

THE NAILSWORTH ENGINEERS

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Part 1 1875 to the Early Twentieth Century

The Buildings

The firm of H.J.H. King and Co. of Nailsworth was established around 1875, when Henry James Hogg King took over the Upper or Node mill on the Miry brook in the Newmarket Valley [1]. By 1879, Kings had moved downstream to the Lower or Lot mill, [2] (ST 847994). The Node Mill (ST 836996) was empty in 1885, but was later occupied by a manufacturer of walking sticks [3]. Kings repaired the Ferrabee beam engine there from time to time. The mill building was demolished for its stone in 1919 [1]. In 1931 the remains were swept away during extensive flooding in the Nailsworth area [2]. The dam and remains of the sluice gear can still be seen. The pond is dry.

The Lot Mill had an extension added between 1885 and 1902 [3], replaced with a larger extension in the nineteen sixties. The old mill building is now used as offices by F.H. Terrett Ltd. Under it is the original water-wheel pit, still containing a King turbine, and part of a feedwater pump which once supplied the boiler of a King engine sited in an adjacent engine house, now gone.

Historical Summary

From these modest premises was carried on a business of mill engineering for local firms, supplemented and in time dominated by the production of a remarkably diverse range of products, from water-wheel speed governors and powered sausage stuffers to kiln heat regulators and a range of unusual steam engines.

"It cannot be denied", wrote the journal "Engineering" in May 1886, referring to the engines, "that this is a most ingenious and novel design". Ingenuity and novelty were characteristics of Henry King's work, and of his son Hubert James Hogg King; neither seems to have been interested in building up a large industrial business. The history of the company is very largely the history of two innovative engineers.

After his father's death in 1895, Hubert extended the business into colliery overwind prevention gear, and into conveying systems for coal, grain and other materials. Hubert died in 1952, aged 79. The business, still established at the Lot mill, continued for a while under different ownership until it was bought by Redler Ltd in the 1960s. They maintained it as a separate business for a few years, eventually absorbing it into their main works at Dudbridge.

Henry James Hogg King

Henry King was born in 1845 at Kings Stanley, son of Peter King, corn merchant and flour miller [1]. As a lad he worked for James Apperley and co. of Dudbridge for two years before 1863, earning a testimonial to the "ability and good general knowledge of our friend Mr. Henry King of Cainscross". A move to Stony Stratford followed, where he "excelled in his profession".

The came employment with Brassey, Wythes and Co. of Glasgow. Entrusted with the inspection of no less than 24,000 tons of cast iron pipe for the Calcutta Water Supply, he designed test equipment which was much faster and more accurate than existing methods. This brought an appreciative testimonial from the Engineer-in-Chief of the Undertaking, written in October 1868 just before his departure for India - "your ingenuity and skill as a mechanical engineer shown in the installation of the Bar Testing Machine and callipers.... a great improvement" [4].

As early as 1864, Henry had taken out his first patent, for improvements to steam engine slide valves. This was followed four years later by two patents for "gauges or apparatus for ascertaining pressure". By 1869 he had launched the firm of H.J.H. King, Engineers, of St. Rollox Glasgow.

In its issue of 28 May 1869, "Engineering" carried descriptions of patent pressure gauges and a micrometer or "linemeter" by King's of Glasgow. The latter measured to 1/1000th. of an inch over a range of three inches. This accuracy was not remarkable for the time, Maudslay having measured to a ten thousandth of an inch in 1805, and Whitworth to a millionth in 1856 [5]. Theirs were large, one-off bench instruments however, whereas King's was much smaller and simpler, for hand use and volume production. Four undated but clearly early leaflets advertise the pressure gauges and linemeter, a patent barometer, and callipers for measuring the diameter of large pipes [4].

In 1874 Henry was in America. His memorandum book contains poetry written while he was there, and a record of his attendance at "a Seance called Spiritual held at Mrs Hardy's Boston" [4]. In May 1875 however he was resident in Nailsworth according to yet another of his patents (no. 1903).

The Reaper and Binder

Indeed from 1869 until his death he registered patents every year except 1874. Many of these were developed into products which sold more or less successfully, as shown by the company order books which survive from 1883 [6]. A notable exception is a series of patents from 1876, at first jointly with E.G.C. Bomford, later with his father-in-law P.C. Evans, for a reaper and binder. The "King and Bomford" machine competed in public trials at Thurlston near Derby in August 1881, but the gold

medal winner was the well established McCormick harvester from America [7]. In 1884 King and Evans entered a "patent narrow width machine" in trials at Shrewsbury, but alas "the machine was pronounced of too heavy a draught for the horses and so excused from further competition" [8]. Evans and Bomford continued to use their machines for some years but I have found no record of others being built.

Mill Engineering

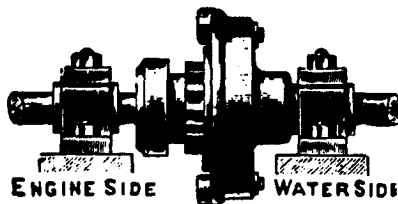
A significant part of the company's business during the 1880s and 1890s consisted of a general engineering service to local factories and mills. The range of activities was very wide. A pulley was turned up for the Nailsworth Brewery for one shilling (5p). A new lathe headstock for Parsloe of Nailsworth was cast, bored and tapped as per old sample; P.J. Evans was supplied with "1 tin of oil and 2 leather thongs". By contrast, for P.C. Evans and Sons a number of pulleys, shafts, pinions, mortice and wallower wheels, wall plates and brackets were made and fitted up and connected to their water-wheel at Brimscombe. An engineering drawing of this installation has survived [9].

Repairs to machinery included line shafting and bearings, pumps, safety valves, thrashing machines, mowing machines, steam engines, gas engines, a bicycle, a lawn mower and a traction engine which shed a wheel on the Wotton Road one Sunday in January 1889.

Power Transmission

Significantly, the first order recorded for the year 1883 from Apperley Curtis and Co. of Dudbridge, was for the supply and fitting of a governor and a clutch. The clutches were of two types, friction and automatic ratchet.

King's Patent Ratchet Clutch



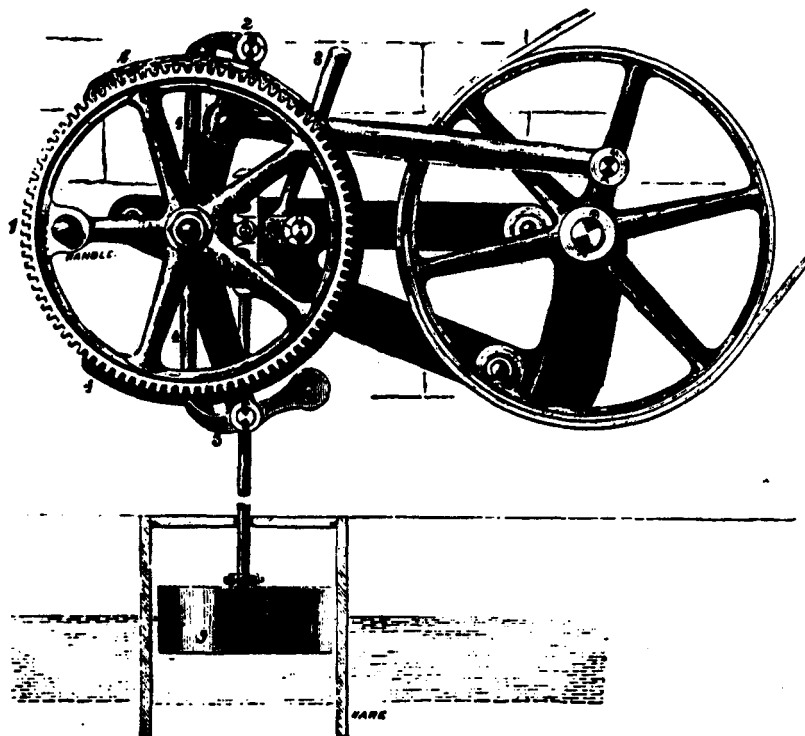
STANDARD PLAIN CLUTCH TO REPLACE FLANGE COUPLING.

The latter were for coupling two motors, usually a water wheel or turbine and a steam engine, in tandem to drive machinery through line-shafting. Rigid coupling often resulted in loss of power due to the waterwheel retarding the engine during periods of low water. The ratchet clutch avoided this

automatically. Friction clutches inserted in the line-shafting allowed individual machines, or groups of machines, to be stopped and started independently [10].

There were three types of water-wheel or turbine governors. Speed governors raised or lowered the weir gate automatically to keep the wheel turning at a constant rate. Float governors acted on the weir gate to maintain a constant height of head water. Combined speed and float governors allowed the wheel alone to drive the machines at controlled speed when water was plentiful. When the supply dropped, the float took over to maintain a head of water, ringing a bell to signal the need to start the engine [10].

King's Patent Float Governor



These products, being introduced during a time of increasing mechanisation and consequent increasing demand for power, sold steadily for many years. A ratchet clutch sale was recorded in 1947. A bizarre application of the speed governor was found in the Far East. In 1883 an order was recorded for "1 Governor for Tread Mill to go to Singapore at £55.0.0. less 10% packing extra."

King's offered a range of turbines, but comparatively few were sold after 1883; however R.A. Lister of Dursley, and Tubbs, Lewis and Company

of New Mills, Wotton under Edge were customers in 1895, and the Golden Valley Ochre Co. of Wick in 1911. A water power system of three Pelton wheels was designed and installed for Winning Meltis and Company of Glasgow in 1912.

Automatic Heat Regulators

The second order recorded in 1883, for kiln heat regulators for the Union Brewery of Wandsworth, was even more significant for the future.

In the brewing process, barley is malted prior to fermentation. Barley grains are encouraged to germinate by being soaked in water and then spread out on the growing floor, usually tiled, at a temperature of 13.3°C, rising to 15.5°C to 16.7°C, until

the required stage of growth is reached. The resulting malt is dried in a kiln at about 100°C.

Beer is a relatively cheap but bulky product, and until fairly recent times most breweries served a local market that could be reached by horse drawn drays carrying heavy barrels. There was therefore a large number of breweries and an equally large number of associated maltings, a big potential market for King's patent automatic kiln heat regulators. Moreover the production of beer was rising throughout the nineteenth century as the population expanded. Additionally, there were the malt whisky distilleries.

An early installation, perhaps the first, was at the Nailsworth Brewery, owned by the Clissolds. A member of the family, apparently recognizing the market potential, joined Kings as sales director. Reading the order books, one follows his sales tours in imagination as the orders come in from the regions of England, Wales, Ireland, the Scottish Lowlands, and from famous distilleries in the remote Highlands and Islands. In 1906, King claimed 650 installations in 276 establishments [11].

The business developed into a comprehensive service to the maltings industry. Already in 1898, Kings were supplying the Cirencester Brewery with a 60 quarters steeping tank, a 40 quarters malt elevator, a hoist, iron furnace plates, doors and firebars, iron doors for kiln shafts and spark chambers, iron girders and columns. When Redlers bought the business in the 1960s, the company was completely equipping new maltings on the "King System", which meant they were fully mechanised and included pneumatic conveying, and automatic turning of materials on malting floors and in drying kilns.

The inspiration for the heat regulators is said to have come from a characteristically ingenious modification to the King domestic oven, which proved difficult to control. Henry modified it by connecting the damper control to an expanding iron bar through a lever [1]. The idea was patented in 1886.

Steam Engines

Probably the most ingenious, and certainly the most interesting product in Henry's time was the steam engine range. The initial patent was taken out in 1885. An entry in the order book dated 24 March 1886 reads "Mr. W. Dangerfield, Chalford. To compound the Borne [sic] Mill Steam Engine £145.0.0. This is the engine described in "Engineering", where the location is described as "Bliss Saw Mills, Chalford". Evidently the engine was successful, for another entry for July of that year reads "W. Dangerfield, Chalford. To compound two Steam Engines on new patent plan £500.0.0."

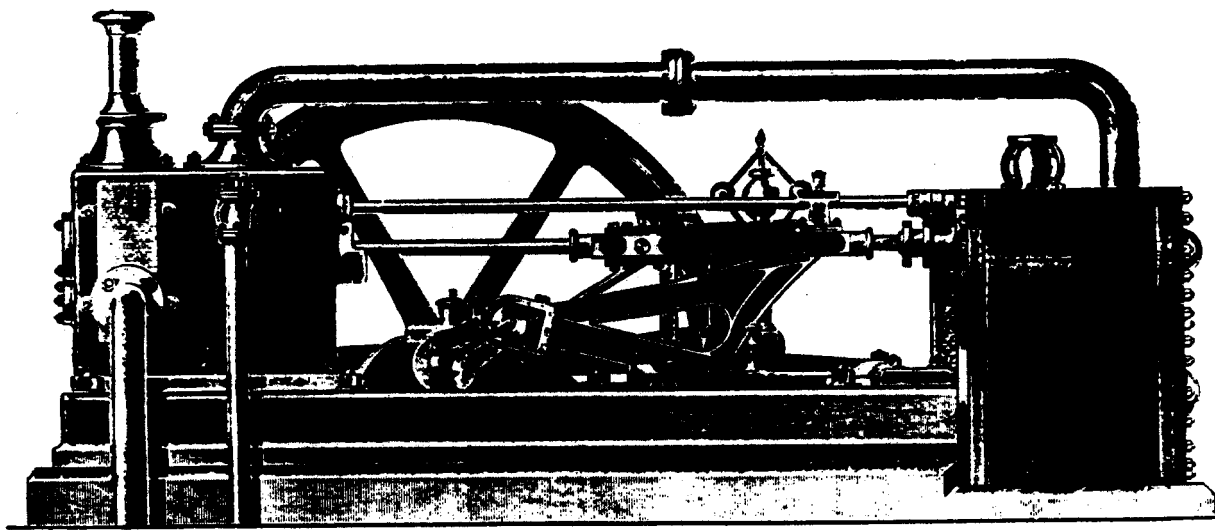
The "new patent plan" involved converting the engines from simple to compound operation. The high pressure cylinder was

mounted above a new low pressure unit; both cylinders drove a single triangular shaped connecting rod. Efficiency and economy were significantly improved, and there were other advantages as "Engineering" pointed out. "The engine will start in any position, the steam passages are extremely short, and all the parts are perfectly accessible. The space occupied is very small..."

PATENT

COMPOUND HORIZONTAL

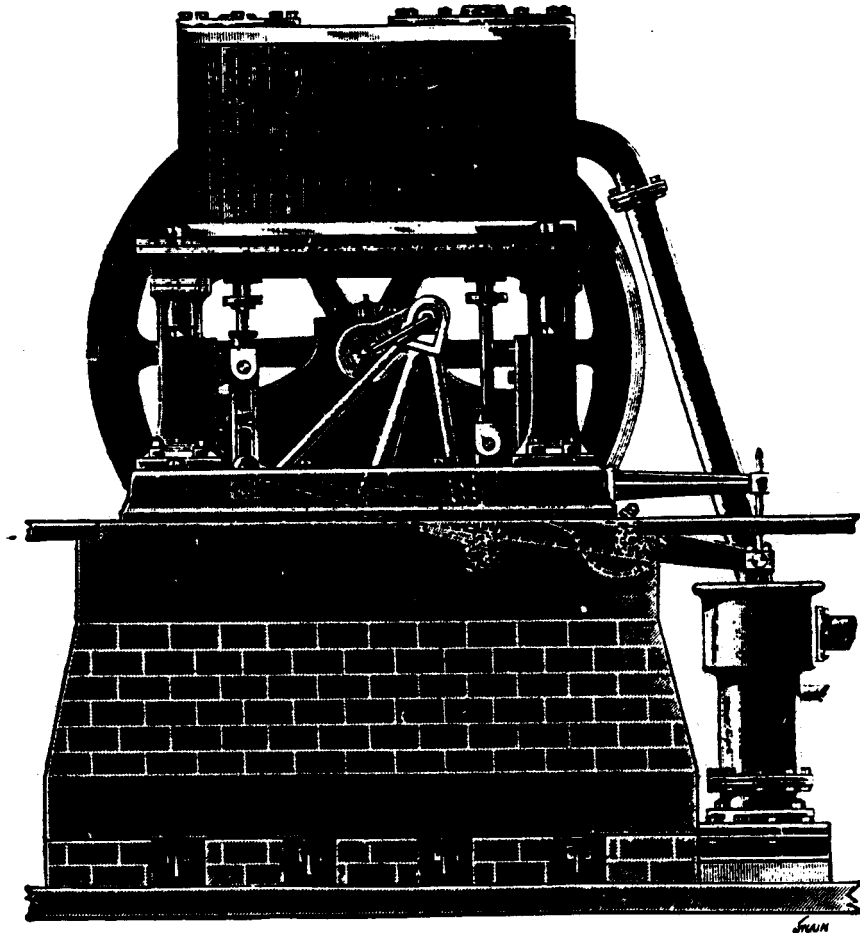
"KING" ENGINE



The Chalford conversions were followed by others; one for Harper and Chamberlain in 1886, and two for Selwyns of Toadsmoor Mills in 1891 and 1892. Meanwhile similar but all-new engines were supplied to Critchley Brothers of Wimberley Pin Mill, Brimscombe, and Apperley Curtis of Dudbridge.

All these engines were horizontals. King realised that a vertical engine designed on the same principals would occupy an even smaller floor space. The first of the verticals was supplied to Edwards and Kinch of Banbury in 1892. Thereafter sales of new engines increased. A catalogue of 1895-6 [12] lists horizontal and vertical, condensing and non-condensing types in a range of sizes. From 1898, a number were shipped to agents in Bombay, and one went to the Rand Mines in South Africa.

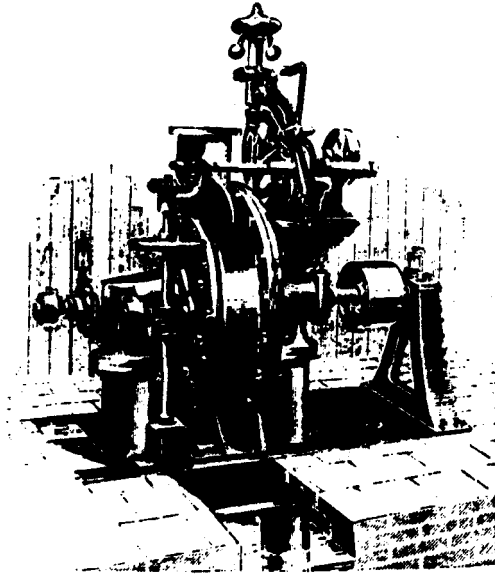
KING'S PATENT VERTICAL COMPOUND ENGINE



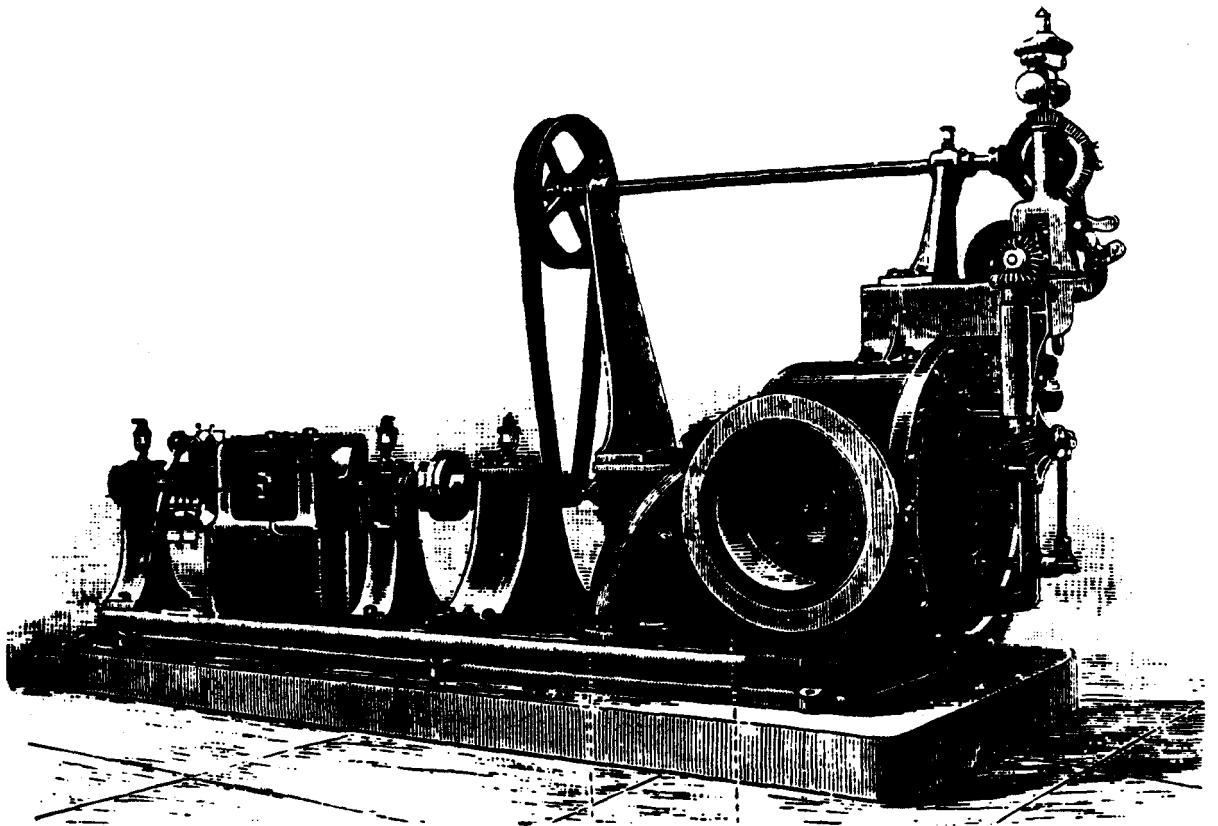
13½ in. x 24 in. x 30 in. Compound "King" Engine, with Condenser below Floor.

A total of 36 new engine sales have been identified from the order books. This does not include an unknown number of King Patent engines in the larger sizes which may have been built by Fraser and Chalmers of Erith. The engine catalogue [12] carries illustrations of two large engines, a compound and a triple expansion type, in which the name of Fraser and Chalmers is clearly visible, cast into the engine bed-plates. The company is not mentioned in the text, and these large engines do not appear in the King order books.

Turbines.



DOUBLE DISCHARGE TURBINE AND NO. 2 SIZE SPEED GOVERNOR.



Horizontal Single Discharge
Turbines.

Other Products

Despite its ingenious design, the King engine had a comparatively short commercial life, being superseded by high speed types [1]. The last sale was recorded in 1908. It was out-lasted by humbler products such as the sausage stuffer or filler, "...the first Patent Power Filler, introduced by us in the Sausage Trade many years since" wrote Kings in 1903 [10]. "Our fillers are still the first in the market." Developed primarily for the neighbouring Hilliers Bacon Curing Co. of Newmarket and patented in 1879, it was still selling in 1916 when the order books end. By then customers included Liptons, Walls, Palethorpes, Bowyers and Harrods of London.

Not all of Henry King's products lasted so well. The pressure gauges were selling in 1883, but faded out after a few years. The linemeter had already disappeared. Between 1869 and 1884 he took out a total of eight patents for "Apparatus for feeding wool or other fibrous materials to carding or other machines". Some of these "Patent Feeding Machines" were sold, to Apperley Curtis and Co. for example, but the local woollen industry was contracting.

The New Century

Nevertheless the company founded by Henry King in 1875 had grown and prospered by the early years of the twentieth century. Changes in the environment were beginning to affect the business however.

The cloth industry was in decline, although Kings did not necessarily lose customers if cloth mills were converted to other manufactures. More significant was the change in factory power transmission technology, from low speed water and steam motors driving line-shafting, belts and pulleys to high speed engines, increasingly gas engines, driving dynamos. This was not a sudden change, and a number of Henry King's products and services for the older technology continued to find a market, but the steam engines did not, and they were an important source of business.

Now, it was Hubert King's responsibility to maintain and develop the company. He addressed the problems with characteristic ingenuity.

Acknowledgements:

My thanks are due to the following:

Doug Drake of Amberley
Betty Mills of Nailsworth
Ray Ayres of Camberley, Surrey
Godfrey Terrett of F.H. Terrett Ltd. Nailsworth
Redler Ltd of Dudbridge.

References:

- 1 Ayres, R.M., "Model Engineer", 4 Feb 1977
GRO PA223/9
- 2 VCH Vol. XI p 214
- 3 25 inch Ordnance Survey Maps 1885 and 1902 editions
- 4 Henry James King Memorandum Book GRO D2794/28
- 5 Rolt, L.T.C. "Tools for the Job" HMSO 1968 ed.
- 6 Order Books 1883-1916 Redlers Ltd
- 7 "The Times" 13 August 1881
- 8 "Bell's Weekly Journal" 11 August 1884
- 9 GRO D2625
- 10 Catalogue, Clutches, etc. 1903 R.M. Ayres
- 11 Publicity booklet 1906 Redlers Ltd
- 12 Catalogue, Engines 1895/6 R.M. Ayres

Patent details from Science Reference Library, London.

Appendix:

King engines or conversions were sold to the following local companies:

Dangerfields, Bliss Saw Mills, Chalford.	3 conversions.
Harper and Chamberlain	1 conversion.
Critchley Bros. Wimberley Mill, Brimscombe	1 conversion.
Apperley Curtis & Co. Dudbridge.	1 horizontal.
	1 unknown.
W. Selwyn, Toadsmoor Mills	2 conversions.
Merrett's Mill, Nailsworth	1 vertical.
Playnes, Longfords Mill, Avening	1 vertical.
P.C. Evans and Sons, Brimscombe	1 vertical.
Tubbs, Lewis & Co. New Mills, Wotton	1 horizontal.
Perkins & Marmont, Frogmarsh Woodchester	1 horizontal.

In 1914 a second-hand King engine was installed at the premises of R. Allen Ltd., millers of Cirencester. I have not located a surviving King engine. A speed governor was supplied to Dunkirk Mills, Nailsworth. It is still there (1989). There is another at the finch Foundry Museum, Sticklepath, Devon.