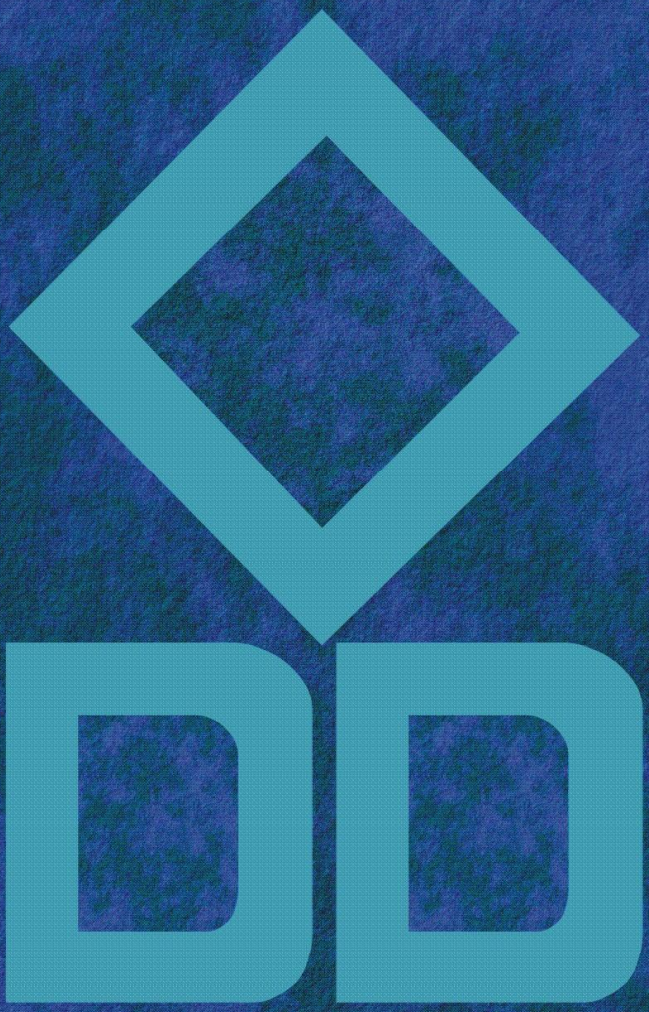
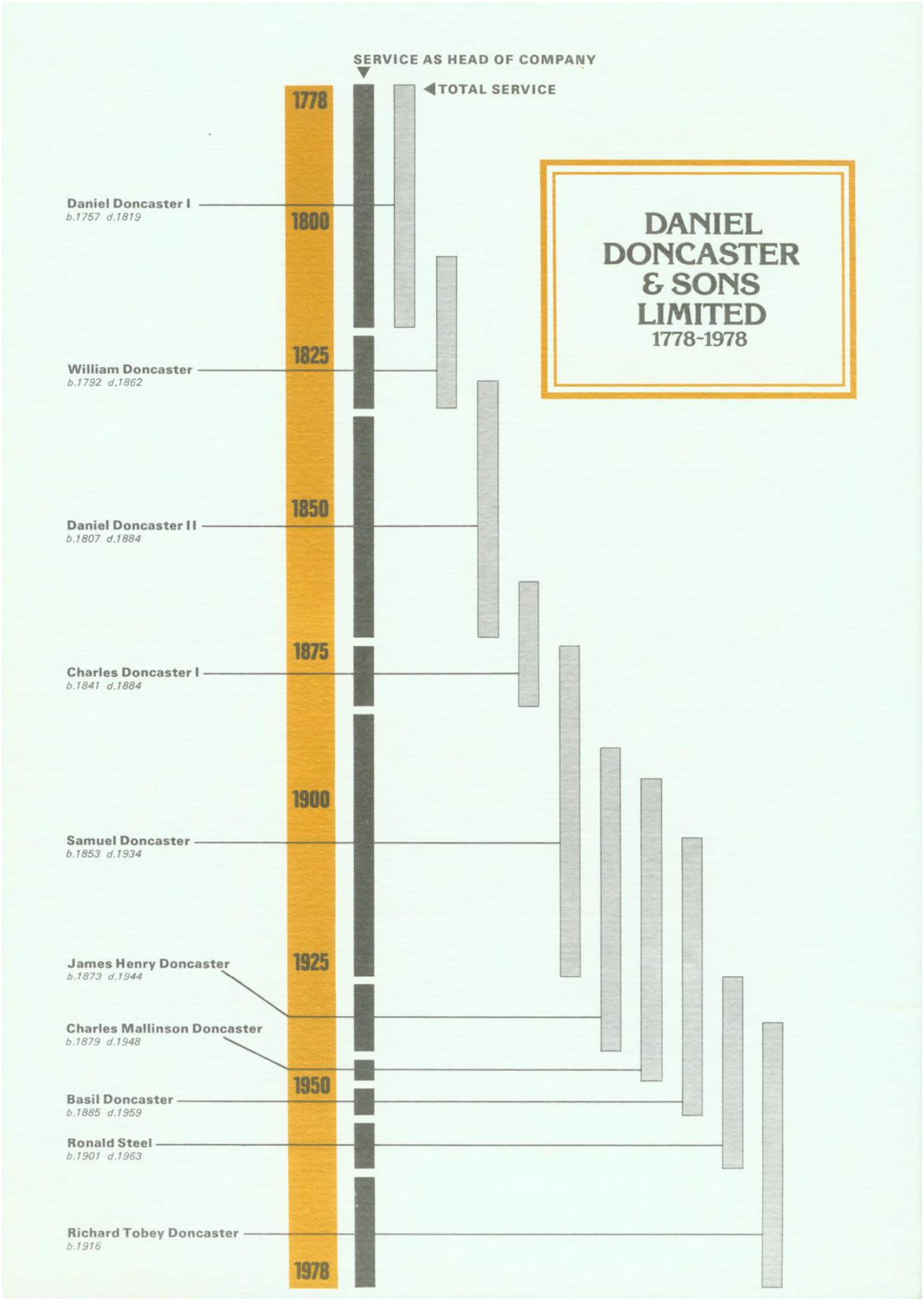
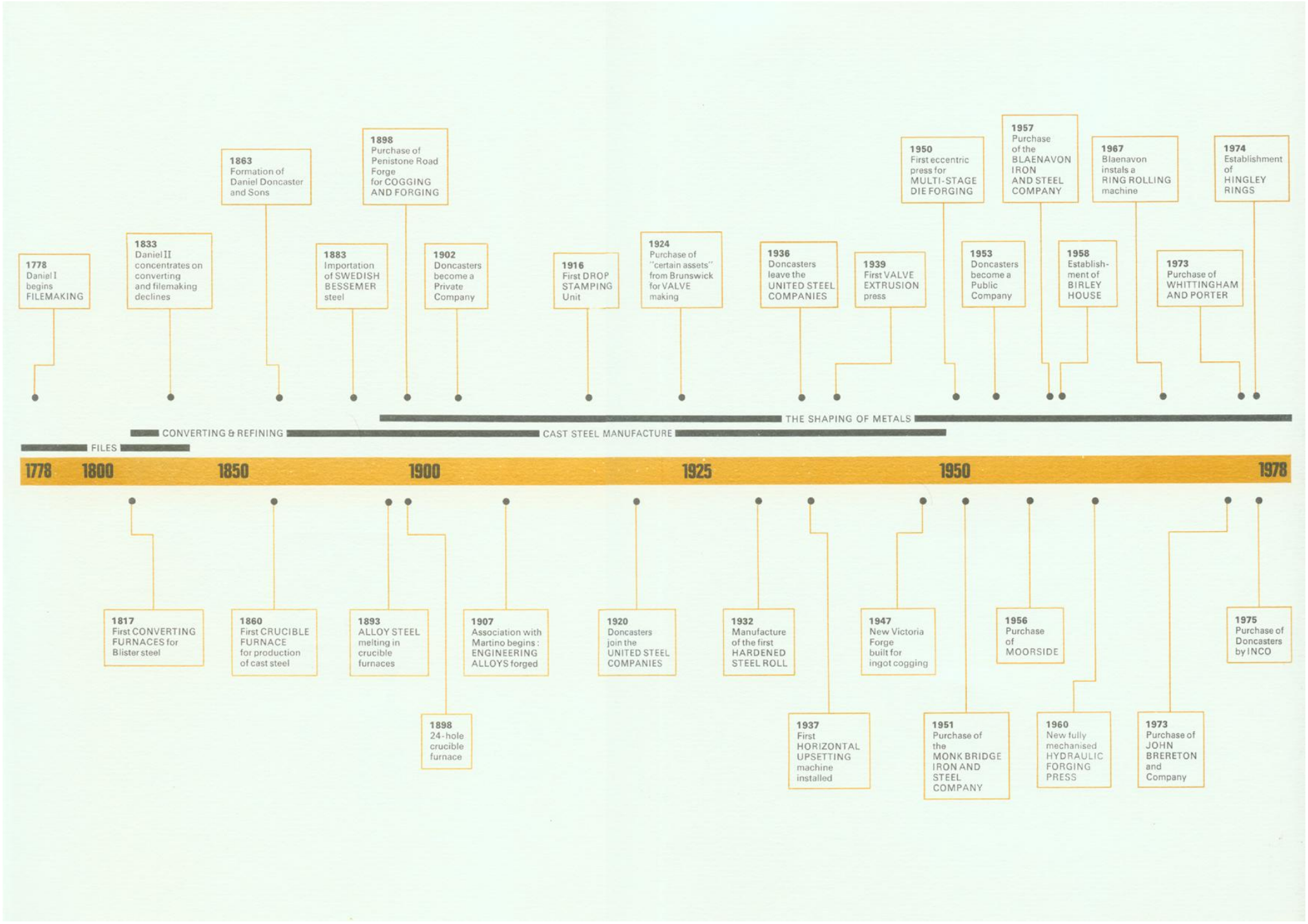
1778 -1978




SERVICE AS HEAD OF COMPANY
TOTAL SERVICE
1778
1800
1825
1850
1875
1900
1925
1950
1978
Daniel Doncaster I
b.1757 d.1819
William Doncaster
b.1792 d.1862
Daniel Doncaster II
b.1807 d.1884
Charles Doncaster I
b.1841 d.1884
Samuel Doncaster
b.1853 d.1934
James Henry Doncaster
b.1873 d.1944
Charles Mallinson Doncaster
b.1879 d.1948
Basil Doncaster
b.1885 d.1959
Ronald Steel
b.1901 d.1963
Richard Tobey Doncaster
b.1916
DANIEL DONCASTER & SONS LIMITED
1778-1978


1778 Daniel I begins FILEMAKING
1833 Daniel II concentrates on converting and filemaking declines
1863 Formation of Daniel Doncaster and Sons
1883 Importation of SWEDISH BESSEMER steel
1898 Purchase of Penistone Road Forge for COGGING AND FORGING
1902 Doncasters become a Private Company
1916 First DROP STAMPING Unit
1924 Purchase of "certain assets" from Brunswick for VALVE making
1936 Doncasters leave the UNITED STEEL COMPANIES
1939 First VALVE EXTRUSION press
1950 First eccentric press for MULTI-STAGE DIE FORGING
1953 Doncasters become a Public Company
1957 Purchase of the BLAENAVON IRON AND STEEL COMPANY
1958 Establish-ment of BIRLEY HOUSE
1967 Blaenavon instals a RING ROLLING machine
1973 Purchase of WHITTINGHAM AND PORTER
1974 Establishment of HINGLEY RINGS
THE SHAPING OF METALS
CONVERTING & REFINING
CAST STEEL MANUFACTURE
FILES
1778
1800
1850
1900
1925
1950
1978
1817 First CONVERTING FURNACES for Blister steel
1860 First CRUCIBLE FURNACE for production of cast steel
1893 ALLOY STEEL melting in crucible furnaces
1898 24-hole crucible furnace
1907 Association with Martino begins : ENGINEERING ALLOYS forged
1920 Doncasters join the UNITED STEEL COMPANIES
1932 Manufacture of the first HARDENED STEEL ROLL
1937 First HORIZONTAL UPSETTING machine installed
1947 New Victoria Forge built for ingot cogging
1951 Purchase of the MONK BRIDGE IRON AND STEEL COMPANY
1956 Purchase of MOORSIDE
1960 New fully mechanised HYDRAULIC FORGING PRESS
1973 Purchase of JOHN BRERETON and Company
1975 Purchase of Doncasters by INCO

FOREWORD

Every Company must have a name and many are those of the founder. That ours has carried on for 200 years and there have been Doncasters all the way may be significant.

But more significant is that, after the first few years when it was just one man, the Company became a group of people working towards the same aim: to be successful.

Not always have the means of achieving success been the same. Not always have the ideas of how to achieve success been the same. That is not surprising for people are not the same. Each has his own particular contribution to make, in his own way.

That the Company has grown indicates a contribution by very many people: in work and effort; in skills and knowledge; in thought and deed.

Such qualities are always needed, everywhere, in every way of life. Without them there is no continuity. Doncasters are indeed fortunate that these qualities have been with us in abundance.

Richard Doncaster

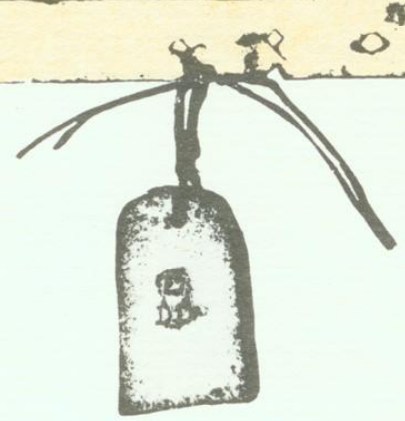
CHAIRMAN

MAY 1978

Daniel Doncaster the Son of Samuel Doncaster
And Apprentice of George Smith ——— of
Sheffield in the County of York Filesmith
was admitted by the Master Wardens Searchers and Assistants
of the Company of Cutlers in Hallamshire in the County of York the
twenty ninth — Day of May ——— in the
Eighteenth — Year of the Reign of our Sovereign Lord
George the Third ——— by the Grace of God
of Great Britain France and Ireland King defender of
the Faith and so forth and in the Year of our Lord One Thousand
Seven Hundred and Sixty Eight in the Time of
Mr Samuel Norris — Master of the same Society and
entered in the Great Paper Book under the Title of ADMISSIONS
OF FREEMEN.

◇
DD

Memorandum That the Day and Year above said the Mark Stampt
in the Margin and impressed on the Lead to these presents
annexed was assigned according to the Form of the Statute by
the Master Wardens and Searchers of the said Society to the
aforesaid Daniel Doncaster to mark his
Files ——— by him to be made To HOLD
to him during his Life paying therefore yearly to the said
Master Wardens and Searchers and their Successors during the
said Term for the use of the said Society the Sum of Two Pence
at the Feast of Pentecost only.



"Memorandum. That the Day and Year abovesaid, the Mark stampt in the Margin, and impressed on the Lead to these presents annexed, was assigned according to the Form of the Statute by the Master Wardens and Searchers of the said Society to the aforesaid Daniel Doncaster to mark his Files by him to be made."

The "Day and Year" were the 29th of May, 1778, "in the eighteenth year of the reign of our Sovereign Lord George III." The "Mark stampt in the Margin" looked something like this:

And the "said Society" was the "Company of Cutlers of Hallamshire, in the County of York" - the Sheffield Cutlers.

Hand-cutting of files, 1806

THE "AFORESAID" DANIEL DONCASTER was then 21 years of age, and had just completed his apprenticeship with George Smith, Filesmith. He had chosen to be a filemaker in preference to following his father's trade of "sope-boiler", and, whatever his reasons for making this choice might have been, he certainly pursued his new craft with great industry until his death in 1819.

There were many things he could not have known on that summer day in 1778. He could not have known that he would live to see his "Sovereign Lord George III" declared mad. He could not have known that within thirty years the great Revolution in France and the rise of Napoleon would have thrown Europe into turmoil. And he most certainly could not have known that a Company, still bearing his name, and still using his mark, would two hundred years later be celebrating those two hundred years of existence, and moreover that his great-great-grandson, the present Chairman of that Company, would one day hold the office of Master of that same Society which had just granted him his mark.

Hand-cut file, 1879

Until replaced by machines, the hand-cutting of files continued into the 20th century

This one thing he must have known: that there was a need for files to shape and smooth an increasing volume of iron goods and steel tools.

There was nothing new about the file itself. We may read in the Bible of how the Israelites "had a file for the mattocks, and for the coulters, and for the forks, and for the axes, and to sharpen the goads." Nor indeed was there anything new in its method of manufacture. The machine tool had still to be invented, rotary powered machinery, apart from that driven by wind or water, had not yet been seen. Nevertheless the move from an agricultural to an industrial society had already started, so that Daniel began his filemaking career at a propitious moment in his country's history.

Daniel must soon have discovered that as a newcomer to the trade his market for files in the Sheffield area was limited. It may well have been that there was no shortage of local competition even in those far-off days. At all events, he soon began to travel, on horseback, farther and farther afield. His son Daniel tells us that in later years his father would spend three months in every year in the saddle, bearing great discomfort, visiting places as far-flung as the Scottish Border, Bristol, and London. He goes on to say that his father's business "for that time, was considerable and profitable – his files and rasps had a good reputation. He understood his work and was careful in his superintendence."

Daniel I died in 1819. By that time it was becoming increasingly difficult for the small firm to make a profit from filemaking. His sons William and John carried on as best they could, John travelling, and William minding the business in Allen Street. Towards the end of his life Daniel had installed converting furnaces. He is listed in the Sheffield Directory of 1817 as a file manufacturer and steel converter; William and John are similarly listed in the Directory of 1821. It was the conversion of the very pure iron of Sweden into quality steel, using the slow and expensive traditional methods of the time, that ensured the continued existence of the firm for the next half century.

John died in 1825, and William was joined in partnership by his youngest brother Daniel in 1829. Daniel II had been apprenticed to a draper in York, but he seems within a short time to have obtained a clearer view of the file business than his brother. As the young brother, the travelling side of the business fell to his lot, and one may surmise that in his three or four years on the road, exposed not only to the elements, but to the fierceness of the competition, he could not see any profitable future in making and selling files. So in 1833 the partnership was dissolved, the assets divided, and Daniel concentrated on the manufacture of steel. He did well. His first year's profit was about £250, nearly eight times the profit shown in the last year of the partnership. But with the decline in file-making Doncasters were to be without an "end-product" for almost a century, until the first hardened steel roll was produced.

Doncaster Steel, Sheffield,

Oct. VII 1857

I take the liberty of handing you a current Price List of Steel delivered in Sheffield.

Yours respectfully, H. Doncaster

BLISTER STEEL.

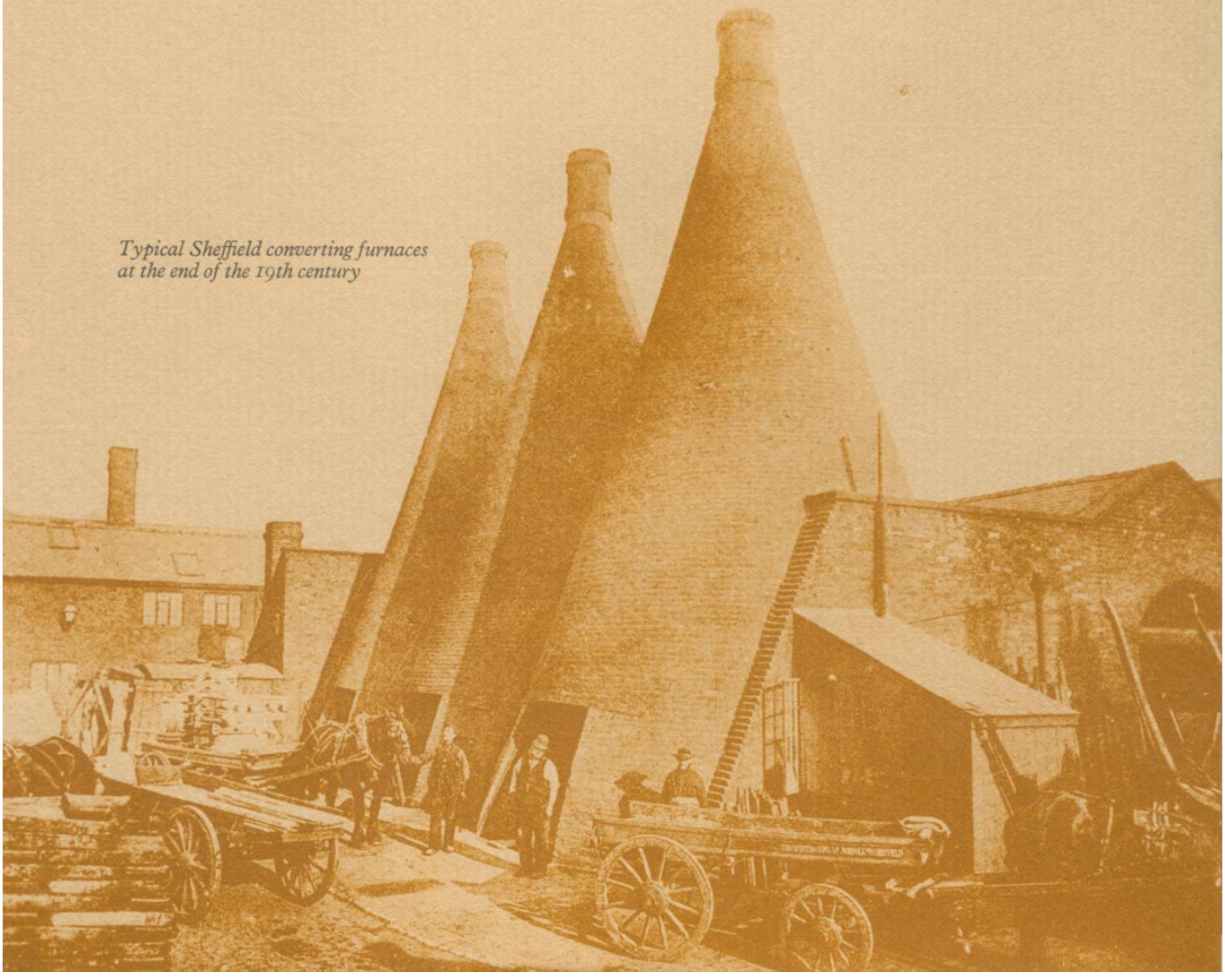
TERMS. Estimated Cost Price as under + 2½ % com. Cash within one month of date of invoice.

N.B.—Our No. 1 Temper is a Spring Heat; No. 2, Cutlers'; No. 3, Shear; No. 4, File Heat; No. 5, Steel through; and No. 6, Hard Melting.

Mark.	Size.	Temper.	Price.	Mark.	Size.	Temper.	Price.
				*D	3 in.	to arrive	20/4 d
English	1 to 2 in sq	No 2	14/5	CCND	3 in.	No 2 to 5	19/10
HP		No 6	16/10	RF	3 in.	No 2 to 4	19/10
HPS		to arrive	17/4	GD	½ × 2 in 7 3 ins.	No 2 & 3	20/11
C	3/16 to 1 in	No 1 to 6	17/4				
UG		No 6	17/10	BF	3 in.	No 2 & 5	21/11
HP		to arrive	17/10				
LSH	1/2 sq	No 2	17/4	RWn		No 5 to 6	24/10
GH	3 & 3¼ in	No 1	18/4				
CST		Best to 1		*S*	cast	No 2 to 4	26/10
TW	3 in.	No 2 to 4	19/4		cast	No 2 to 6	27/10
					cast	No 5 & 6	28/10
KB		No 5 to 6	19/4	B	cast	No 2 to 6	31/10
				W	3 in.	No 3 to 6	31/10
FINSPONG	3 in.	No 1 to 6	18/4	OO	cast	No 2 to 6	34/10
E	3 in.	No 2 to 4	19/10	G	cast	No 2 to 6	34/10
CB	2½ in.	No 2 to 4	19/10	L	cast Sign	on furnace	35/10

This 1857 Doncaster price list for Blister Steel made by the cementation process includes products from the celebrated pure Swedish irons

DANIEL II's DECISION to concentrate on steel making was not in any way revolutionary. In the Sheffield Directory of 1833, of the total number of file, edge tool, and saw makers, one third were also engaged in the conversion of steel. Others had become aware of the difficulties. Daniel II may not have been the first to respond; but he did respond, and – not for the last time in the history of Doncasters – with considerable energy and determination. For the next 30 years, in Doncaster Street, where his father's garden and orchard had been, he busied himself with the cementation of Swedish iron into "blister steel", heating long flat bars of the material in charcoal for days on end until he was satisfied that the process was complete. His product could be sold directly to the crucible re-melters; or he could send it to one of the local forges for hammering into the well-known "shear" or "double-shear" steels which he then sold to the cutlery and allied trades. In 1862, ten years before his retirement, he took his three eldest sons into partnership. It was not long after this date, that he changed the name of the business to Daniel Doncaster & Sons. Of the three sons, Charles I was



Typical Sheffield converting furnaces at the end of the 19th century

eventually to become the chief partner, and the main-spring of expansion until his death in 1884.

By 1862, the great age of Victorian engineering had arrived. The Stephensons, Brunel, and many others had laid a pattern of railway lines upon the countryside; the iron, and later the steel ship was taking the place of the traditional wooden vessel. Men could marvel at the *Great Eastern* steamship – 22,000 tons, 692 feet in length, on its hull some 30,000 wrought iron plates fixed by 3,000,000 rivets. They could gaze in awe at the magnificent Britannia tubular railway bridge, more than a quarter of a mile long, spanning the Menai Straits. The Crystal Palace dominated its surroundings. Anything was possible. Bessemer, Siemens and Martin had slashed the price of steel. The powered machine tool was becoming common, with its insatiable appetite for cutting tools.

The Doncaster family responded. Cast steel was needed for the tools. Daniel II installed a crucible furnace, a second was soon added, and later on a third. It is not without interest to note that crucible steel continued to serve a need until the middle of the present century, despite successive improvements in other steels and methods – high speed steel, electric arc melting, and finally the induction furnace. It was the latter which put an end to the trade.

As the century drew to its close, the background had begun to alter once again. Doncasters had from the early years imported and

A

B

A *Doncaster cementation furnace with charge material*

B *Treading the clay for crucible pots*

C *Weighing "ingredients" for a crucible steel "recipe"*

D *Preparing to teem crucible steel*

C

D

merchanted those same pure Swedish irons which they used in their own steel making. Ⓛ from Leufsta was a notable example. Known as "Hoop-L", this famous mark was sought by the cutlers and melters of Sheffield, and by blacksmiths throughout the country. To this trade was to be added, from 1883 onwards, the importation and stock-holding of the much-prized Swedish Bessemer steels. There was, however, a problem. The imported ingots had to be hammered to sizes suitable for the customer before re-sale. Doncasters had no hammers. In typical Sheffield fashion, they arranged for the hammering to be carried out on their behalf as "hire-work", and much of this business was placed with a small forge owned by John Denton on land which was almost an island, just off the road to Penistone. But by 1898 Doncasters were not finding it easy to compete with a rival who had his own hammers, hammers which moreover were bigger and better than those of John Denton. We shall see later what action Doncasters took.

Doncaster cementation furnaces 1941

Six pot crucible furnace hole ▶

During the last twenty years of the century, while the Swedish Bessemer trade was growing, alloy steels of various types were beginning to find favour. Forms of the alloying metals tungsten, manganese and chromium were in demand. In the tradition of the second Daniel, who, whenever the time seemed right would make the most of a profitable opportunity, Doncasters had begun from about 1870 onwards to purchase not only for their own use, but also for merchanting, the manganese-bearing "spiegeleisen" – "looking-glass-iron", so-called because of its shiny appearance when broken. This material was in fact used primarily as a cleansing agent in steel making. Later on, however, a trade was to develop in materials specifically required for alloying purposes: some nickel was purchased as early as 1892, to be followed by tungsten, ferro-chrome, and ferro-vanadium.

ABOVE
Denton's Upper Slack Forge, on the Loxley river, Penistone Road c. 1880

RIGHT
Doncaster workers on the banks of the river Don, Penistone Road c. 1905

The year 1897 marked the Diamond Jubilee of Queen Victoria. The fleet stood at anchor for review at Spithead, and the whole nation rejoiced. And in that year, because of the difficulty in finding hammer capacity for the Swedish Bessemer, and because of their interest in alloy steels, the Doncaster family was once again poised for change. With the death in 1884 of Charles I, the responsibility for running the business had come to rest upon the shoulders of a younger brother, Samuel – "Mr Sam". He began by taking into partnership his brother-in-law Herbert Barber who had entered the business some years before. He was then joined by Charles I's son, James Henry – "Mr Harry"; and, in 1898, by his own son Charles Mallinson – "Mr Charlie". It was to be Mr Sam, Herbert Barber, Mr Harry, and Mr Charlie (accompanied a few years later by his younger brother Basil Wilson – "Mr Basil") who would be in charge of the fortunes of Doncasters over the next several decades. They

were responsible for the next real change in the scope and products of the business.

Mr Sam and Herbert Barber began by making two decisions. In 1898 they demolished the three existing 6-hole crucible furnaces, and replaced them on a new site close by in Hoyle Street with an efficient 24-hole furnace; and in the same year they bought the Penistone Road

Sheffield stockyard and transport c. 1920

forge from John Denton, to re-equip with steam hammers up to a weight of 5 tons, and to fight the competition in Swedish Bessemer. This, as we shall see, was not to be the last of Doncasters' acquisitions of existing businesses and factory sites; but it was a vital step in their development. From then on the men who worked for Doncasters were to possess skills of a very different sort. The traditional craft of the melter was to be replaced by the hand and eye of the forge-man, whose experience told him the exact time at which to draw the material from the furnace, how hard and for how long to hammer it, when to re-heat, and when the desired size had been attained. These skills were acquired in part with the purchase of the forge. But as the years passed they were to grow, embracing the work of more difficult materials, their heat treatment, the use of more complicated equipment. Mr Basil has recorded an early incident:

> "*Once walking past . . . our best finisher, he stopped me, and said he didn't like the way I looked at him. I asked him what he meant . . . He replied that he imagined that I was thinking 'There is Bob idling, doing nothing again.' As a matter of fact, he explained, he was on with high speed steel, and you could not force high speed steel. It was the same as this – if Mr Sam said 'Now Basil thou's got to do this,' you might say you wouldn't, but if Mr Sam said 'Now Basil thou'll do this to please me' – you would, wouldn't you? Well it's just the same wi' high speed steel – you've got to coax it – you can't drive it.*"

Such were the men who worked under the forging hammers.

A Doncaster crucible pot of molten steel

BELOW *Doncaster recipes for crucible steel from the 1880's*

RECIPES

FOR

THREE MAIN OR STANDARD TEMPERS OF STEEL,

From which any intermediate tempers can afterwards be arrived at.

No. 1 FOR SAW FILES, &c.,

CONTAINING 1.30 % CARBON

24 lbs. Swedish Bar Iron
20 „ Warner's Carbonizing Iron
1 „ Speigel eisen.

No. 2 for TOOL STEEL for TURNING, &c.,

CONTAINING 1.10 OF CARBON.

34 lbs Swedish Bar Iron.
15 „ Warner's Carbonizing Iron.
1 „ Speigel eisen.

No. 3 FOR SAWS, TABLE KNIVES, &c.,

CONTAINING .75 OF CARBON.

40 lbs. Swedish Bar Iron.
4 „ Warner's Carbonizing Iron.
1 „ Speigel eisen.

The Speigel is added for the purpose of neutralizing the sulphur, every part of which requires 7 parts of Manganese to neutralize it.

As the present century opened, the history of Doncasters had almost, but not quite, entered its third phase, that of shaping metals to satisfy the many requirements of the new age. In those early days of the Penistone Road forge some shapes must have been produced: we hear, for instance, of locomotive pistons. But the trade was still essentially in tool steels. It was a lucky mistake in addressing an envelope which, although indirectly, helped to bring about that change in the emphasis of the business of the Company – for Doncasters had become a private Company in 1902 – which was to be of such importance in the years to come. An enquiry in 1907 for die blocks to a well-known Birmingham firm, the Martino Steel and Metal Co. Ltd., New Caledonia Works, was wrongly addressed to Sheffield instead of Birmingham. This enquiry was delivered to Wm Turner and Sons Ltd., "Caledonia Works", in Sheffield. Having opened the envelope in error, Turners forwarded its contents to Martino, at the same time indicating their willingness to supply the blocks since they were in the business, and Martino, they believed, were not! In the event, Martino obtained the order, and re-ordered on Turners, who in turn placed the order with their own suppliers Doncasters. And so there began an association with Martino which quickly developed into a thriving business in die blocks; more significantly it led to an increasing use of Martino's range of engineering steels, to forged shapes in their materials, to the introduction of heat treatment on the Penistone Road site, to the installation of the first drop stamping unit in 1916 – a major step, this – and finally to the joint entry in 1920 of Martino and Doncasters into the United Steel Companies.

The memory of the original Doncaster site remains in this 1978 street sign

WHILE THIS RELATIONSHIP WITH MARTINO was developing and maturing, Doncasters were becoming involved with yet a further range of materials, which paved the way to a very different type of forging. In 1912 Doncasters were asked to quote for the supply of a steel which must possess some rather demanding properties. It must exhibit "an absence of scaling and malleability at temperatures between 700°C and 1100°C, together with high tensile strength both initially and at high temperature." The material was needed for the poppet valves of an internal combustion engine. In response to another enquiry a little time later, Doncasters supplied a modified form of one of the tool steels in their range; and so a new, if only temporary, use was found for a tool steel – but the supply of later and better types of valve steel became an interesting side of the business. It also showed from which direction the wind of change was blowing. Some valve forgings for the Gnome Rhone engine were later to be made in the smithy, but it was some years before serious production was started with the acquisition of "various assets" from the Brunswick Drop Stamping Co. Ltd.

The Great War broke out in 1914, and through those wartime years, by the agency of their association with Martino, of the new drop stamping unit, and of the valve steel trade, Doncasters

Penistone Road forgemen in 1928

were entering the business of the motor car, the omnibus, and the lorry. The railway business had largely passed them by. Through the whole of the 19th century the family attention had almost entirely been devoted to the continually growing demand for tool materials. But they were from now on to concentrate more and more on supplying the needs of the age of convenient motive power, of power transmission, and of popular transport. They were founder-members of the Drop Forgers' Association when it was formed in 1918. The third phase in the history of the family and the firm had been ushered in. There was no drama at the beginning, but we shall see that as England and the world moved on through the years of this century, so did the pace of progress and expansion accelerate dramatically.

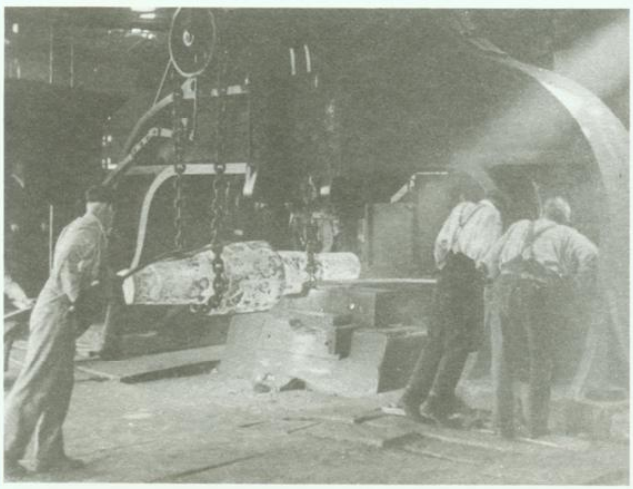
The fifteen years after the end of the Great War were to be difficult for most businesses, and Doncasters were no exception. In 1920 the Company became a part of the United Steel Companies, and this helped it through the bad years. United Steel offered not only financial support, but also assisted with sales outlets and organisation. In order to expand the sales of its materials, and in particular of its alloy steels, the parent company encouraged the growth of drop stamping. A new stamp department was soon established, which later included a counter-blow hammer of great power. The necessary heat treatment and die-sinking facilities were installed. New skills had to be learned: how to work "off the bar"; the change in the sound of the blow as the stamping approached its final thickness; the judgement of "offset" and of "fill". The air was heavy with the smell of the burning sawdust which lubricated and extended the life of the dies, so painstakingly carved by hand in the die shop; for the die-sinker also had become a vital member of the workforce. The production of drop stampings became a major part of the business. An order from the Vauxhall Motor Company marked the birth of an association which was to grow through the years, and has lasted to the present time. Valve forging was also introduced, and would eventually itself occupy a position of some importance in the Company's activities. The steam hammer business continued: ingots were cogged; blocks, blanks, bars and shafts were forged. The materials belonged not only to Doncasters, but also to their customers, for with the Denton forge had come an active participation in the Sheffield hire-work business which continues to this day.

Mr Sam died in 1934 at the age of 80. He had been succeeded as Chairman in 1931 by his nephew Mr Harry. But by then the main burden was being carried by three men: Ronald Steel, of whom we shall speak in a little while; Mr Charlie; and Mr Basil.

Mr Basil – who can forget his unfailing courtesy even to the youngest employee? And his sense of humour, not perhaps always appreciated. He describes the first critical meeting with the newly appointed Managing Director of an important Group:

> *"No one seemed to want to say anything and so, as usual, I stuck my neck out and asked whether I could tell a story . . . I referred to a recent incident in which, when I was dictating, I had said something about this Group . . . My typist however thought that the word I used began with 'T' not 'G', but instead of putting 'troop' (a company, a band of soldiers, etc.) put 'troupe' – a band of actors, performers or mountebanks. This . . . did not seem to amuse, and I got no good marks for my humorous effort – nor did I ever quite live it down I fear."*

Mr Basil's particular concern had been the tool-steel trade, and the development of the valve business, and these were interests which he never lost. He was to become Chairman in 1948 on the death of his brother, and to retire in 1955, two years after the Company had become public.



ABOVE LEFT
Heavy forging before the days of mechanisation

ABOVE RIGHT
Grinding drop forgings prior to machining in 1928

LEFT
A battery of Sheffield drop stamps in the 1920's

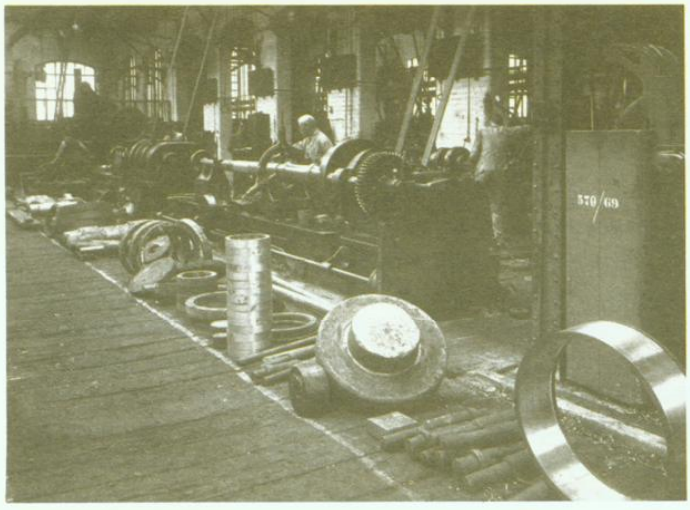
No account of the history of Doncasters would be complete without mention of Ronnie Steel. He was appointed to the Company by United Steel in 1931 as General Manager. A Director of the Company, he exercised an increasing influence upon Doncasters' affairs as the years passed. Shortly after his arrival he was instrumental in providing the firm with its first end-product since the file – the hardened steel roll. Used in the cold rolling of metallic strip and foil, this highly specialised roll had largely been made outside the shores of the United Kingdom, and there was a need for an indigenous source of supply. Forging, heat treatment, subsequent machining and grinding – all these operations had to be performed with scrupulous care, and were intolerant of slip-shod work. New equipment was installed, methods were developed and perfected, yet further skills were acquired, and the name of Doncasters became known in another section of industry. Ronnie Steel made the roll business into his own special province, and woe betide the hapless man – or woman – who was guilty of delaying the passage of one of his orders through the shops! He helped Doncasters to leave United Steel in 1936, and at that time joined the re-formed Company as Managing Director. His vision and energy were of great importance to the advance of the firm until his sudden death in 1963, after eight years as Chairman.

From 1936 on, the history is one of almost continuous modernisation and expansion. The activity of horizontal upset forging began in 1937 with the installation of the first small machine, the forerunner of many and larger machines. One year later there took place an event of no little significance. In Mr Basil's own words:

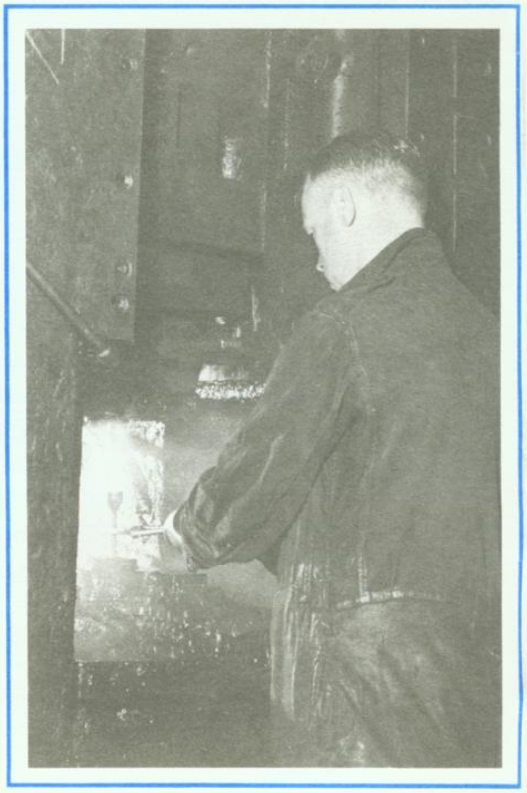
> *"Just before 5.0 p.m. one evening in April 1938, Ronnie Steel came running into my office and said 'I've got a meeting that I must go to at 5 o'clock and I have a lunatic in my office who seems to know a lot about valves. Can you take him down to the Board Room and give him a cup of tea'.*
> *He wasn't a lunatic, but a great enthusiast, and his enthusiasm was for valves . . .".*

It transpired that this "enthusiast" had just returned from the United States where he had become enchanted by a new and revolutionary method for forging valves by an extrusion process. The method was not unknown to Mr Basil. He had heard of it some years before, but the report had not been favourable. He was still doubtful, but became convinced a few months later that the method could no longer be ignored. From that moment on events moved rapidly, and by the outbreak of war in the following year, and with the assistance of Thompson Products in Cleveland, Ohio, the first of the many National Maxipres eccentric forging machines had been installed.

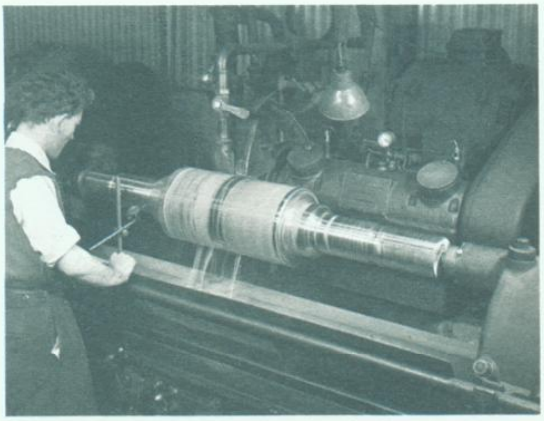
It is at this point that Richard Tobey Doncaster enters this account. The son of Mr Basil, Mr Richard joined the firm in 1939, working in the shops and learning the business. To him, and to the manager of the valve department, was entrusted this new project. They visited the United States, and on their return steered production through the first difficult months. It is said that at times they could scarcely be recognised beneath the thick black grease which was used in the process! Mr Richard became Managing Director in 1955, and succeeded to the Chairmanship in 1963, after the untimely death of Ronnie Steel. The present Chairman, he has guided the Company through the last fifteen years of growth including its entry into Inco, finding the time for a diversity of outside interests, not the least of which has been his participation in the affairs of the Cutlers' Company, whose Master he became in 1972.



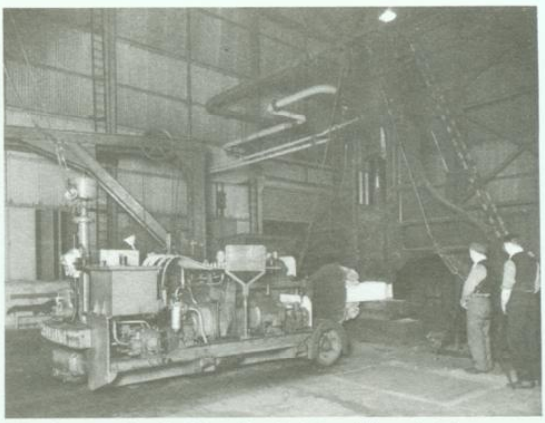
ABOVE *The forge machine shop in the 1930's, now an engineer's store*



RIGHT *The first stage of valve extrusion*



Precision grinding of a hardened steel roll to a polish finish



The first mechanical handler in New Victoria Forge 1947

And so in 1939, for the first time outside the United States, the manufacture of valves by forcing a solid cylindrical slug of hot metal down a tube, and through a hole at the bottom to form a stem, began at Penistone Road. This process today forms an almost indispensable step in forging most of the turbine and compressor blades which are produced at Leeds. It is strange to reflect that Mr Basil was once reliably informed that it would never work!

In 1939 the country again went to war, and for the next six years the efforts and resources of Doncasters were channelled into the manufacture of many of those steel products which suddenly became so vitally necessary. Rocker arms, valves, propellor hubs, connecting rods, gears, these and a variety of other parts were forged in large quantities for delivery to Rolls Royce, the Bristol Aeroplane Company, Vauxhall, Leyland, and other famous names besides.

The end of the struggle in 1945 saw Doncasters increased in size by the installation of a second valve press and a second upsetting machine, and by extensions to the roll and machine shops. Expansion continued. The New Victoria Forge was built for ingot cogging. Fully mechanised, it was the first of its kind in the country. In it there roamed a huge mechanical creature with a giant claw, which handled the material, served a battery of furnaces, and gripped the hot metal even as it was being hammered. No more cranes, slings, and levers! There were bigger eccentric presses, now to be used for the rapid production of closed-die forgings in multi-stage dies. There were larger upsetting machines.

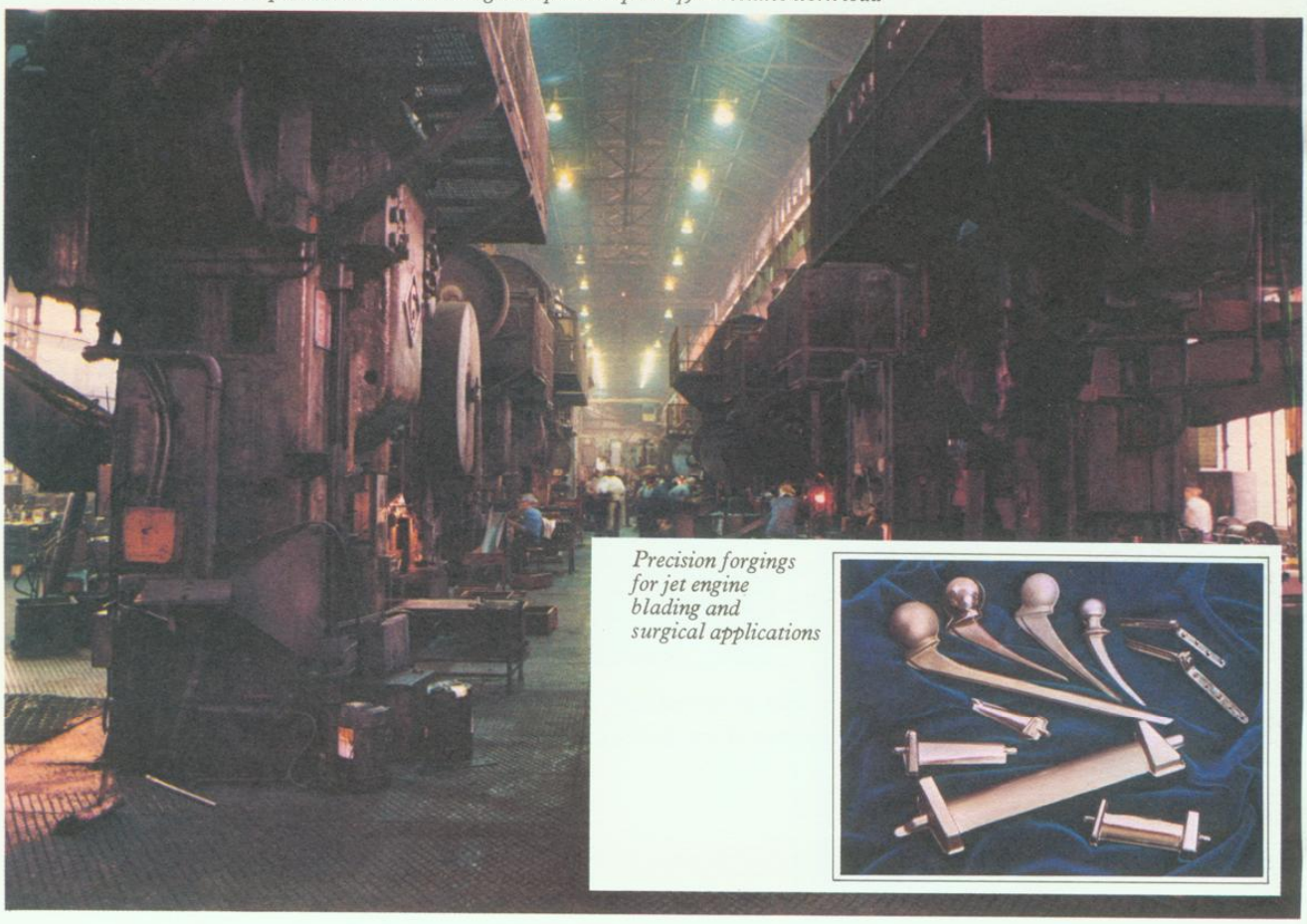
Not long after the end of the war there was added to a diverse order book a request from Rolls Royce to try to make a few oddly shaped parts in a material consisting almost entirely of nickel. They were to be machined into turbine blades for the now fast developing gas turbine aero-engine – the 'jet'. They were successfully hammered, although we may believe that the dies bounced a little in the final blows. And with the production of those first 'Nimonic' stampings there began a new, and immeasurably fruitful stage in the relationship with Rolls Royce already established by the wartime production of Merlin engine valves and other parts. There began also an increasing interdependence between Doncasters and the makers of this new material, Henry Wiggin, which was recently strengthened by the purchase of Doncasters by Inco.

As the century moved into its second half, fortune smiled again on Doncasters. They purchased a derelict Victorian factory site with an interesting history of its own not far from the

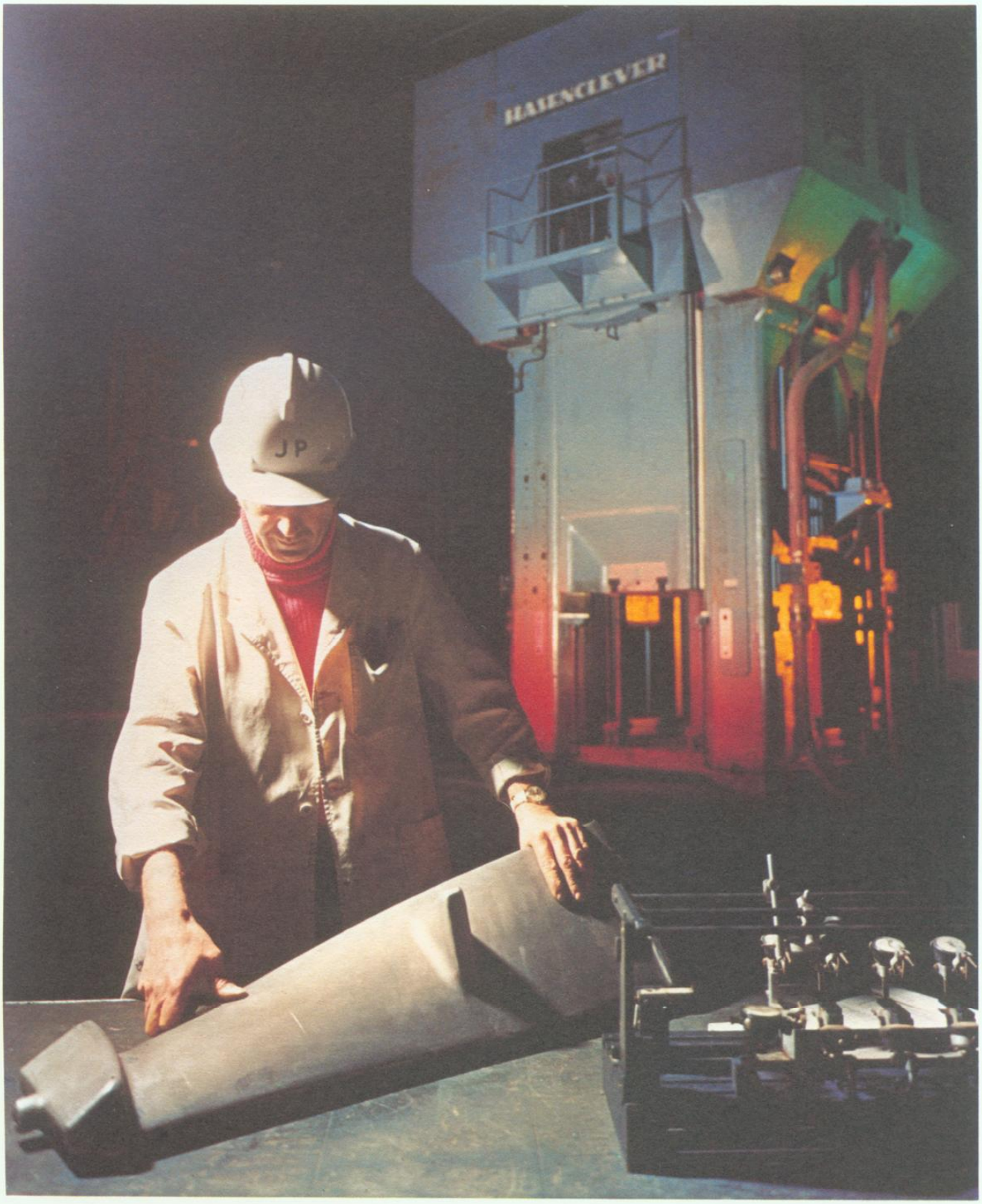
centre of Leeds. The Monk Bridge Iron and Steel Company had owed its prosperity to the railways, and on their decline had failed to meet the challenge of the new age. Doncasters did not suspect, in 1951, just how important this acquisition was to be. They were doubtful; they thought, but were not sure, that there would shortly be a large increase in the need for valves and drop stampings, and that additional space would be needed. But a jet-powered civil air-liner was under test at De Havilland; and military jet engines were urgently needed for the war in Korea. Sheffield was already busy with the manufacture of some jet blades. It was soon decided that the Leeds site should be given over, at least in part, to the manufacture of these difficult precision components. Within a dozen years, making virtually nothing but blades, Monk Bridge was rivalling its parent company in size, installing larger and larger presses the while. Erected in 1974, the latest press can exert a force in excess of 14,000 tonnes!

Some five years after the purchase of Monk Bridge there was a further acquisition, this time on the other side of the Pennines, in Oldham. In an old mill at Moorside there began the machining of precision blade forgings which were sent across the hills from Leeds. Although it was a landmark in the development of Doncasters, this activity was never in itself to be of any great consequence; but the importance of Moorside increased sharply with the supply a few years later to Rolls Royce of a hollow turbine blade. Lengthwise holes had to be accurately drilled in each forging, whose aerofoil was then again deformed between dies to establish the desired internal and external shape. The hollow blade became of major significance to the Oldham business, and its production has continued to the present time. An increasing competence in machining led before long to a further diversification. Work started at Moorside on the manufacture of the by now well known Pilgrim nut. This nut could be designed in any desired size – Moorside was to concentrate on the larger sizes –

The Screw Press Department at Monk Bridge has presses up to 14,000 tonnes work load

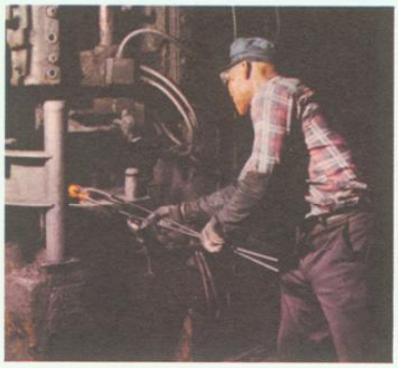


Precision forgings for jet engine blading and surgical applications



This giant Screw Press at Monk Bridge is among the largest in the world for precision-forged turbine and compressor blades, discs and special components

Precision forging at Monk Bridge depends on precise timing and placing of the hot piece by the furnace man



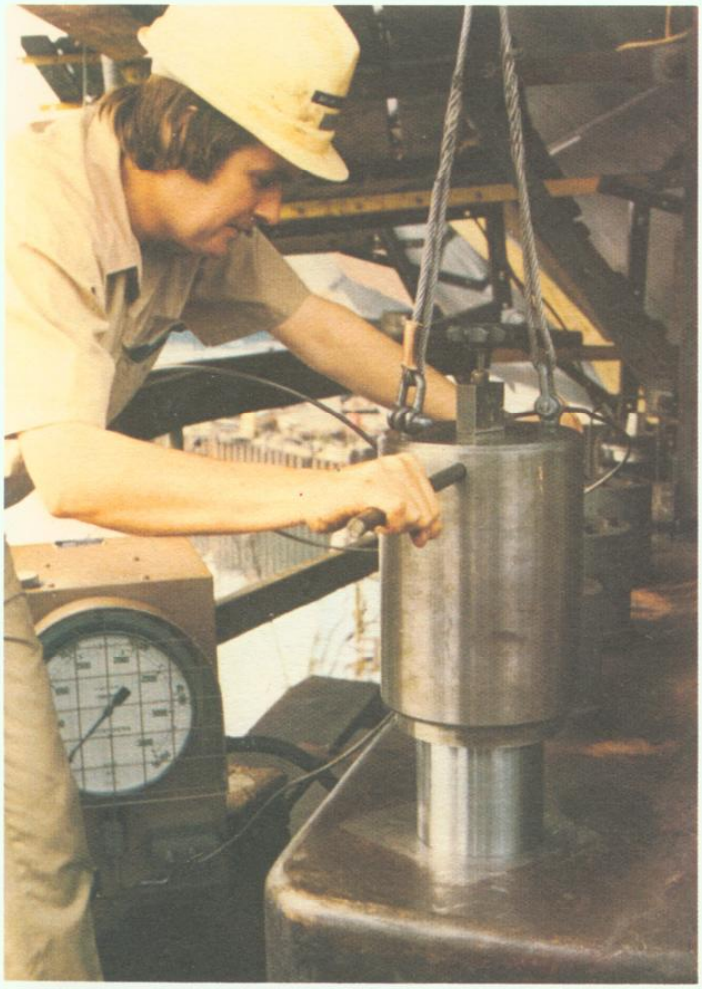
Blade measurement takes place at many stages of inspection. Visual read-out of tolerances plays an important part in the final product

Precision die making is one of the key items in the success of precision forging

ABOVE *As blades get bigger and aerofoil forms more complex, shutter gauge systems ensure accuracy of inspection*

LEFT *A Rolls-Royce compressor rotor finished from Monk Bridge titanium precision forged blades*

and had an in-built hydraulic tensioning and release system. It was to be sold to ship owners and builders to replace the nut which traditionally holds the screw on to the propellor shaft, and which, once tightened, is notoriously difficult to dislodge. To the Pilgrim nut was later added a range of hydraulic fastening and tensioning devices, of use in fields of engineering far removed from the original marine application. For the third time in its history, Doncasters had an end product.



ABOVE *A Moorside sales engineer positioning a Morgrip bolt to fix a ship's rudder at a shipyard on Tyneside*

ABOVE *Hollow turbine blades are checked dimensionally at every step in manufacture at Moorside*

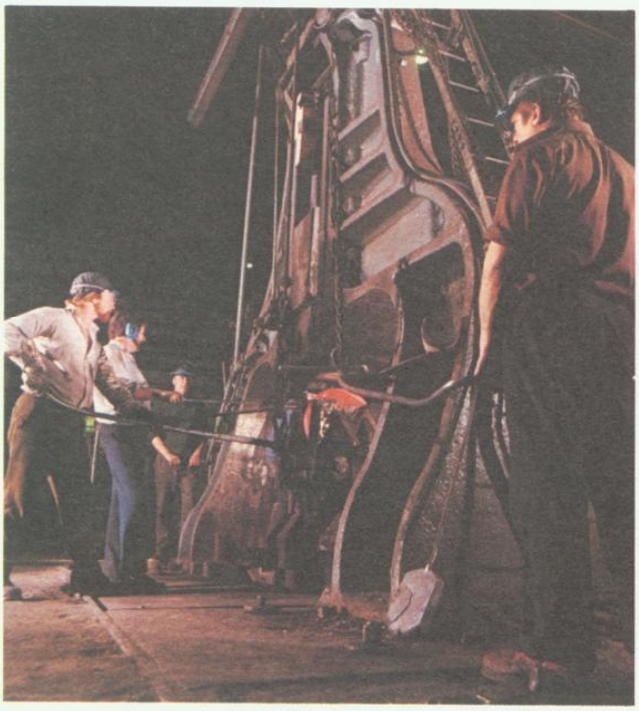
ABOVE *Automatic and precisely spaced drilling of flange bolt holes is done on this specialised machine by John Brereton & Co. Ltd at Oldham*

BELOW *Morgrip bolts are automatically machined on a numerical-control lathe, then checked for accuracy by the Moorside operator*

BELOW *Rolls-Royce hollow turbine blades are hot coined to aerofoil form on a screw press at Moorside*

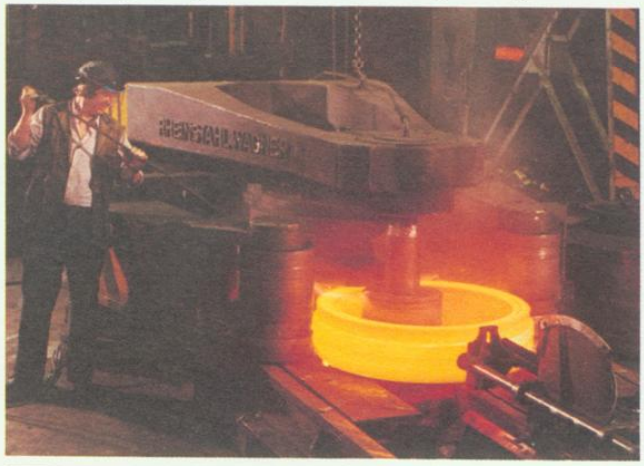
One further end product remains to be described – the pipe flange. From about 1962 onwards Doncasters had been supplying open die forgings to the small Manchester firm of John Brereton and Company. These forgings could be in materials extending from carbon steel to advanced corrosion resistant alloys; they were machined into pipe flanges for use on oil rigs, and in chemical and petro-chemical plant. Brereton was purchased by Doncasters in 1973, and later transferred to Moorside in 1977. This acquisition gave Doncasters a direct entry into the growing market for special flanges to suit a variety of applications and environments.

In parallel with this expansion into blades and other components there occurred a considerable growth in the open die hammer business at Penistone Road. To satisfy the need to expand, Doncasters bought in 1957 the Blaenavon Iron and Steel Company in South Wales. This was another site rich in industrial history. During the 18th century the Blaenavon works had smelted pig-iron, mining and quarrying its own raw materials. One hundred years later there had begun the



LEFT *The 50 cwt steam hammer at Blaenavon makes preforms which are finished by ring rolling as well as specific shapes for aerospace, oil and chemical plant*

BELOW *Blaenavon's speciality since 1967 has been the profile rolling of rings up to 3 metres diameter in aerospace alloys*

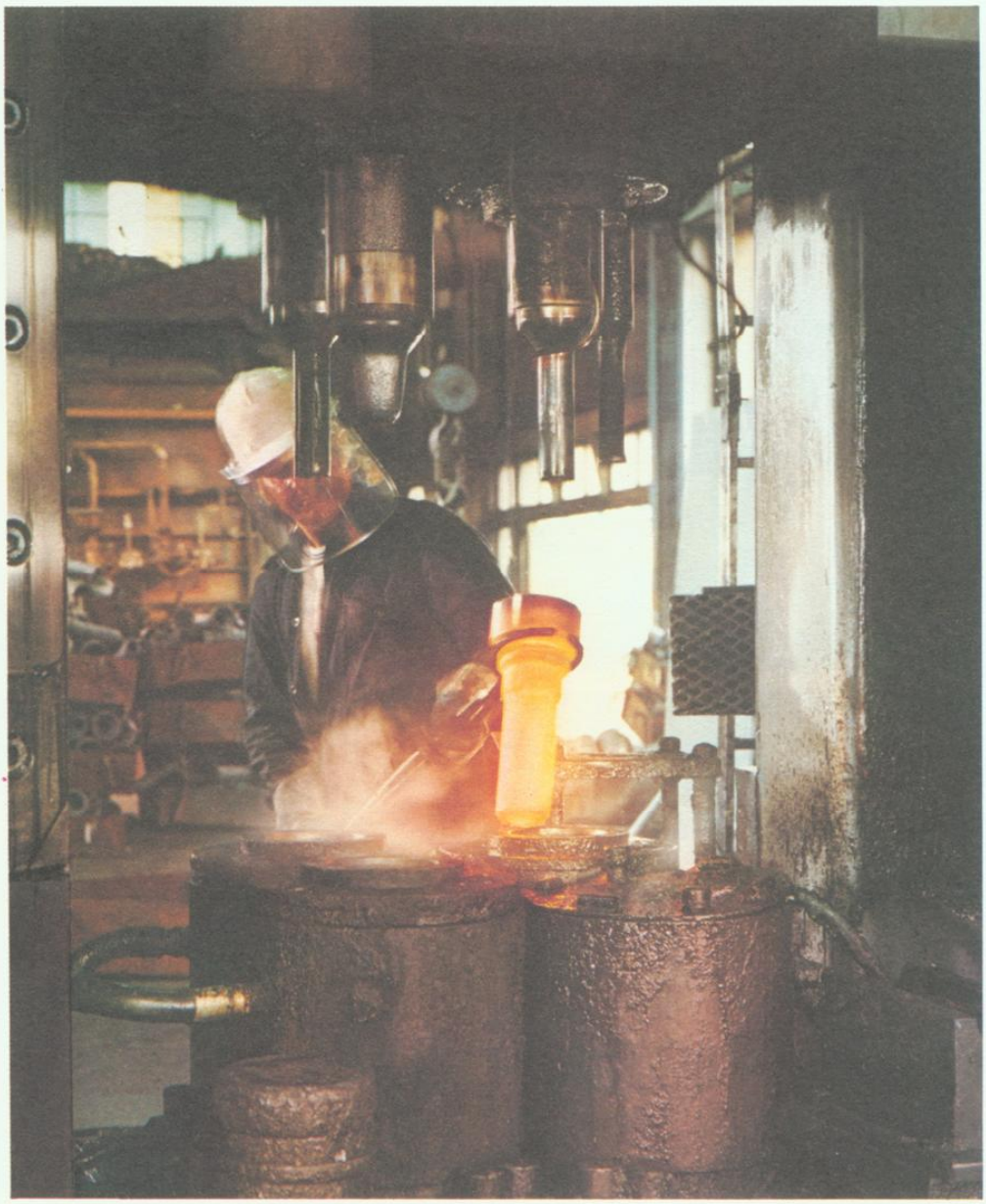


A titanium alloy ring, destined for a jet engine is machined at Blaenavon before final testing

Aerospace components require a series of non-destructive tests after forging, including ultra-sonic immersion crack detection

Blaenavon ensure quality control by marking identification codes on every ring

melting of steel, using the new Bessemer and open-hearth processes. A monument in the factory now commemorates Sydney Gilchrist Thomas' experiments which led to the ability to use high phosphorus pig-iron in the Bessemer convertor. During the first world war Blaenavon had been regarded as the largest iron and steel works in Europe, but like the old Monk Bridge Iron and Steel Company it had not been able to adapt successfully to the changing needs of the twentieth century. Doncasters brought new life and a new appearance not only to the factory, but to the small township, again with products and techniques which perhaps could not have been foreseen at the time of acquisition, and with improvements to the surrounding landscape. Blaenavon was originally purchased to supplement the Penistone Road output of the traditional hammered products in the traditional materials, but has ended by supplying the gas turbine and chemical industries with forged and part-machined rings in titanium, nickel-based, stainless and other alloys – the same alloys which go into the blades of Monk Bridge. The earlier rings were hammer forged, but a modern ring rolling unit was installed in 1967.



Starting from solid billet, the Lasco 630 ton extrusion press at Sheffield produces hollow axle hubs for heavy trucks

In 1974, by taking over a part of the Dudley factory of Wright Hingley, Doncasters added to their resources a further complete and working ring rolling facility.

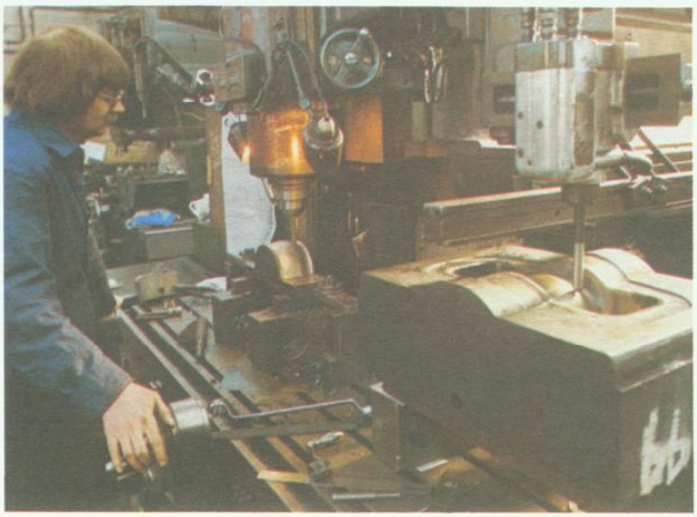
During the years of expansion from 1951 onwards much had also been happening in Sheffield. There was no room at Penistone Road for the special testing and development which were needed to support the growing aero-engine business, and in 1958 new laboratories were established at Birley House, on the outskirts of Sheffield. To these was soon added the Group Headquarters; separation from the day-to-day activities of Penistone Road would make it easier to administer the newly acquired companies.

The Penistone Road works itself was not being neglected : a second mechanised forge was

ABOVE *A diesel rocker arm starts its forging process on a Whittingham & Porter Press*

LEFT *Sheffield Stamp Inspection Department handles a wide range of shapes, weights and test requirements every day*

ABOVE *The die for a tractor steering arm nears completion in Whittingham & Porter's die shop*



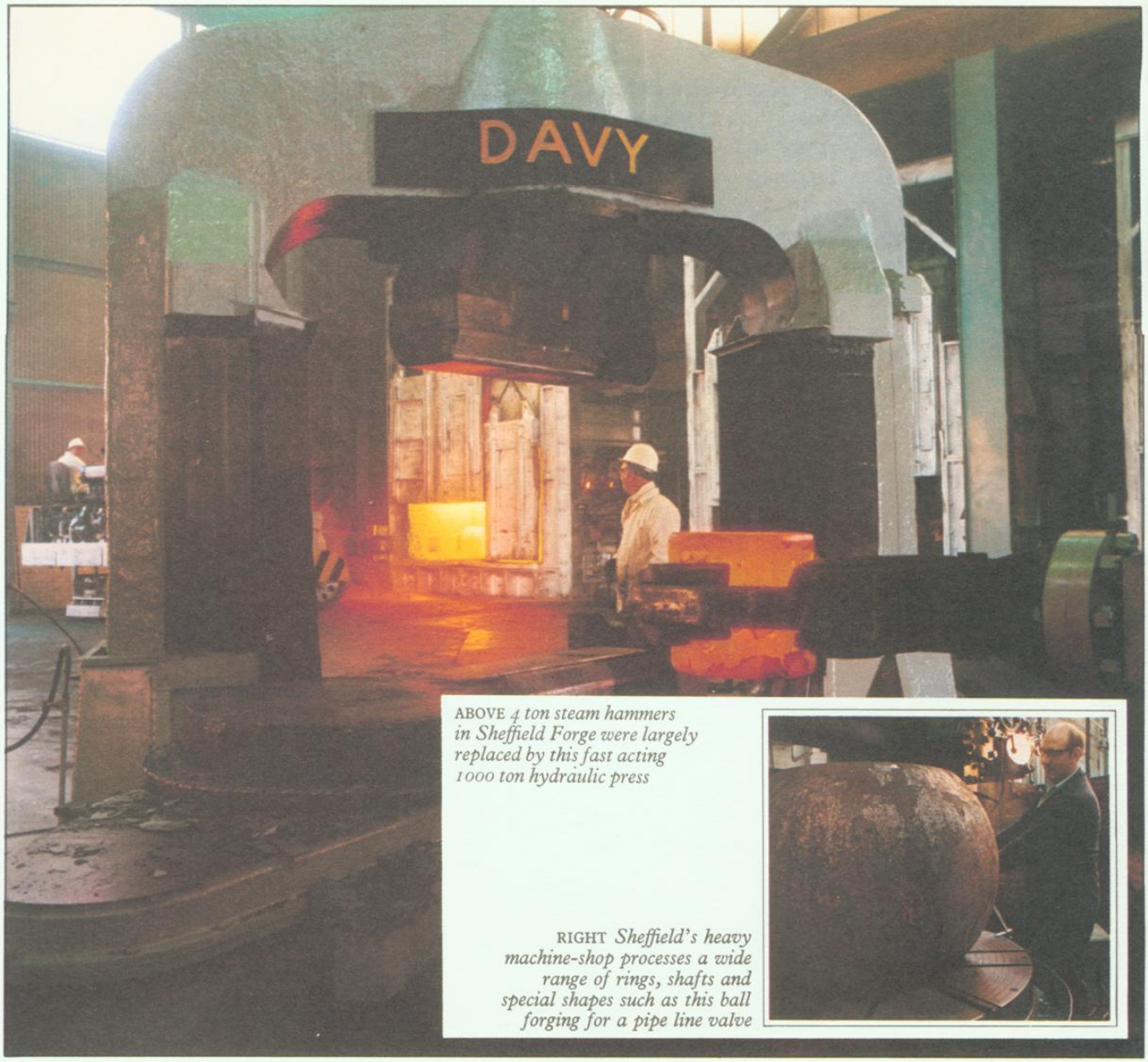
LEFT *Copy-milling on a heavy duty die sinker in the Sheffield die shop*

built by the side of the New Victoria Forge; there were further eccentric presses, a new die shop, billet shears, a modern 1500 ton hydraulic cogging and forging press, affording perhaps still one of the most interesting spectacles in the factory, a high frequency melting furnace – for at long last the old crucibles had become dated, and there was to be no more melting at Hoyle Street. The list is endless. Modern high output extrusion presses, additional heat treatment and ancillary processing plant, a smaller hydraulic forging press, and a host of smaller items were installed.

The acquisition in 1973 of the long-established firm of Whittingham and Porter enabled Doncasters to extend still further its range of drop forged parts. Situated in the dockland of Hull, and with a history stretching back to 1880, Whittingham and Porter brought to Doncasters their own skills, their own outlook, and their own products.

ABOVE *The 1500 ton hydraulic press at Sheffield has a high output due to the forging manipulators and furnaces in the shop*

LEFT *Speedy mini-manipulators keep hot preforms and rings on the move at the Sheffield ring mill*



ABOVE *4 ton steam hammers in Sheffield Forge were largely replaced by this fast acting 1000 ton hydraulic press*

RIGHT *Sheffield's heavy machine-shop processes a wide range of rings, shafts and special shapes such as this ball forging for a pipe line valve*

In 1975 a fundamental change took place; Doncasters were bought by International Nickel. Once again there was a move to meet the needs of the times, creating opportunities, and leading towards the future. Doncasters now formed part of an organisation well experienced in the wider aspect of international trade.

Today, in 1978, we see the companies of the Doncaster group each still engaged in its own way in satisfying the requirements of the society of which it forms a part. The last twenty-five years have witnessed the addition of fresh skills to those of the forger and stamper. The activities of Doncasters increasingly involve people who understand the chemistry and metallurgy of the new materials and processes, workshop practice, the techniques of instrumentation and precision measurement, and many other subjects. But it is still men like Bob in Mr Basil's story who lend back-bone to the enterprise, men who know when to 'drive' and when to 'coax', men who are familiar with the countless tricks of the trade which experience alone can teach.

WE HAVE TRACED the growth of Doncasters towards the diversity of the present day, a diversity far greater than the Doncasters of long ago could ever have envisaged. Almost a century and a half have elapsed since the files of Daniel I began to give way to the manufacture and stock-holding of tool materials. Through the last seventy years this trade has in its turn been largely overshadowed by the forging, the processing, and the machining of engineering and aircraft components. To the widening range of Sheffield products have been added the rolled rings of Blaenavon and Hingley, the blades of Monk Bridge, the machine shops of Oldham, the particular aptitudes of Whittingham and Porter, and the research and development of Birley House. The older engineering materials have been augmented by stainless steels, by the light but strong alloys of titanium, and by alloys of nickel which are designed to operate at high temperature, or to resist corrosion in a variety of hostile environments.

Yet through the varied activity of 1978 there runs a common thread, which links the present with the early years of the century. The new type of product which was then introduced has been developed and exploited, but the market which is being served is still the same. Energy production and conversion, power generation, transport – these are the particular social needs which Doncasters still seek to meet. Doncasters' parts will be found in oil rigs, chemical plant, and power stations, in ships, aircraft, buses, lorries, and cars; and it is interesting to reflect that the parts themselves may have been machined by cutting tools whose steel has passed through a Doncaster factory.

Birley House has developed special apparatus for the determination of hydrogen in titanium alloys

Approval of forgings in high nickel-base alloys involves stress rupture testing at elevated temperatures in Birley House laboratories

Computer-controlled tensile testing is the latest addition to Birley House facilities

This pattern of work may reasonably be expected to continue, although the shapes and the materials may become increasingly complex. Society is now indicating its future needs. It is agreed that energy and raw materials must be conserved, that there must be less waste. Doncasters may be led into fields which cannot be foreseen. Some of their products may no longer be metallic, and some of the processes may seem to have little in common with forging. It may be that more parts will be delivered ready to fit without further work, for it is apparent that some final manufacturers are anxious to confine their activity as far as possible to design and assembly; and with the supply of ready-to-fit components will come a much increased responsibility for functional integrity.

It is too early to predict whether the Doncaster historian of fifty years hence will think it necessary to add a further phase to those three phases of development which have been outlined in this brief account. New products may be introduced; old machines may be discarded; old processes may disappear. But the people and skills of Doncasters will carry on, and the aim of Doncasters will remain, as always, the same: to provide, like Daniel I, those articles which they believe to be relevant to the social requirements of the times.

The company wishes to acknowledge
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in preparing the text of this book

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Birley House, Sheffield

Group headquarters, Research and Development laboratories

Subsidiary Companies:

DONCASTERS SHEFFIELD LIMITED

Penistone Road, Sheffield

Forgings and Drop Forgings for Capital Equipment, Vehicle and General Engineering Industries

DONCASTERS MONK BRIDGE LIMITED

Whitehall Road, Leeds

Precision Forgings for Aerospace, Power Generation and other critical applications

DONCASTERS MOORSIDE LIMITED, JOHN BRERETON & COMPANY LIMITED

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DONCASTERS BLAENAVON LIMITED

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