fifty years

REAVELL & COMPANY LIMITED

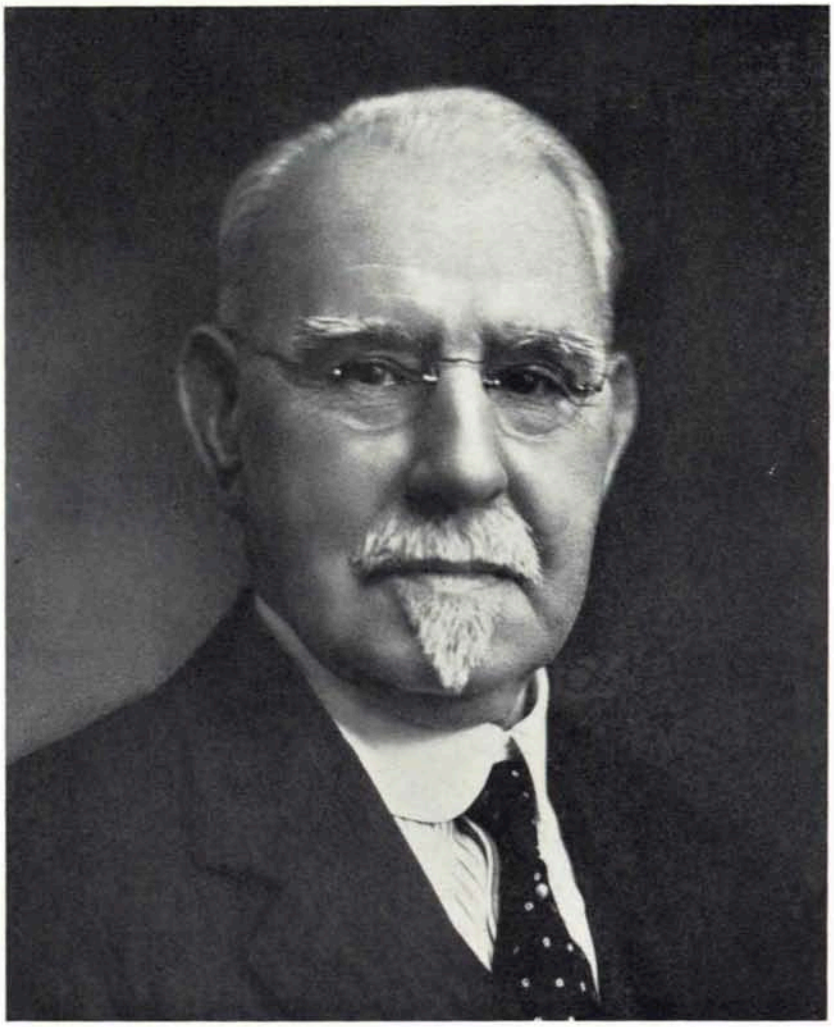
IPSWICH

fifty years

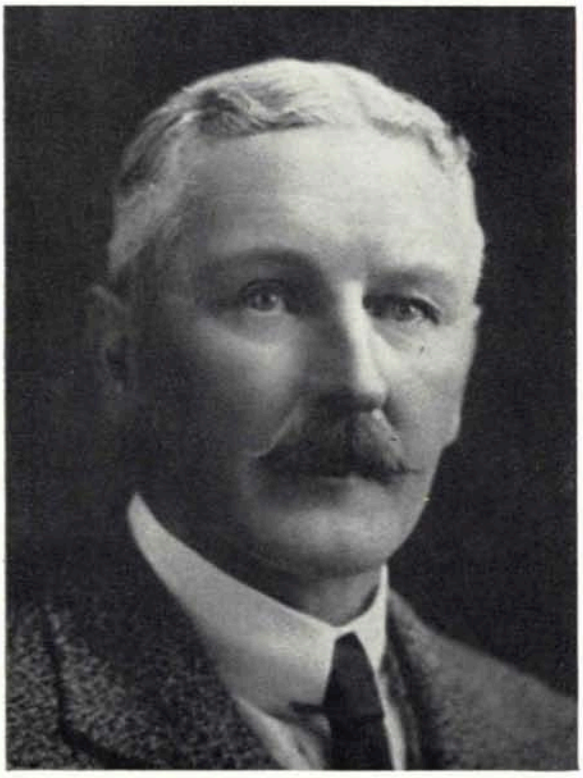
SOME NOTES OF THE PROGRESS OF
REAVELL & COMPANY LIMITED FROM
1898 to 1948

RANELAGH WORKS, IPSWICH
11th June, 1948

THE FOUNDERS
OF THE
COMPANY



SIR WILLIAM REAVELL



CHARLES GASKELL

WILLIAM HARDING SCOTT

FIFTY YEARS

WILLIAM REAVELL, the original Reavell of Reavell & Company Ltd., was born at Lyne Capel, near the Surrey and Sussex border, on March 2nd, 1866. He received his general education at the Grammar School at Alnwick, in Northumberland, where his father was then living, and in 1882 was apprenticed to Hawthorn Leslie & Company Ltd., of Newcastle-on-Tyne. After completing his training in 1887 he stayed on for two years as a draughtsman and continued to attend evening classes at the Armstrong College. In 1889 he went to London to Maudsley Sons & Field as a marine draughtsman and stayed with them for two years, during which time he attended evening classes at the Birkbeck Institute and the City and Guilds Technical College. From 1891 to 1897 he was with Babcock & Wilcox Ltd., starting as a designer of marine water tube boilers and becoming manager of their Marine Department. In 1897 he was appointed general manager of Peter Brotherhood & Company's Lambeth Works, but gave up this position in the next year, as by that time he wanted works of his own, laid out as he wanted them, so that he could realize his own conception of a modern engineering works and carry out his ideas as to how it should be run.

His brother-in-law, William Harding Scott, who was one of the pioneers of electrical engineering, and had founded his own company in Norwich in 1883 as Paris & Scott, now Laurence, Scott & Electromotors Ltd., had, amongst his other inventions, designed a new type of high-speed steam engine specially adapted for direct coupling to electric generators which was not very suitable for production in his electrical works, so that he was looking for someone to build it for him. Mr. Reavell had an idea for an air compressor which promised to be more efficient and more compact than anything of the kind which existed at the time.

director of the Thames Iron Works, joined the board of directors as its first chairman, and Mr. C. Wilson, a friend and colleague of Mr. Scott's, and Mr. T. R. Elkington, the editor of the *East Anglian Daily Times*, who was a friend of Mr. Reavell's, completed the original board of directors.

Various places had been considered as possible sites for the new works, and Ipswich was finally selected as the home of the new company as being a reasonable distance from London and easily accessible by road, rail, and sea. The Great Eastern Railway Company, as it then was, had a suitable site to offer on the right bank of the River Orwell near the railway station, and in 1898 about 2½ acres of land were purchased on the understanding that more could be acquired when it was needed for future extensions. As the site was between the Ranelagh Road and the River Orwell, and there was already an Orwell Works in the town, it was decided to call the new works "Ranelagh Works".

The directors were very anxious that the new works should be in every way up to date. There were no old buildings or old machine tools to be fitted into the new plans, so that they had a perfectly free hand, and to make sure that everything that was best in the latest ideas should be included, Mr. Reavell visited the newest factories which had been established on the Continent and in America. The result of this was not only that the shops were of the most modern and efficient type when they were put up—all electrically driven with electric lighting and heated by the exhaust steam from the engine which drove the electric generator—but the original buildings with very little alteration were suitable to form part of the present layout, which can be regarded as a natural development of the original plan.

The illustration on p. 4 shows the works when first built, and those on p. 30 show it as it is now, while the diagrams on pp. 16 and 17 show the main steps in its development as extensions were required to meet the growing business of the company.

While the new buildings were being put up, one of the cottages on the opposite side of the Ranelagh Road was taken as a temporary office; Mr. E. Bruce Ball, later managing director of Glenfield & Kennedy Ltd., was engaged as chief draughtsman with

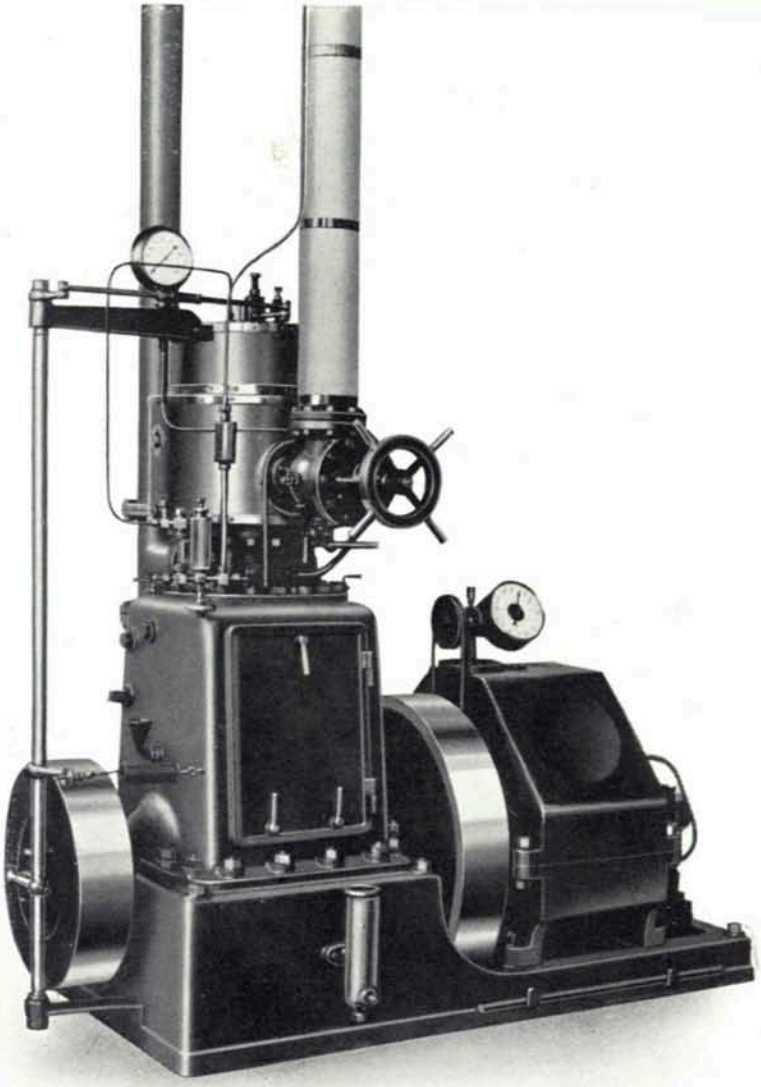
a few assistants to prepare the detail drawings, and a foreman pattern-maker and two or three men were set to work in a local joinery works so that patterns could be made and castings bought to be ready when the new works was able to deal with them. No foundry was included in the original plan, all castings being bought out, chiefly from the Tortoise Foundry at Halstead, in Essex.

Early in 1899 the buildings had been completed, Mr. J. Brown had been engaged as works manager, and enough modern machine tools of British and American make had been purchased to enable the company to start building its first Scott engine. This was to drive an electric generator to supply the power and light for the works, which were being served temporarily by a second-hand Allen engine which had been bought for the purpose.

The working hours adopted were unusual in this country in those days, as it was then customary for men to work for two hours before breakfast. It was realized that hungry men tire quickly and are not highly efficient, and that they would work much better if they had breakfast before they came to work, so the hours were fixed at 7 in the morning till 12 midday and from 1 p.m. till 5.30 in the afternoon, work finishing at midday on Saturday. This meant that there were 52½ working hours in the week, but the men were paid for 54 hours if no time had been lost during the week. At that time it was usual to pay either a fixed rate per hour, or a fixed price for the job, but at Ranelagh Works from the first the premium bonus system was adopted, which is still in use there, by which a standard time is fixed for the job, and the man receives a bonus equal to half the saving he makes by reducing the time taken.

The Scott engine differed from other steam engines in being a compound engine in which both stages of expansion took place in the same cylinder, and though double-acting, exerted a constant downward thrust on the crank. The crank-case was enclosed and splash lubrication used, the parts being in constant thrust making this type of lubrication specially suitable as a large area of the bearings could be left uncovered by the retaining caps. The piston was annular in form and had two piston rods, each with its own crosshead, these being connected by the gudgeon-pin. The valve worked in a ported liner which passed through the centre of the

piston and was driven by a bell-crank pivoted in the crank chamber and connected at one end by a link to a pin near the centre of the connecting rod and to the valve spindle at the other. The high-pressure steam was admitted to the upper side of the piston at the top of its stroke, the lower side being open to exhaust, and when it reached the bottom of the stroke the exhaust valve was closed and ports opened connecting the spaces on the two sides of the piston for about half the upward stroke. At that point the transfer ports were closed and the steam below the piston expanded doing work while the steam which was left above the piston was compressed to its original pressure in the clearance space provided for the purpose. This very much reduced initial condensation and was the chief reason for the high efficiency of this type of engine.



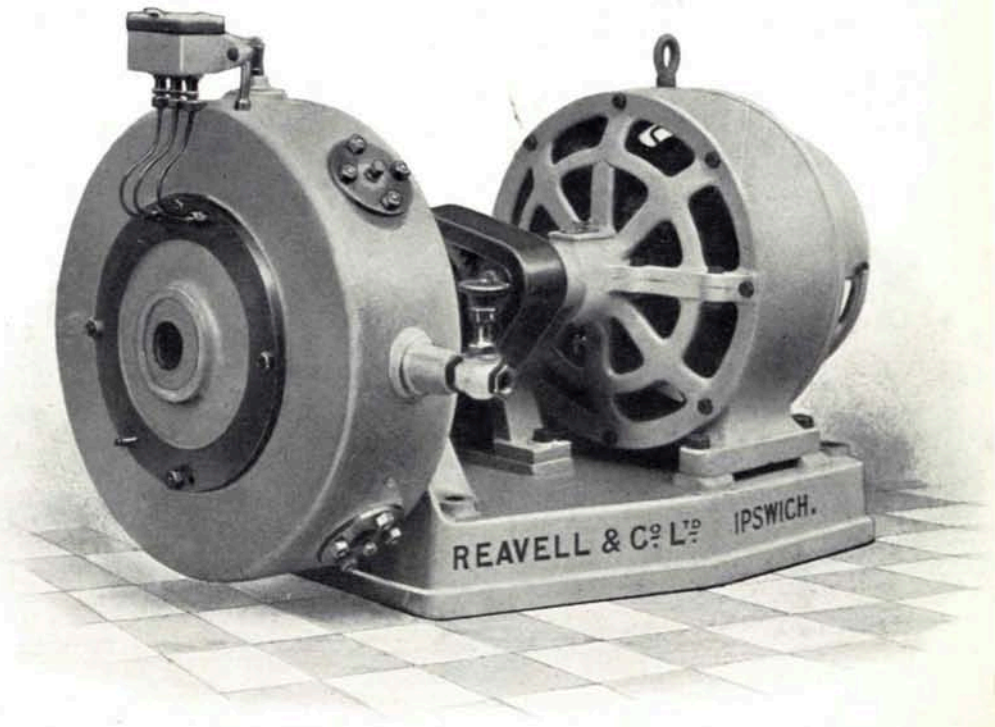
THE FIRST SCOTT ENGINE 1899

The first engine, which soon had to be supplemented by a two-crank engine of twice the power, was a single-crank engine of only 60 h.p. and was soon completed. Some orders for engines had been secured so that the company was able to start production in earnest and numbers of engines with one, two, or three cranks were built. At that time electric light was coming into general favour, and municipal power stations were being put up in all cities and towns of any size. The Scott engine was particularly suitable for driving

electric generators, as its special construction enabled it to run at higher speeds than most other engines of that period, so that it could be directly coupled to a generator running at a reasonable speed. The company was kept busy for about four years building these engines, and equipped power stations for Ipswich, Barnstaple, Dartford, Horsham, Heckmondwike, and many other cities and towns, as well as supplying engines for a large number of factories and large stores for driving generators for electric light and power.

In addition to the Scott engine a large number of single-acting and double-acting steam engines were built for electric lighting and for driving the forced draught fans which were also made in the works at that time. The company had been put on the Admiralty list and secured an order for thirty-six sets of fans and engines for three battleships which were being built by the Thames Iron Works. A few air compressors and some pneumatic hoists were also made at this time.

Mr. Brown left at the end of 1899, and his place as works manager was taken by Mr. W. Jones until early in 1901, when he left and Mr. Bruce Ball took over the duties of works manager, Mr. E. W. Jones being engaged to take his place as chief draughtsman. Mr. H. K. Finch became a director in 1900 and was for a short time at the works as assistant to Mr. Reavell. After that he remained on the board until he resigned in 1946. Mr. Bruce Ball left in 1903, and Mr. H. A. Hartley came as works manager. He



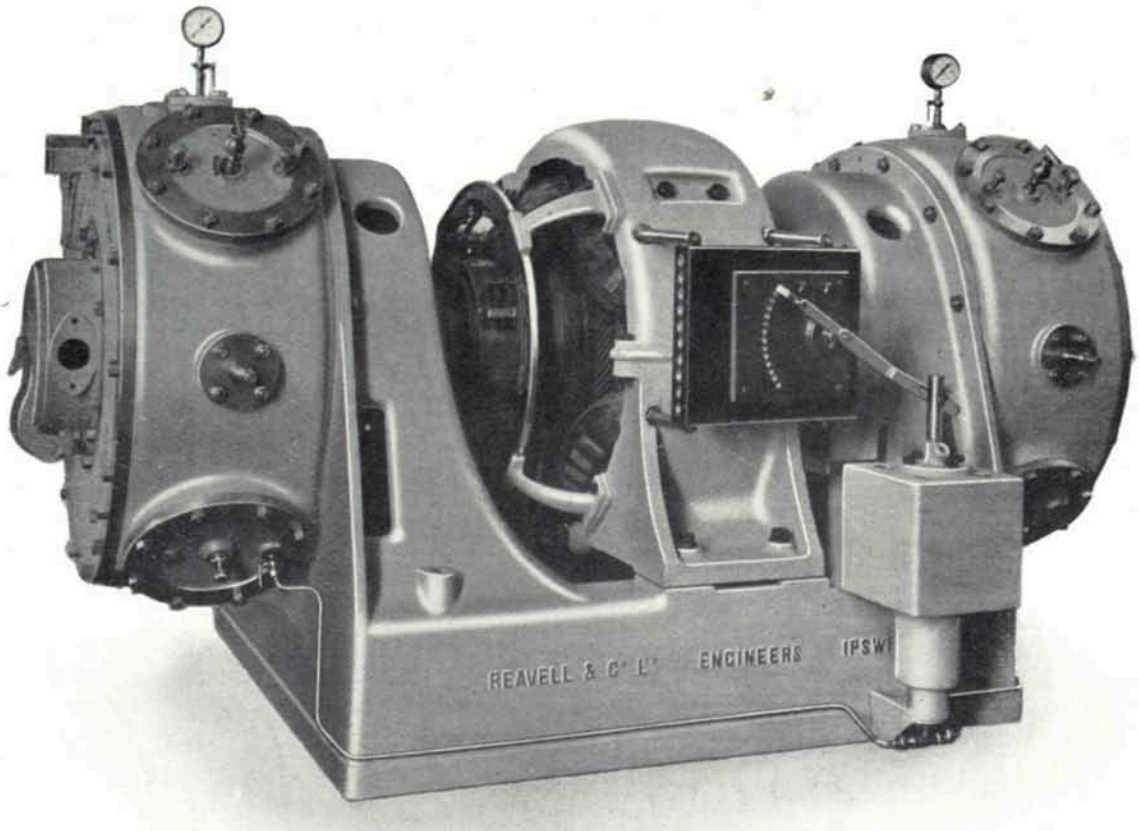
THE FIRST "QUADRUPLEX" COMPRESSOR 1899

joined the board of directors in 1908 and continued as works director until his death this year.

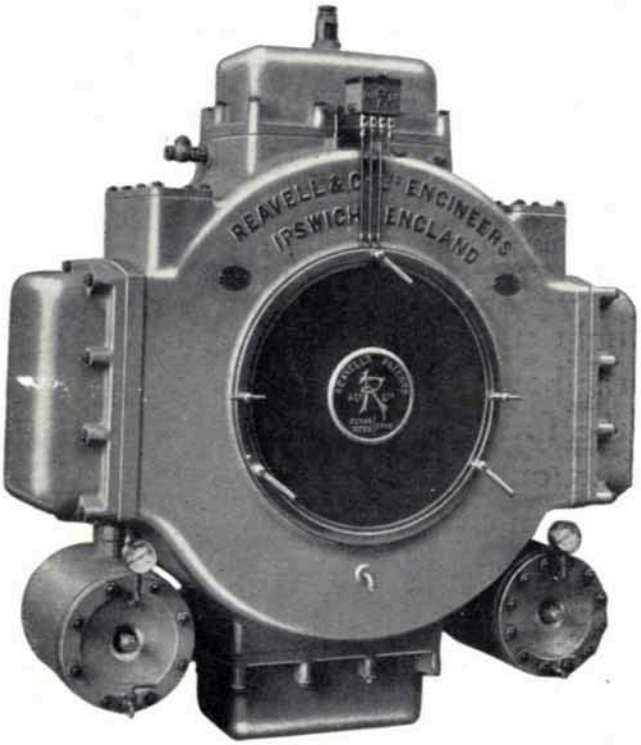
When the introduction of forced lubrication made it possible to increase the speed of double-acting engines, so that they were suitable for direct coupling to electric generators, the Scott engine, which was virtually a single-acting engine, could not compete in price, in spite of its high efficiency and low steam consumption, as naturally a double-acting engine with the same size of cylinder would give nearly double the power at the same speed with only about the same weight and cost. The orders for Scott engines, therefore, fell off rapidly, and although the company continued to build small double-acting steam engines, including a large number for lighting the L.C.C. Thames steamboats in 1905, it was their other product—the air compressor—which provided the work which was needed.

A number of compressors had already been made, and these at first were all single-stage machines, of which there were six sizes, varying in capacity from 17 to 160 cu. ft. of free air per minute, all for 100 lb. per sq. in. The fact that Compressor No. 1, which was a machine with cylinders 6 in. diameter by 6 in. stroke built in 1899, was still running and giving good service in a paint works near London until they were "blitzed" in the Second World War, speaks well for the work put into these early compressors.

These first compressors were the quadruplex machines designed by Mr. Reavell, which had four cylinders arranged radially in a circular casing. This casing was cast with an annular space through which the cylinders passed, so as to form an ample water-jacket, and a common passage round the cylinder heads to receive the air discharged through the multiple delivery valves. These valves were light steel valves, spring loaded, with gunmetal seats arranged round the head of each cylinder. The pistons were of the trunk type, and the four connecting rods were driven by a single crank-pin. No suction valves were used. The central part of the casing was the suction chamber as well as the crank chamber, and air was admitted to the cylinders through ports cut in the hollow gudgeon of the connecting rod which coincided with similar ports in the top of the piston during the suction stroke and closed as the connecting



DOUBLE-ENDED TANDEM TWO-STAGE COMPRESSOR 1902



THREE-STAGE QUADRUPLEX COMPRESSOR 1905

rod swung over at the end of the stroke. This feature was largely responsible for the very high efficiency of this type of compressor.

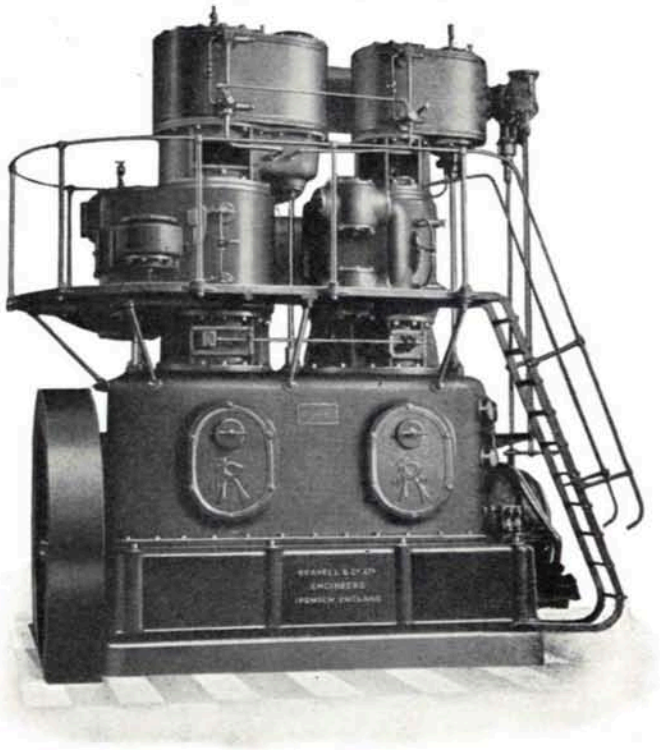
With the increased use of rock drills, coal cutters in collieries and other pneumatic tools, there was a demand for compressors of greater capacity, and in 1902 the company brought out its tandem two-stage quadruplex compressor, which was built for capacities up to 600 cu. ft. of free air per minute, and was fortunate in securing orders for a large number of these machines for the construction of the London tube railways. From that time the air compressor was firmly established as the company's principal product, and it has remained so ever since, though its form has been altered from time to time to suit new requirements.

In 1905 there was an important new development in the business. An experimental air compressor had been built with the idea of developing the quadruplex compressor as a three-stage machine for working at a pressure of 3,600 lb. per sq. in. for torpedo charging in the hope that the British Admiralty would adopt it in place of the leather-packed machine then in use, which required frequent renewal of leathers. The machine itself was not a complete success, but it provided just the experience which was required to enable the company to answer satisfactorily in 1905 Dr. Diesel's appeal for a compressor which would run continuously at a pressure of 1,000 lb. per sq. in. to supply the injection air for his pressure ignition engine. The machine produced for this duty was a three-stage quadruplex compressor, with two first-stage cylinders horizontal, one second-stage cylinder at the bottom, and one third-stage cylinder at the top. All the four pistons were driven by a single crank-pin which was attached to the end of the Diesel engine crankshaft, the compressor casing being attached to the engine-bed. The cylinders with their valves and the intercoolers between the stages of compression were all enclosed in an ample water-jacket. This machine proved to be exactly what was required, and large numbers were supplied to Carel Frères of Ghent, Willans & Robinson of Rugby, and many other builders of Diesel engines up to the time when air injection was generally replaced by pump injection and compressors were only required for charging starting-bottles and manœuvring, for which simpler and cheaper machines were suitable.

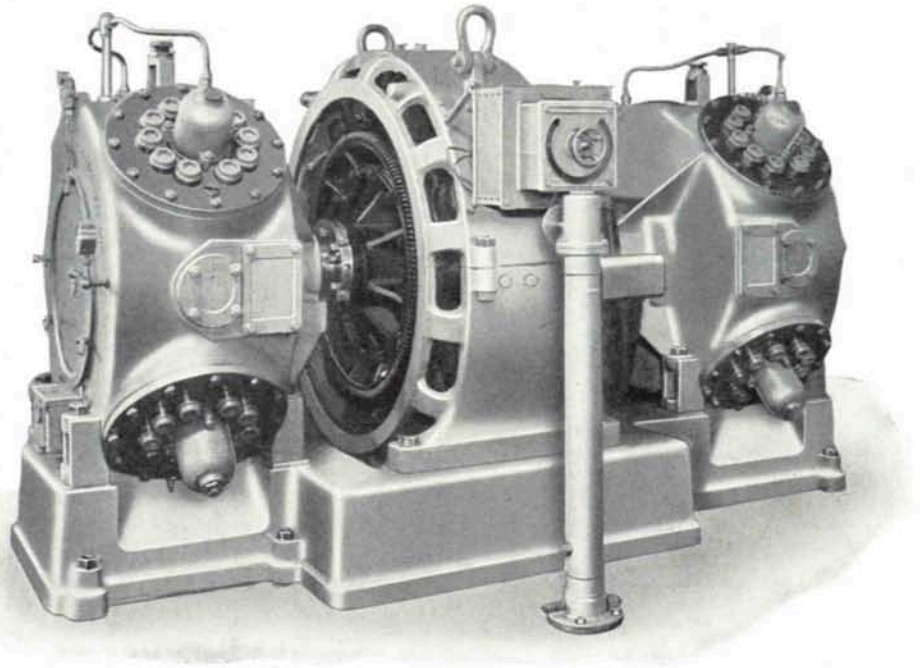
Another type of compressor introduced in 1909, of which many were supplied for the same duty, was a novel design of three-stage machine, known as the "V" class, in which the second stage had no valves, the first- and third-stage cylinders were in tandem at the top, and the second stage at the bottom. The idea was that on the upward stroke the volume in the first-stage cylinder was compressed into the smaller volume of the second-stage cylinder and the intercooler. The pressure was retained by the first-stage delivery valve, and on the downward stroke the air was further compressed into the smaller volume of the third-stage cylinder and the intercooler, the air which had passed the third-stage suction valve being discharged through the final delivery valve on the next upward stroke.

Various other types of compressor were built during this period, including horizontal and vertical double-acting machines, some of these with steam cylinders incorporated, and in 1908 the "Axial" type was produced. This was a very simple machine with no connecting rod. There were two horizontal cylinders vis-à-vis with a double-ended piston having a vertical bore in the middle in which worked a turned cross-head which had a bore at right angles to its axis to receive the crank-pin. The working pressure for this type had to be limited to 60 lb. per sq. in. to keep the load on the crank-pin reasonable, but it was cheaper to make than the quadruplex type, and large numbers were sold.

In 1907 Mr. William Paul, of the well-known Ipswich firm of corn merchants and maltsters, joined the board of directors, and was elected chairman when Mr. A. F. Hills retired in



TWO-STAGE STEAM-DRIVEN DOUBLE-ACTING VERTICAL COMPRESSOR 1911



DOUBLE-ENDED
SINGLE-STAGE
COMPRESSOR
1907

1912. He resigned the chairmanship in 1924, but remained a director until his death in 1928. His son, Mr. Hugh Paul, joined the board in 1922 and was chairman from the time his father resigned until his death in 1947.

In 1908 oil engines were added to the company's products. These took the form of petrol-paraffin engines, some of which were sent abroad for driving centrifugal pumps for irrigation, but most were used for country-house lighting. These did not prove a great success, as continual visits were needed to show the gardener or odd-job man—who usually had charge of the engine—what he had done wrong, and this more than absorbed the profits made on building the engines.

The quadruplex compressor for pressures up to 100 lb. per sq. in., which still formed the bulk of the output of the works, was completely redesigned in 1907 as a single-stage machine in sizes up to 500 cu. ft. per minute for singled-ended machines or twice that capacity when double-ended, and with only minor alterations this remained the standard Reavell compressor until the end of the First World War.

This new form of quadruplex compressor proved very satisfactory and with the demand for these machines and the high-pressure compressors for Diesel engines it was necessary to extend

the works. In 1908, 90 ft. was added to the length of the shops and more office accommodation was also provided. In 1909 a new brick chimney-stack was built to replace the original iron chimney, and in 1910 the drawing office was more than doubled in size. In 1911 a two-bay foundry, with two cupolas, two coke ovens, and a sand blast chamber, was put up to enable the company to make its own iron castings, and in 1912 the length of the main works was again increased.

When the war started in 1914 the works were asked to make 18-pounder shells, but it was very soon decided that they might be much more usefully employed. The company was appointed by the Admiralty to be repairers for the submarines based at Harwich. A shed was put up at the Ipswich Docks, and any submarine which required overhaul or repair used to come up from Harwich so that it could be dealt with. Some of the earlier jobs to be done consisted of replacing the star clutches, and it was gratifying when, as a result of this work, the company was asked to make the star clutches for the new submarines which were being built. Later, several different types of hydroplane gear for submarines were made, incorporating improvements suggested by Mr. Reavell.

A few rotary compressors had been made before the war. These were of the crescent type with the rotor and blades enclosed in a perforated drum, rotating freely on its own bearings with a little clearance inside the casing, as still made. One of these machines was tried in a submarine for discharging the water from the ballast tanks, and as it was found that it could not be heard nearly so far away as the piston-type machine then in use, it was adopted for the duty, and large numbers of them were supplied.

For the War Office three special types of hand-operated compressor were designed for working up to 700 lb. per sq. in. for charging the recuperators of guns and howitzers, and after satisfactory types had been produced, several thousand were supplied.

In 1915 a new three-story building was put up for producing shell fuses, the work being all done by women with only a few men acting as tool setters. There were about three hundred women working in two shifts, so that the work was continuous, and some thousands of fuses were turned out each week.

Towards the end of the war the same shop was used for making "Gray-Wimperis" gyroscopic bomb-sights for aeroplanes, the gyroscope being driven by an air turbine running at 25,000 r.p.m., developed by Reavell & Co., which was supplied with air by a rotary compressor fixed under the plane and driven by a small windmill.

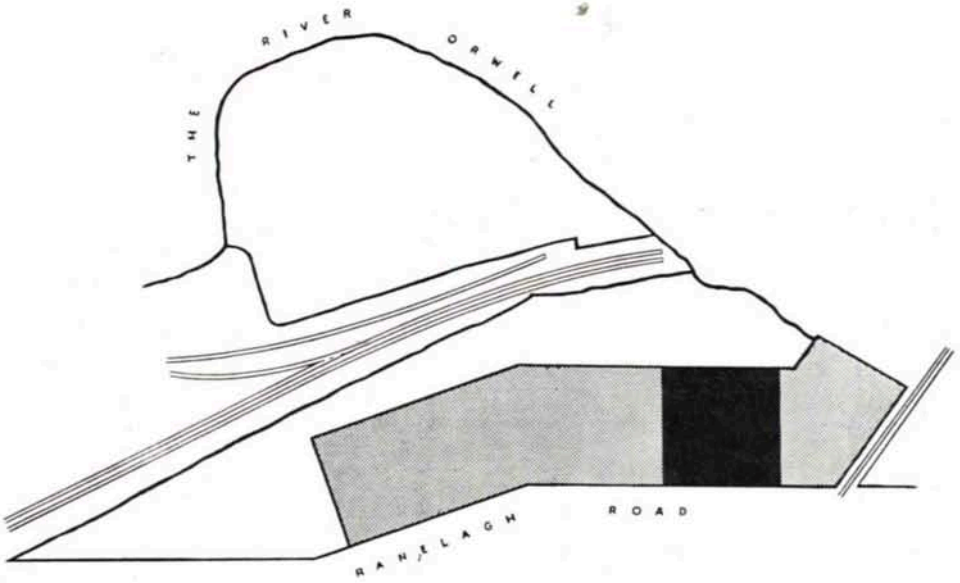
In addition to this special work, there was also a large demand for compressors of standard types for other firms having war contracts, and many three-stage compressors and some five-stage machines were supplied to the R.N.A.S. for compressing hydrogen into bottles for airships and observation balloons.

In 1916 an extension was necessary to the offices, and this was built with a canteen above it to provide meals for the workers. The works ran day and night continuously until the end of the war in 1918.

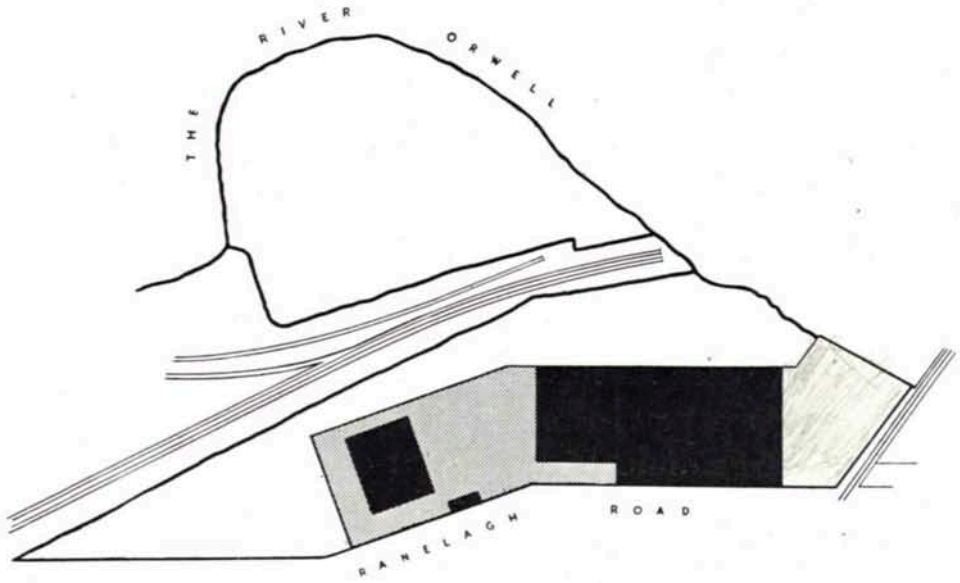
The end of the war brought the cancellation of Government contracts for large numbers of machines for war purposes, and new orders had to be found to take their place. During the war several new competitors had appeared who were making single-acting vertical compressors, which though not so efficient as the Reavell quadruplex compressor had the advantage that they were much simpler and cheaper to make, which was an important matter at that time, when all manufacturers were trying to get their factories back on to a peace-time basis as quickly and cheaply as possible. This made it difficult to sell the quadruplex compressor except to old customers, who appreciated its efficiency, so it was completely redesigned in a new series of sizes up to 1,200 cu. ft. per minute, known as the "Q" class, and had many new features provided to make it foolproof and suitable for running at higher speeds. It was also decided to make a cheaper type of machine for customers who would not pay the price for the quadruplex machines, and the company therefore started to make the simple single-stage, single-acting, vertical splash lubrication compressor in sizes up to 300 cu. ft. per minute, of which thousands have been, and are still being, supplied. The single-stage, single-acting type was not considered suitable for larger capacities on account of the difficulty of getting rid of the heat of compression. A line of two-stage, double-acting

HOW THE WORKS GREW

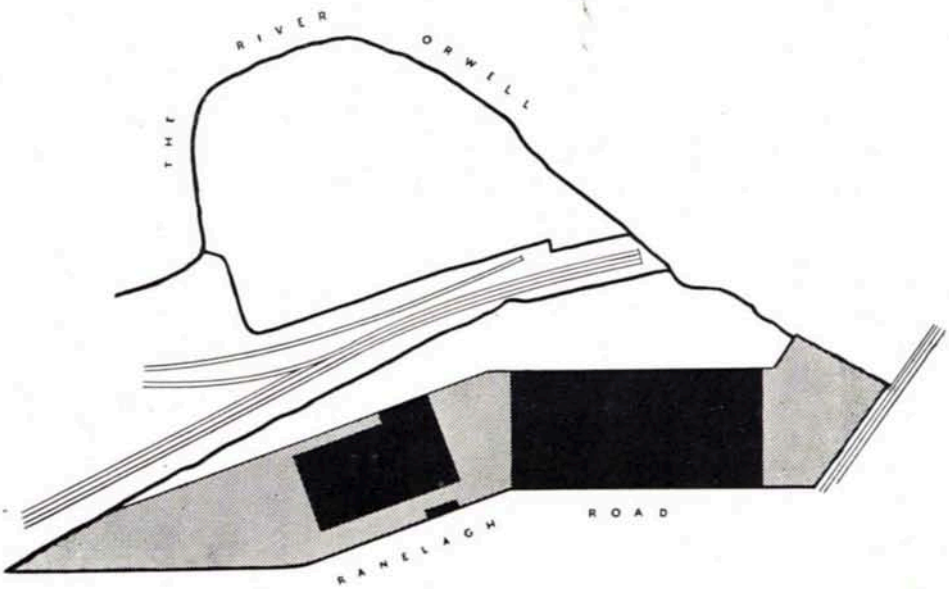
1898



1911



1920

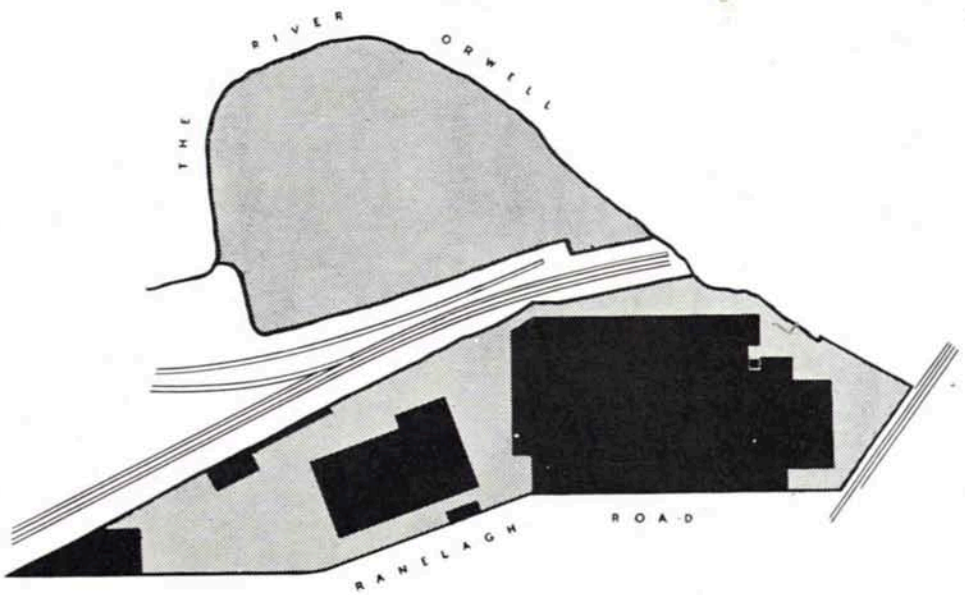


LAND ACQUIRED

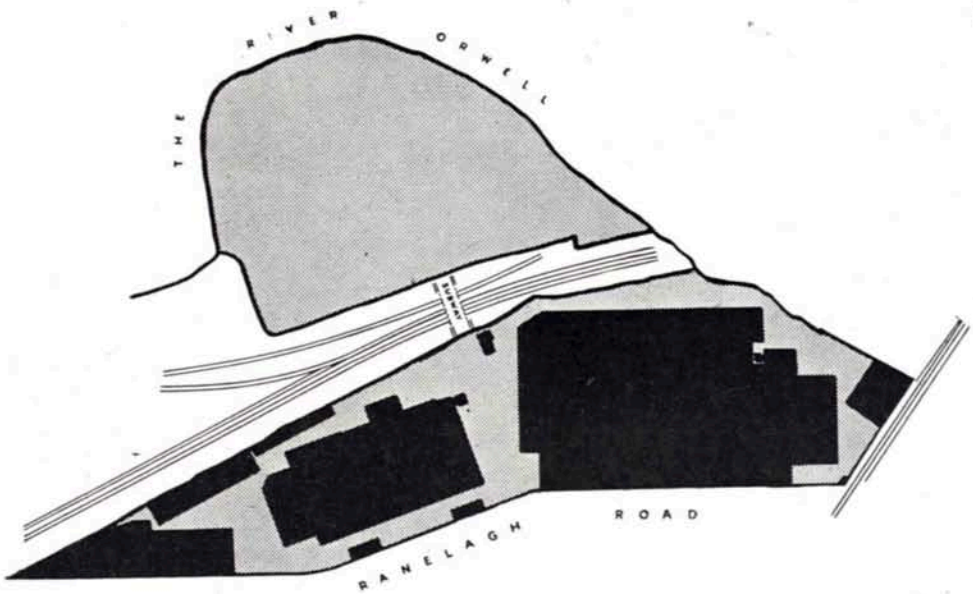
BUILDINGS

HOW THE WORKS GREW

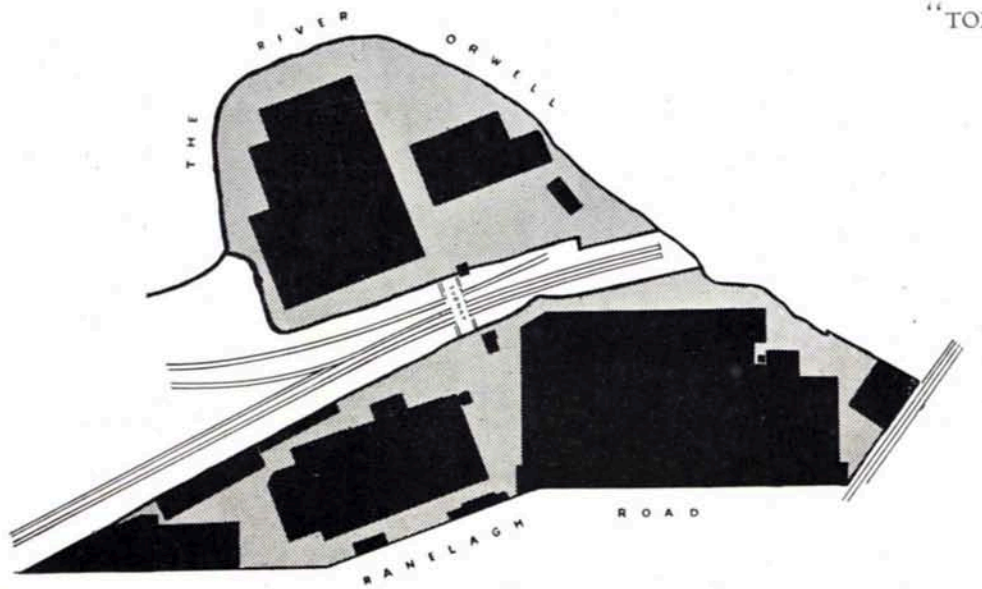
1930



TODAY



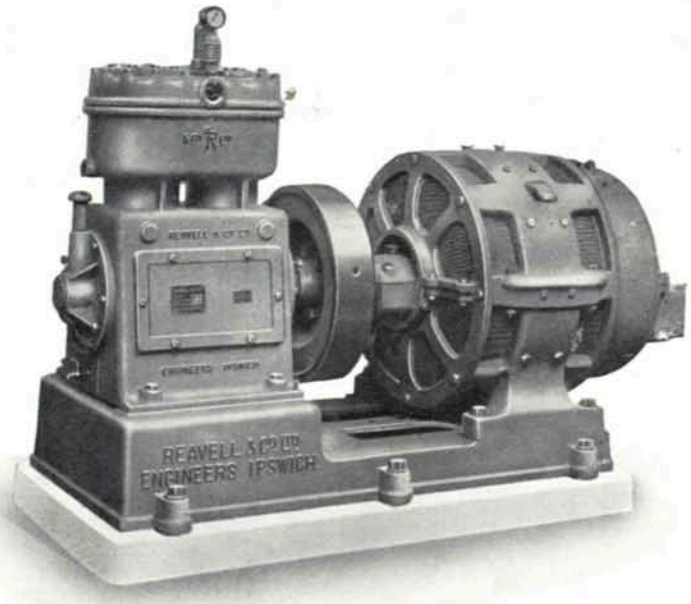
"TOMORROW"

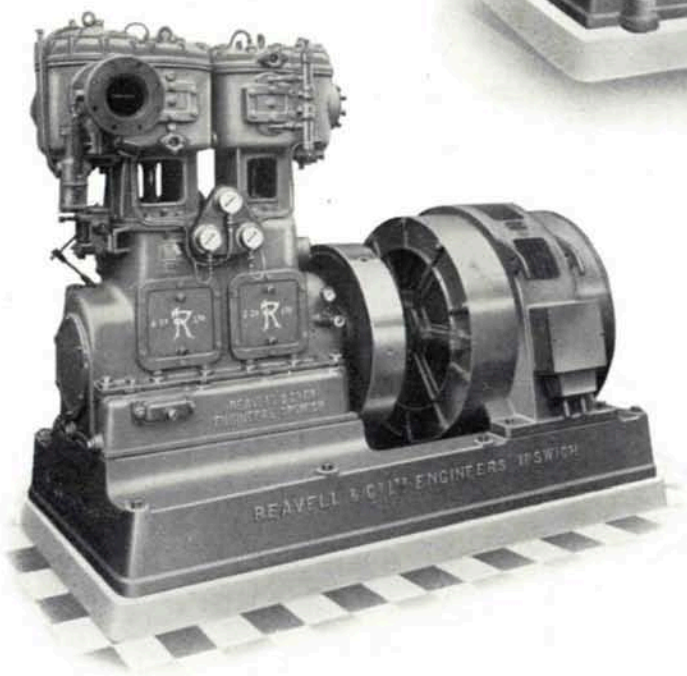


LAND ACQUIRED

BUILDINGS

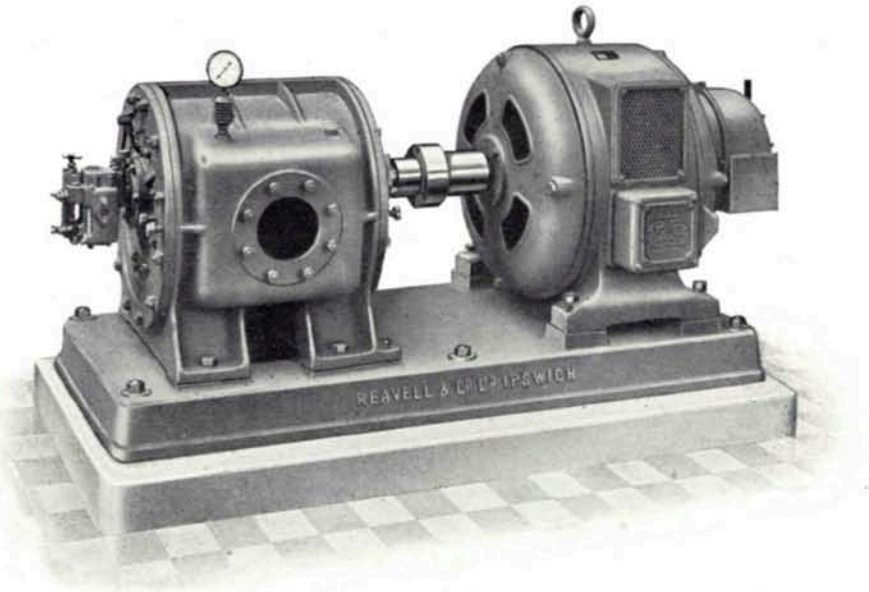
SINGLE-ACTING
VERTICAL COMPRESSOR





TWO-STAGE
DOUBLE-ACTING
VERTICAL COMPRESSOR

ROLLING DRUM
ROTARY
COMPRESSOR

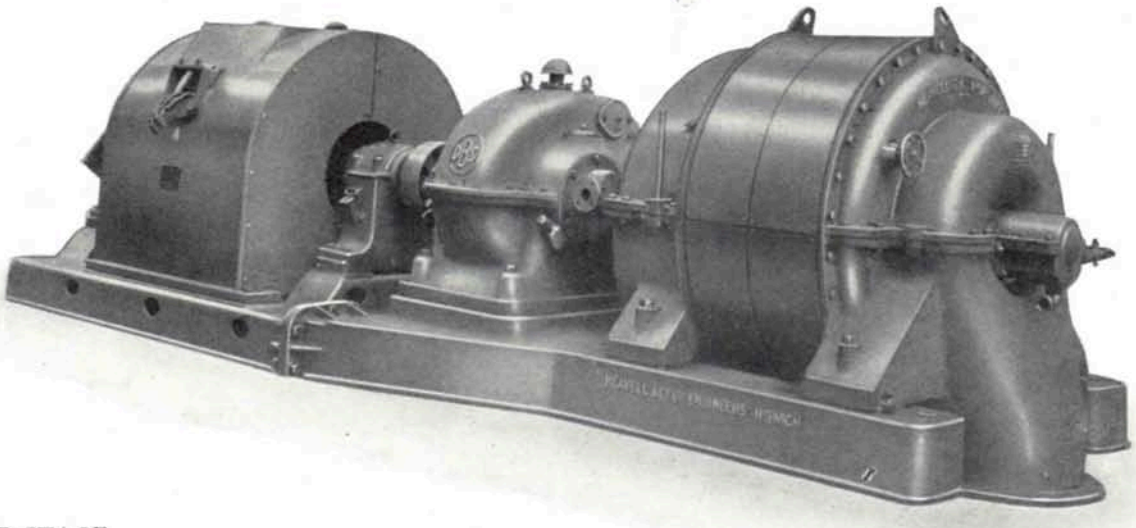


vertical compressors had been designed, and some sizes had been made as early as 1910, including some steam-driven machines of about 1,750 cu. ft. per minute capacity, for continental shipyards. These were now brought up to date, and provided a series of compressors for capacities of 500 cu. ft. per minute and upwards for pressures up to 120 lb. per sq. in. Among the many users of this type of compressor is the Ford Works at Dagenham, who have selected one size as their standard compressor, and now have about fifteen of them in use.

The rolling-drum rotary compressor, which has already been mentioned in connexion with the ballast tanks of submarines, was designed in several sizes and provided a very useful series of machines for pressures up to about 20 lb. per sq. in. and for capacities up to about 3,000 cu. ft. per minute.

Just before the war, the company had arranged to acquire the British Empire rights in a patent by the German Aerzener Company for a special type of turbo compressor, and in connexion with this Mr. Reavell had a narrow escape from being interned in Germany for the duration of the war, as he had gone to Germany to sign the agreement and had only left the day before war was declared. The first two of these turbo compressors had been built in 1916, but it was not until after the war that they began to form an important part of the output of the works. Since that time the turbo side of the business has developed enormously, and new types have been designed for various duties including some for smaller capacities than had previously been considered suitable for turbo compressors. Turbo machines have proved particularly suitable for gasworks' use, and it is satisfactory to note that about 95 per cent of all the London gas passes through Reavell turbos.

During the war the streets in London and other cities had been to a great extent neglected, and there was a large demand for portable petrol-engine driven compressor sets for breaking up the old surface so that they could be remade. The concrete breakers used for this purpose and the portable compressors for operating them were at that time usually imported from America. Reavell & Company had built their first petrol-engine driven portable compressor in 1905, and they were soon building the compressor sets



THREE-STAGE
TURBO COMPRESSOR

which were wanted, and also made the concrete breakers for use with them. They continued to build portable air compressors with petrol or Diesel engines until the Second World War, when they were obliged to give them up to make room for more urgent work. They have not yet started to build them again, nor have they decided just what form they will take when they do start, but they are still making their "John Bull" concrete breakers.

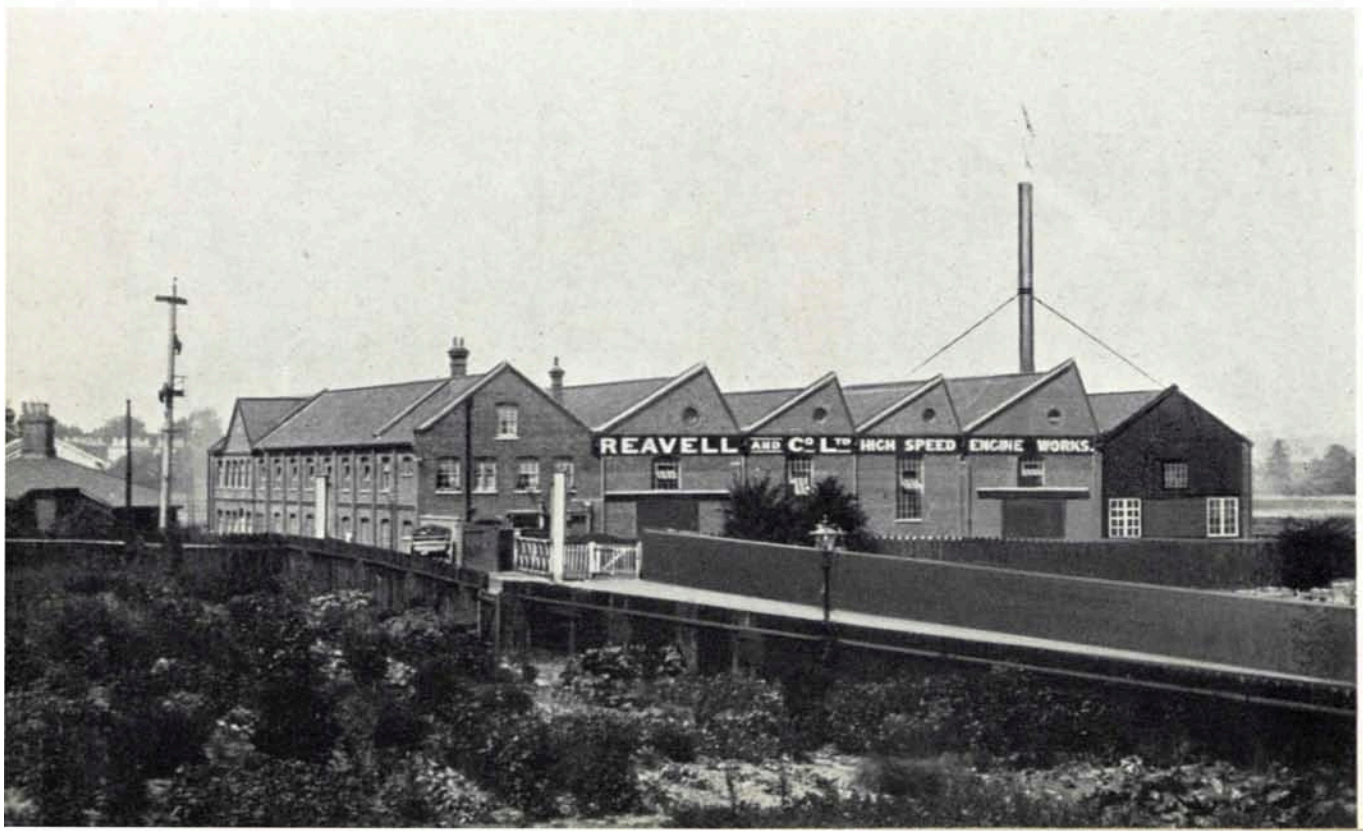
About the same period the Reavell-Mossay Pneumatic Tool Company was started with the idea of manufacturing and introducing a Belgian patent pneumatic pick into the British collieries, Reavell & Company manufacturing the picks in the shop which had been used for making shell fuses, and Mossay & Company Ltd. doing the selling. The pick, however, was not very well received, either on account of the prejudice of the miners against anything new, or the unsuitability of the British pits for that type of work, so that no great number was sold. A modified form of the pick, however, proved to be very useful for other purposes, such as the demolition of brickwork and concrete of moderate thickness, also when fitted with a spade instead of the usual moil point, for digging in hard clay. Many hundreds of these tools were made for the Army during the Second World War, arranged for use as picks or spades.

There was another market which up to that time had been almost completely in the hands of a company selling American machinery. This was the supply of pressure and vacuum brakes for

There were then no firms in this country which were giving very much attention to the design of air compressors, which were slow-running machines, mostly horizontal, made by pump makers or general engineers, and with the increased use of rock drills and other pneumatic tools, it looked as if there should be a growing demand for efficient compressors to operate them.

About the same time Mr. Reavell met and made friends with Charles Gaskell, who had been working in Buenos Aires for a shipping firm, and had recently returned to London, and was looking for something interesting at which he could work and in which he could make use of some money which he wanted to invest. So these three decided to start a company to produce the Scott engine and the Reavell "Quadruplex" compressor. Sufficient capital was found with the help of relatives and friends, and the company was incorporated on June 11th, 1898, as Reavell & Company Ltd. Mr. Reavell became managing director, which office he held until his death early this year at the age of eighty-two. Mr. Gaskell took on the duties of financial director and secretary, which he continued to perform until his death in 1931. The third founder, Mr. Scott, was too much occupied in the affairs of his own company in Norwich to take any considerable part in the management of the new company, but remained a director and always attended its board meetings until his death in 1938. Mr. A. F. Hills, the managing

RANELAGH WORKS IN 1899



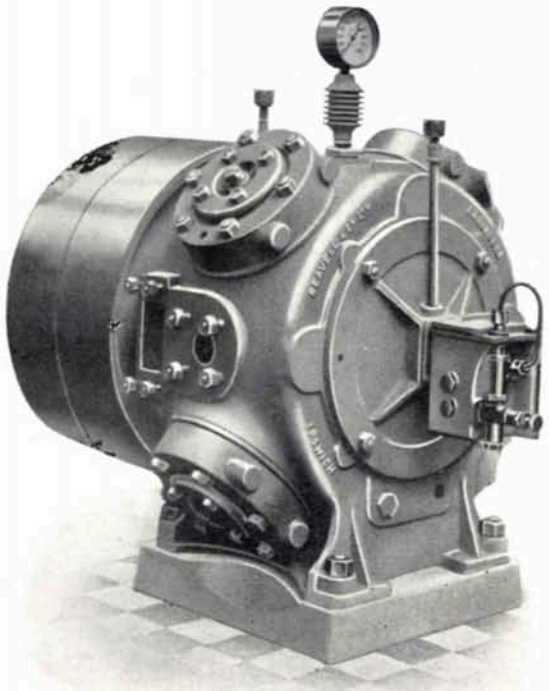
railways, including the compressors or exhausters for operating them. Reavell & Company were quite prepared to make the compressors and exhausters, but did not want to make the brake gear, which was not work which suited them, so they entered into an arrangement with Messrs. G. D. Peters & Company Ltd., of Slough, who started two subsidiary companies, the British Air Brake Company and the Consolidated Brake Company, to sell the complete brake equipment with compressor or exhauster made by Reavell & Company and the other parts by G. D. Peters. For the compressors the single-acting vertical type was used with two unjacketed cylinders, the machine being specially built for direct attachment to an electric motor so as to make a light, compact unit. For the vacuum brakes the rolling-drum rotary made a very satisfactory exhauster. Large numbers of both types have been sold for use on electric trains, tramcars and trolley buses, and more recently on motor-buses and commercial vehicles.

In 1920 most marine Diesel engines still had air injection, and with the increasing popularity of the Diesel-engined ship, there was a considerable demand for compressors for 1,000 lb. per sq. in., not only for air injection but for charging receivers for starting and manœuvring, and in 1920 the company started building a new type of three-stage vertical compressor for that purpose and also produced a two-stage machine for bottle-charging up to 1,000 lb. per sq. in. by adapting their two-cylinder, single-acting, vertical compressor, using one cylinder for the first stage of compression and the other as a cross-head guide for the second-stage piston, which was made in one piece with the cross-head. The second-stage cylinder was in the same casting as the first-stage cylinder cover, and horizontal intercooler tubes were taken through the cylinder water-jacket in the main casing. This type was known as the "HCSA" class, and when later air injection had been generally replaced by pump injection so that it was no longer necessary to have a pressure of 1,000 lb. per sq. in., machines of similar construction but with larger cylinders were made for a pressure of 450 lb., known as the "CSA" class. To suit some engine builders, who preferred a pressure of 600 lb., another series—the "MCSA" class—was designed later on the same lines with cylinders to suit that pressure.

HIGH-PRESSURE TWO-STAGE
COMPRESSOR HCSA TYPE

THREE-STAGE VERTICAL
COMPRESSOR MARINE TYPE

THREE-STAGE OXYGEN COMPRESSOR



QUADRUPLEX COMPRESSOR QR TYPE

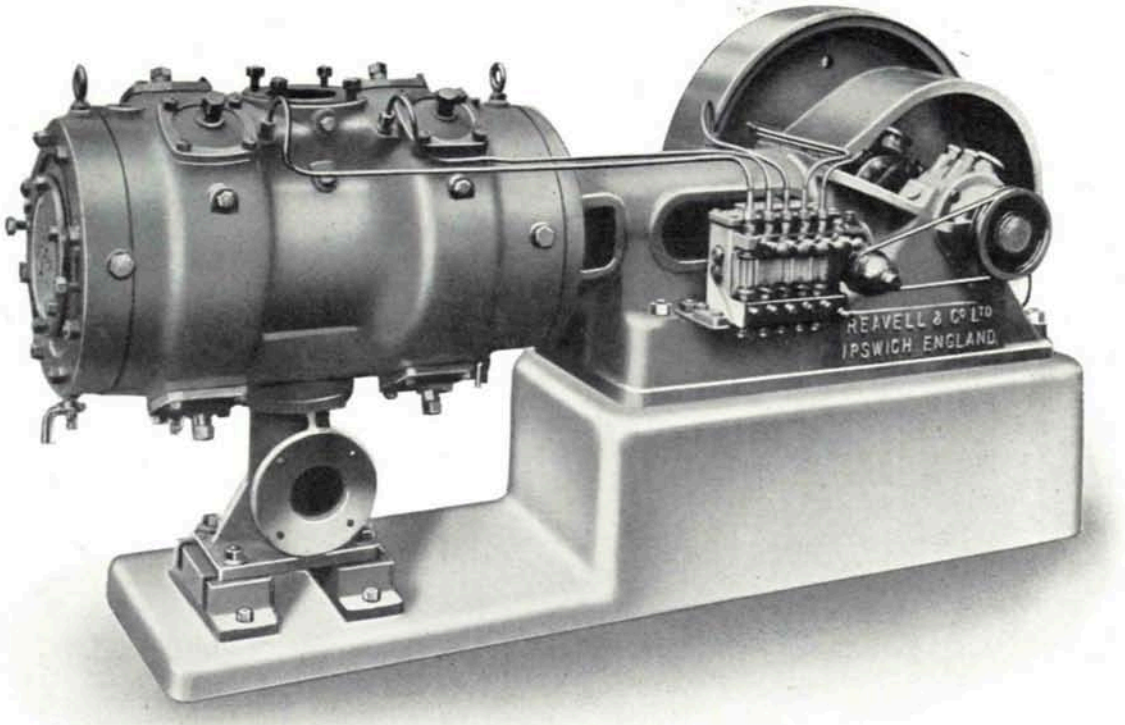
Reavell compressors had been used for many years for compressing coal gas, hydrogen and other gases, but until 1924 the company had not made the special compressors required for dealing with oxygen. In that year, however, they started to build three-stage oxygen compressors with water lubrication, and machines for dealing with that gas now form part of the regular output of the works.

In 1926 a new type of quadruplex compressor was produced, known as the "QR" type, in which roller bearings were used for the main bearings and connecting-rod big ends. The four bearings for the connecting rods ran on one hardened steel sleeve on the crank-pin, and the cylinders were staggered in the casing so as to give a straight thrust on each rod. To avoid the necessity of the usual outer bearing a second crank-web with shaft extension for a roller bearing housed in the front cover was attached to a coned extension of the crank-pin. These machines were suitable for running at considerably higher speeds than any of the earlier quadruplex compressors and were, therefore, more suitable for directly coupling to electric motors. Trinity House, who had been using the earlier "Q" type machines for many years for operating fog signals in lighthouses and lightships, now use the "QR" quadruplex machines for that purpose.

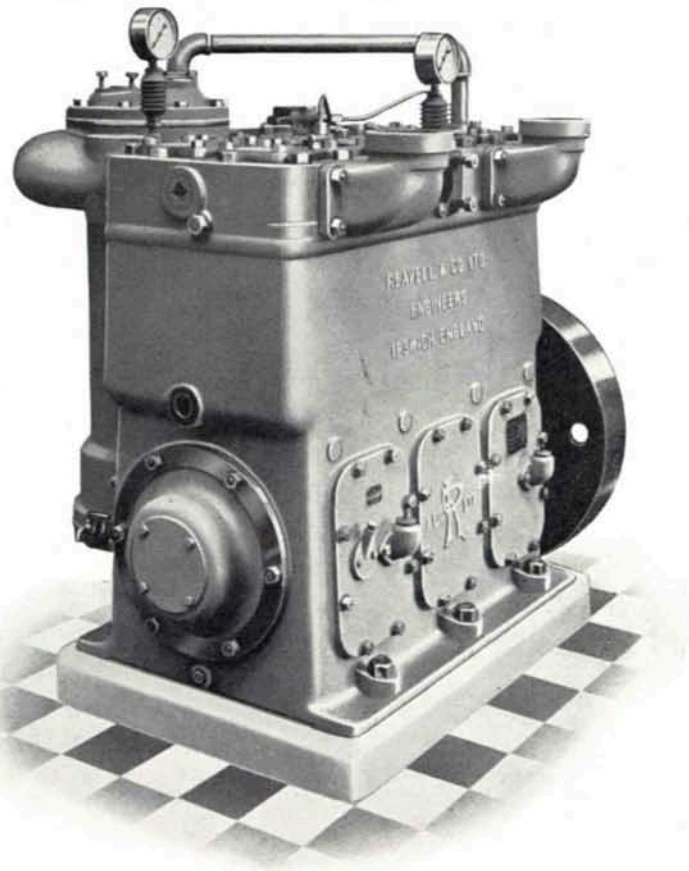
Mr. Reavell had been a member of the Institution of Mechanical Engineers since 1907, and after becoming a member of the Council in 1917 and a vice-president in 1923, he was President of the Institution in 1926. For this reason the summer meeting of the Institution that year was held at Ipswich, and Ranelagh Works had the honour of a visit from the members on June 15th.

In 1927 the company started a new venture in acquiring the British Empire rights for the German patented "Askania" regulator which appeared to have a very wide field of application, particularly for gasworks and coke ovens. Manufacture was started on a small scale, using part of the Hammer Shop, but the demand grew so rapidly that it was soon necessary to build a new shop and later to double its size to deal with this work.

In 1928 Mr. R. L. Quertier, who came to Ranelagh Works in 1906 and had been in charge of the company's London office since 1911, joined the board of directors, and in the same year Captain



HORIZONTAL DOUBLE - ACTING VACUUM PUMP



TWO-STAGE
SINGLE-ACTING
COMPRESSOR
TSAC.11 TYPE

Kingsley Reavell, the only son of the managing director, also joined the board. After completing his training in the works, he had served with the Forces in the First World War, returning to Ranelagh Works in 1919.

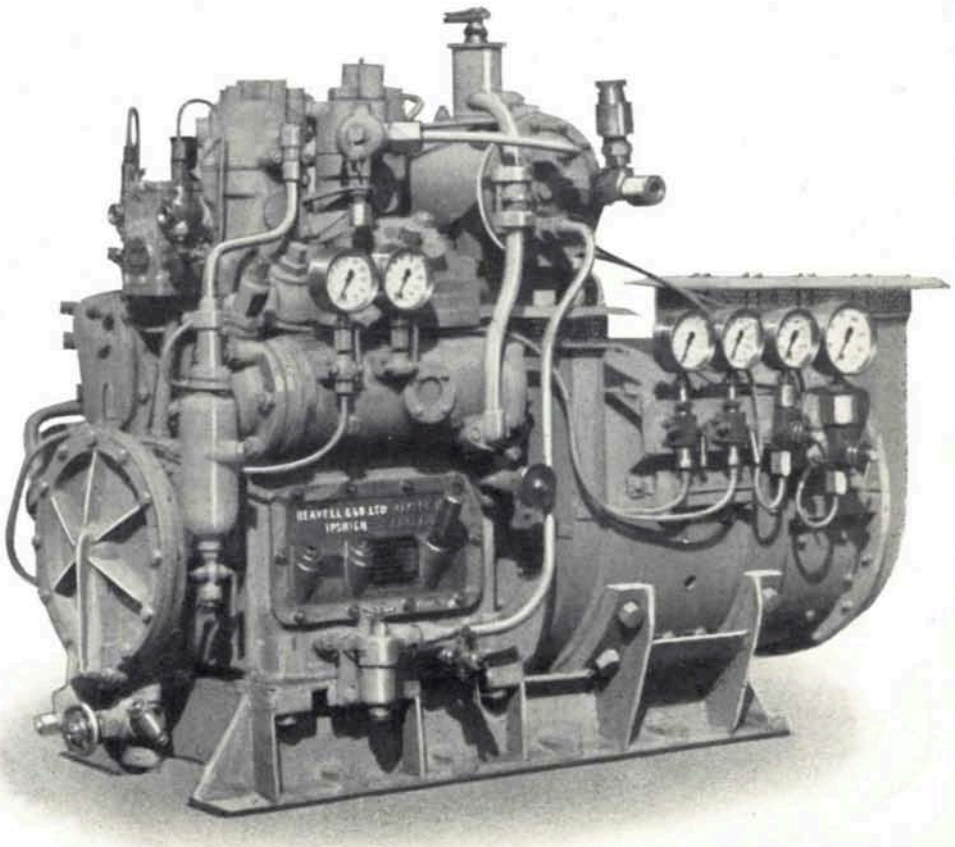
The year 1929 was not a good one for business generally, and the effect of this was to give the company the opportunity of adding about 50 per cent to the area of the shops without seriously disorganizing their work. This new extension included a new erecting shop, 40 ft. wide and much higher than the original shops, to enable much larger machines to be dealt with, new stores built across the end of the machine shop with an upper floor for works offices, and a new tool-room and jig stores. A strip of land between the works and the river was purchased to make room for these extensions, and in 1930 about three acres more were acquired for future extensions on the other side of the railway. This land was low, and being in the bend of the river was subject to flooding, but it served as a convenient dump for ashes and spent sand from the foundry, by which the level of a great part has been raised well above flood level, so that it is now ready for new buildings as soon as they can be put up. A subway has already been constructed under the railway line to give access to it.

Some horizontal, double-acting compressors and vacuum pumps had been made ever since 1909, and in 1936 a new series of machines of this type was designed specially for use as vacuum pumps in sizes from 160 to 2,000 cu. ft. per minute. In the same year a three-cylinder, two-stage, vertical compressor of 400 cu. ft. per minute, known as "TSAC.11" was introduced to fill the gap between the single-stage, single-acting, vertical machines which covered up to 300 cu. ft., and the two-stage, double-acting type, of which the smallest size gave 500 cu. ft. per minute. This gap had presented a problem for some time, as 300 cu. ft. per minute was considered to be the limit for the single-stage, vertical type, and it had proved impossible to produce a 400 cu. ft. two-stage, double-acting machine much more cheaply than the 500 cu. ft. size. The new machine, however, could be produced at a reasonable cost, which made it possible to compete successfully with the large single-acting vertical compressors which some competitors were offering.

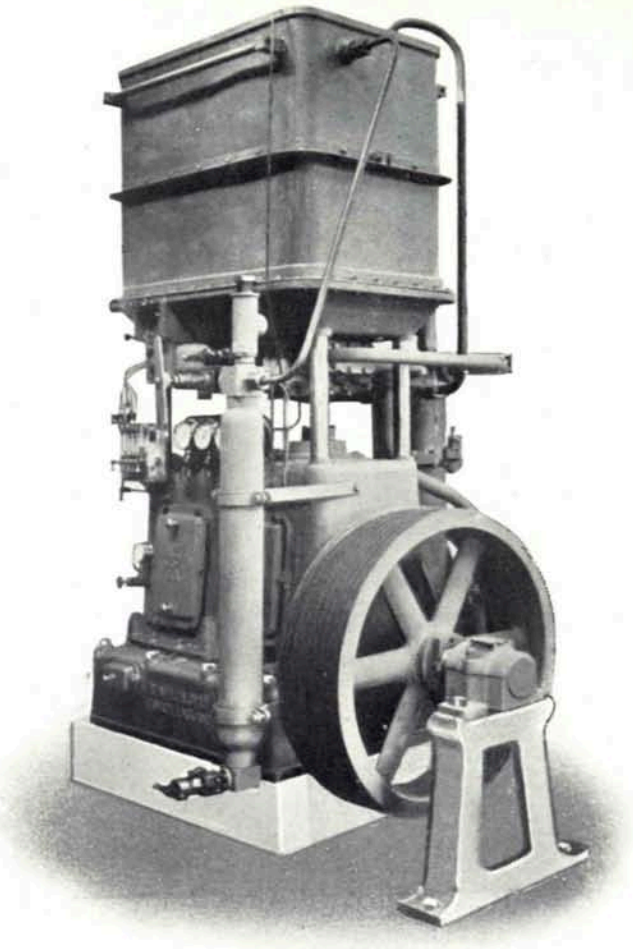
In the 1938 New Year Honours List the name of William Reavell appeared as a Knight Bachelor, in recognition of his many national services, and everyone at Ranelagh Works was highly gratified and felt that he had a share in this honour.

The shadow of the Second World War was felt at Ranelagh Works some time before it actually started, as for some years the company had been building torpedo-charging compressors for use on warships, including submarines, and their single-acting vertical machines had been adopted for general service compressors on battleships and cruisers. The augmented naval programme, in view of the possibility of war, meant that large numbers of these machines were required, and standard types of compressors were also needed for the shadow factories which were being put up for producing aero engines and aircraft. Most of these factories were modelled on existing works for which Reavell & Company had supplied the compressors, so that naturally the same make of machine was asked for. The works were, therefore, already very busy when war was declared, and all through its duration were working night and day trying to supply all the various compressors which were asked for.

The works were very fortunate in escaping damage by air raids, though there was a very anxious moment when a damaged German



HIGH-PRESSURE COMPRESSOR FOR TORPEDO CHARGING



HIGH-PRESSURE COMPRESSOR
TANK TYPE

bomber missed the end of the erecting shop by inches in its descent. Underground shelters had been constructed and the Air Force used to send a special warning when an air raid was imminent, so that work could continue until the last safe moment, leaving just time for everyone to reach the shelters before the raiders could arrive.

The works provided its own fire brigade and fire watchers, and a company of the Home Guard was formed in the Ipswich Battalion, raised and commanded by Lieutenant-Colonel K. Reavell, this company being manned and officered entirely by employees at Ranelagh Works.

Large numbers of high-pressure hydrogen compressors were built for the Air Force for compressing hydrogen into cylinders for inflating barrage balloons, and many oxygen compressors for charging the cylinders of the breathing apparatus for high-altitude flying.

High-pressure air compressors were required by both the Admiralty and the Air Force for torpedo charging. Two types were supplied, both vertical four-stage machines, one being for use at depots was built in cast iron with the cylinders and intercoolers in an open tank at the top so that any leaking joint could be at once detected, while the other was for use in ships and was constructed mostly of gunmetal. Large numbers of both types were built, including those for practically all the new submarines which were built during the war.

Compressed air was required for operating the pneumatic brakes and clutches in tanks, and two new compressors were specially designed for this work and thousands of them supplied. These were two-stage, single-acting, air-cooled machines, arranged for direct driving from the main engine. Two new types of compressor were also designed for the Air Force for servicing trolleys for aircraft. Both were two-stage air-cooled machines, one for 100 lb. per sq. in. for tyres, etc., and the other for 450 lb. for charging starting-bottles. These machines were driven by Petter air-cooled engines and were mounted on light trolleys with pneumatic tyres, so that they could be easily wheeled about the aerodromes to the point where they were needed. Another special high-pressure compressor was designed for the Air Force, which had to be as light as possible and self-contained, so that it could easily be carried on aeroplanes to temporary airfields abroad to be used for charging the high-pressure cylinders which supplied the air for the pneumatic operation of the instruments on the planes. These machines were made mostly of aluminium, driven by the lightest petrol engine obtainable, and mounted in a tubular frame. These machines were also adopted by the Fleet Air Arm for charging aerial torpedoes, and the compressor—in that case driven directly from the main engine—formed the torpedo-charging equipment in the famous two-man submarines which made the final successful attack on the Tirpitz.

Machines of the same type, but larger and not of the same specially light construction, were also made for the Army for charging high-pressure cylinders at base depots, so that they could be sent up to the front for recharging the recuperators of guns and howitzers when required instead of using the hand-driven compressors which had previously been used for this purpose.

Another new compressor was produced for charging the starting-bottles on the Diesel engine-driven Hunt class destroyers and motor patrol boats. This machine was arranged for direct attachment to a small Lister-Diesel engine. The compressor, having no main bearings of its own, was driven by a crank disc fixed on the engine shaft. This made a much more compact set than the earlier arrangement, in which a complete compressor had been coupled to

the engine on a combination bed-plate. Another interesting piece of work which was undertaken was the design and manufacture of the pneumatic steering-gear for target boats which carried no crew and were navigated by wireless control from a distance.

With numbers of these different machines being built, as well as all the standard types of compressor needed for Admiralty depots, aircraft factories and firms working on war contracts, and the hundreds of pneumatic picks being made for the Army, it will be realized that Reavell & Company were able to make a very real contribution to the war effort in the Second World War.

The end of the war did not make Ranelagh Works any less busy as, though the war work ceased and some contracts were cancelled, so much civil work had had to be held up for so long, and machinery had been run to death during the war, that orders came in very much faster than the works could execute them, and times of delivery had to be very greatly extended. A large proportion of these orders were, and still are, for export, so that the company has the satisfaction of helping in the much-needed export drive.

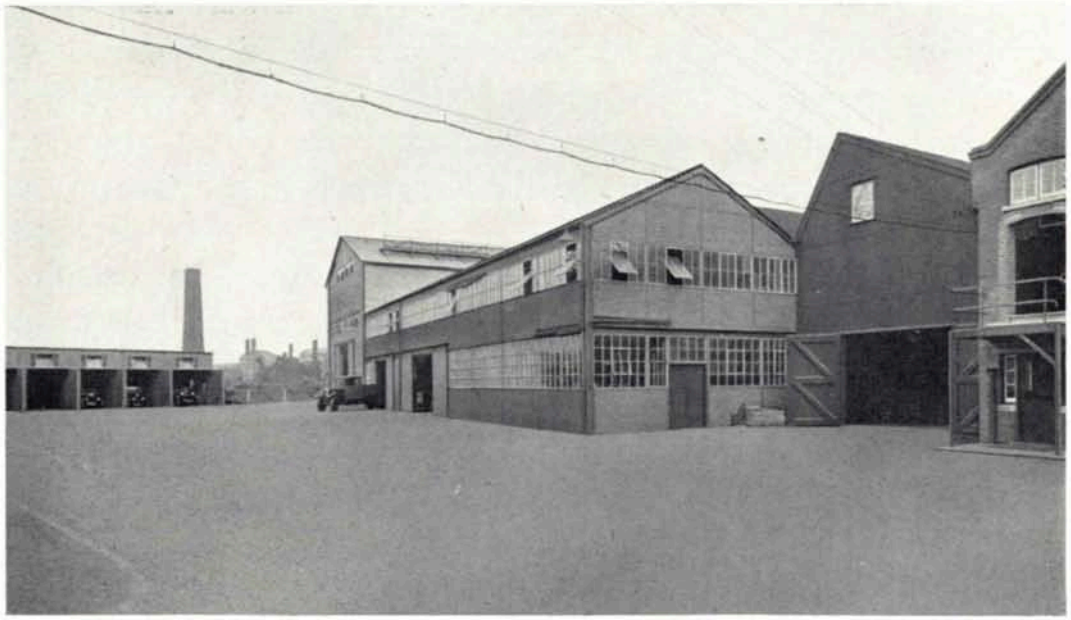
Since the war the works have been too busy turning out standard compressors to do very much in the way of producing new types, but as there has been a considerable demand for compressors to produce absolutely oil-free compressed air and gases, especially for chemical works, and experience has shown that the only way of ensuring that air shall have no taint of oil in it, is to avoid its ever coming into contact with oil, vertical, single- and two-stage compressors are now being made with carbon piston-rings and gland packing, which require no cylinder lubrication. Several of these machines have been made and are being built for the I.C.I. and other chemical manufacturers, and one of them has been sent out to a brewery abroad.

Another important addition to the many types now built is the axial flow turbo compressor, the first of which is now nearing completion in the works, and is for an important Government contract.

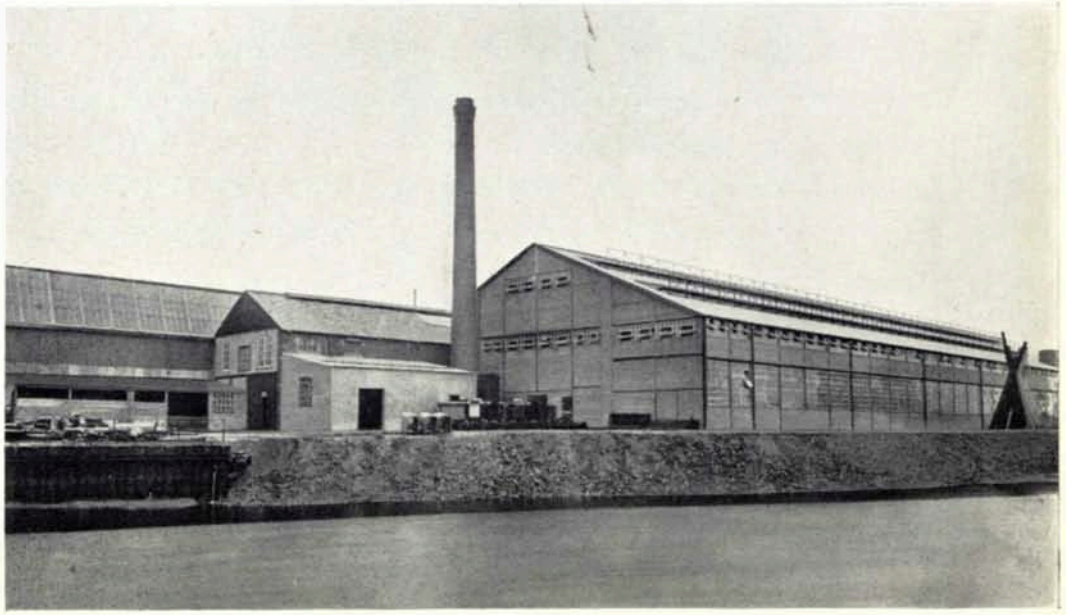
There was a change in the board of directors last year, owing to the death of Mr. Hugh Paul, who had been chairman for a

RANELAGH WORKS IN 1948

EXTERIOR OF OFFICES



CENTRAL YARD



WORKS FROM RIVER

number of years. Sir William Reavell became chairman, as well as managing director, and Mr. L. G. Banyard, who has been secretary since Mr. Gaskell's death in 1931, and Mr. D. A. Palmer, who is managing director of Messrs. Joseph Rogers & Sons Ltd., joined the board. Mr. Palmer received his engineering training at Ranelagh Works, and was assistant to Mr. Reavell from 1909 to 1914.

When Sir William died early this year, Mr. Hartley was elected chairman, but only held this office for a very short time, as he died only two months after Sir William.

Mr. D. A. Palmer has now been elected chairman with Mr. Quertier as deputy chairman, and Mr. Quertier and Lieutenant-Colonel K. Reavell are joint managing directors. Mr. Quertier will be responsible for the technical side of the work, including design and research, while Lieutenant-Colonel K. Reavell will continue as sales manager and supervise the running of the works.

There has always been a strong community spirit at Ranelagh Works, which has from the first been "a happy ship" with Sir William as its loved and respected captain, and it is striking to note how many of its crew stick to their ship, as there are many in the works and offices who have served for over thirty years, and some for considerably more than that time. The ship has now lost her original captain, and his passing is a great sorrow to everyone, but it is hoped that the tradition he established will remain and the voyage continue happily under the direction of the officers who served under him.

In the earliest days there was an enthusiastic cricket club and works teams were got together for various games, but it was not until 1920, when the company acquired a piece of land on the outskirts of the town and turned it into a fine sports ground with tennis courts and bowling green and built a pavilion, that the works teams could play on their own ground. The Ranelagh Works Athletic Association was at once started with Mr. Gaskell as its first president, and sections were formed for cricket, football, hockey, tennis, and bowls, other sections being added later. The Association also promotes indoor entertainments, using the works canteen for dances, concerts, and dramatic performances, though recently the dramatic section has had to take a larger room in the

town, as the canteen was not large enough to hold the people who wanted to see their performances.

After the first World War in 1919 a victory fete with athletic sports and tea was held on a hired field, and this was so popular that as soon as the new sports field was ready the sports meeting became a regular annual event every year. A Christmas party is given in the canteen for the children of all employees with tea and some form of entertainment, and presents, which is a very popular event. In the summer-time, outings are usually arranged for the staff and for the men, and in the winter there is usually a staff dinner.

It is hoped that anyone who has read this account of the first fifty years of Reavell & Company Ltd. will have received an impression of good work done and good progress made, and will have realized how Sir William Reavell with his tireless energy and enthusiasm inspired everyone at Ranelagh Works to do his utmost to ensure the success of the company. It was with great sadness that we had to record his death in the jubilee year of the company he had founded and built up, and now we have suffered the further loss of Mr. Hartley, our works director, who, since 1903, was so closely associated with Sir William in the development of the company's activities. The loss of these two senior directors was indeed a heavy blow, but the inspiration remains, and everyone at Ranelagh Works is determined to do as well or even better, so that the company's next fifty years may fitly carry on the story we have recorded.

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OVERSEAS AGENTS

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Australia	John Carruthers & Co. (Pty.) Ltd., Sydney ; Harris, Scarfe & Sandovers Ltd., Perth
Canada	Reavell & Co. (Canada) Ltd., Montreal
China	Arnhold & Co. Ltd., Shanghai ; Dodwell & Co. Ltd., Hong Kong
Denmark	The Scandinavian Steel & Shipping Agency, 16 Amaliegade, Copenhagen
Egypt	Sayer & Colley, Cairo
France	Maison J. Hanning, 19 Rue de Bassano, Paris
Holland	Internationale Nautische Handel Maatschappij, Cornelis de Wittlaan 39, Den Haag
India	Turner Hoare & Co. Ltd., Bombay and Lahore
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New Zealand	Turnbull & Jones Ltd., Wellington and Christchurch
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