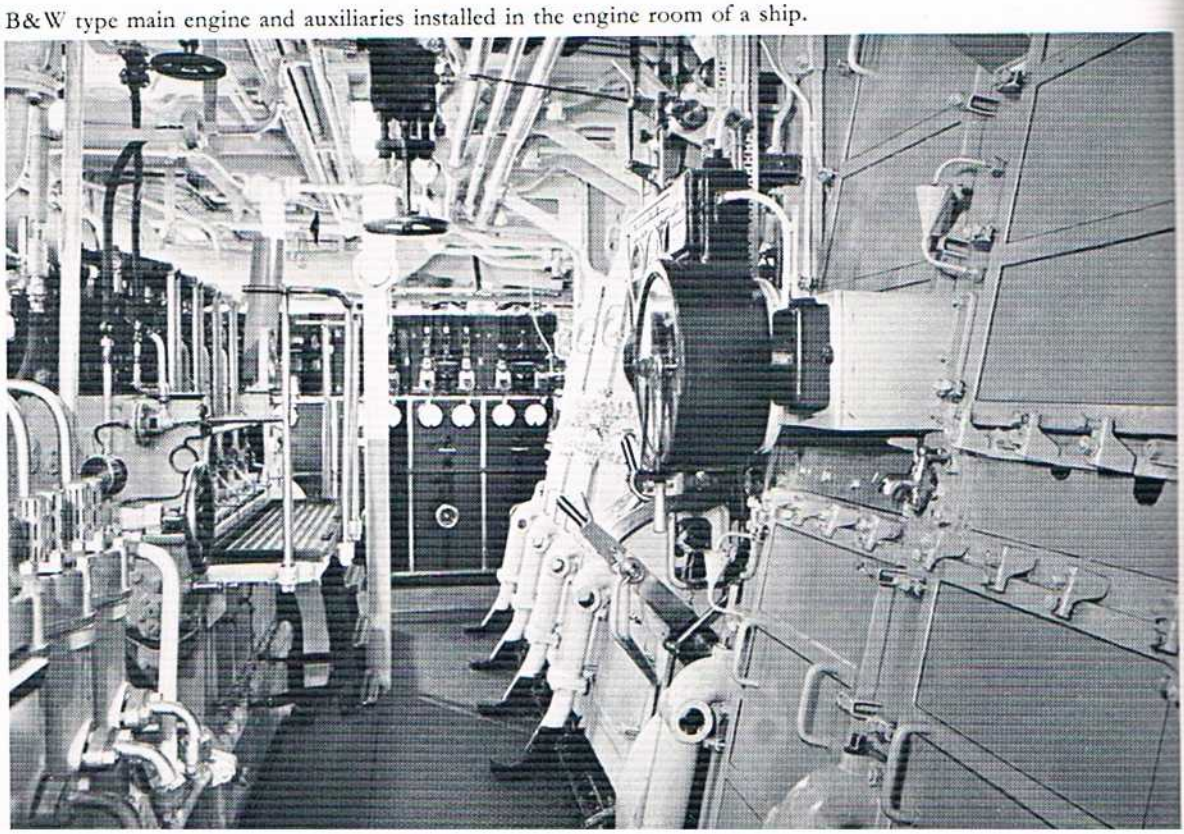


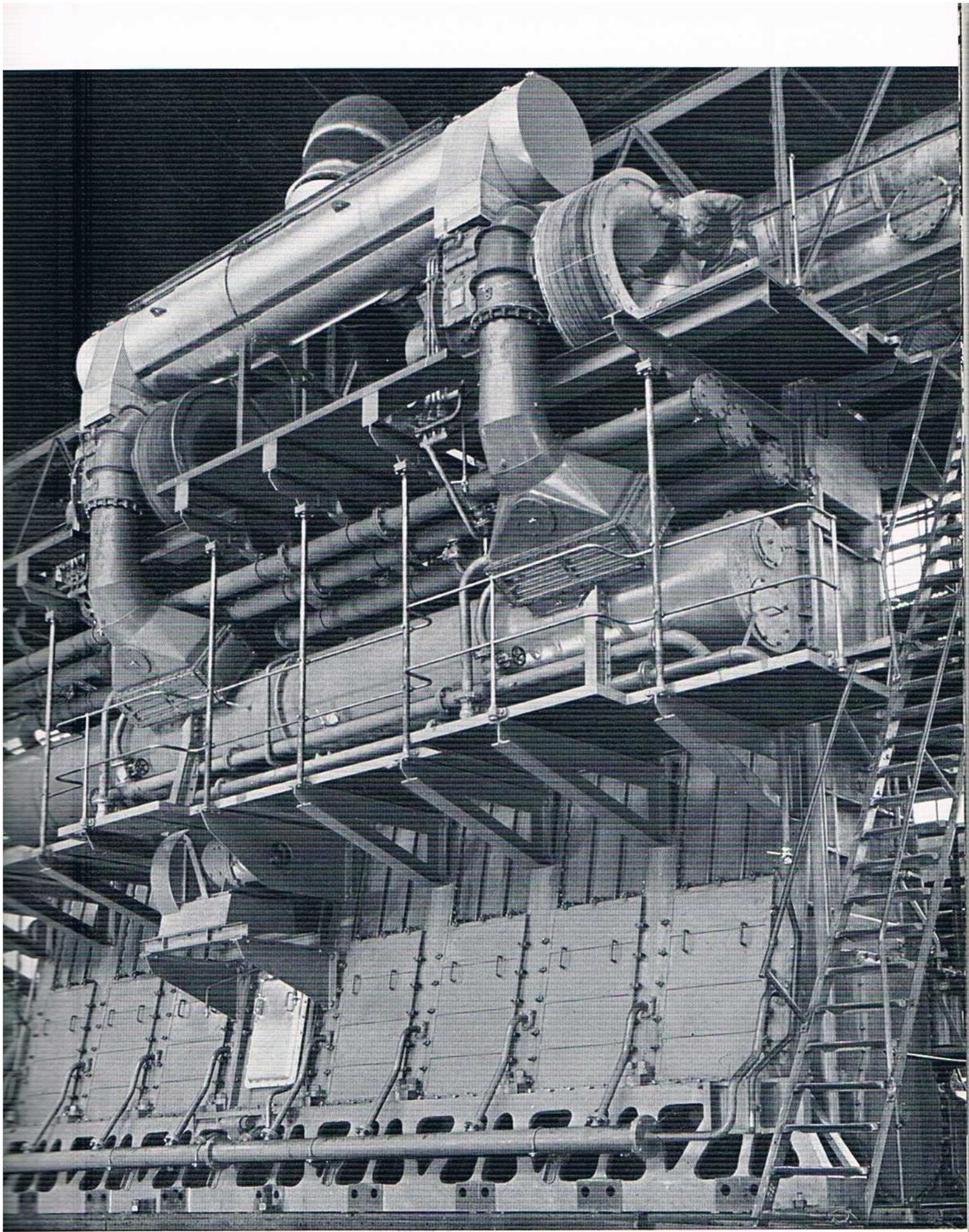
In order to deal with construction of new larger marine diesel engines, extensive developments have been necessary at the Company's works at Christianshavn. A new test shop has been built. It is over 300 ft in lenght and more than 70 ft wide, with about 85 ft headroom, and it has accommodation on its test beds sufficient to allow three of the largest type of marine diesel engines to be erected simultaneously. The crankshaft shop has been extended to give a greater production of these units. Its present output is sufficiently large to supply not only B&W itself but also the Company's licensees. Concurrently with the building of the new large turbocharged diesel engines, the Company carry on production of 4- or 2-stroke, single-acting, trunk piston, crosshead, or opposed piston engines.

The annual production of B&W diesel engines in Denmark totals about 350,000 BHP, and including the production of all licensees, Burmeister & Wain engines totalling approximately 1,000,000 BHP are built every year. The production of the large marine diesel engines is equal to approximately 30 per cent of the world's total production of marine diesel engines for ocean-going ships.

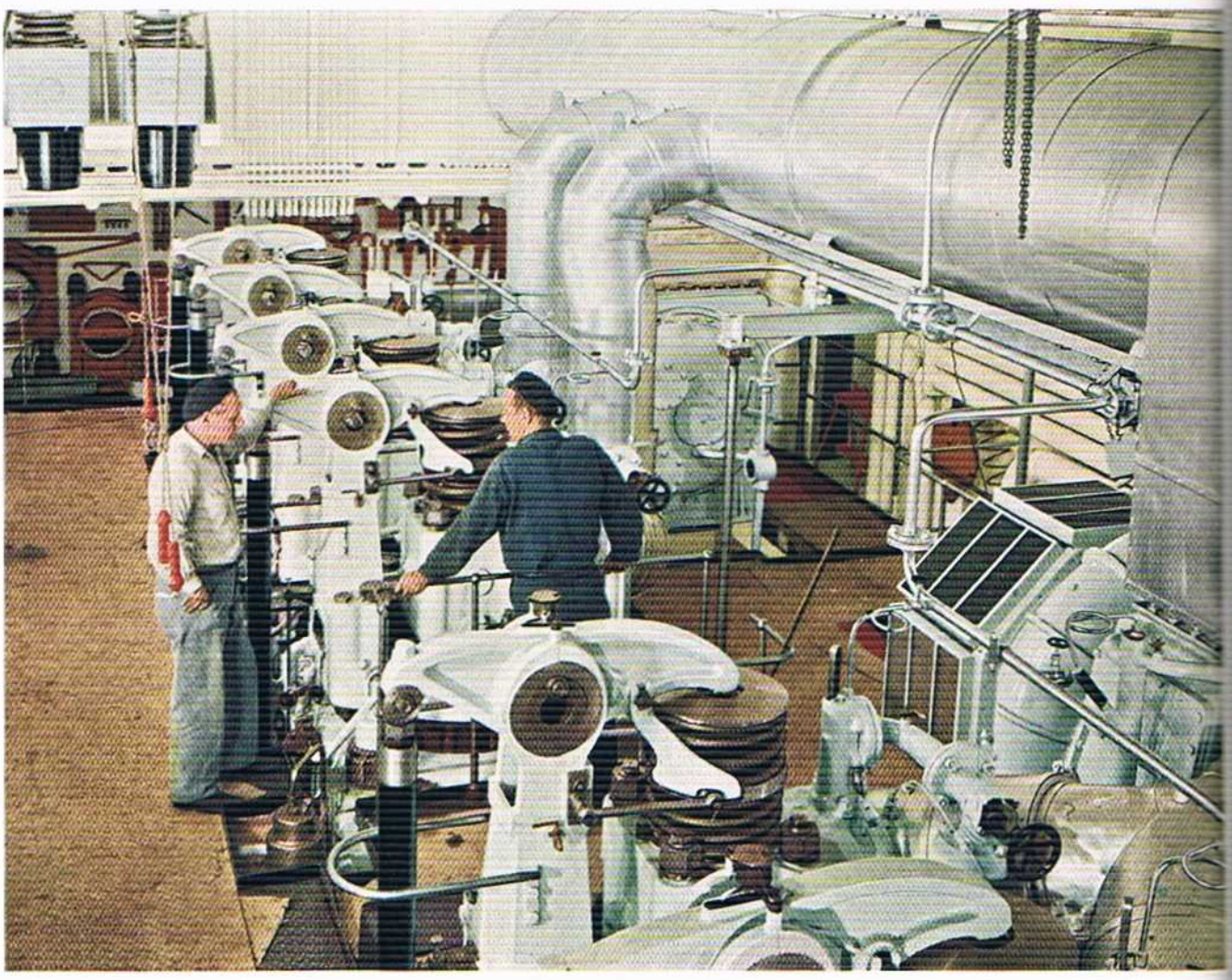
9-cylinder, single-acting, 2-stroke marine diesel engine, type 50-VBF-90, with turbocharge. Cylinder diameter 500 mm, length of stroke 900 mm. Output in normal continuous operation 5,600 IHP, equivalent to approximately 5,000 BHP, at 200 rpm.

B&W type main engine and auxiliaries installed in the engine room of a ship.

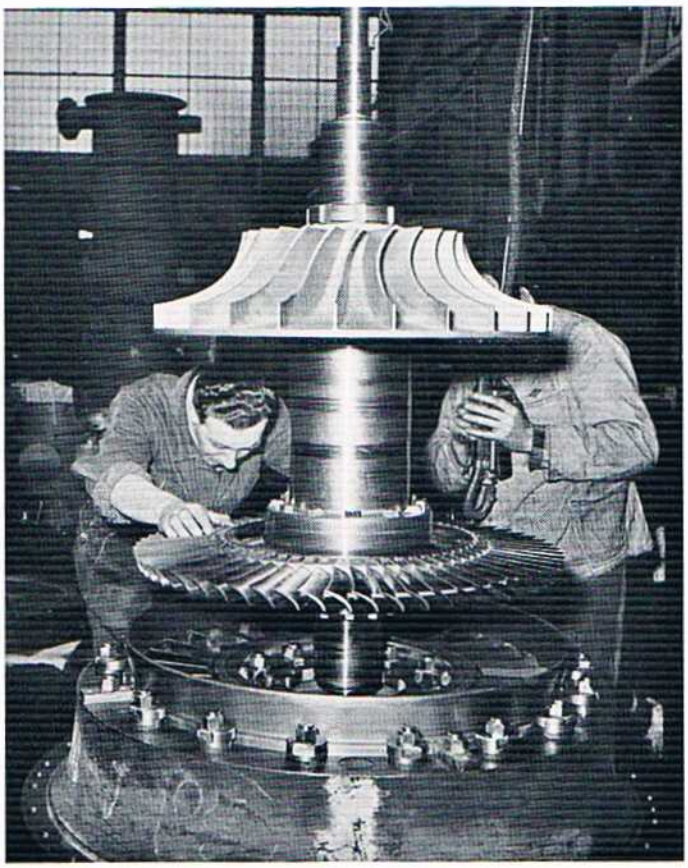




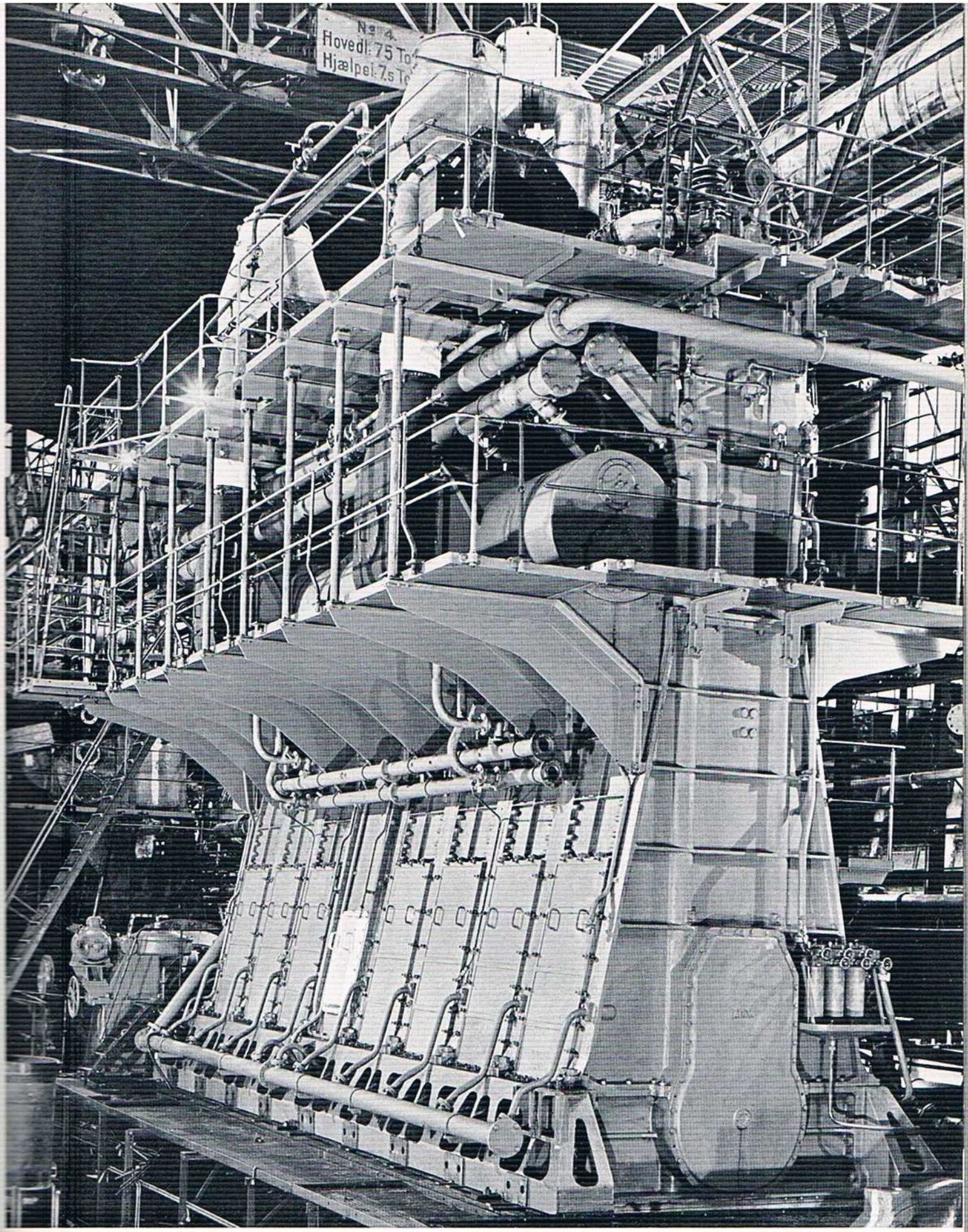
7-cylinder, single-acting, 2-stroke B & W marine diesel engine, type 62-VBF-115, with turbocharge. Cylinder diameter 620 mm, length of stroke 1,150 mm. Output in normal continuous operation 6,450 IHP, equivalent to approximately 5,750 BHP, at 150 rpm.



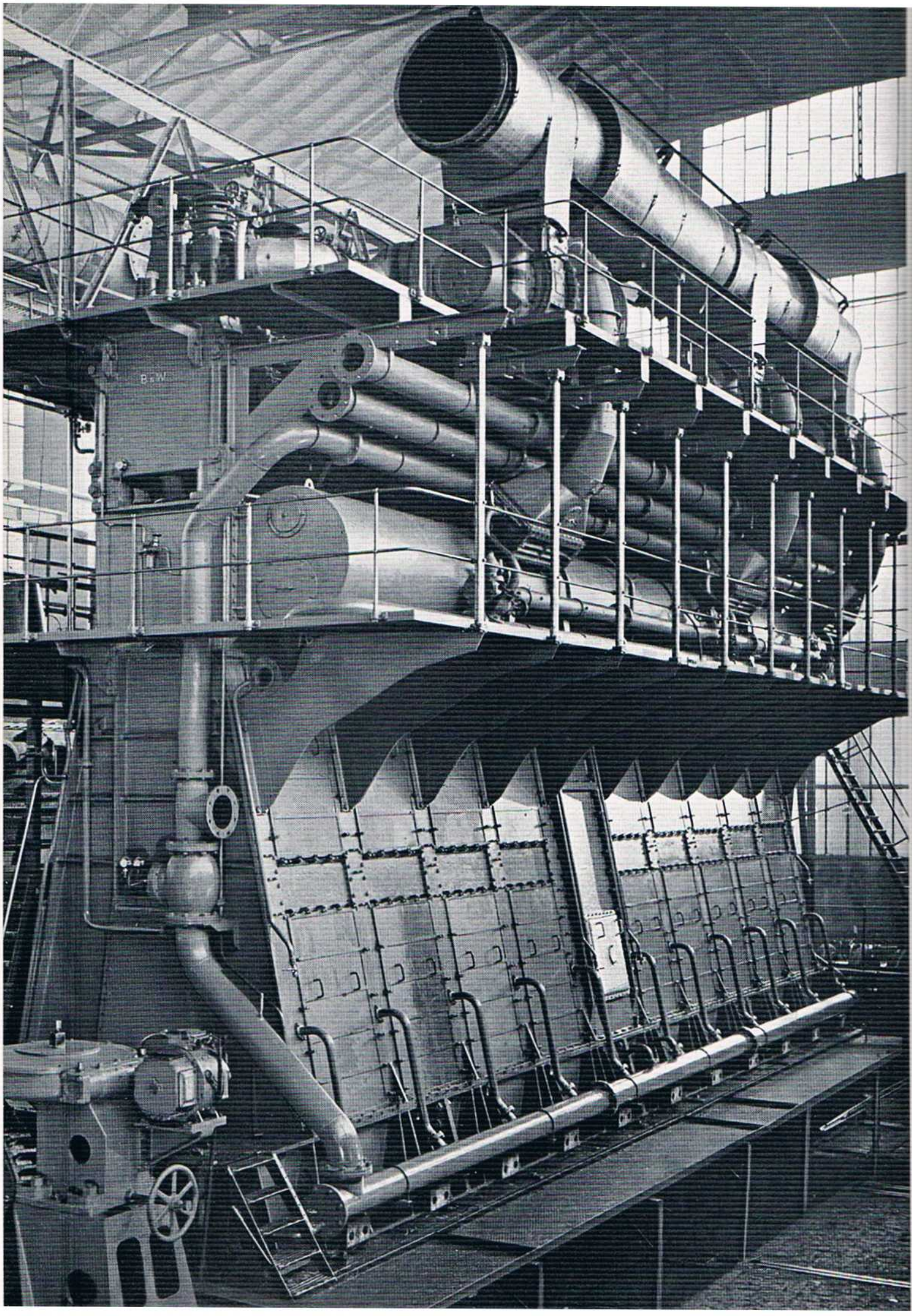
Top of a turbocharged B&W diesel engine, installed in a ship. Turbocharging of 2-stroke engines – a B&W achievement – was first introduced in 1952. This development means increased power, improved fuel economy, less weight, and less space requirements.

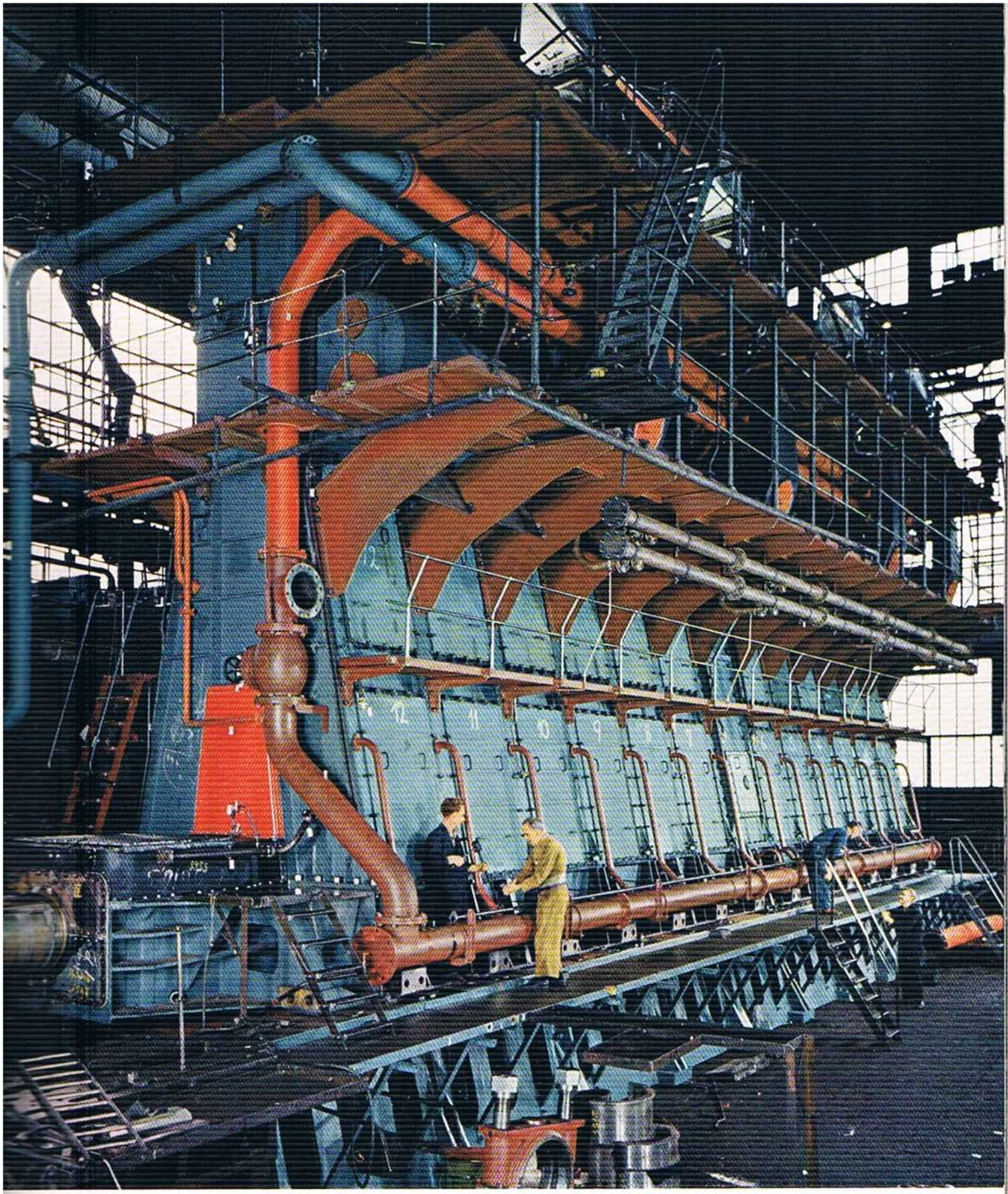


Assembling a B&W turbocharger. Although Burmeister & Wain formerly used turbochargers of foreign manufacture, the company has in recent years taken up this manufacture, both for its own and for the licensees' production.



7-cylinder, 2-stroke, single-acting, crosshead marine diesel engine, type 74-VTBF-140, with turbocharge. Cylinder diameter 740 mm, length of stroke 1,400 mm. Output in normal continuous operation 9,300 IHP, equivalent to approximately 8,300 BHP, at 125 rpm.


B&W



This marine diesel engine, the largest ever built by B & W, shares with a similar unit built by Hitachi - under B & W license - the distinction of also being the world's largest. 12-cylinder crosshead type 74-VTBF-160. Cylinder diameter 740 mm, length of stroke 1600 mm. Output in normal continuous operation 16,800 IHP, equivalent to approximately 15,000 BHP, at 115 rpm.

9-cylinder, single-acting, 2-stroke marine diesel engine of the crosshead type 74-VTBF-160, with turbocharge. Cylinder diameter 740 mm, length of stroke 1,600 mm. Output in normal continuous operation 12,500 IHP, equivalent to approximately 11,200 BHP, at 115 rpm.

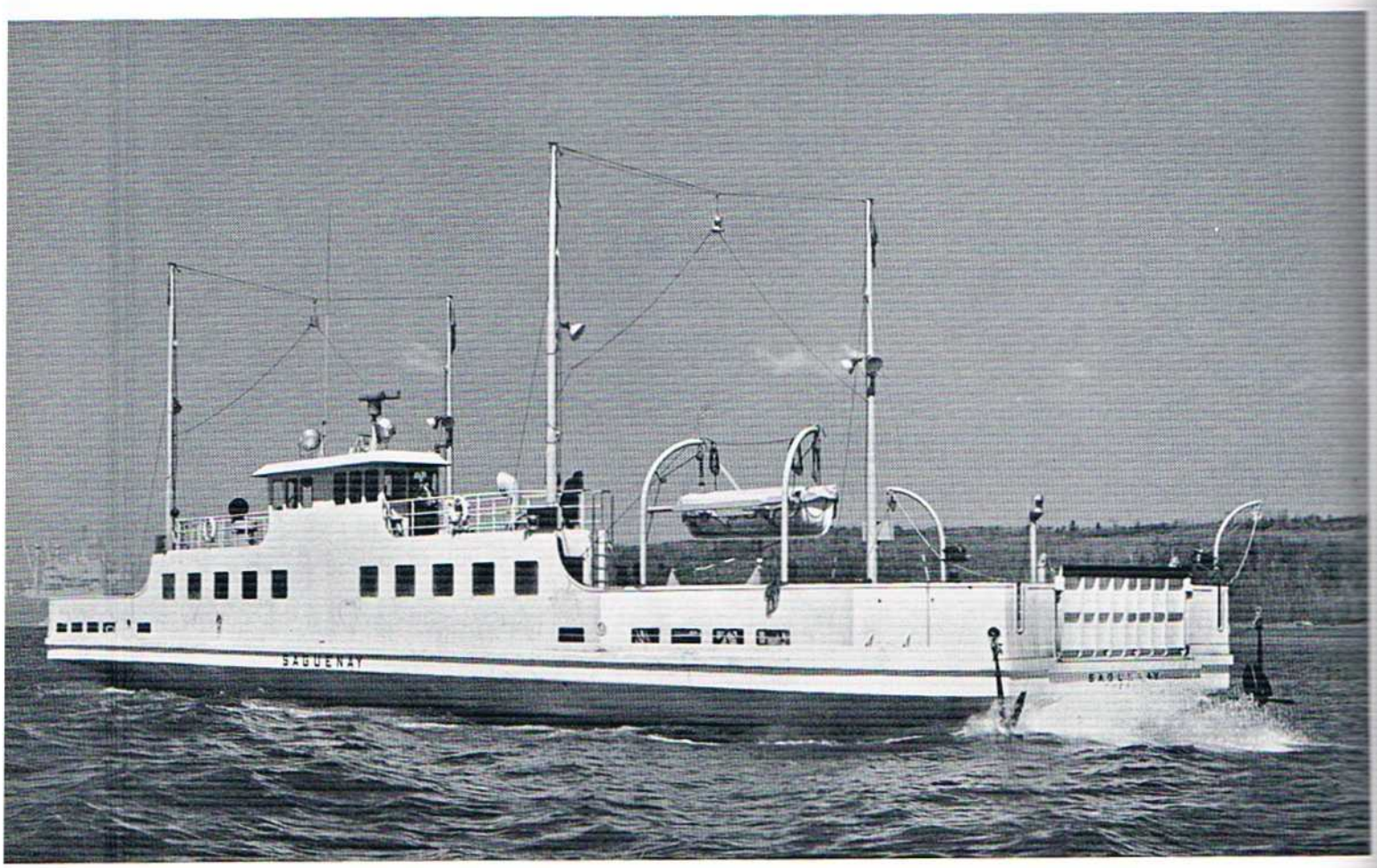

S144

For fishing boats, tug-boats and small cargo vessels etc., Burmeister &Wain builds the sturdy and economical B&W ALPHA diesel engine, which functions on the 2-stroke principle, and without valves. Its simple design and small space requirements make this type ideal for all small and medium-sized vessels. They are dimensioned in accordance with the demands of the classification societies.

The B &W ALPHA engines are available in types 340-400 F and V, which are manually operated and develop from 100 to 280 BHP, and in the hydraulically operated types 340-400 FO and VO, developing from 210 to 420 BHP. A larger type in two different designs, designated as 490 R and 490 VO, develops from 480 to 960 BHP.

For the V and VO engines, special propellers with controllable pitch are used. While a propeller with fixed blades will give the ship a certain speed at a certain draught, the controllable pitch propeller will eliminate the difficulties arising from changes in speed, draught and weather conditions, by allowing the pitch to be adjusted to the best setting for the existing circumstances.

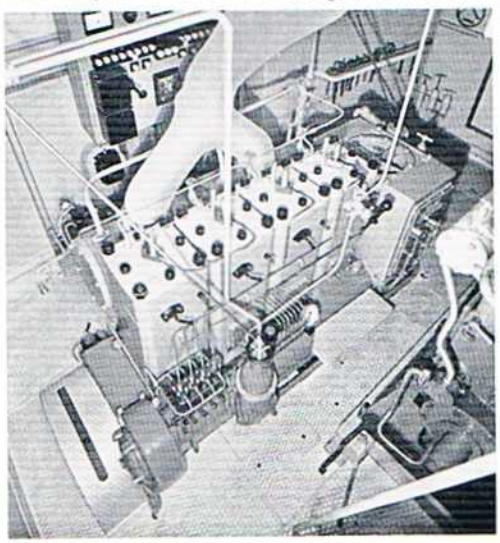
The controllable pitch propeller offers the important advantage, that if a blade is damaged, only this one blade need be replaced, and this can be done quickly and easily. Furthermore, the initial price of a B &W ALPHA engine with controllable pitch propeller is lower than that of engines with reversing gear and fixed propeller, owing to its less complicated design.

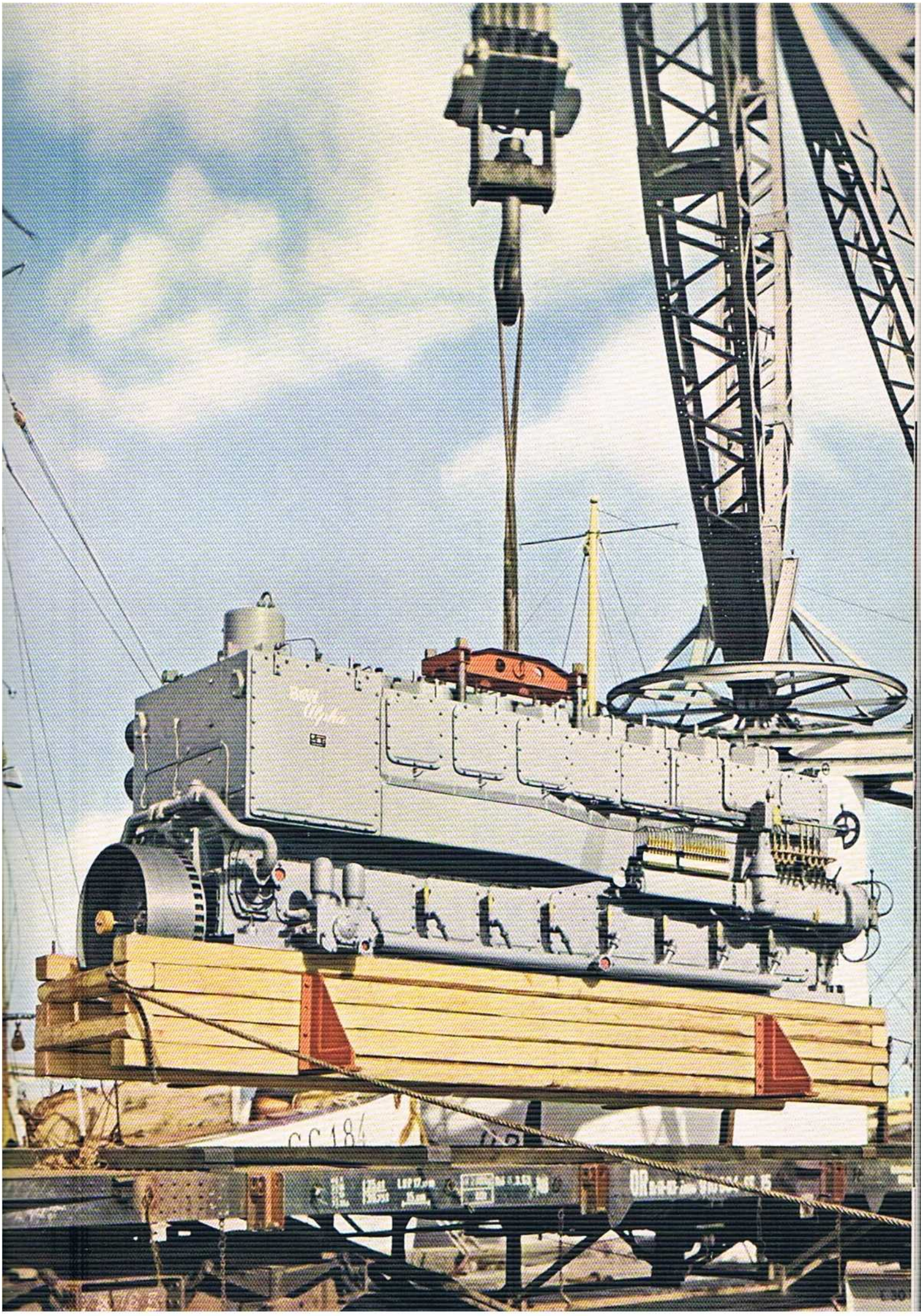


The motor ferry „Saguenay", owned by Clarke Steamship Co., Montreal, is the first Canadian ferry equipped with B & W ALPHA diesel engines. In this ferry, which runs in shuttle service and thus does not turn round, two 4-cylinder engines of the type 400 VO are installed. They are placed on the centre line of the ferry. Output in normal continuous operation is 235 BHP from each engine at 365 rpm. The entire engine plant is so arranged that it is controlled from the bridge.

Two specially built 60-GRT refrigerator boats, the „Coronel Medeiros" and the „Velho Lino", each designed to carry 12,000 litres of milk on the Amazon, Brazil, have been equipped with 4-cylinder B & W ALPHA diesel engines of the type 400 VO with controllable pitch propellers. The output of each engine is 280/310 BHP at 375 rpm.

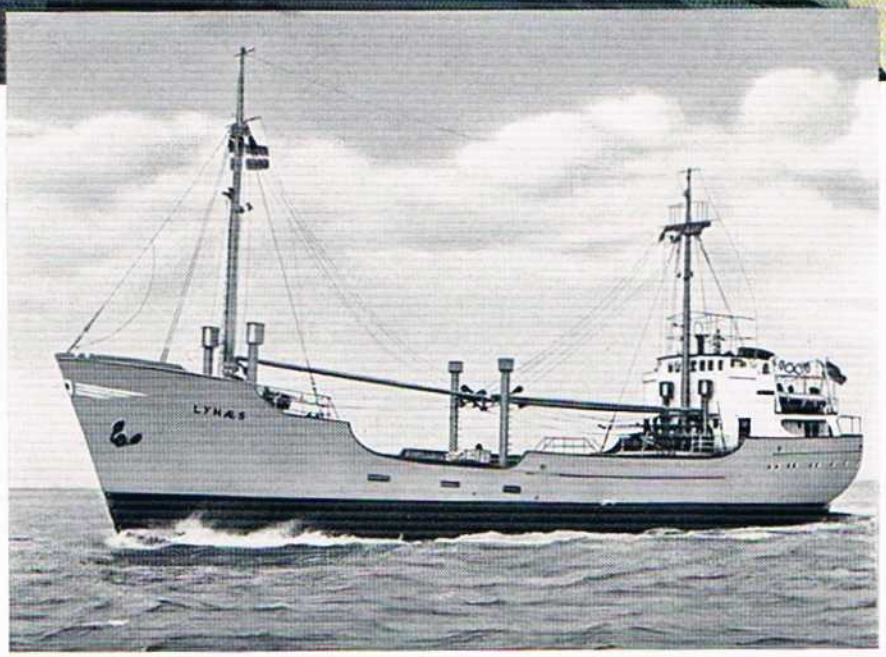
The installation of the B & W ALPHA diesel engine in one of the refrigerator boats.



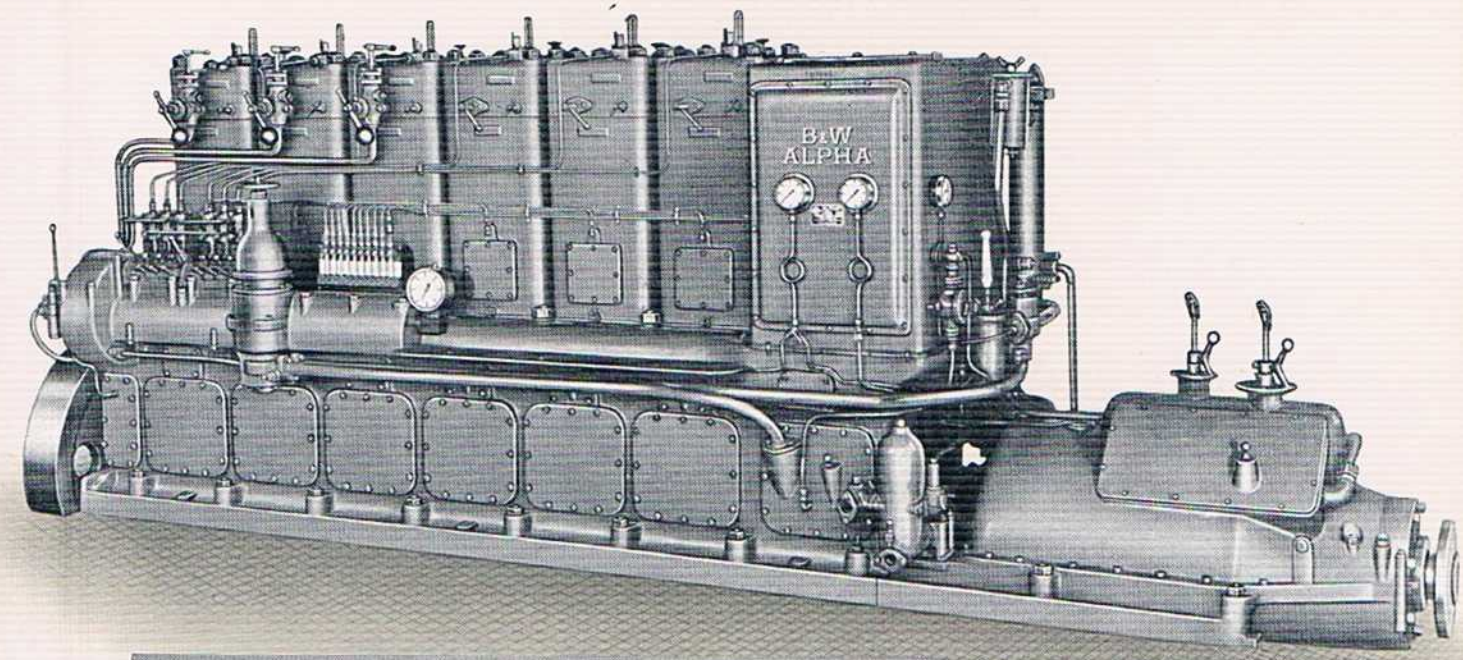


M/S "Folla", belonging to Namsdalen Aktie-Dampskibsselskab, Namsos, Norway, and equipped with a 5-cylinder B & W ALPHA diesel engine, type 490 VO. Normal output 600 BHP at 310 rpm.

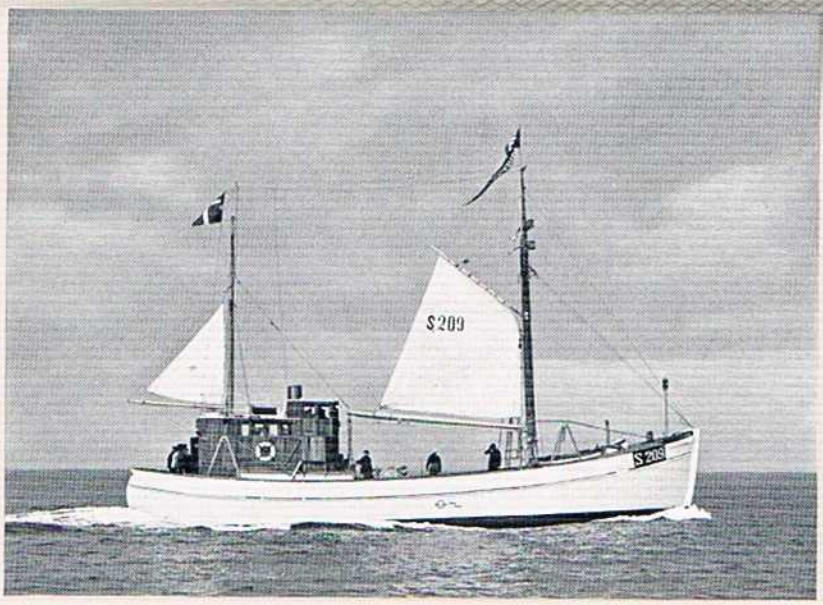
8-cylinder B&W ALPHA diesel engine, type 490 VO, on the test bed. Cylinder diameter 290 mm, length of stroke 490 mm. Normal output 960 BHP at 310 rpm.



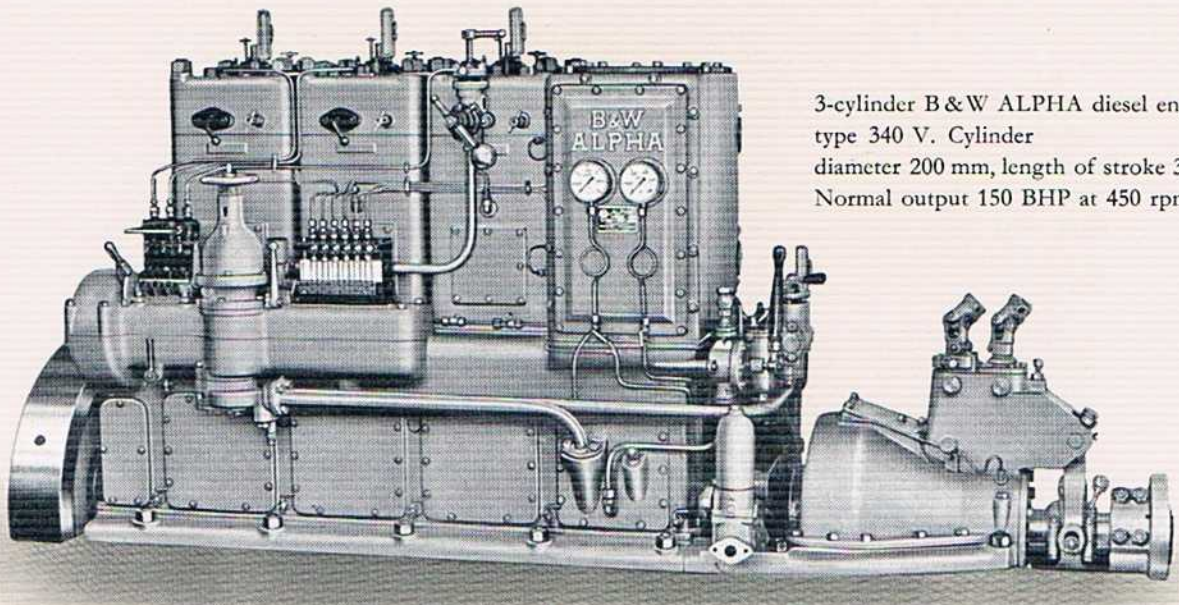
M/S "Lynaes", belonging to Rederiet Solnaes, Copenhagen, Denmark, and equipped with a 4-cylinder B & W ALPHA diesel engine, type 490 R. Normal output 480 BHP at 310 rpm.



6-cylinder B&W ALPHA diesel engine, type 400 VO. Cylinder diameter 230 mm, length of stroke 400 mm.
Normal output 420 BHP at 375 rpm.



Fishing vessel "Vera Marina" ex "Jacob Henriksen", belonging to Sr. Pedro Euzébio, Rio de Janeiro, Brazil, and equipped with a 4-cylinder B&W ALPHA diesel engine, type 400 VO.
Normal output 240 BHP at 375 rpm.



3-cylinder B&W ALPHA diesel engine, type 340 V. Cylinder
diameter 200 mm, length of stroke 340 mm.
Normal output 150 BHP at 450 rpm.

Burmeister & Wain, as leading designers of large marine diesel engines, found it natural to participate in the development of marine auxiliary engines too. They have made many contributions to the improvement of this type of engine and B&W auxiliary units are famous for their reliability and economy in operation.

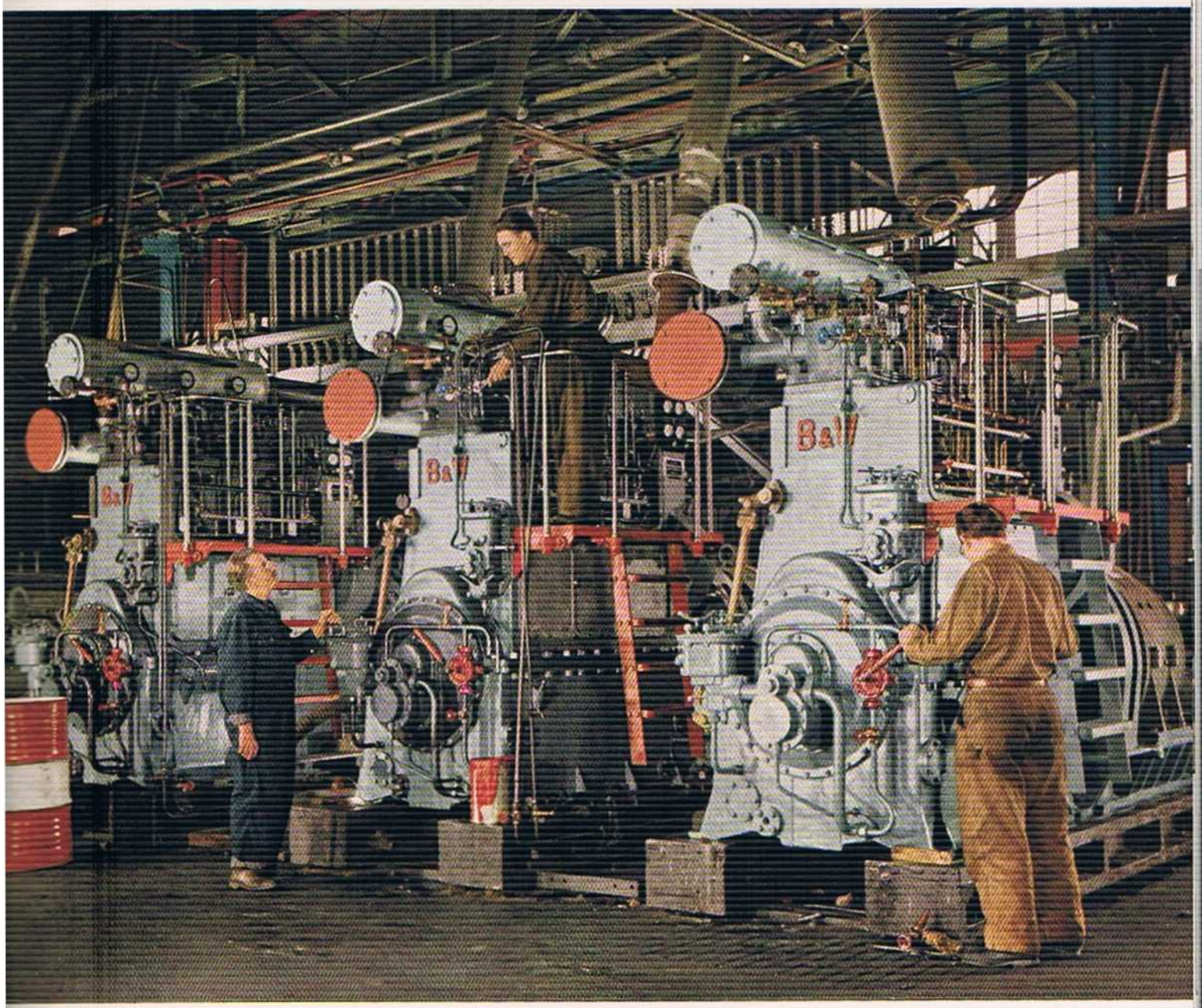
In the design of the engines, the greatest possible consideration has been given to the accessibility of the individual parts to reduce to a minimum the time required for overhauls.

Since the first B&W auxiliary engines were installed together with the first direct reversible marine diesel engines in the m/s "Selandia" in 1912, they have been further developed and in all respects kept pace with the main B & W marine engine improvements.

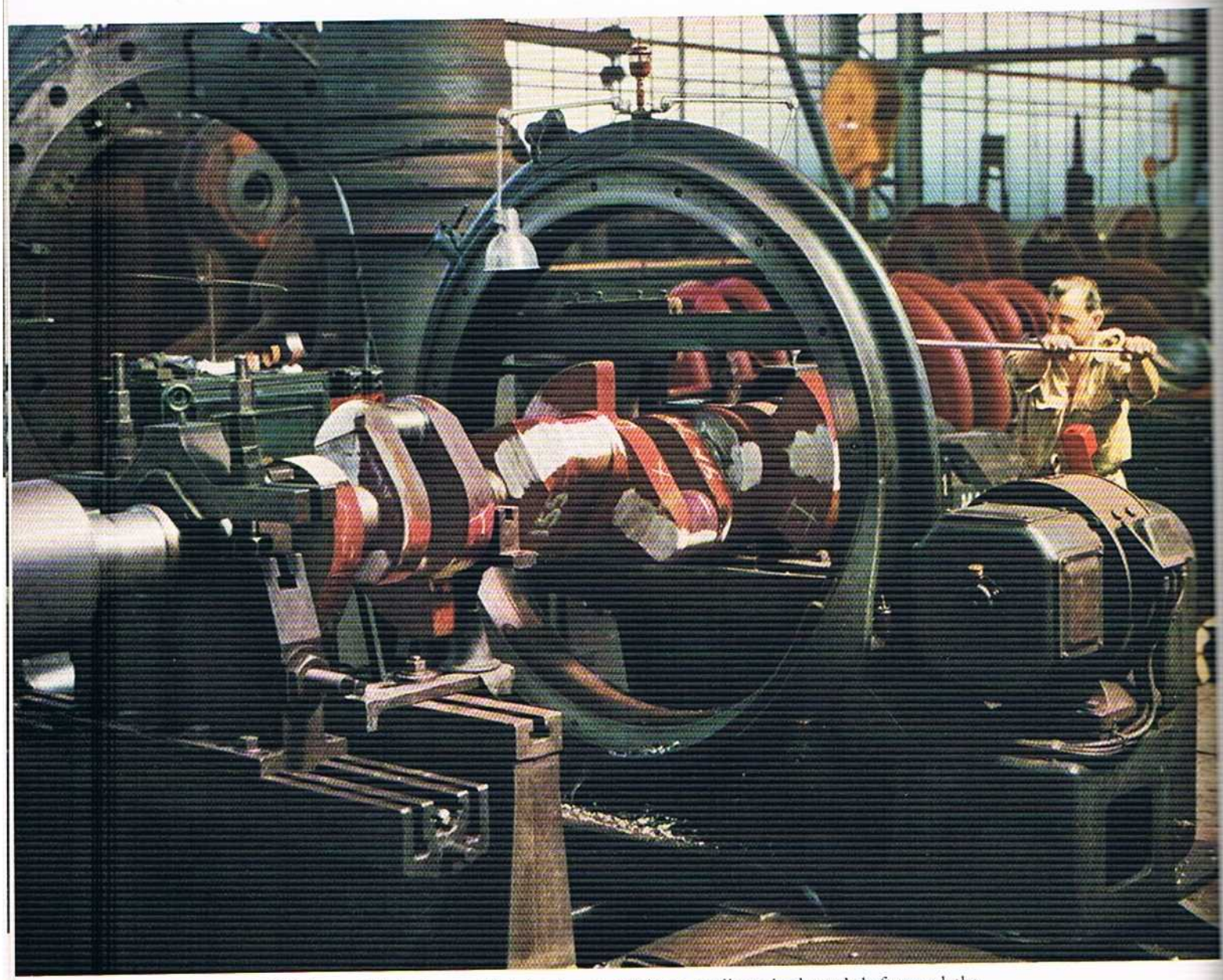
In Denmark, B&W auxiliary engines are produced by Burmeister & Wain's subsidiary company, Aktieselskabet Holeby Dieselmotor Fabrik, and by Elsinore Shipbuilding & Engineering Co., Ltd.; abroad by many of the B&W licensees. They are built as 4-stroke single-acting trunk piston engines, and units are available with from 2 to 8 cylinders. The output range covers from 70 to 1320 BHP. Most of the auxiliary diesel engines may be fitted with turbocharge, resulting in a considerable increase to their output. Since 1912, Burmeister & Wain and its licensees have delivered close on 6000 auxiliary diesel engines with a total horsepower output of more than 1.2 million BHP.

B&W

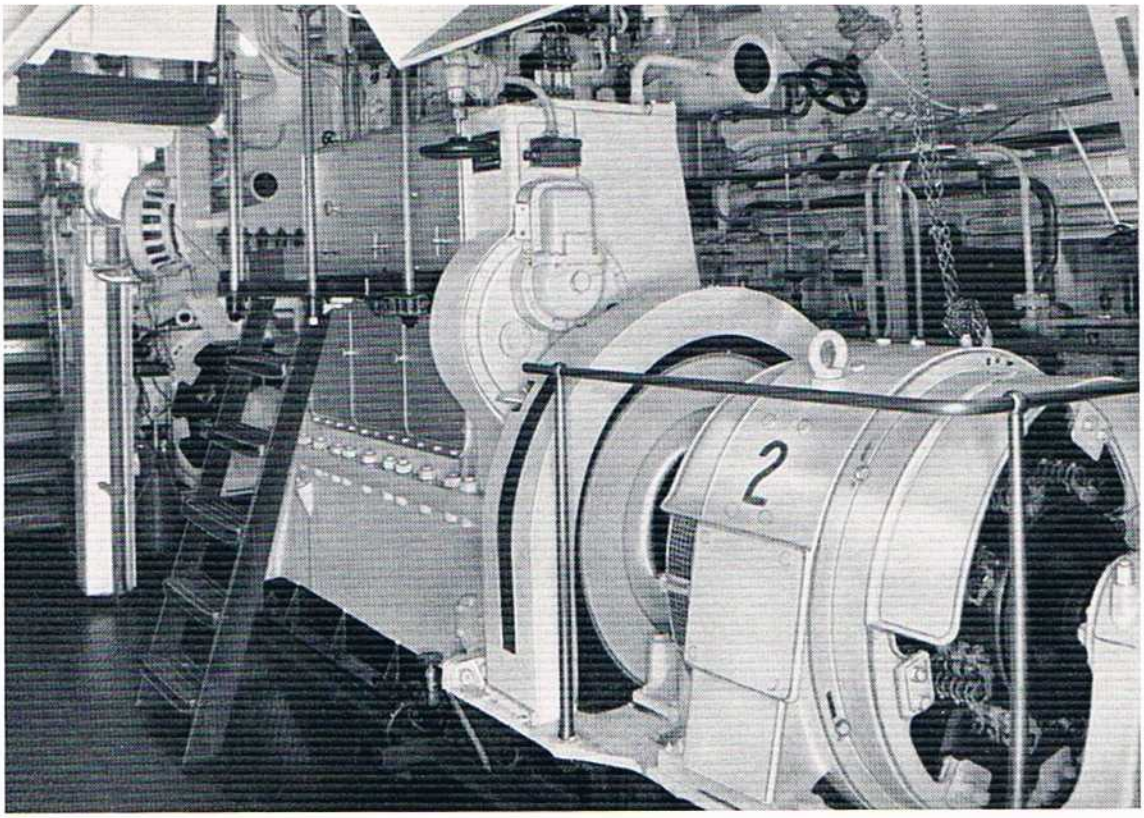
Auxiliary Diesel Engines



Erecting marine auxiliary diesel engines for testing in the engine work's test shop.

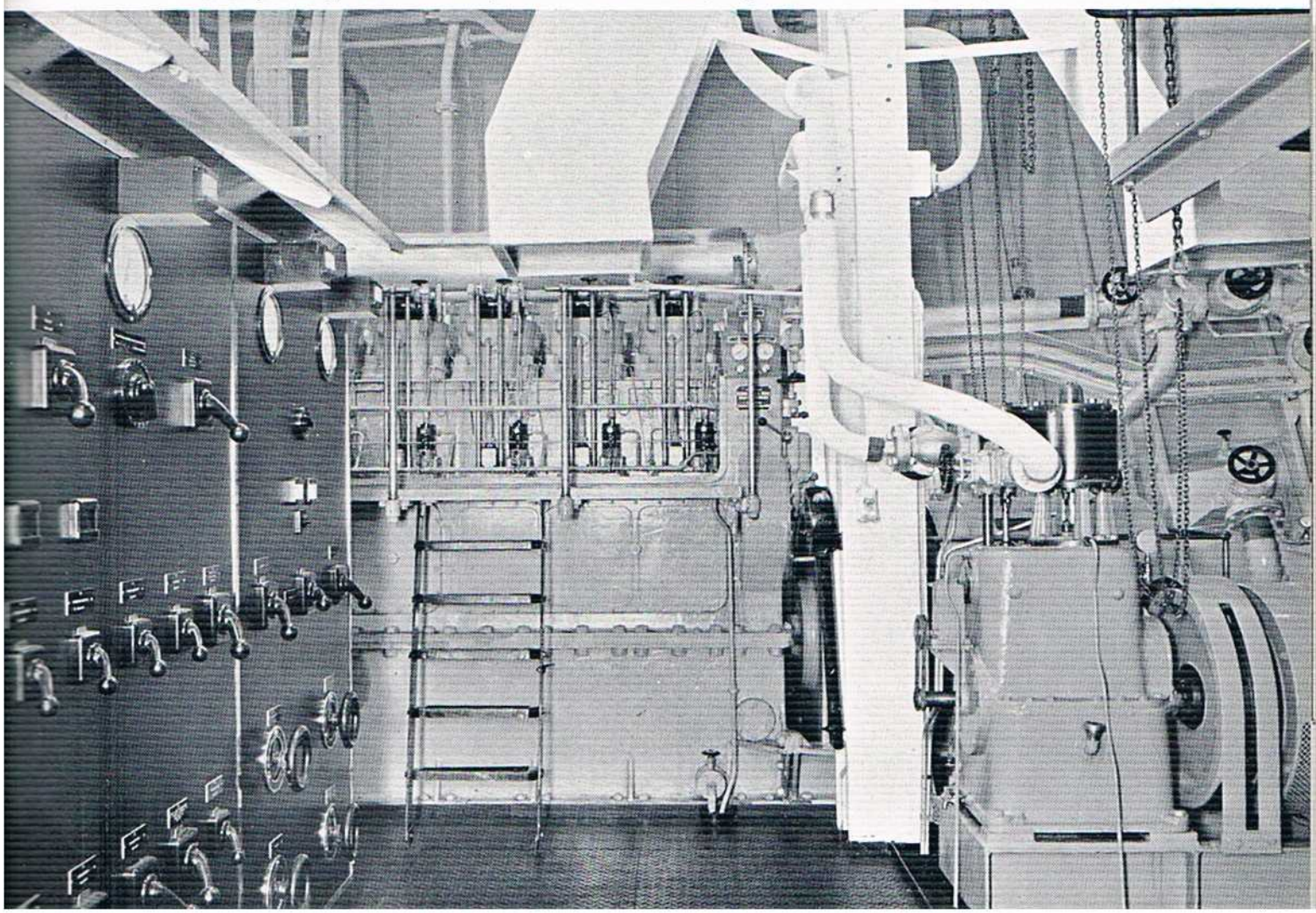


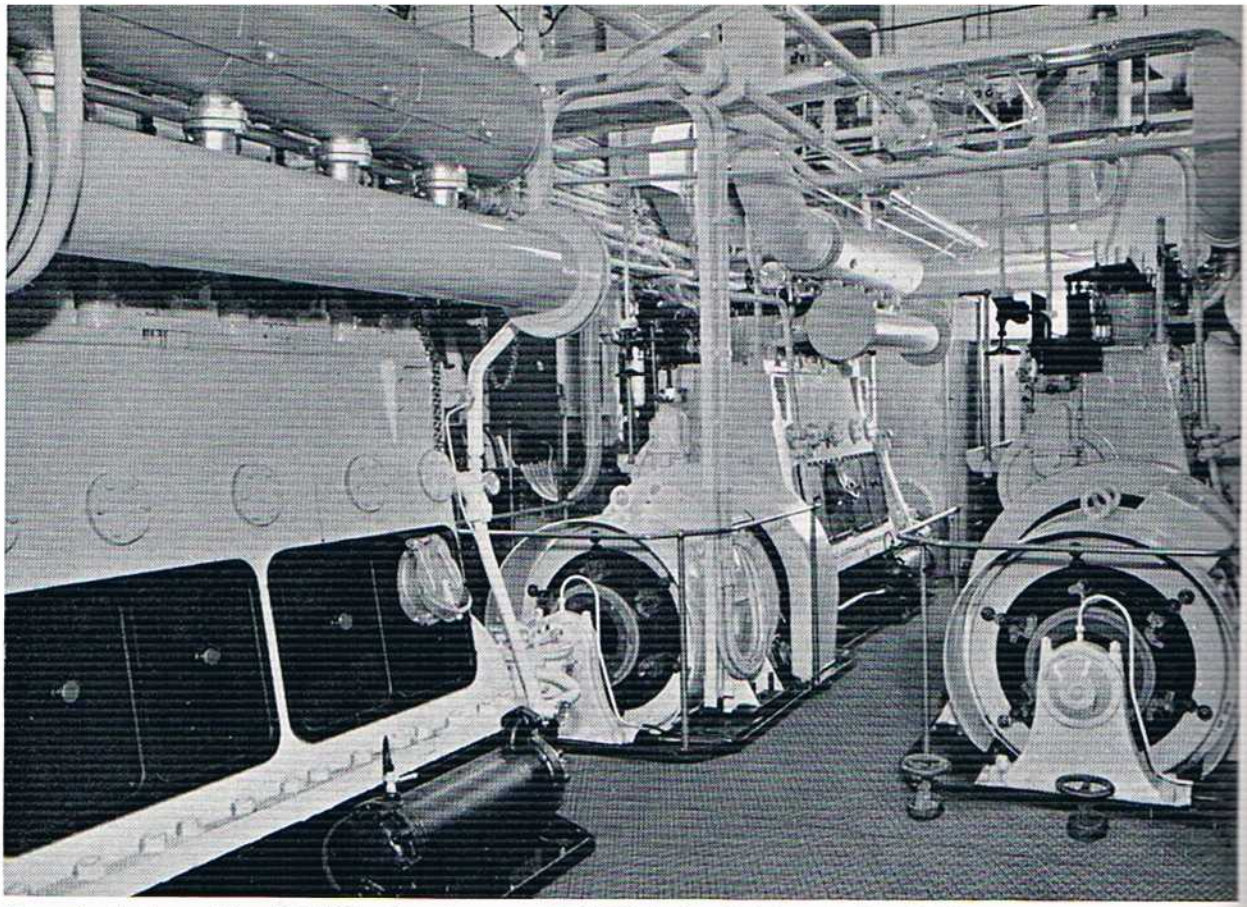
From Burmeister & Wain's crankshaft shop at Christianshavn: turning a medium-sized crankshaft on a lathe.



4-cylinder auxiliary B & W diesel engine, type 25-MTH-40, with built-on dynamo. Cylinder diameter 250 mm, length of stroke 400 mm, output 240 BHP at 500 rpm.

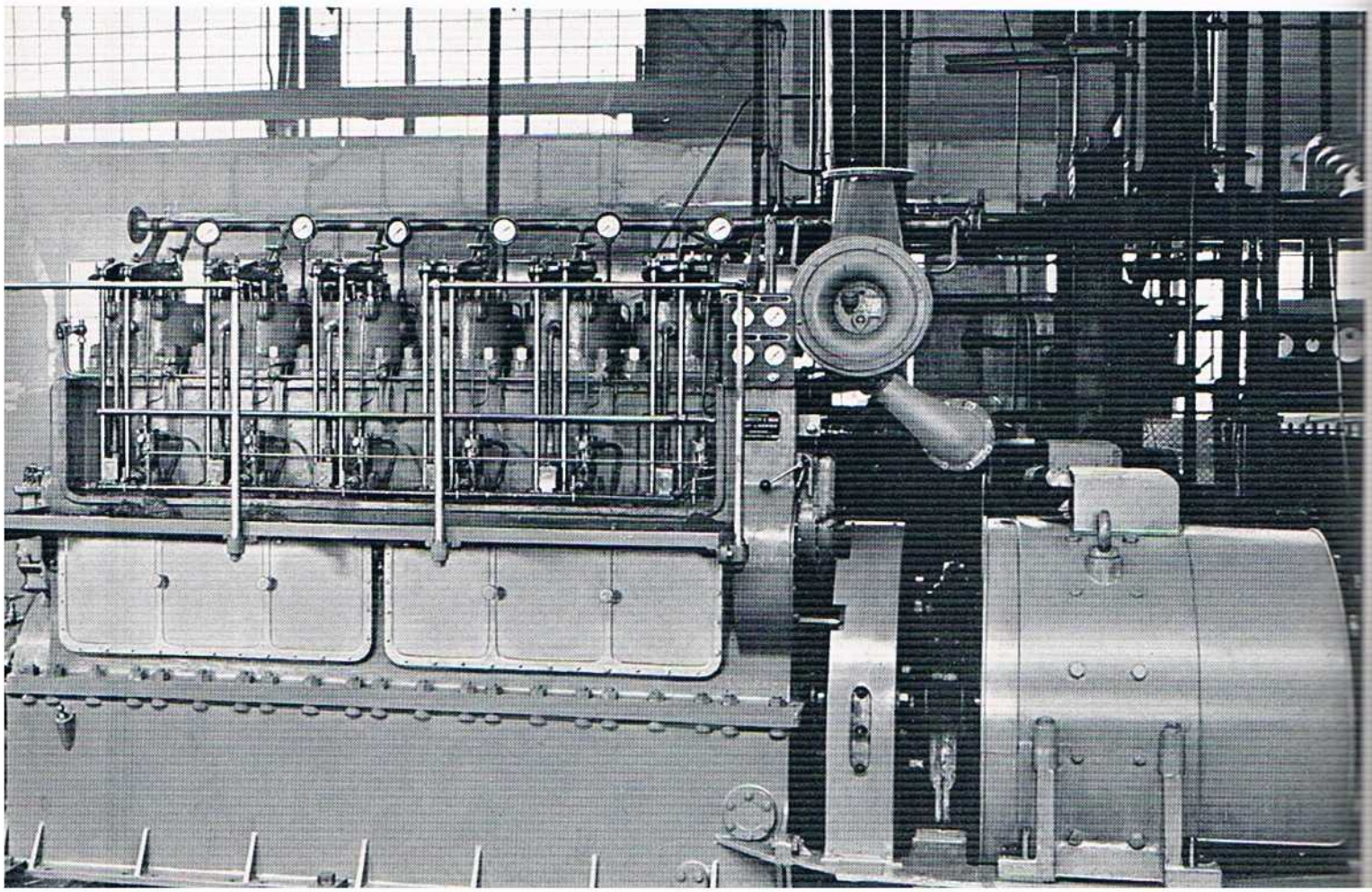
Interior from a ship's engine room. In the background a 6-cylinder auxiliary B & W diesel engine of the 4-stroke, single-acting trunk piston type 25-MTH-40. Cylinder diameter 250 mm, length of stroke 400 mm. Output 360 BHP at 500 rpm.

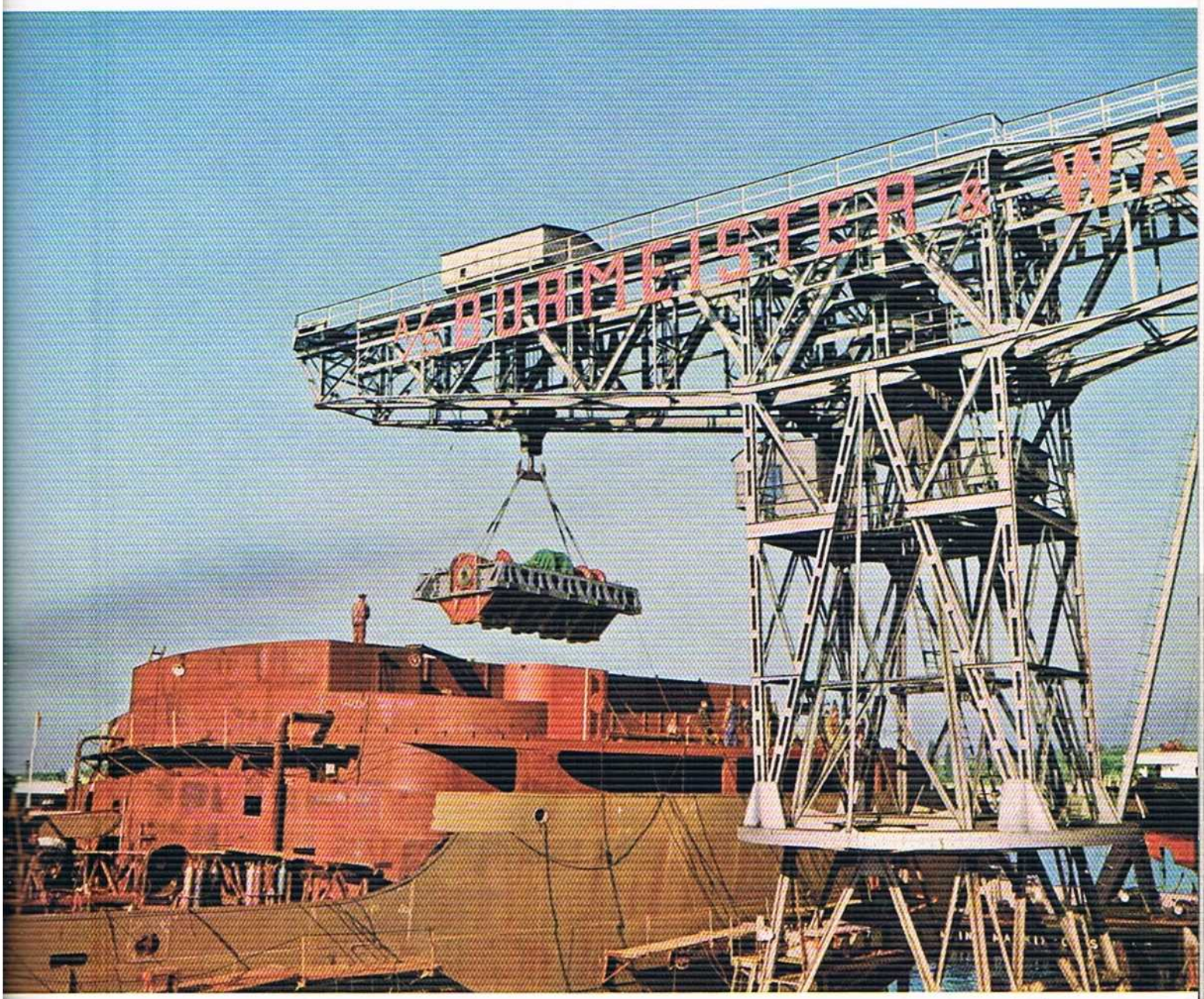




Three 4-cylinder auxiliary B & W diesel engines, type 25-MTH-40, installed in m/s "Songkhla".
Cylinder diameter 250 mm, length of stroke 400 mm. Each engine develops 240 BHP at 500 rpm.

6-cylinder auxiliary B & W diesel engine of the 4-stroke, single-acting trunk piston type 25-MTBH-40 with turbocharge. The engine is direct coupled to a D.C. generator.
Cylinder diameter 250 mm, length of stroke 400 mm. Normal output 510 BHP at 500 rpm.



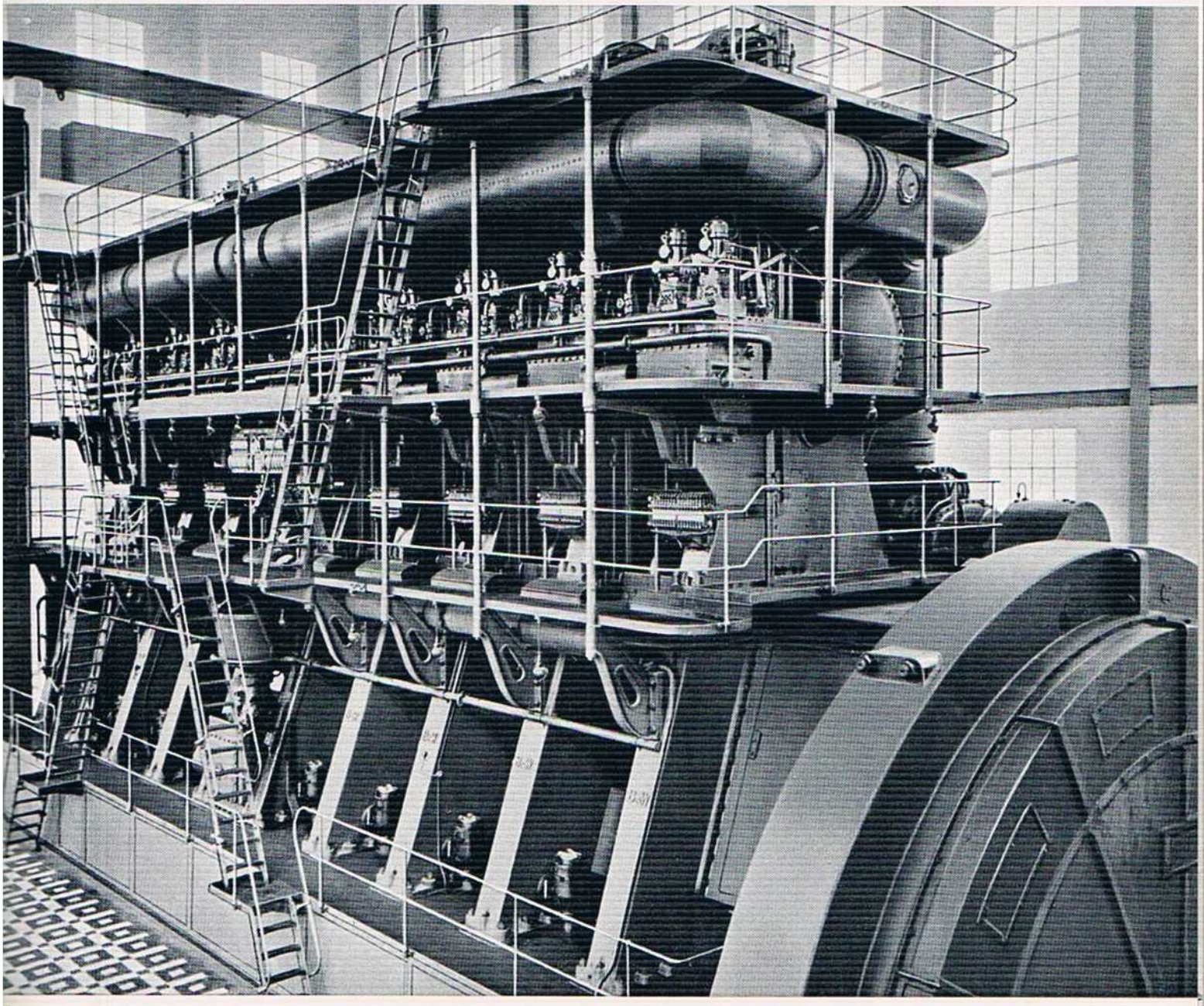


The bedplate of a B & W diesel engine being swung on board a newbuilding at B & W's shipyard on Refshale Island.

The development of Burmeister & Wain's stationary diesel engines, following the delivery of the first ten diesel engines in 1904, was rapid and uninterrupted. In 1933, a temporary climax was reached, when a double-acting, 2-stroke, 8-cylinder diesel engine was delivered to the H. C. Oersted Power Station in Copenhagen. This engine, which is 75'6'' long and 52'6'' high, develops in normal continuous service 22,500 BHP. For more than a quarter of a century it has remained the world's largest diesel engine. Developments continued, however: new stationary engine types were designed, and the field of application constantly extended. In the snow and ice of Greenland, in the deserts of Iraq, in the heat of Africa and the mountains of South America – indeed, under all climatic conditions – B &W's stationary diesel engines confirm, year after year, through their reliable and economical service, Denmark's reputation as the leading country in diesel engine design.

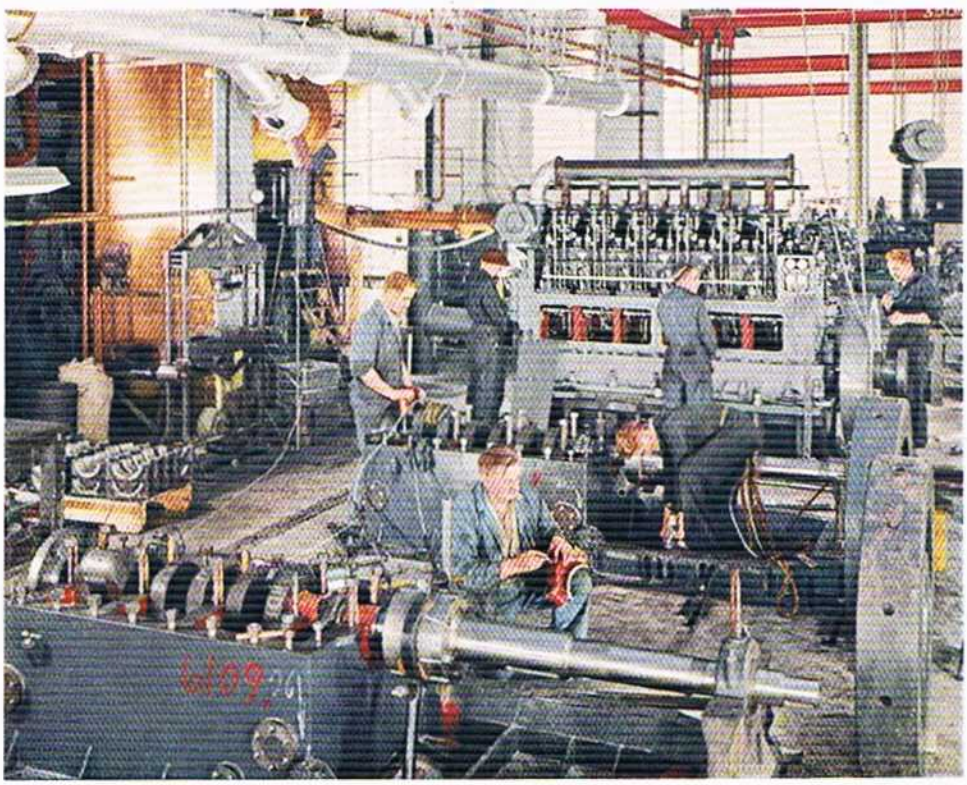
Burmeister &Wain's stationary diesel engines are available in sizes from 70 BHP and upwards, and can be either double- or single-acting and work according to the 2-stroke or 4-stroke principle. Most types can be delivered with turbocharge, which considerably increases their output; or in case of a given output, the number of cylinders can be reduced accordingly. At high altitudes, turbocharging offers the advantage that the power loss caused by the reduced barometric pressure may be compensated for by appropriate designing of the charging system.

Stationary Diesel Engines



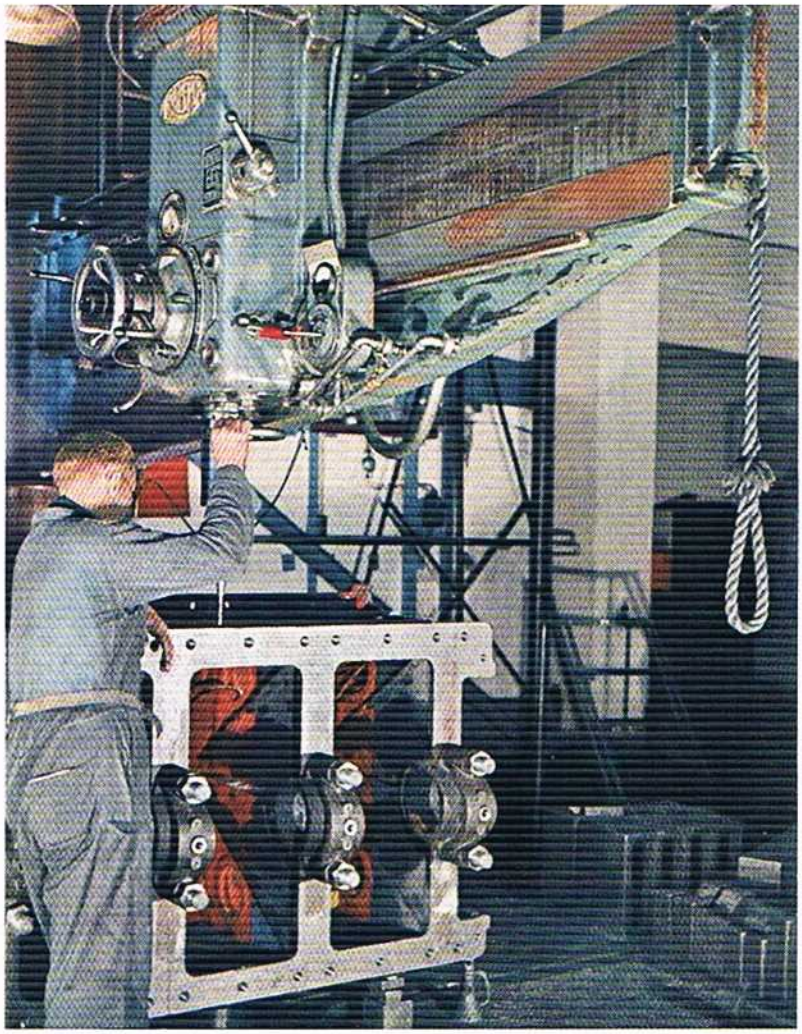
8-cylinder, double-acting, 2-stroke stationary B & W diesel engine, type 84-WS-150, delivered to the H. C. Oersted Municipal Power Station in Copenhagen. Cylinder diameter 840 mm, length of stroke 1,500 mm. Normal output 22,500 BHP at 115 rpm.

5-cylinder stationary B&W diesel engine of the 4-stroke, single-acting trunk piston type 25-MTS-40. Cylinder diameter 250 mm, length of stroke 400 mm. Output in normal service 300 BHP at 500 rpm.

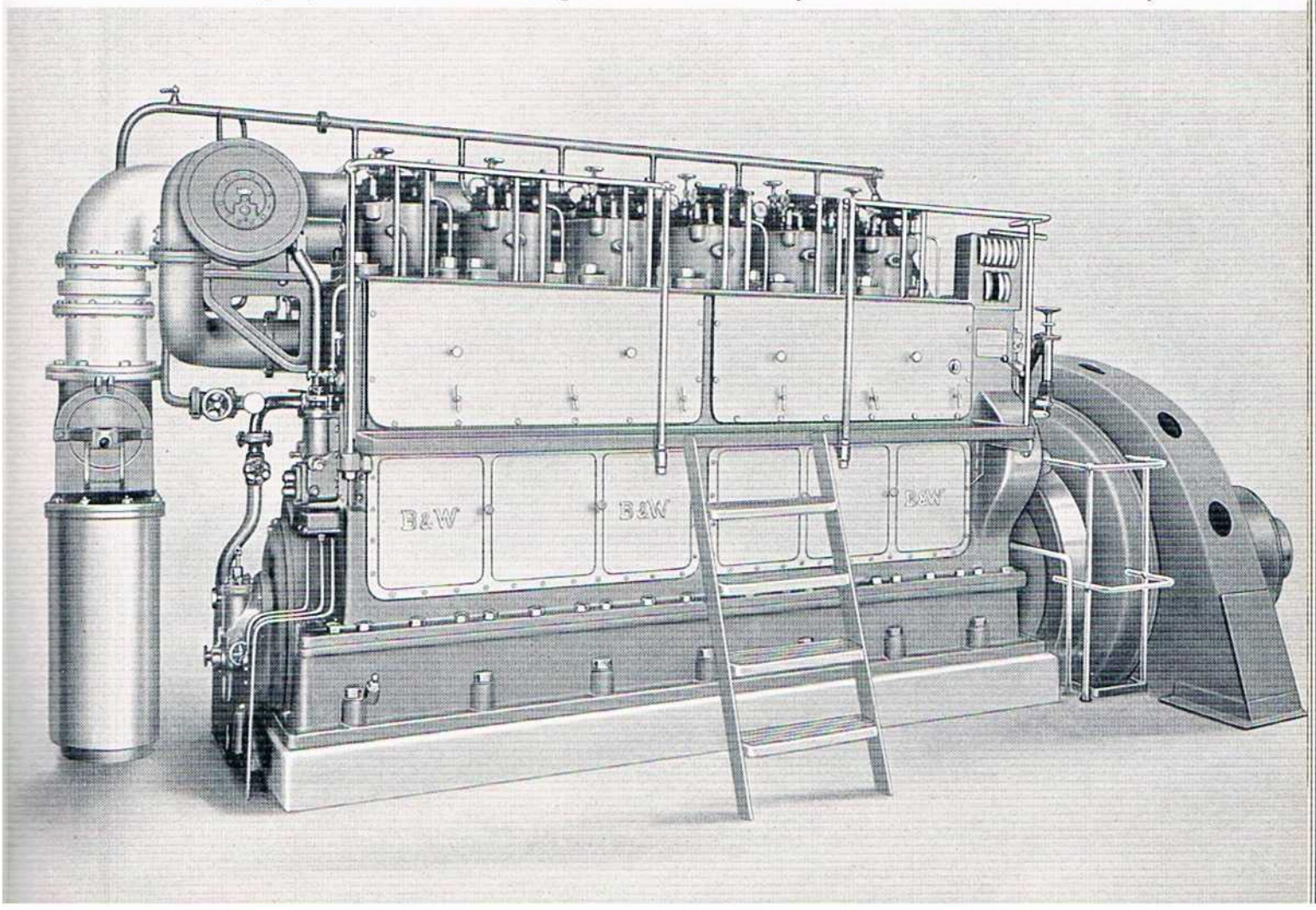


Assembling smaller stationary diesel engines on the test beds at B&W's subsidiary company, Holeby Dieselmotor Fabrik.

One of the main reasons for the success of the B&W engines is the scrupulous attention paid to finishing processes in the B&W workshops. Fully up-to-date machine tools operated by specially trained workers ensure the highest standard of workmanship.

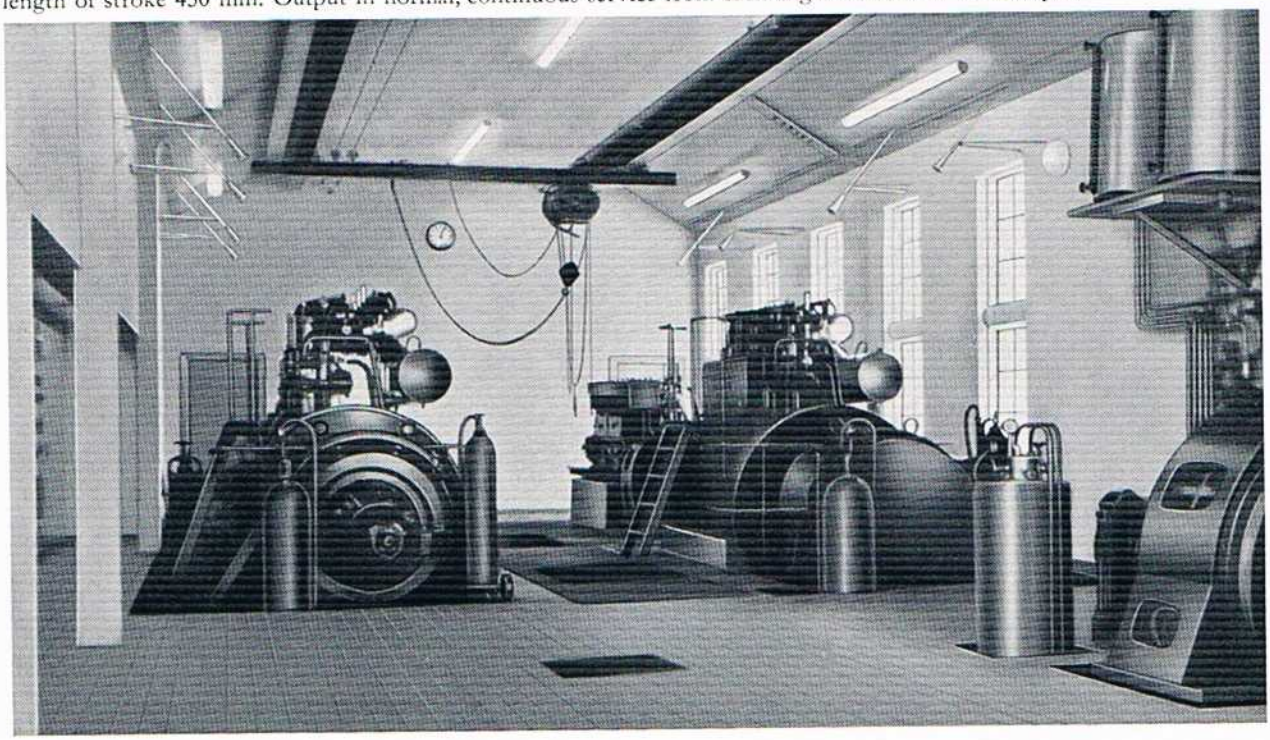


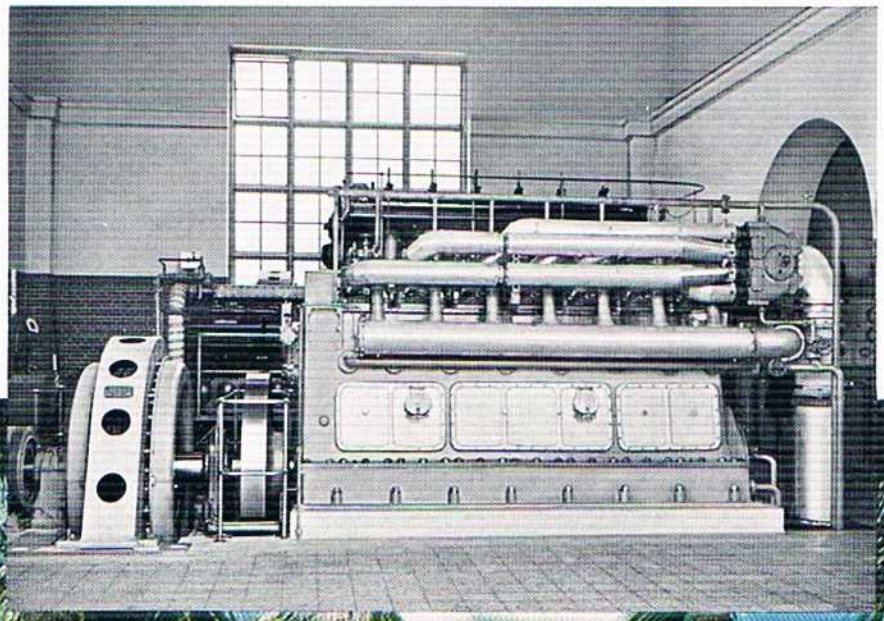
6-cylinder stationary B&W diesel engine of the 4-stroke, single-acting trunk piston type 25-MTBS-40 with turbocharge. Cylinder diameter 250 mm, length of stroke 400 mm. Output in normal service: 510 BHP at 500 rpm.



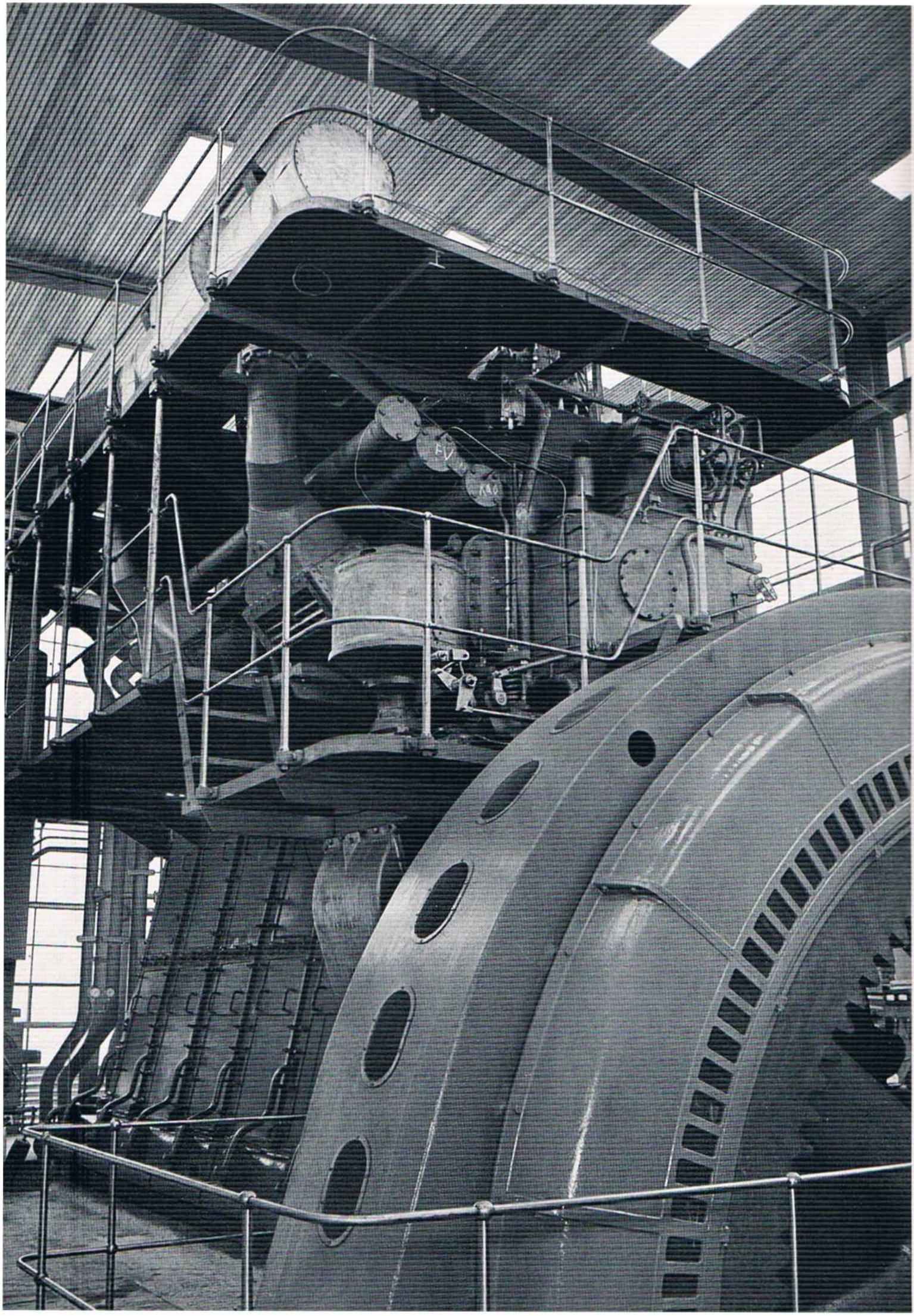
The sea approach to the Danish lead mines at Mestersvig in Greenland. Three B&W diesel engines, type 25-MTBS-40 with turbocharge, are installed here for electric power generation.

6-cylinder, 4-stroke stationary B & W diesel engines, type 28-MTS-45. Cylinder diameter 280 mm, length of stroke 450 mm. Output in normal, continuous service from each engine: 630 BHP at 428 rpm.



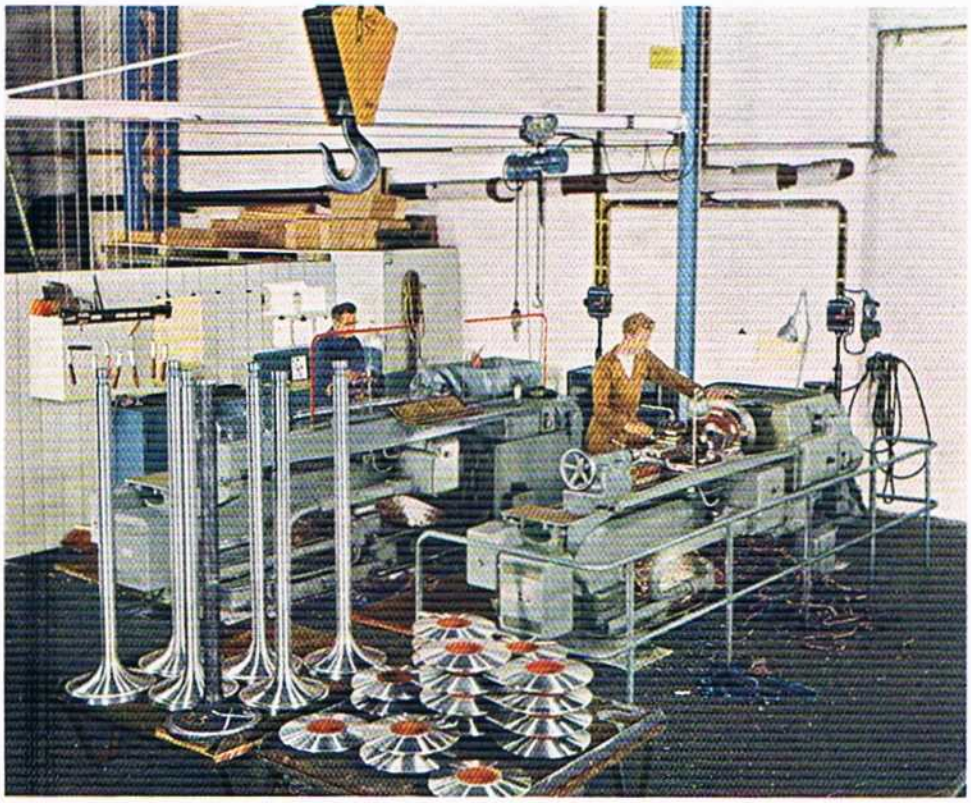


7-cylinder, 4-stroke, turbocharged B & W diesel engine, type 25-MTBS-40, installed in a power station. Cylinder diameter 250 mm, length of stroke 400 mm. Normal output 595 BHP at 500 rpm.



As a step in the centralization of Denmark's electricity supplies, power production has in recent years been concentrated on some ten large plants. These will eventually serve the entire country as the minor power stations in smaller towns and villages are closed down.

In the case of the power plant for the city of Frederikshavn, there were special factors to consider. As an important naval base, this city necessarily had to have an unfailing power source, and be independent of outside electricity supplies. The negotiations on this matter led to the delivery by B &W, at the end of 1953, of a new diesel plant, consisting of a 6-cylinder, 2-stroke stationary diesel engine with turbocharge, coupled to a Danish built generator. This engine was the first 2-stroke stationary diesel engine with turbocharge ever built, and is of the type 50-VTBS-110, developing 3,400 BHP at 167 rpm.

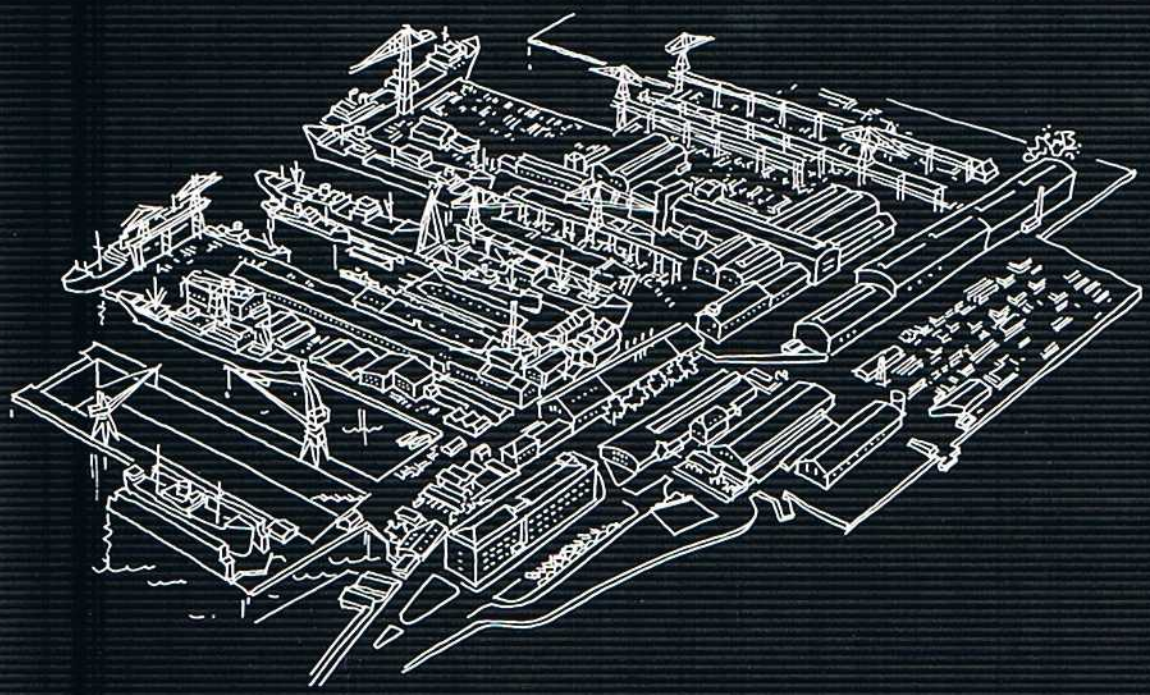


Semi-automatic machining of exhaust valve spindles and spring dishes.

The world's first turbocharged 2-stroke stationary diesel engine, delivered by Burmeister & Wain to the Municipal Power Station at Frederikshavn, Denmark.

B&W

Shipyard



Burmeister & Wain's shipyard at Refshale Island was established in 1872 to supersede the company's first yard at Christianshavn. It has been extensively modernized and enlarged several times, most recently in 1952-56, and is a fully up-to-date and well equipped shipyard. A new extension of the existing yard, scheduled for completion around 1960 and comprising 2,500,000 sq. feet new land, a building dock for ships up to 70,000 tons dw., and new workshops to serve it, will enable the company to compete even more effectively on the international market.

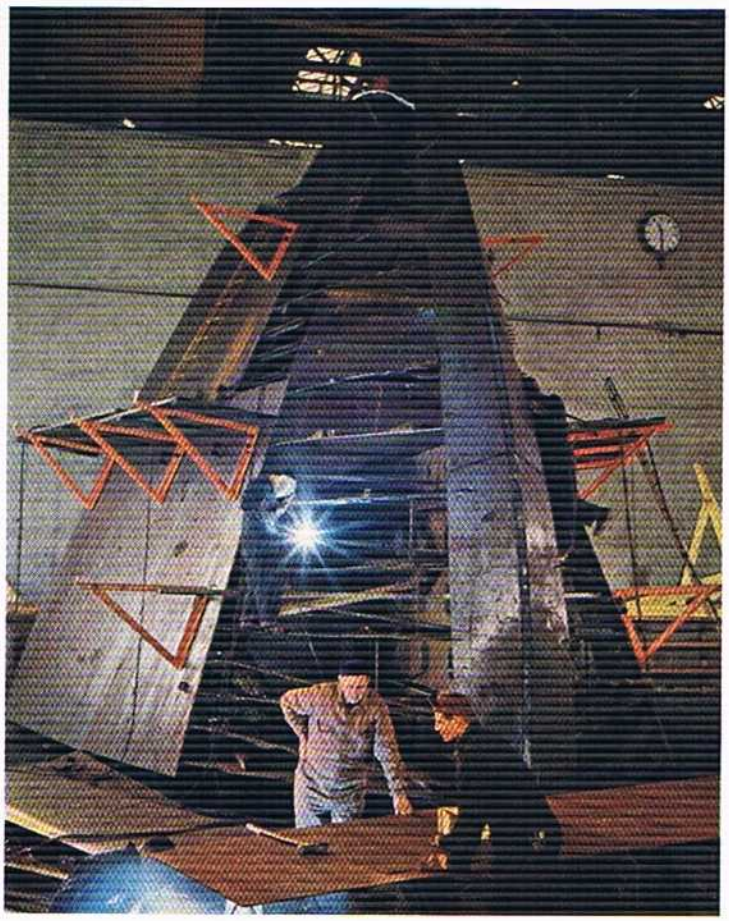
The shipyard now covers a total land area of about 2,100,000 sq. feet, and the water area of about 248,000 sq. feet. There are four berths for vessels of up to 200 m (650′) in length, three slipways with capacities up to 2,000 tons, a floating dock with a lifting capacity of 7,000 tons, a dry dock for vessels with a total length of up to 475′, and the new dry dock that is described in detail on page 69.

Transportation equipment consists of modern elevated cranes at all slips, one 40-ton floating crane and a large number of stationary and mobile cranes with capacities up to 100 tons. Further, there are fully equipped workshops for platers and welders as well as boiler and copper forges, carpenter's, joiner's, and electrician's shops. Since 1854, B &W has built cargo, tank, refrigerator and passenger vessels, as well as a number of special purpose ships. Since 1912 nearly all ships built here have been motor vessels.

Shipbuilding and Ship Repairs

View of a small section of the shipyard area, showing in the centre the newest 38,000 tons dw. dry dock.

Burmeister & Wain's yard at Refshale Island at the entrance to the Copenhagen harbour has always been in the forefront with new methods and with the utilization of all technical aids. The picture above shows a new building just put in hand on the slip.



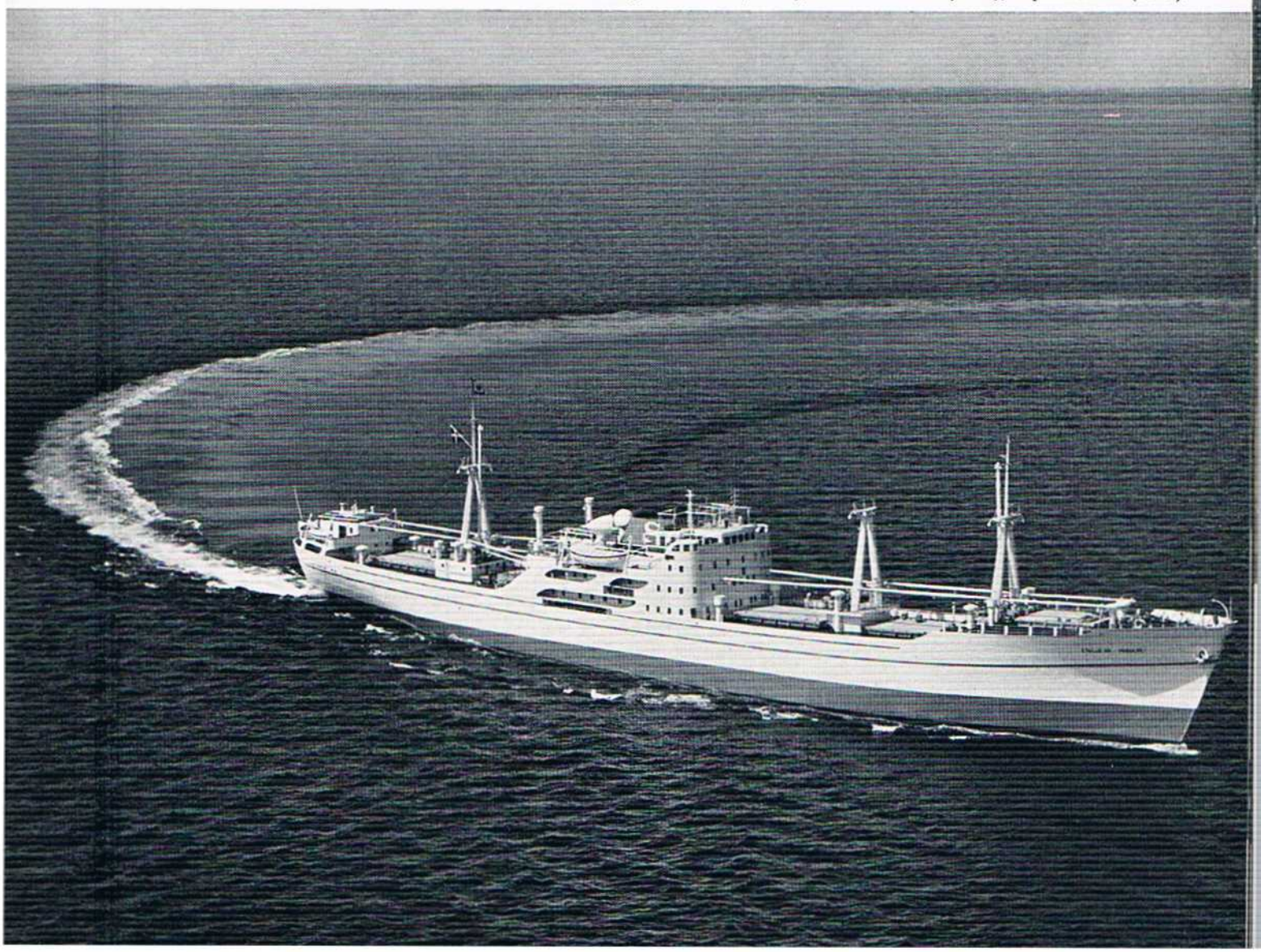
Welding is used to a great extent in modern shipbuilding. In the yard's welding shop, complete sections of the vessel are made up and afterwards carried to the building slip by means of elevated cranes.

Frame after frame, bulkhead after bulkhead is placed in position, and the new ship gradually takes shape.

M/S "Simba", cargo motor ship, 10,300 tons dw, built for The East Asiatic Company, Copenhagen. Length 139.0 m (456′0″), breadth 19.1 m (62′6″), depth 11.6 m (38′3″). The main engine is a 2-stroke, single-acting, 7-cylinder crosshead engine with turbocharge. Cylinder diameter 740 mm, length of stroke 1,600 mm. Normal output 9,870 IHP at 115 rpm. Speed on loaded trials 16.8 knots.

M/S "Kongedybet", passenger and cargo motor ship, 2,310 GRT, built for A/S Dampskibsselskabet paa Bornholm af 1866, Ronne, Denmark. Length 81.9 m (269′0″), breadth 13.3 m (43′6″), depth 5.2 m (16′11″).

M/S "Inger Skou", cargo motor ship, 6,950 tons dw, built for Rederiet Ove Skou, Copenhagen. Length 121.9 m (400′0″), breadth 17.2 m (56′6″), depth 10.8 m (35′6″).



M/S "Nicoline Maersk", cargo motor ship, 9,650 tons dw, built for A. P. Moller, Copenhagen. Length 135.6 m (445'0"), breadth 19.4 m (63'6"), depth 12.7 m (41'6"). The main engine is a 2-stroke, single-acting, 10-cylinder crosshead engine. Cylinder diameter 740 mm, length of stroke 1,600 mm. Normal output 11,500 IHP at 115 rpm. Speed on loaded trials 17.25 knots.

M/S "Thor Odland", cargo motor ship, 7,050 tons dw, built for A/S Produce, Haugesund, Norway.
Length 121.9 m (400′0″), breadth 17.2 m (56′6″), depth 10.8 m (35′6″).

M/T "Dagali", motor tanker, 19,150 tons dw, built for A/S Ocean, Oslo, Norway.
Length 166.1 m (545′0″), breadth 21.5 m (70′6″), depth 11.9 m (39′0″).

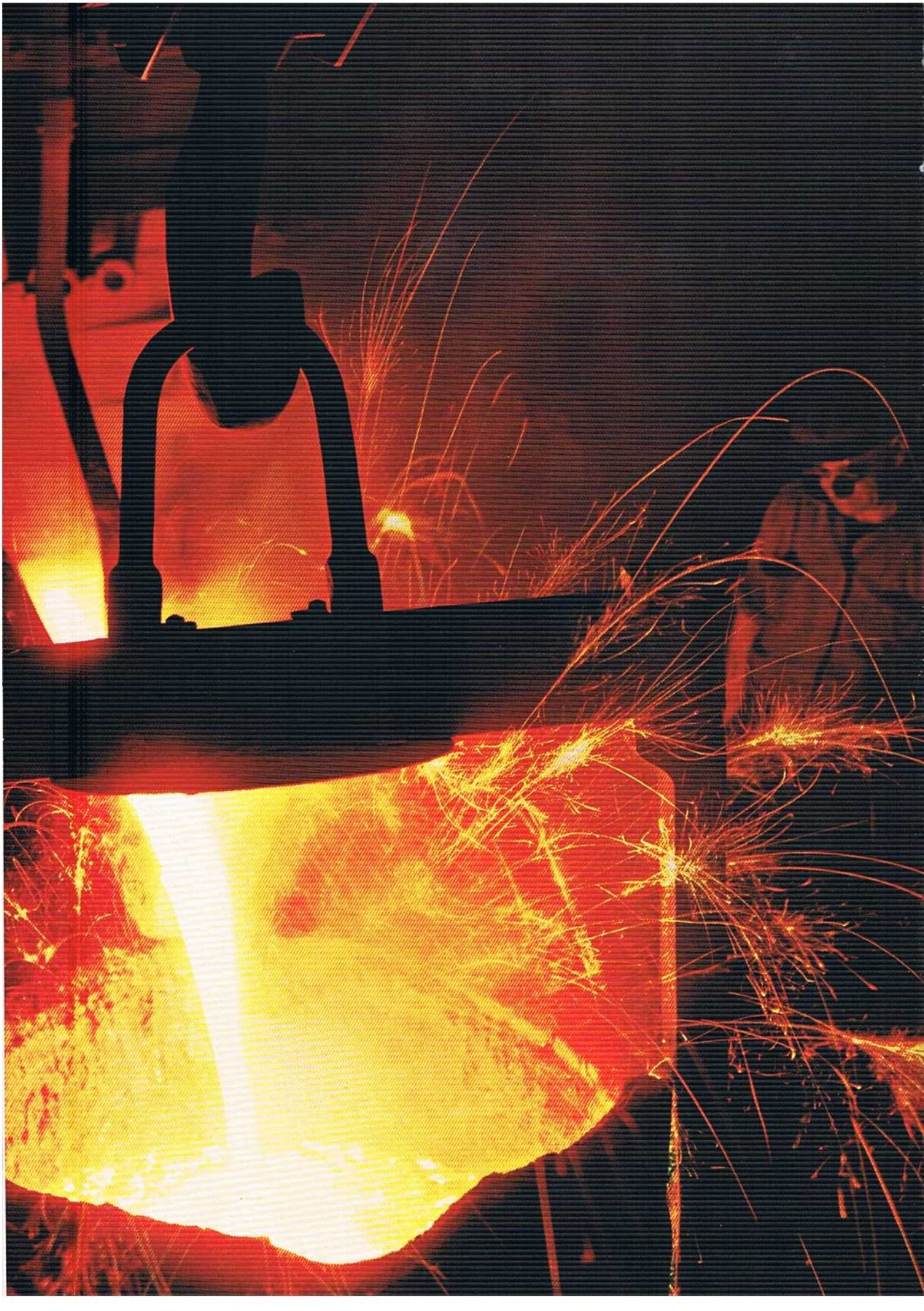
M/S "Songkhla", cargo motor ship, 10,340 tons dw, built for The East Asiatic Company, Copenhagen. Length 139.0 m (456′0″), breadth 19.1 m (62′6″), depth 11.6 m (38′3″). The main engine is a 2-stroke, single-acting, 7-cylinder crosshead engine with turbocharge. Cylinder diameter 740 mm, length of stroke 1,600 mm. Normal output 9,870 IHP at 115 rpm. Speed on loaded trials 16.8 knots.

M/S "Thorshøvdi", whale factory, 23,250 tons dw, built for A/S Thor Dahl, Sandefjord, Norway. Length 182.7 m (600′0″), breadth 23.6 m (77′0″), depth 17.4 m (57′3″). Two single-acting, 2-stroke, 6-cylinder main engines of the crosshead type 62-VTF-115. Cylinder diameter 620 mm, length of stroke 1,150 mm. Total normal output 7,400 IHP at 125 rpm. Speed on loaded trials 12.5 knots.

M/S "Bogotá", cargo motor ship,
10,200 tons dw, built for
the East Asiatic Company, Copenhagen.
The main engine is a 2-stroke, single-acting,
8-cylinder crosshead engine of welded
construction, with turbocharge.
Cylinder diameter 740 mm, length of stroke
1,600 mm. Normal output 11,100 IHP
at 115 rpm. Speed on loaded trials 17.5 knots.
M/S "Bogotá" is the first large Danish-built
cargo motor ship with engine room aft.

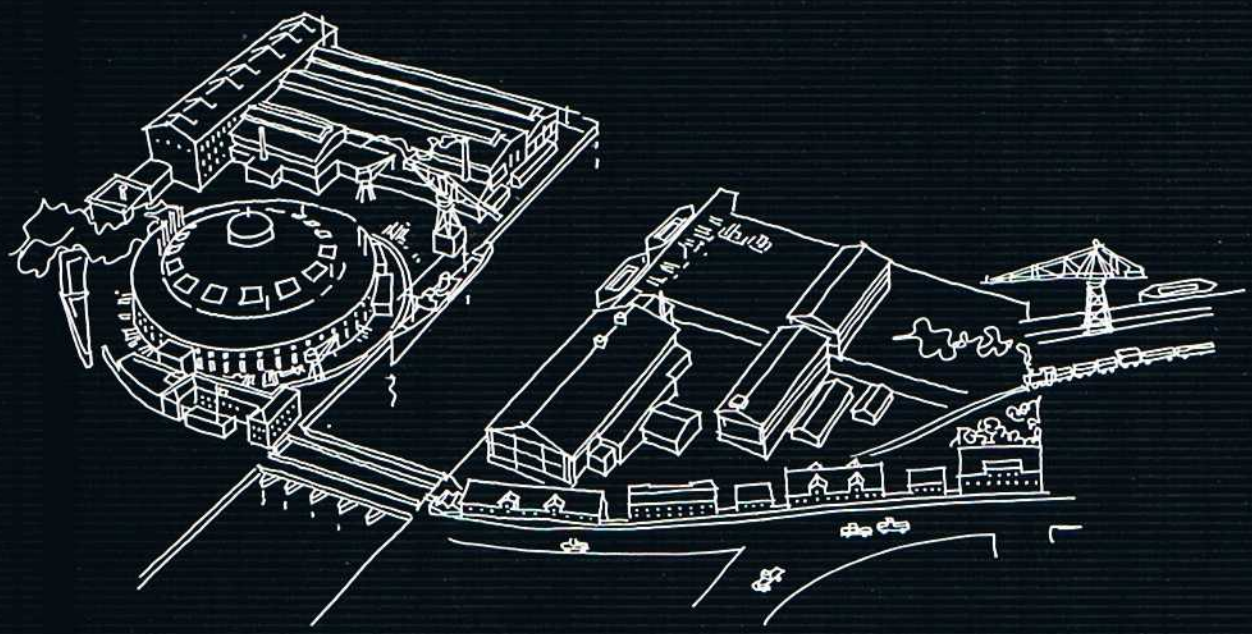
Top of a large B&W main engine with
turbocharge. One of the B&W turbochargers
is to be seen in the middle of the picture.

M/S "Lars Maersk", cargo motor ship, 7,410 tons dw, built for A. P. Moller, Copenhagen. Length 114.3 m (375′0″), breadth 16.5 m (54′0″) depth 9.8 m (32′0″). The main engine is a 2-stroke, single-acting, 6-cylinder crosshead engine of B&W's type 62-VTBF-115, with turbocharge. Cylinder diameter 620 mm, length of stroke 1,150 mm. Normal output 4,500 IHP, equivalent to approximately 4,050 BHP, at 130 rpm.



B&W

Foundries and Forges



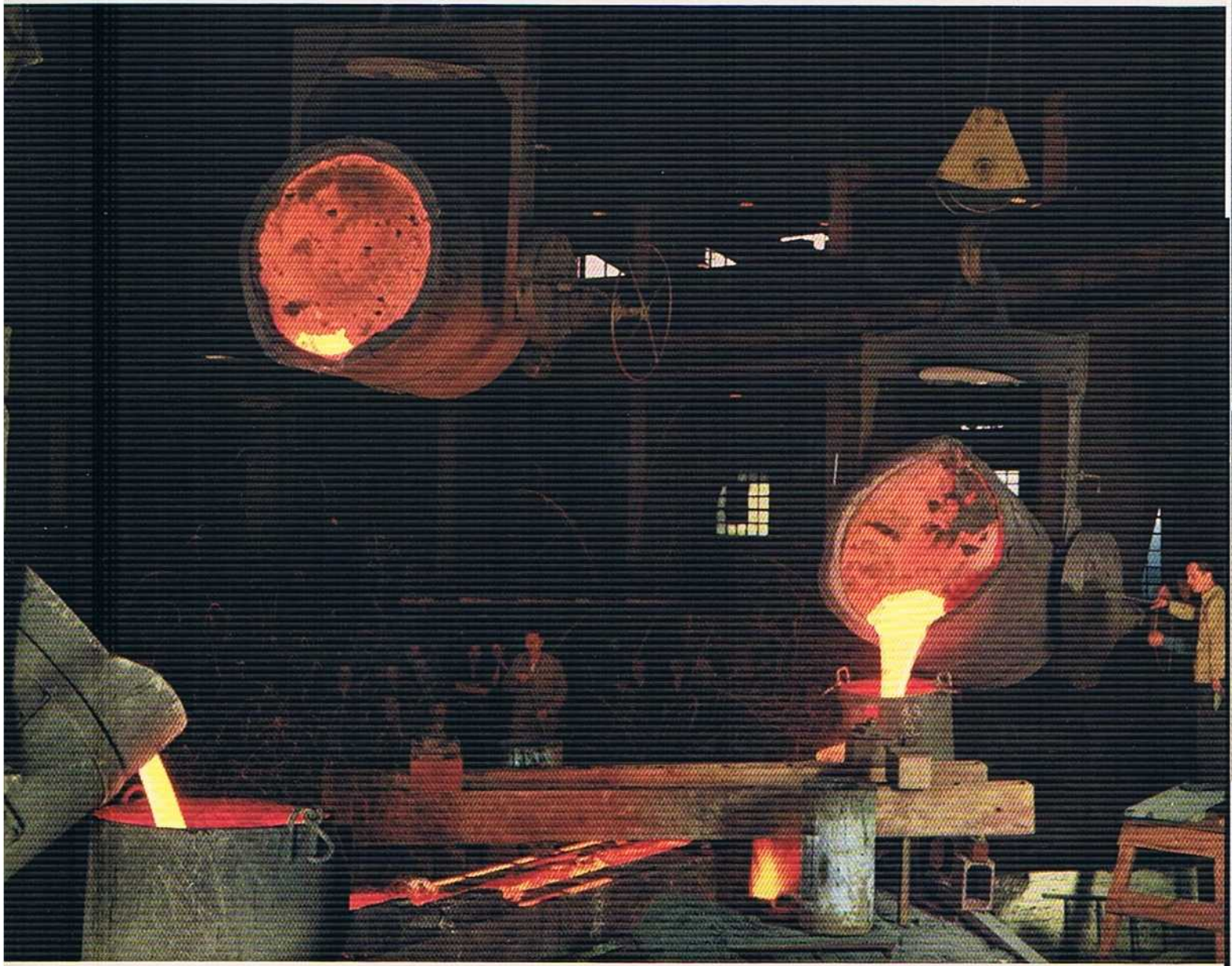
The foundries and steel works at Teglholmen on Copenhagen's South Harbour were established in 1922. The circular foundry building, the largest of its kind in Scandinavia, is 72′3″ high and almost 295′0″ in diameter, and is remarkable in that the roof is supported by one center pillar, which also acts as centre pivot to seven radial traversing cranes.

The annual production amounts to about 17,000 tons of iron castings, 35 per cent of which is special iron, and the rest ordinary iron. In the steelworks annual production amounts to about 28,000 tons of liquid steel, consisting of 14,000 tons of forgeable ingots; 7,000 tons of carbon steel; 2,000 tons of chromium molybdenum steel; and 5,000 tons of rolling ingots. In addition, about 75 tons of 11–13% chromium steel, 250 tons of heavy and 20 tons of light nonferrous metals are produced here.

Foundry plant includes three cupola furnaces with a capacity of about 12 ts/hour, one 6.5-ton and one 3.5-ton electric-arc furnace, two 35-ton oil-fired basic open-hearth furnaces and a number of crucible furnaces. In the adjacent press forging shop there are 750- and 2,000-ton presses, with an annual output of about 8,000 tons of rough forgings, while the hammer forge, with its nine pneumatic hammers, the largest of which is 1.5 tons, has an annual output of about 600 tons of forgings for smaller elements. In connection with the foundries and forges there is a large machine shop for rough-machining, forging, and steel casting. The plant at Teglholmen supplies castings and forgings to B&W's engine plant and shipyard, as well as to a number of outside customers.

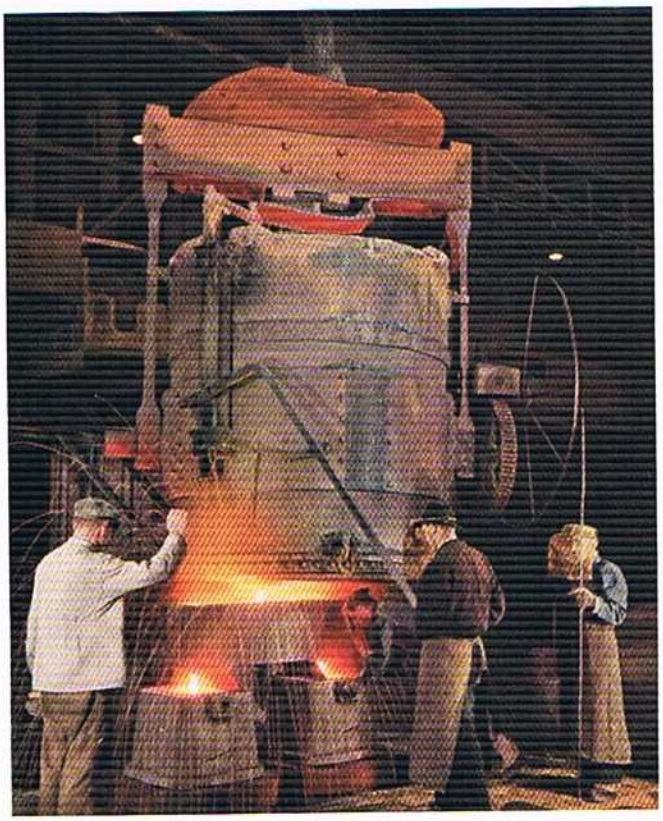
B&W

Steel and Iron Casting, Forging, etc.



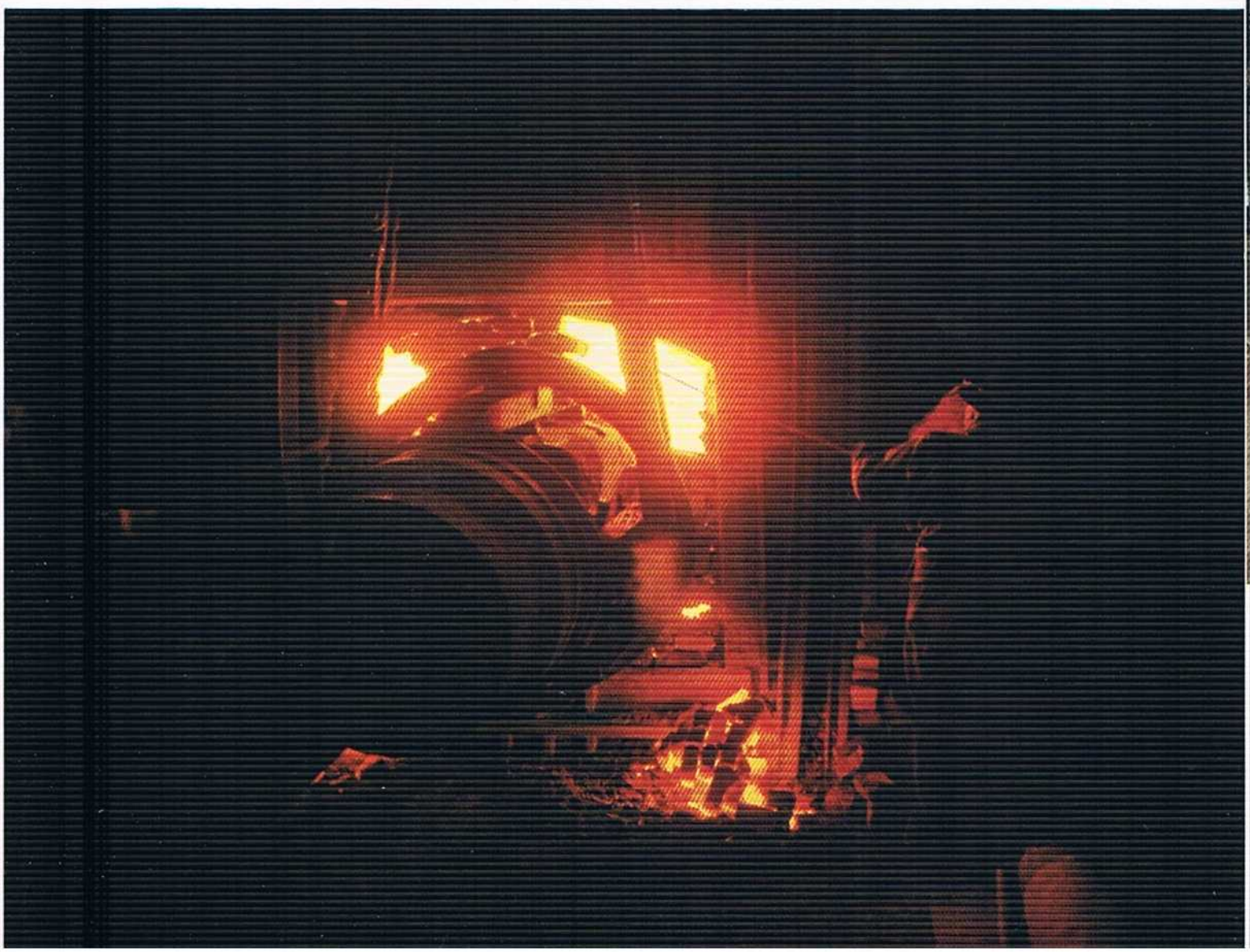
Casting diesel engine parts in B & W's iron foundry at Teglholmen.

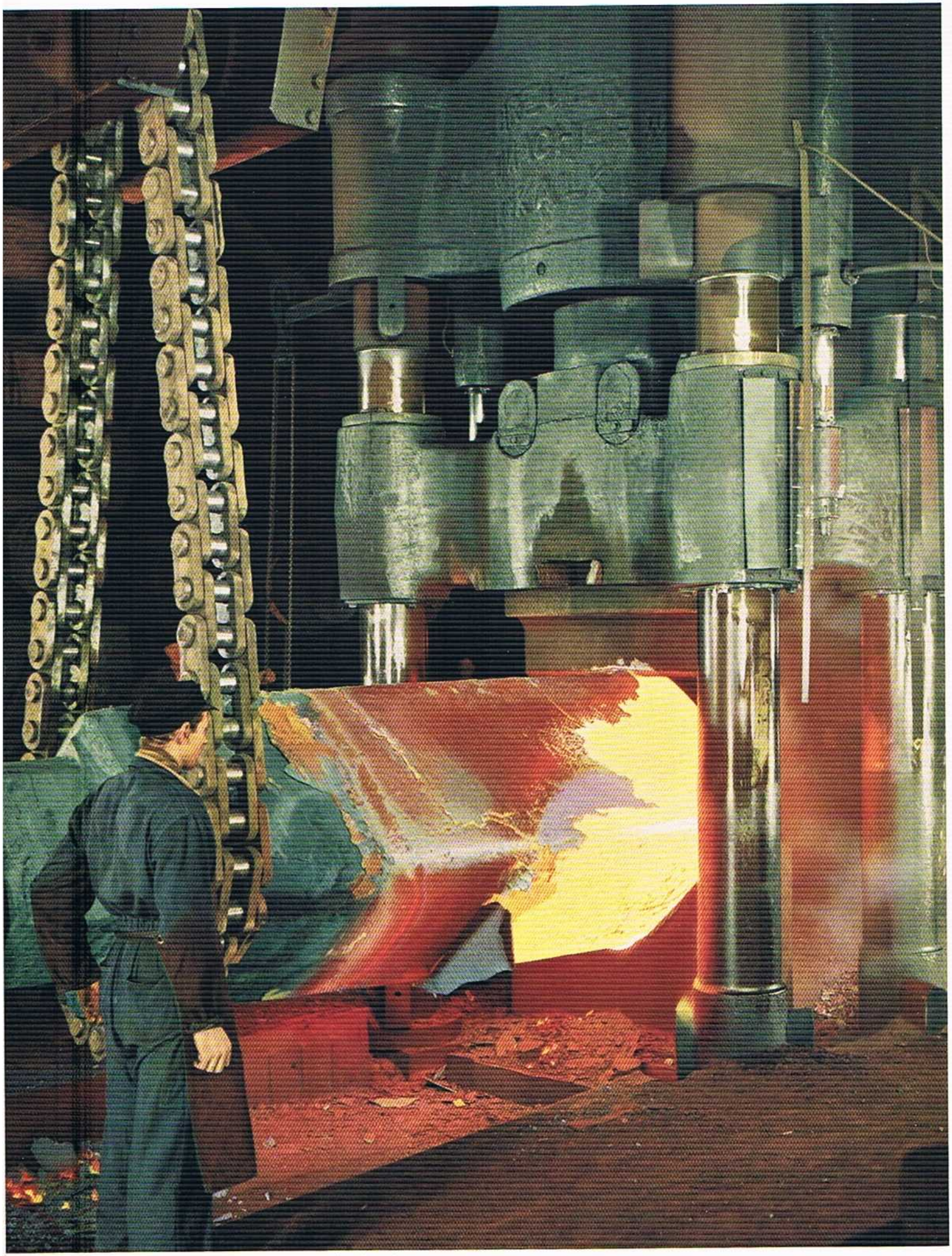
Reheat furnaces for handling heavy forgings, propeller shafts, etc. After this treatment the elements pass to hydraulic presses for further shaping under pressure of up to 2,000 tons.



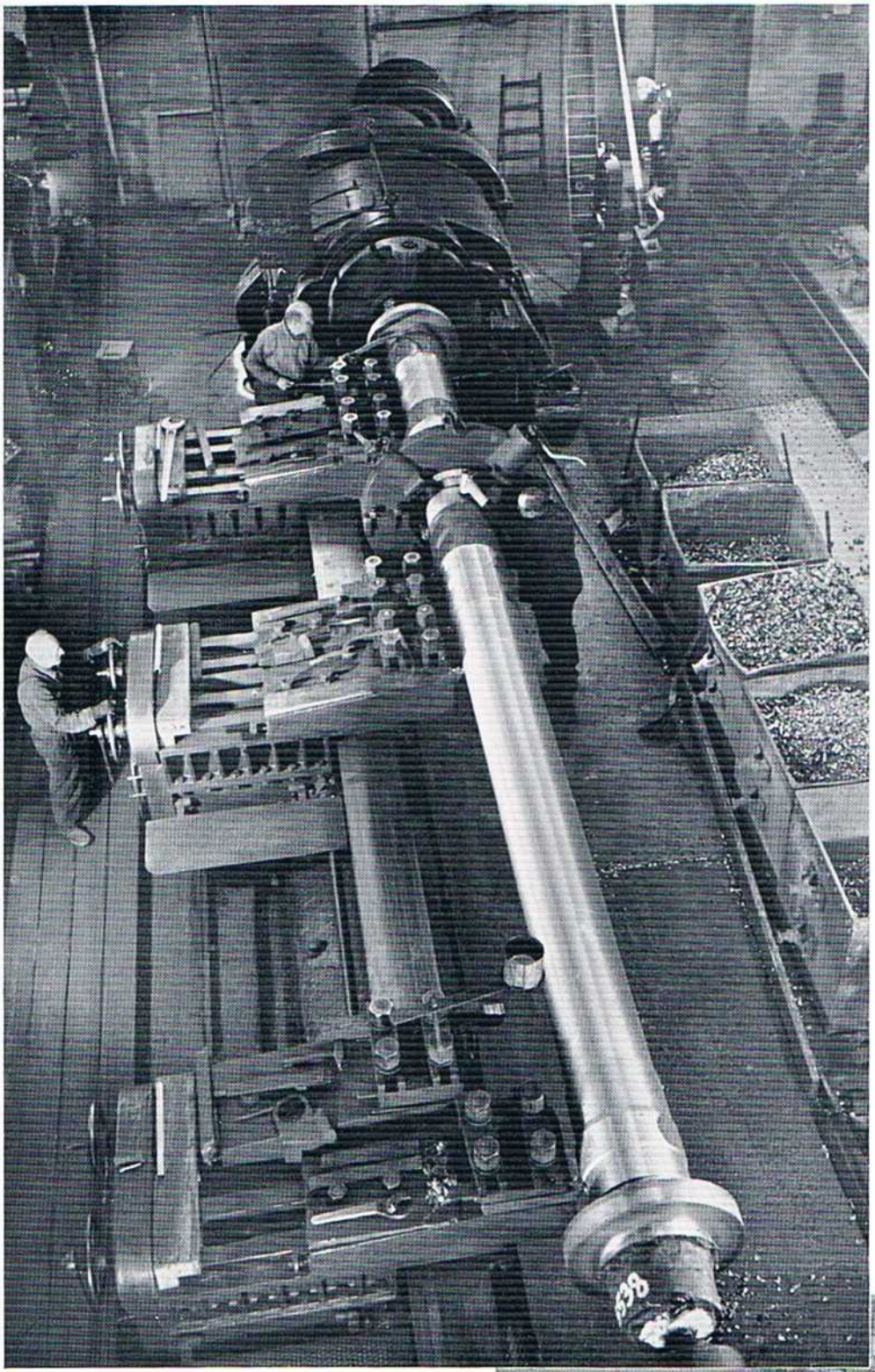
Steel from one of the 35-ton open-hearth furnaces is tapped from a laddle into moulds.

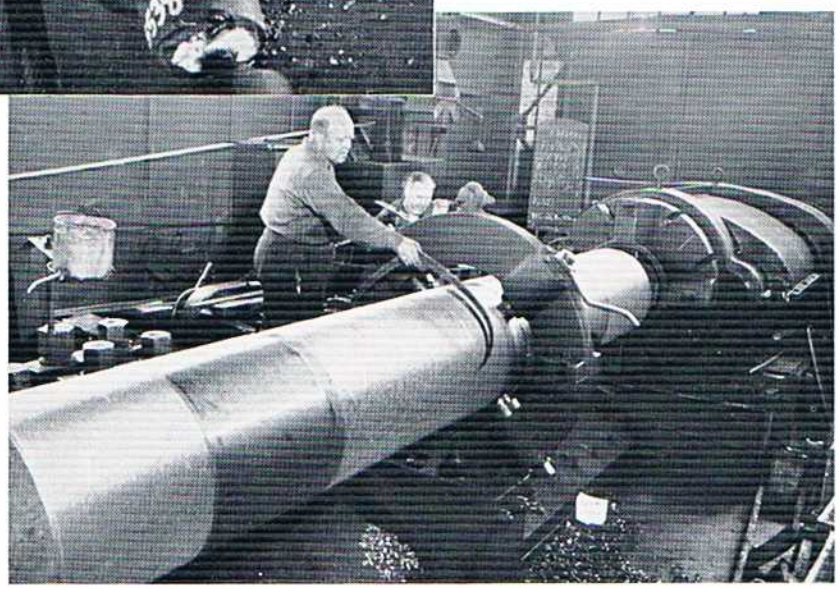
The foundries at Teglholmen supply B&W's engine works and shipyard with castings and forgings and also deliver such products to numerous other industrial concerns in Denmark. For instance, a large number of forging ingots are made for rolling mills, where they are rolled into plates, beams, rods, etc. All casting of iron and steel is carried out under the most perfect control, and samples of each casting are carefully tested in the B&W foundry laboratories.





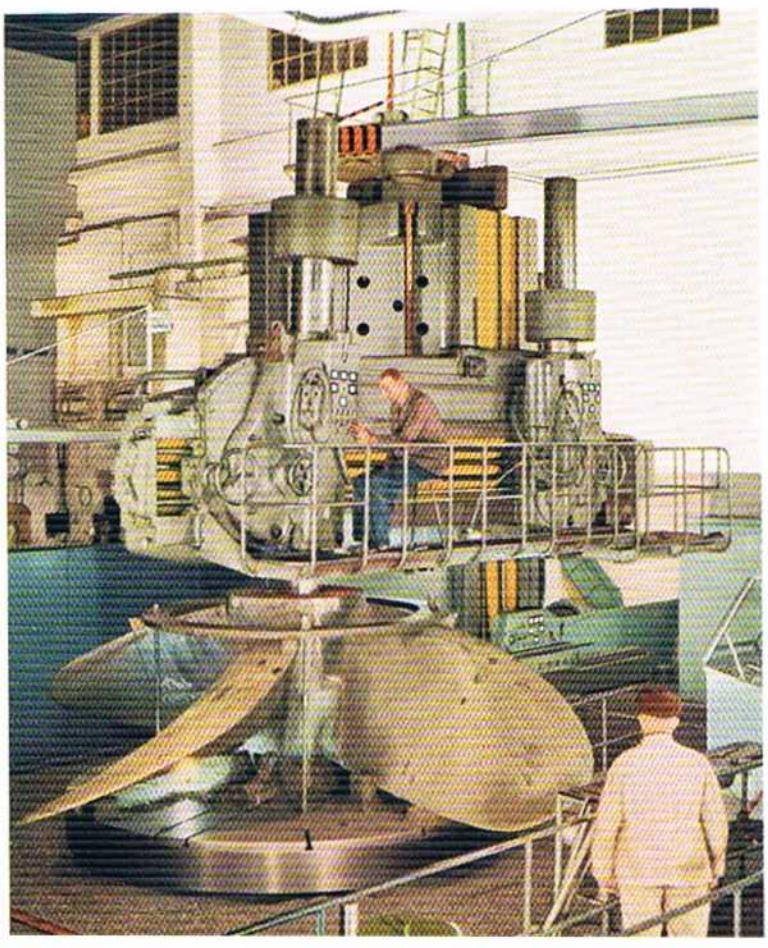
In the 2,000-ton hydraulic press in the forging shop,
the rough blanks are forged into the required shapes and dimensions.



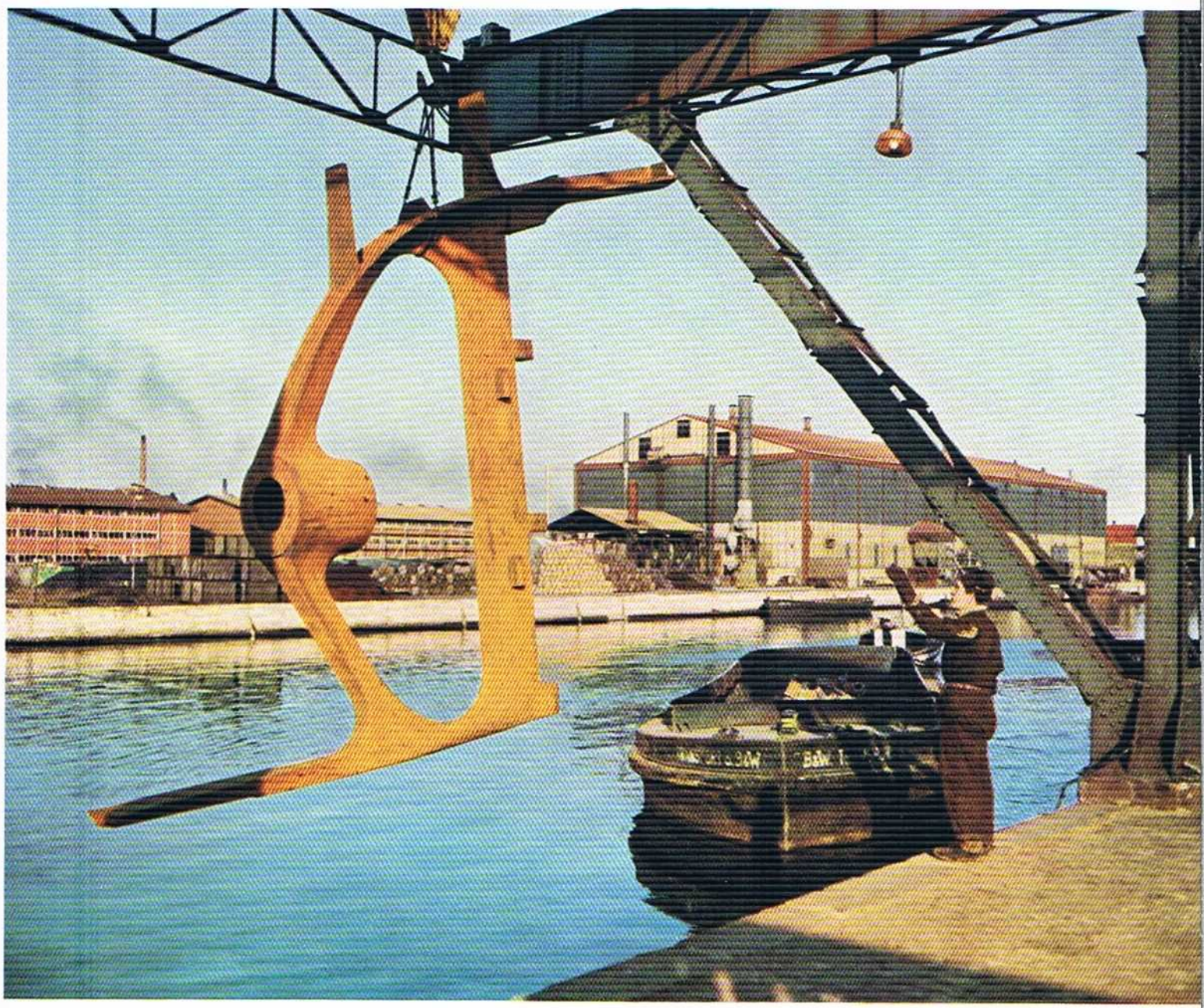


After forging,
the heavy blanks are rough-turned
in the machine shop before
they are sent to the engine works
or the shipyard
for finish-machining.

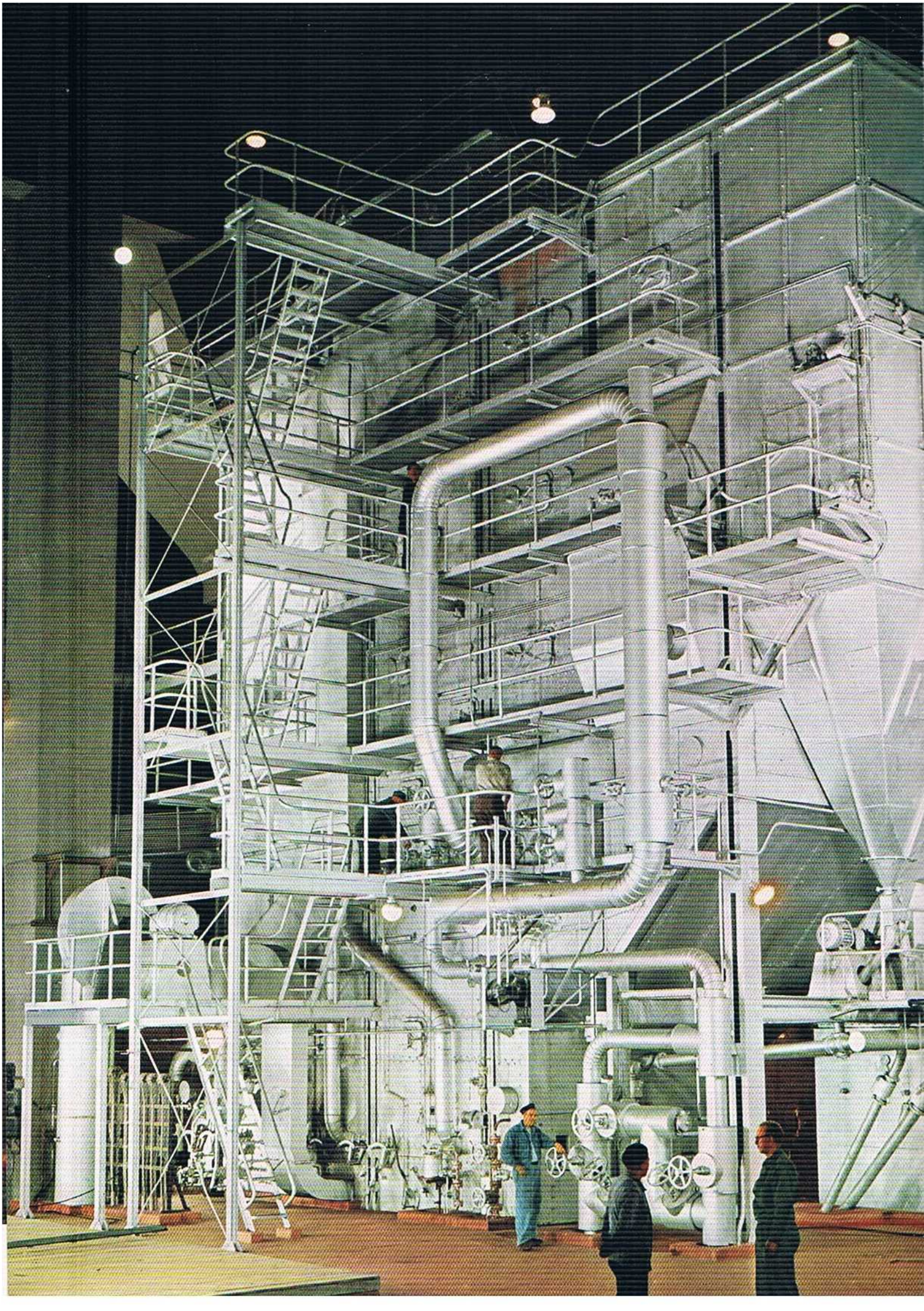
Besides certain parts for diesel engines, the B&W foundries also make castings for the shipbuilding at the Refshale Island. This picture shows a typical example of this type of product.



One of B & W's modern machine tools boring a large propeller.

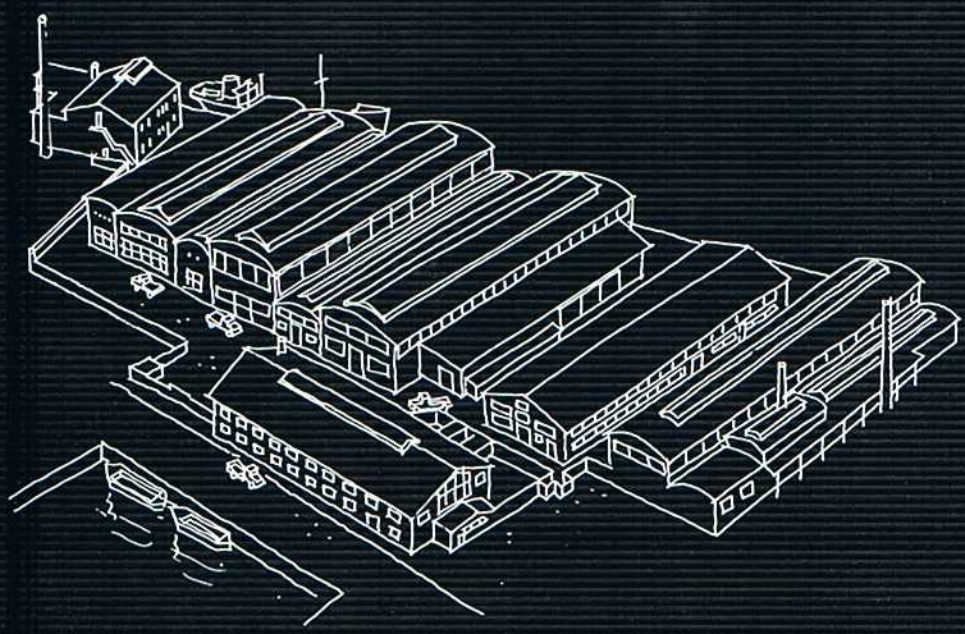


The castings are transported from the foundries at Teglholmen to the engine works at Christianshavn or the shipyard at Refshale Island in large lighters, towed by B&W's own tug-boats.



B&W

Steam Plants



Since the delivery in 1847 of the first steam power plant with an engine of 16 HP, stationary steam boilers and steam power plants have been produced in large numbers by Burmeister & Wain. Well over 2000 boilers have since the set up of the firm been delivered for installation in ships or in stationary plants. The production of stationary boiler plants today range from small boilers with a steam output of a few tons per hour to giant plants with an output of many hundreds of tons of steam per hour. Boilers of the largest capacities for modern reheat plants are within our production programe.

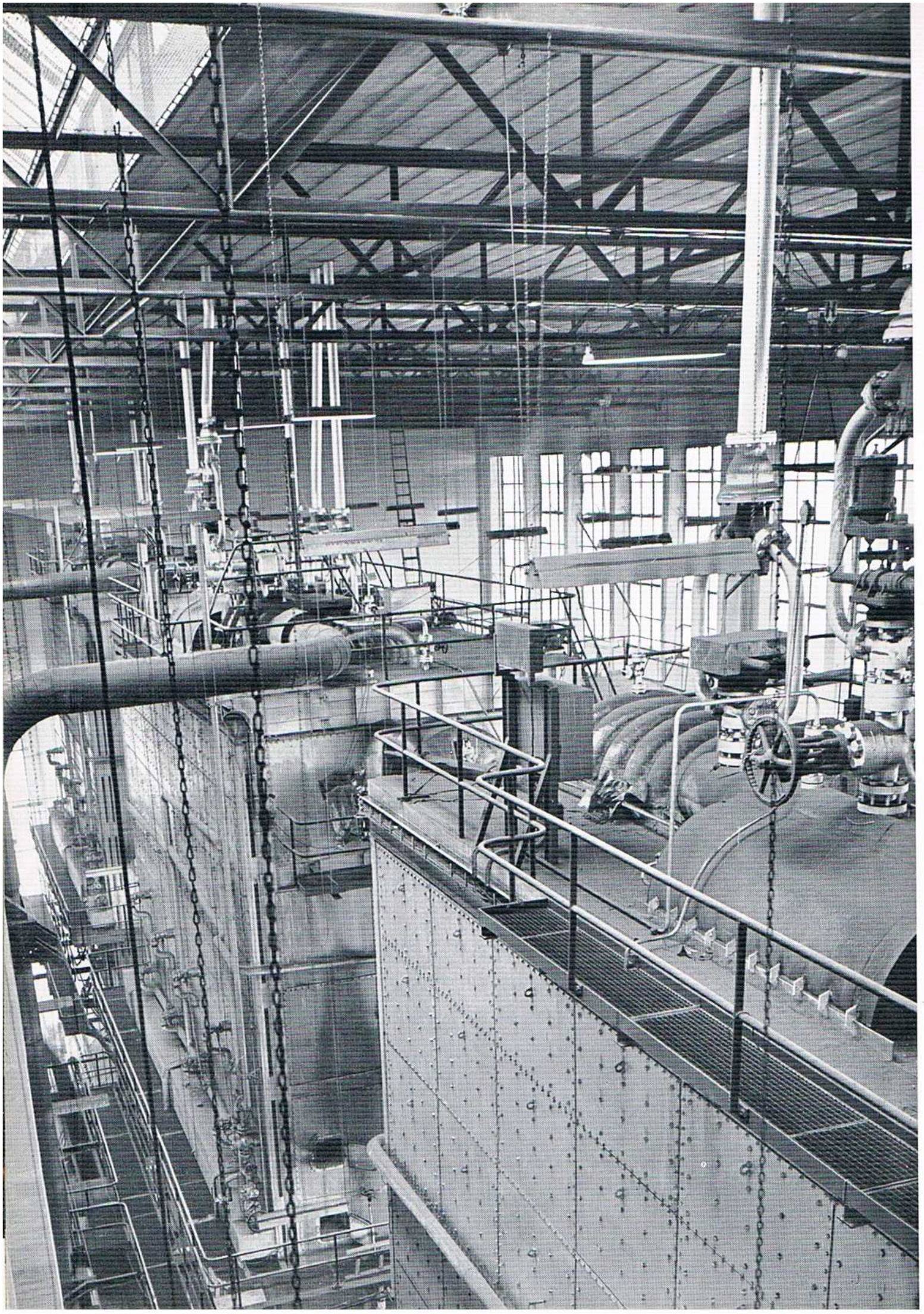
Notable boiler plants built during recent years are those for the Skærbæk Power Station in South-East Jutland and for the Funen Power Station near Odense, Denmark. In three deliveries a total of 6 boilers have been delivered to the Skærbæk Power Station. With coal firing five of these boilers are rated of 90 tons/hour and the sixth boiler of 120 tons/hour m.c.r. The steam pressure at the superheater outlets from boilers is 1200 p.s.i. (85 atm.) and the steam temperature 505° C. For the Funen Power Station three boilers each for 120 tons/hour m.c.r. have been delivered. Fired with Danish lignite these three plants have shown remarkable low production costs for electricity. The boilers plants for the above mentioned power stations as well as for many other plants are of the natural circulation design. For higher steam pressures once through boilers of the Benson type are as a rule preferred. Benson boilers of 250 and 400 tons/hour m.c.r. are being built for the Masnedø Power Station and for the Asnæs Power Station, respectively. The steam pressure for these plants is 2000 lbs. sq.in. (140 atm.) and the steam temperature 535 and 545° C, respectively. Both plants are built for reheat.

The production also covers all sorts of appurtenances for boiler installations such as firing plants for gaseous, liquid, or solid fuel, fly ash precipitators, fuel and ash handling plants, pipe lines, deæreators, feed water tanks, etc.

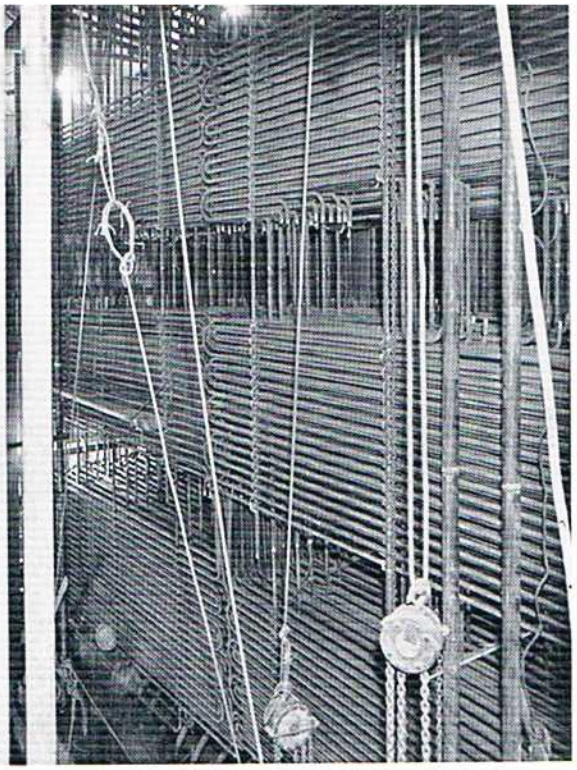
B&W

Stationary Steam Plants

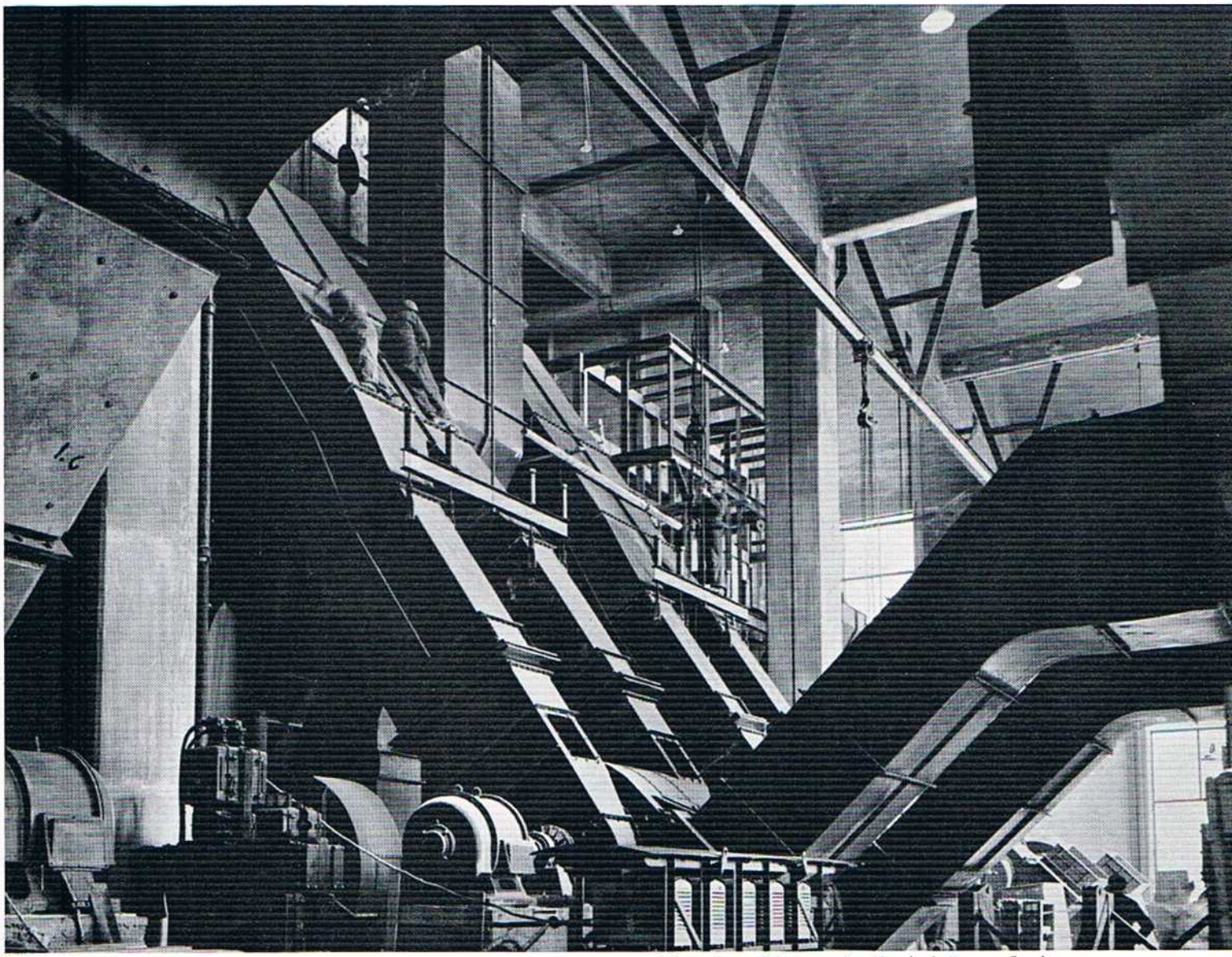
The Funen Power Station at Odense, Denmark.



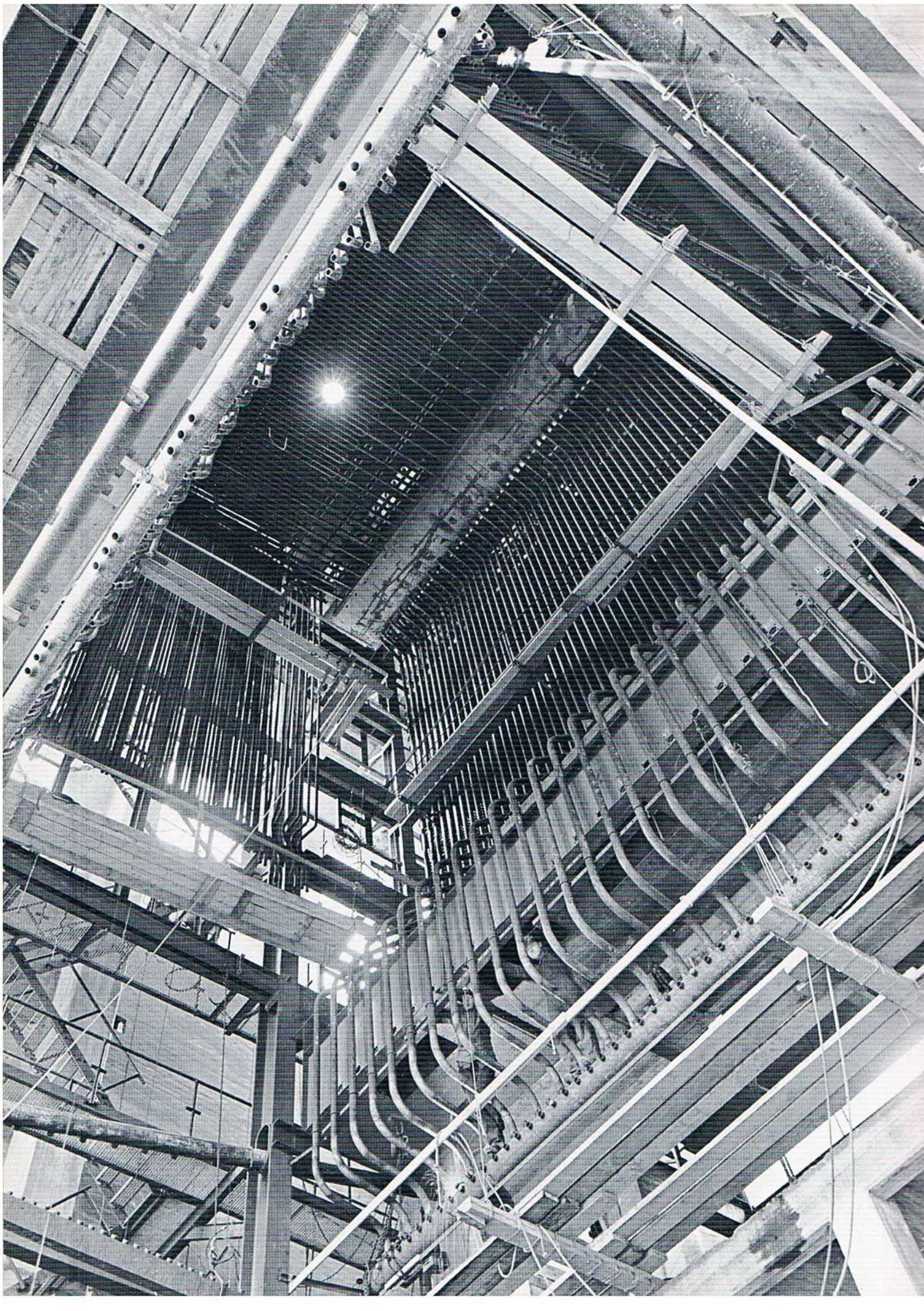
View from the boiler house
at Funen Power Station, Odense.



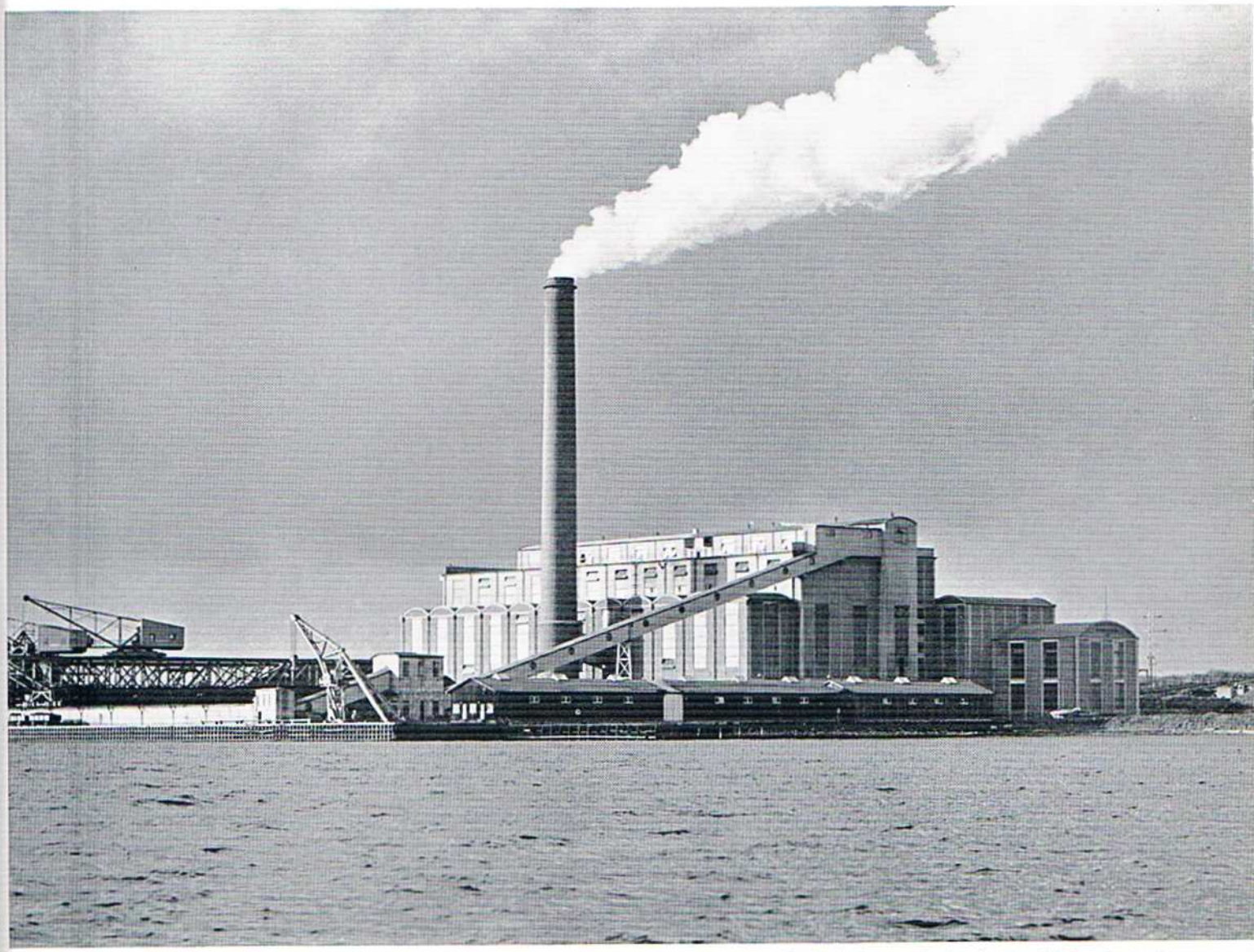
Economizer of a large
boiler plant under erection.



Mounting of flues at the Skærbæk Power Station.



View from the erection of
a large natural circulation boiler plant
at Aalborg Power Station.



Skærbæk Power Station in South-East Jutland.

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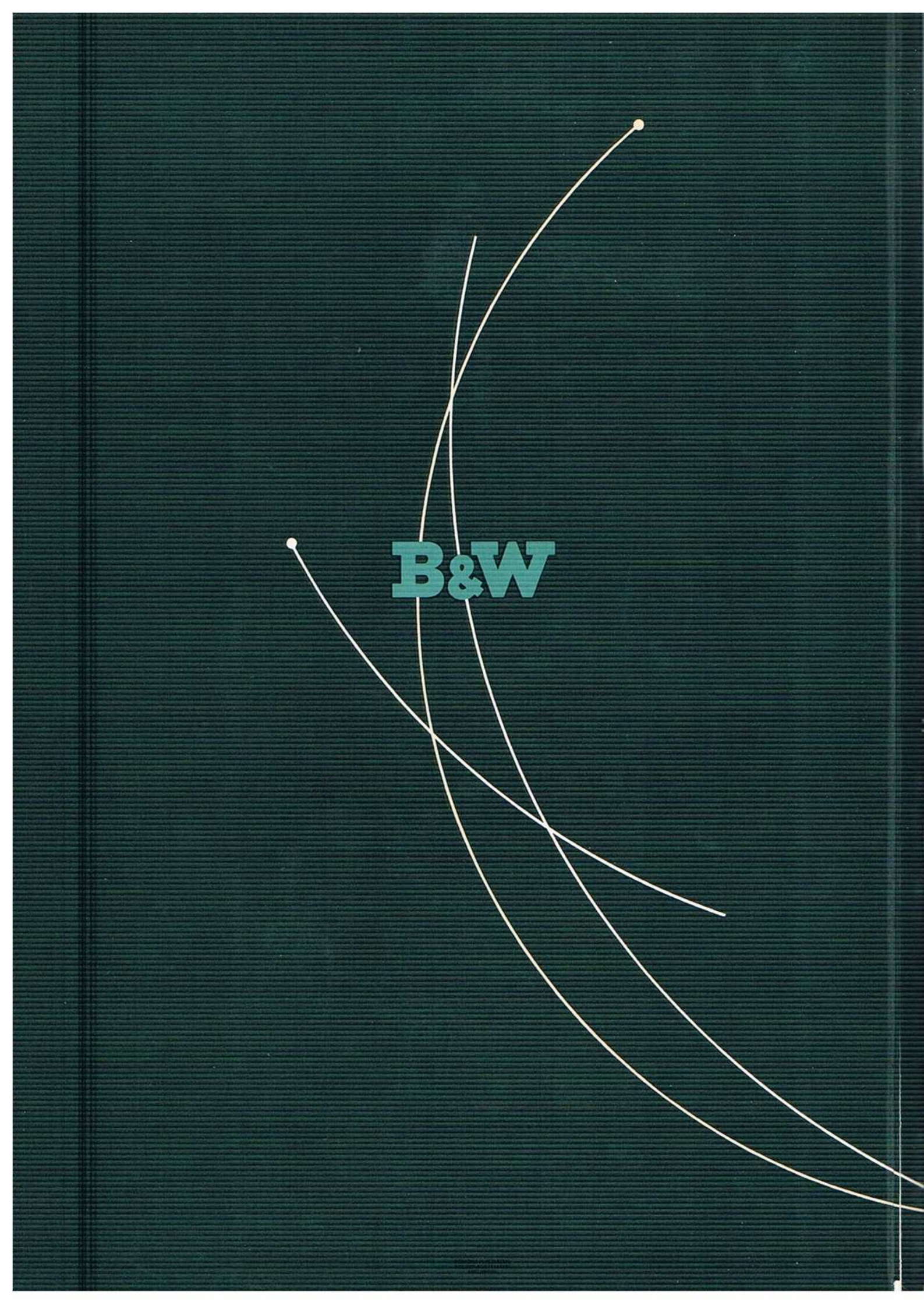
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