NAPOLEON

Napoleon is a 600 Tonne mechanical "Double Action" Deep Draw Crank Press, capable of producing seamless pressings of a an ultimate total maximum depth of 20 ins (500mm) and was designed and built by Harry Braime, his partner, Stanley Dobson, the Technical Director, and by their highly skilled Tradesmen. Napoleon was built around the same time that this factory was constructed by T.F. & J.H. Braime in 1911 & 1912.

This construction consisted of merging entirely new buildings with renovated earlier buildings dating from around 1850, built by the previous owners of the "Union & Brookfield Foundry Estate". The "Prospectus" issued by Tom Braime to borrow the funds for this investment stated that the reason that they had to relocate again in Hunslet, for what was the 2nd time in less than 20 years, was to build premises which were high enough to accommodate the largest of the new series of very high presses, which they needed in order to take opportunity to secure the new business. The Braime brothers were two of the first engineers in the UK to fully develop the new manufacturing process of Deep Drawing of metal.

DEVELOPMENT OF A NEW MANUFACTURING PROCESS

This "Prospectus" claimed that the existing buildings of Brookfield Foundry Estate, running along the far wall of the facility, parallel with Brookfield Street, were ideal because "they were already high enough" to accommodate the largest of the new mechanical presses, which they were designing and building in order to manufacture steel pressings. The process of deep drawing also needed a higher quality and more ductile type of steel with a smoother and more consistent surface "rolled" finish to minimise friction and achieve the consistency of the process. So the plan had been for Braime also to manufacture this new better quality of Steel themselves on this site too in Leeds to avoid the high cost of transporting it from South Wales. This

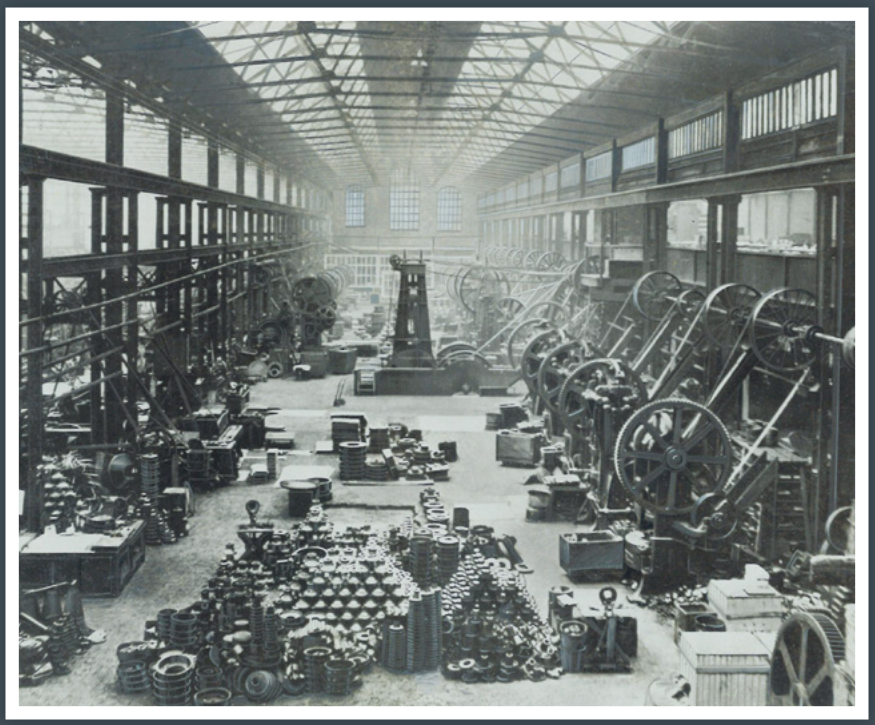
helps explain the huge height of the intermediary middle bay and the large 14 Tonne overhead crane, (which can still be seen running on its dedicated track over this bay, and would have been needed to move the steel billets through production.

"Napoleon" was one of a series of approximately 15 giant mechanical "Crank" Presses, designed by Harry Braime, with the support of his Technical Manager, Stanley Dobson, who was primarily responsible for the determination of the sequence of operations & for the manufacture of the "Tools", in the "in-house Toolroom", staffed by Apprenticed Engineers, also like both Tom & Harry Braime. Both the machines and the Tooling was built on site by their highly skilled workforce. Each press in this "series" was given its own personal name, such as "Napoleon", or "Kitchener". Pre-war rearmament began in 1912-13, so the project to produce their own special steel was abandoned to enable them to cope instead with the increase in the demand for presswork; the steel for production continued to be shipped by train from South Wales to the new Leeds Central station, very close to the factory; it was then moved by horse and cart to be delivered through the very narrow ornate decorated archway adjacent to the existing Visitor & Employee entrance; this same entrance was used to receive all steel materials by HGV's until this entrance was moved to the new Goods Inwards & Dispatch facility at the rear of the premises less than 10 years ago.

DEVELOPMENT OF A NEW MANUFACTURING BATCH PROCESS

Napoleon is called a "Double Action" draw press because it was designed to perform the two simultaneous actions required to draw a seamless product from a previously prepared shaped flat steel "blank" (circular, square or rectangular), pre-cut from a steel sheet. The first "action" is that the downforce of the press clamps the outer periphery of the "blank" to the top smooth face of the Die, into which is fitted the "Die" of the Draw Tool; while the second downforce of the press drives the shaped "Punch", which has been connected to the central ram of the press), and

this central ram drives the punch tool into centre of the flat steel blank, forcing the steel into the "die" cavity; under a combination of force and pressure, and with the help of the heat being generated; the steel is physically forced over the radius of the Die, and "flows" into the narrow space between the separate profiles of the Punch & Die of the tool; this narrow space determines the wall thickness of the new part at each stage of manufacture; If the outer clamping force is too great, the product being drawn is torn apart with cracks starting almost immediately around the upper wall of the new pressing; if the outer clamping force is insufficient, the steel is simply dragged too quickly into the Die, which becomes crumpled and the intended new shape splits across the bottom of the proposed new shape. If the combination of the two forces are combined correctly, the double drawing action creates a new seamless steel enclosure which conforms to the shape of the die and the inner profile of the Punch, and as the mechanical press completes its cycle, the punch is withdrawn from it, allowing the new seamless part to be ejected or withdrawn from the die once the Punch tool has been fully withdrawn and the full press cycle or "stroke" has been completed with the ram returning to its starting point at "12.00" O'clock" ie at "top dead centre." When the punch has fully withdrawn from the new seamless shape, it can be set aside waiting for its next planned manufacturing operation. For the manufacture of very deep products, there are multiple operations, up to say 15 Drawing Operations, with each operation completed in one production batch until another press is set with the new pre-made tooling designed for the subsequent operation.



Typical original Linear Plant Layout of Pressing Machinery and of Work in Progress required for Batch production

The process of "Deep Drawn Pressing" involves a series of operations during which the steel becomes "work hardened", and previously before a second deeper drawing operation could be performed the component had to be "annealed" in a coal fired furnace to restore the molecular structure of the steel; the guiding technical "rule"

was that the maximum reduction per operation was to reduce the starting diameter of the original blank or previous shape by 50%, so the manufacture of deep parts like the nose cones of naval shells could only be done using a series of carefully calculated individual drawing operations, step by step.

The photograph of the new central bays shows "piles" of batches of newly made steel enclosures, temporarily stored on the ground, waiting for the next drawing operation in the sequence. The new technology of deep drawing relied on the skills of correctly designing the necessary minimum number of manufacturing operations and equally the manufacture of the specific Die & Punch tools needed at each step in the process. A high level of skill and experience is required to design the process, and also for the skilled staff of the Toolroom to manufacture the actual individual Tools. Even more demanding was the design and manufacture of the specialised machinery, like Napoleon for this new technology.

The manufacture of a final complete new product or component has to be achieved by performing a number of similar drawing operations; in general the maximum reduction at each stage is to reduce the ratio between the starting original outer diameter of the steel blank and the resulting diameter of the next step after the each operation by a maximum of 50%. The severe pressure on the steel in the deep drawing process, "work hardens" the steel to such an extent that the steel changes its molecular structure and often the new shaped product has to be annealed to restore the steel structure between each separate drawing operation, so production is carried out in a number of separate "batches" interspersed by heat treatment.

BATCH PRODUCTION USING A SEQUENCE OF INDEPENDENT MANUFACTURING OPERATIONS.

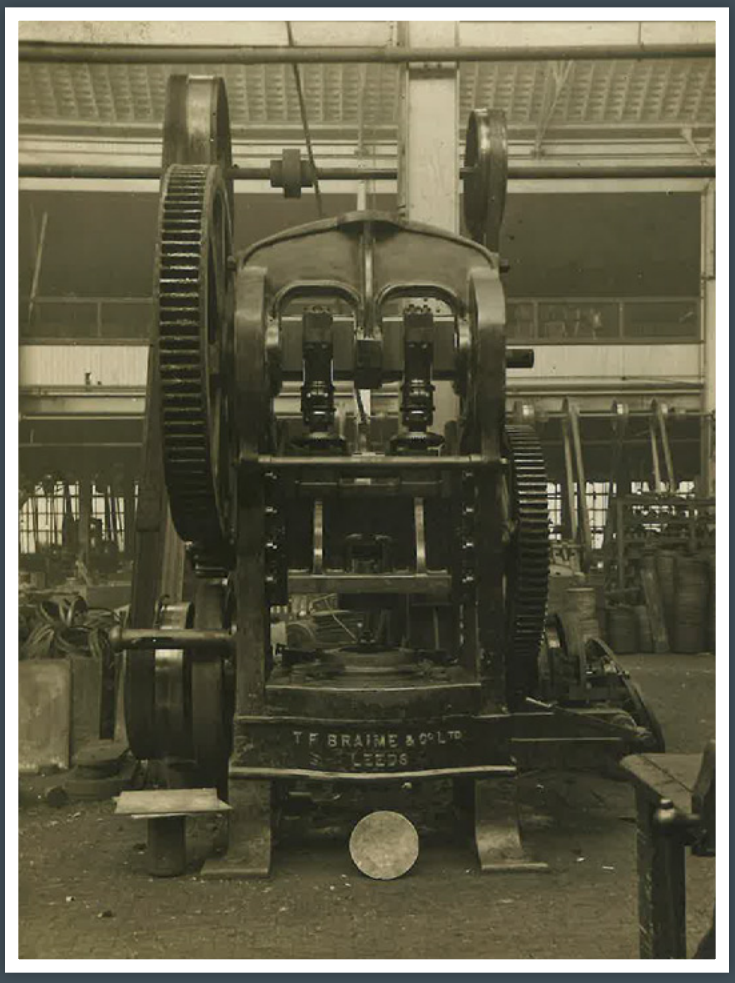
ADVANTAGES OF DEEP DRAWN PRESSINGS OVER PREVIOUS TRADITIONAL MANUFACTURING PROCESSES.

Before the development of the new technique of Deep Drawn Presswork, the manufacture of steel enclosures was initially carried out in a traditional Blacksmith's forge, which required hammering out one product at a time using a hand furnace and a hammer. Tom & Harry Braime came from a long family line of Blacksmith's; in their case, originally based in the nearby village of Barkston Ash. The Blacksmith was partly replaced by the relatively expensive process of casting moulten metal, as was done by Braime's predecessor on this site, the Union Foundry. Occasionally a highly skilled but very slow process was used of "metal Spinning." The other traditional processes available for joining metal involved either Riveting overlapping sheets of metal or for lighter constructions, Welding or Soldering the fine edges of the metal sheets; (Soldering was the process used to manufacture the original Braime Oilcans); both processes resulted in a relatively weak and unstable bond. In contrast, the new technology of Deep Drawing created a "seamless" product which, together with the added structural strength created by the corner radii, resulted in permanent and very robust product. The new process of Deep Drawing was ideally suited to achieve the much more economic "mass production", and so was ideally suited to meet the sudden increase in demand from an exploding

population for “mass produced” consumer products, such as cookware, as well as for ammunition, automobile parts, and domestic “white goods”.

PLANT LAYOUT

The series of large individual mechanical presses, like Napoleon, were originally installed in a single line in what was named “the Heavy Press Shop”, which ran along the back wall on the far side of the three manufacturing bays; each machine was connected by its own leather belt to a single overhead “Line Shaft”, and driven independently from a single coal fired steam engine, housed in a single remote “motor house”. The Press Operator connected the Press to the line shaft by engaging a hand clutch. Rather than each machine being fitted with its own independent motor, connecting each independent machine to a single power source was the traditional way in that era of driving manufacturing machinery, as used in cloth mills, and was of course “energy efficient”. This method of manufacture defined the typical layout of workshops, forcing it to be set in long rigid uniform lines of machinery. In the 1950’s when 10 of the original series of 15 giant mechanical presses were finally scrapped, the remaining best 5, including Napoleon, were all “modernised” by fitting independent motors.

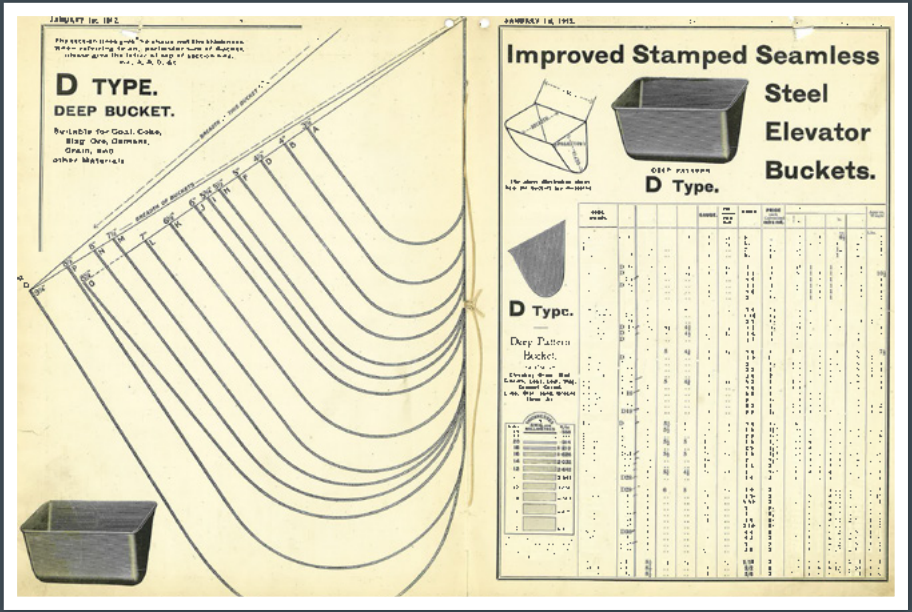


Press 14, small single action, mechanical Press built on site

These presses were the backbone of the manufacturing business for roughly 50 years and were used typically to produce large deep steel pressings, such as the spherical domed pressings, originally used as “floats” in the UK Fishing Industry, and later used as the enclosures for ground mines and for the sea mines which ringed the UK during WW1. Napoleon also manufactured munitions such as the nose cones for the entire range of naval shells, for the guns designed by Vickers Armstrong, as illustrated in the adjacent sketch, which were used by the British battleships during the major naval battle of Jutland, fought between May/June 1916 between the British Grand Fleet, under Admiral Jellicoe, and the Imperial German High Seas Fleet in the last major naval battle in history. (The immediate result of the battle was an expensive draw with both sides claiming victory. But, in fact, the long term outcome was the success of the British Navy in very largely confining the German Navy to its home ports and so maintaining a blockade of Germany throughout WW1). Braime also made parts of military aircraft, during both World Wars, including components for both the Lancaster & Wellington bombers, and parts of armoured vehicles, such as the first tanks, and of course, manufactured very large volumes of artillery shells, also for Vickers Armstrong. In particular Braime became renowned for developing a new and novel production method, for manufacturing the “Rifling” Bands required to maintain a shells’s accuracy in flight and this product is still displayed in the Imperial War Museum.

START IN 1950 OF INVESTMENT IN NEW MACHINERY

Post WW1, the presses were used to manufacture a multitude of parts for the rapidly expanding motor industry, including for both Austin & Morris Motor Company’s, until the combined company set up their own in-house Press Shops. Braime also manufactured parts for Rolls Royce, which they continued to do until the 1990’s, as well as parts for Construction & Quarrying vehicles for Kirkstall Forge and Bamfords.



Outer cover of 1st Catalogue in 1905 and List Prices for range of pressed steel Elevator Buckets, for which Braime became the global market leader

In the 1950's, Braime began to invest in a large new series of faster & more compact modern Double sided mechanical Presses, made externally by Wilkins & Mitchell, of Darlaston, to start manufacturing products for the explosion of the Domestic "White Goods" Industry, which came from the USA during the Post 2nd WW Boom. Subsequently, the very large mechanical presses, like Napoleon, were replaced by a further new investment in single station very large & tall Hydraulic Deep Drawing Presses, which although manufactured by new Scandinavian specialist machine builders, like Lagan Press, both were largely designed and developed by Anthony Braime, the eldest godson of Harry Braime who had designed Napoleon. Mechanical Crank Presses had always been restricted to a single cycle & speed which could not be controlled and reached their maximum force at "6 0-clock" ie at bottom dead centre, whereas the advantage of Hydraulic presses was that it was possible to accurately control both the speed and down-force throughout the press cycle, allowing deeper and more gentle deep drawing, and because this caused less "work hardening" of the steel, the increasing use of Hydraulic Presses allowed the elimination of very expensive inter-stage annealing between multiple pressing operations.

END OF LINE FOR NAPOLEON

Five of the original presses were retained to manufacture the largest of the original deep industrial pressed steel elevator buckets, a range of products which had been invented globally by the brothers in circa 1900, and who released their catalogue of about 400 alternative designs & sizes in 1905), as well as the the company's own range of "Shop Pans", or large industrial storage bins; other pressings were of products where the sales volume did not justify the need to invest in expensive new tooling, which was always required by more modern machinery. Before being finally taken out of production, Napoleon was used for the last time in 1991, during the Gulf War, to manufacture the Aluminium wheel Hubs for Tank Transporters for the MOD which Braime had first manufactured in 1939.

NAPOLEON'S CONTRIBUTION AND SIGNIFICANCE TO THE BUSINESS

"Napoleon" illustrates the remarkable engineering skills of the two founders who not only developed and pioneered in the UK the introduction of the new technology of Deep Drawn Presswork, using solely the skills learnt when they did their Apprenterships in Leeds, but also designed and built their own machinery for this new technology. In that era, the challenge facing new businesses was not finding new customers, as demand was almost infinite, but finding the capital to purchase the necessary manufacturing machinery. Tom & Harry Braime came from a humble background in the local colliery village of Rothwell, and had no resources of their own. They overcame that challenge by designing and building the machinery themselves and distributed their Prospectus by hand on the platforms of Leeds station to try to raise money to buy and build a new facility, which showed the level of their ambition and willingness to accept risk.

The range of heavy mechanical Draw presses, like Napoleon, were the backbone of the business, and produced the large volume of parts which enabled the new business to survive through both the post war recession of the 1920's and "the Great Depression" starting in 1929.

Nicholas Braime, (youngest Great Grandson of Harry Braime). April 2024.

BRAIME
GROUP PLC