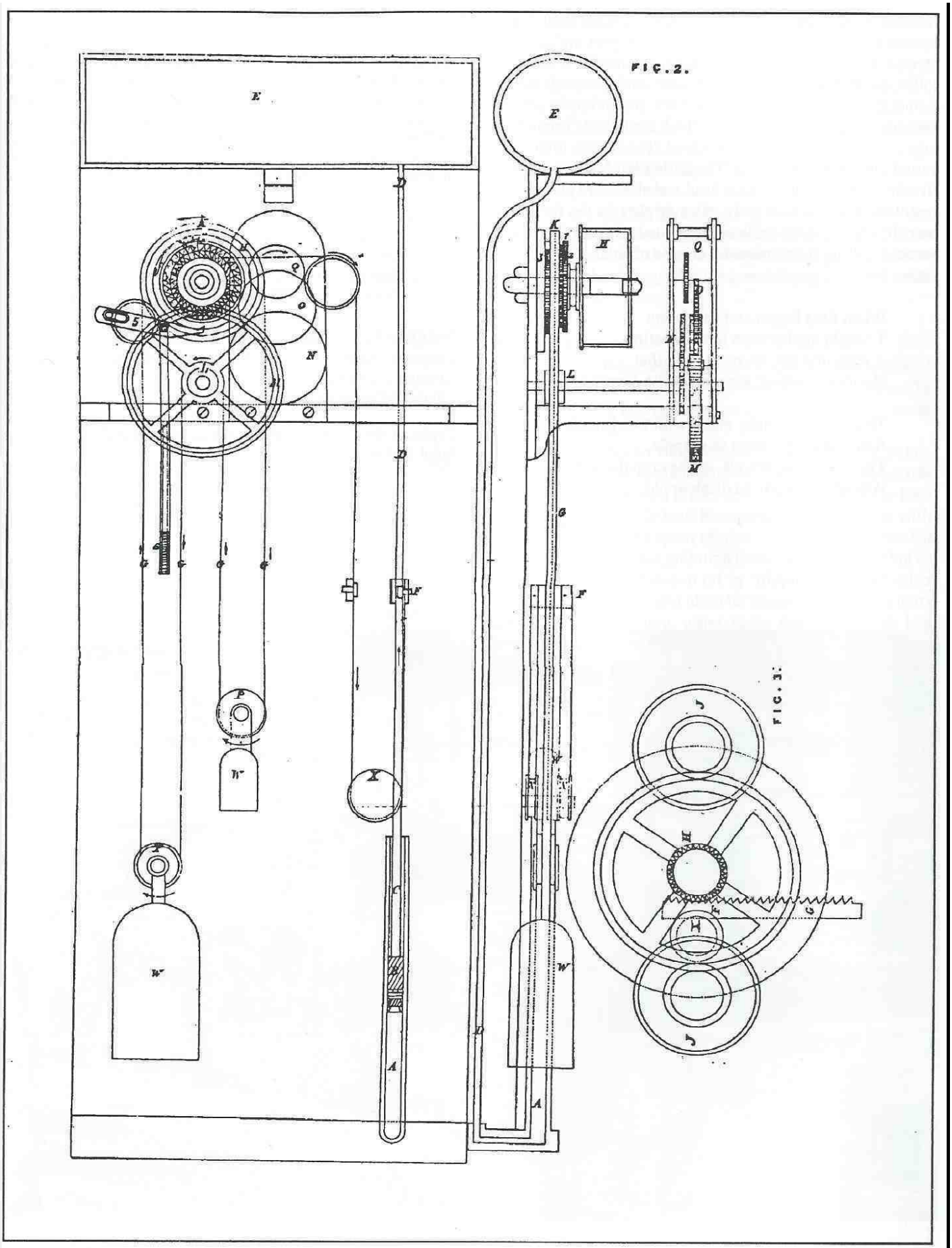


Drawing from Patent Specification No 2353 'Obtaining and applying motive power for winding clocks, ventilating, &c', 1866

Enterprise in Precision Engineering: The Early Years of the Horstmann Family of Bath

Stuart Burroughs

The fortunes of the Horstmann companies in Bath have mirrored the city's industrial history, in this century in particular, but like Stothcrt & Pitt or Harbutts, the activities of the Horstmann family have not only put Bath on the world map as a place of industry but also as a city of invention. The object of this article is to chronicle the history of the company up to the beginning of the twentieth century.

Gustav Horstmann was born at Oesterweg in Westphalia, Western Prussia, in 1828. His parents were of farming stock although his mother was a local primary school teacher. Forsaking both activities he trained as a clock and watch repairer and maker under the famous Dejean (himself a pupil of the equally famous Breguet) and on completing his apprenticeship won himself a Silver Medal in 1850 in a national competition for making a fine pocket watch. Gustav spent the next three years as a journeyman watchmaker, travelling widely.

In 1853 he finally left Germany and moved to England. The reasons for this may be only conjectural but, after the 1851 exhibition and the common knowledge of Britain having a wealthy and dynamic atmosphere, the young man may have been attracted to set up in business himself. After a short spell attempting to find work in London, he moved to Bath in early 1853. Again the reasons can only be guessed, but Bath at this time was home to a prosperous, ageing population with a large proportion of retired military and professional inhabitants - with expensive timepieces in need of repair. On 22 June 1853 he married Louisa Knott, the daughter of a Wiltshire farming family, after a short courtship, at Walcot parish church. By this time Gustav had already arranged a permanent site for his business. Unlike the past, travelling from city to city undertaking freelance repair, he put down roots in partnership with George D. Cottell, another young watchmaker, in a very small arcade shop at 5 The Colonnades, Bennett Street (now incorporated into the north wall of the Assembly Rooms). His occupation here was short lived and by 1858 he had moved to 5 Bladud's Buildings. The name of George Cottell disappears from the trade directories and he may have left the area. Within a few years he had moved to 4 Prince's Buildings, then 7 George Street in 1861, before finally coming to rest in larger premises at 13 Union Street in 1884. Here, at last, Gustav seems to have drawn breath. Up to this time his life seems to have been lived at breakneck pace but the moves charter the success of this solo operation as gradually the repair shops move closer and closer to the city centre, finally ending up just short of the prestigious Milsom Street. Union Street would act as the base of operations for the rest of his life.

Similarly the range of work seems to grow and change over his period, by 1884 the repair shop was offering not only clock and watch repair and manufacture but opticians' and jewellery work, electroplating and battery charging and was contracting for the winding and repair of larger public and church clocks and carillons. By 1890 they were responsible for the care of the Abbey and Guildhall clocks and the Abbey carillon. With the growth of the business had come growth in his family: their first child Ada was born in 1861, Otto in 1863, Ernst Hermann in 1866, Albert in 1869, Augusta Louisa in 1870 and Sidney Adolph in 1881. All the male members of the family would take the business to greater heights in the twentieth century while the daughters, along with their mother, would provide a profitable sideline in dress making and repair in a shop at 34 Brock Street in Bath.1

Another aspect of the operation, played out against the prosperous business, was that of invention. Not content with simply repairing and constructing timepieces to standard patterns, Gustav had increasingly been concerned with developing his own methods and ideas. Inevitably concerned with the production and measurement of timepiece components he entered in 1856 a competition held by *The English Mechanic* magazine to devise *'the most accurate and foolproof device or method for the measurement of the smallest item'*.[2]

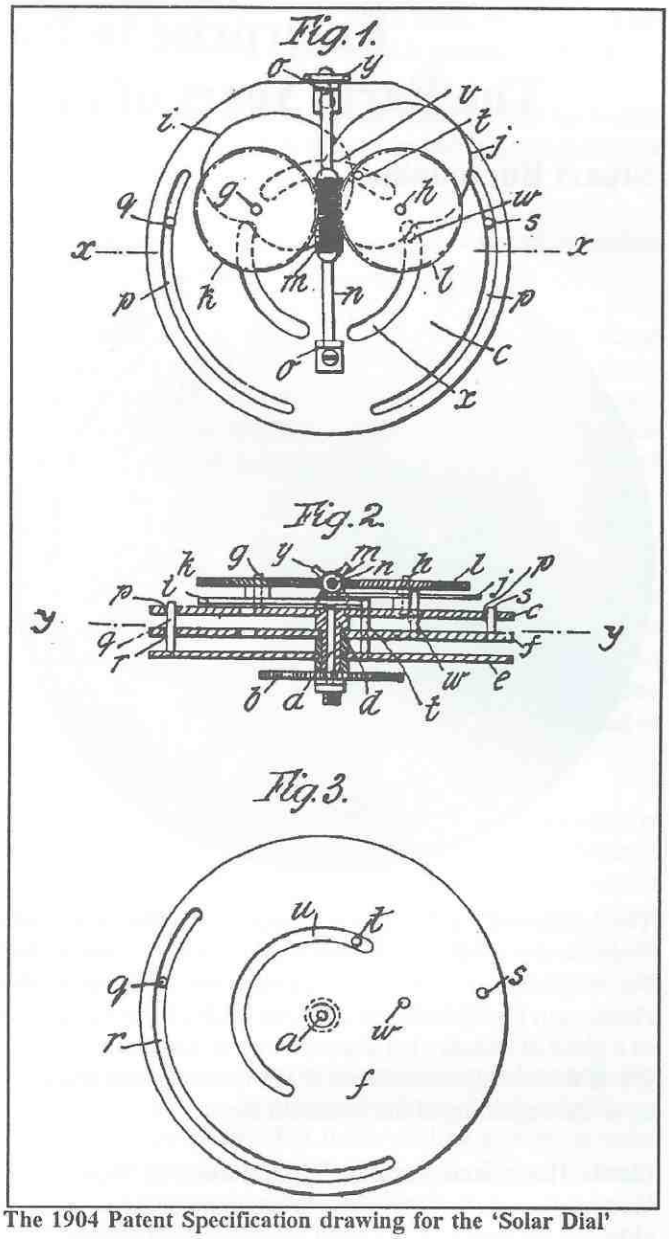
Although Maudslay's micrometers had attained accuracy to $^{1}/_{1000}$ of an inch this could not be done without the risk of damaging small or fragile items. Horstmann's submission, a micrometer of delicate construction, allowed measurement to a similar degree. However, it allowed the pressure on the item to be predetermined. Thus, if a fragile watch part were to be measured, the action of the anvils (the measuring jaws), could be controlled. Gustav won first prize and, although the original now resides at the Science Museum, the idea was never capitalised upon and no more were made for sale, although one was used by him for a short while. What is interesting, in

examining correspondence, is his appreciation of the way in which developments in other fields of technology could be utilised in timepiece construction. He subscribed to *The Engineer* as well as horologist periodicals and kept in touch with developments in larger timepieces. In 1864, he wrote to the inventor of the new pendulum for 'Big Ben' at the Palace of Westminster, asking for construction details. The inventor, Lord Grimethorpe, claimed his clock escapement was accurate to within one second, and Gustav's intention was to scale down the mechanism for his own domestic clocks. By 1866 the company appears to have been doing reasonably well as he employed four staff at the shop in George Street. On 13 September of the same year Gustav Horstmann, with the help of some lateral thinking and Grimethorpe's escapement, took out a patent for what was to become his most famous invention, the self-winding clock:

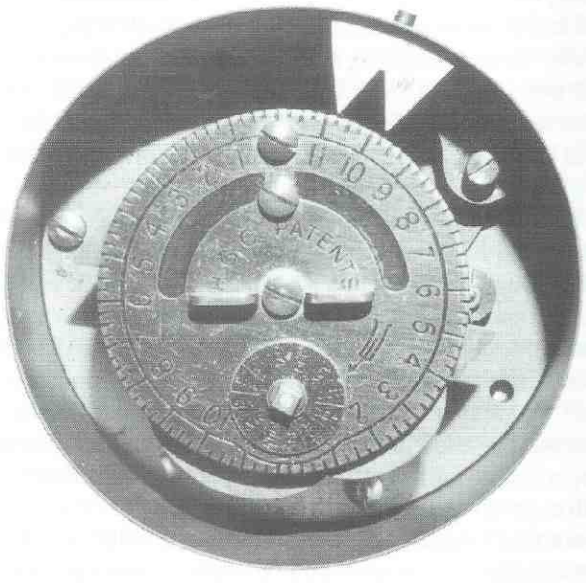
> *A new or improved mechanism for obtaining motive power; particularly applicable for the self winding of clocks, timepieces and other machinery requiring winding.*[3]

Although there had been mechanisms before which apparently removed the need for winding or regular attention, Horstmann's invention was effectively the first use of thermostatic control for clocks, or any other device. The expansion and contraction of a volatile liquid in a closed cylinder above the mechanism, due to changes in the ambient temperature, was used by a system of balanced pulleys and pistons to drive a one-way winding mechanism -this allowed for winding whether the liquid was expanding or contracting. In addition tests were also carried out for the opening or shutting of domestic or greenhouse windows -as the temperature drops below a certain limit the contraction of liquid would close the window. The major drawback was the need for a regular change in temperature and of course the use of thermostatically controlled windows in a room with a clock of this type would cause it to stop in no time! On a more practical level, construction proved difficult. The material within the cylinder required an airtight seal in order that the piston driving the winder worked in a vacuum. The material used to seal the link and act as an intermediary fluid was glycerine which was found to be corrosive of the delicate mechanism. Other problems in acquiring sufficient quality parts proved the clock to be a masterpiece of invention over practicality.

Consequently, only a handful were made, one for show in the shop, another for the Bath Town & County Club in Queen Square and several others now in family hands. Each one was slightly different and were hand-made by Gustav Horstmann at George Street. No attempt was made seriously to market or encourage interest in the invention and, although provoking interest in technical circles, the absence of appropriate materials saw it relegated to that of an interesting novelty. For the rest of his life Gustav devoted himself to the raising of his family, ensuring that all his sons completed apprenticeships in precision engineering and developing the business. The business was prospering through the 1870s with several local concerns on their books (Jolly's in Milsom Street, for example), and were ordering quantities of metal supplies from J.B.Bowler, ironmonger and brassfounder of Corn Street,



The 1904 Patent Specification drawing for the 'Solar Dial'



An early timeclock fitted with a 'solar dial'

Bath.[4] Otto left the family firm in 1889 to set himself up as a bicycle repair engineer at 31a Rivers Street. A year later Gustav and his wife moved to a house named 'Hillside' on Newbridge Hill from the family residence in Brock Street. It was here in 1893 that Gustav Horstmann died, aged 55, after a short illness. From an historical point of view, the story might have ended here. However, the training of the sons in mechanical and, especially, precision engineering and the tradition of experimentation at the small shop propelled the company forward into the twentieth century. The need for precision timepieces and measuring instruments by industry was becoming acute as industry moved increasingly towards smaller components and split-second timing. In addition, the public services, -particularly water, electricity and gas lighting- were spreading their networks and increasingly looking to industry for automatic control mechanisms. This need, coupled with the expertise in timepiece development, caused Horstmann to produce their own contribution to the technological revolution, the 'Solar Dial'.

In 1902, W.T. Ellery, chief engineer of the Bath Gas and Coke Co Ltd, approached Hermann Horstmann about the repair of a time control used for the lighting and extinguishing of gas street lights. Up to this time the human gas lighters had been replaced in some towns with simple 'two train clocks' -a clock in which, like an alarm clock, two mechanisms are connected, the first to keep time, the second to activate a mechanism to do a job eg ring a bell or open/shut a gas valve at a predetermined time. The timeclock (or timeswitch as they became known) would be set to control a flow of gas to a pilot light at predetermined times. Although more accurate than domestic clocks, they required regular winding and their great disadvantage was their need for constant readjustment due to the changing hours of daylight during the solar year. On examining the time control the Horstmann brothers replied:

> *We think we can give you an altogether better job with quick action and automatic variation of the times of lighting and extinguishing according to your schedule. This will save you time and money in setting and will also save gas owing to the daily resetting which could be carried out.*[5]

What the brothers had discovered, through the examination of the action of simple cogs, was a mechanism which automatically compensates for the daylight hours. After several years of development on 20 December 1904 a patent was taken out for:

> *An invention which consists in the provision of one or more variable points, pins, cams or levers in the circumference of a disc which are used for switching directly or indirectly These pins are made to move circumferentially by the rotation of cams relating to a fixed schedule.*[6]

The 'Solar Dial', as this simple mechanism was known, was no more than 3 in across. When fixed to the face of a simple time control it revolved every 24 hours (an important development which replaced moving hands) while fixed to it two irregular shaped cams revolved during the course of a year. Reading off the shapes of these, two moving pins moved in arcs across the dial and could be read off the hours marked on the face of the dial. These pins would activate the valves or electrical switching. The cams governed the lighting/extinguishing schedule and were in the early days called the 'governing cams'. The 1904 patent was taken out by Albert, Sidney, Otto ,Emst and William Edgar (an associate) from the Union Street shop and, unlike their father, they were able to mobilise capital through a series of contacts to develop and market their invention. In 1905 they acquired 86 Walcot Street, Bath, for the sole purpose of manufacture of the timeclocks and dials. The time clocks were simple assemblies of commercially available parts. It was the solar dials which, if required, could be fitted specially. It must be remembered that not all time clocks for industrial use were required to have the compensating mechanism. The earliest production models had seven-day movements -*'Only Weekly Winding Necessary'* stated the advertisement- and a 14-day movement was also available. Eventually a 40-day movement was available but the soot produced by gas lights necessitated cleaning of the lamp glass and this could be combined with winding after this period. By 1906, 20 people were employed in timeclock manufacture and interest was being shown by lighting companies all over Britain. However, only 147 clocks were manufactured in the first year and it was several years before timeclock manufacture became more than a profitable sideline to the Union Street shop's operations. In October 1906 the *Bath Evening Chronicle* reported:

> *There are a dozen incandescent lamps in Upper Oldfield Park and curious phenomena may be observed in regard to them at lighting up time any evening. This evening, to be precise, 8 minutes past 8, the whole of the lamps will be lit automatically and to correspond they will be extinguished in the early morning at the time appointed. Last evening I saw the dozen lamps light up untouched within 2 minutes either way of 6 minutes past 8 and the most ingenious part of the invention is that it adapts itself by daily changes to the lengthening or shortening of the days. This most ingenious of inventions, economising labour and saving gas, is the work of the three brothers Horstmann of Union Street*.[7]

Not only were the brothers now operating on two different sites but under two different names. The Union Street shop would continue until 1925 repairing and servicing clocks, etc, as it always had. This was known as 'G. Horstmann & Sons'. The timeclock-making side, however, became known as 'Horstmann Gear Co Ltd'. Sidney Horstmann, the youngest of the brothers had served his apprenticeship with a Colonel Hippersley (a motor engineer and amateur inventor) at Ston Easton and, on returning to Bath, set about the development of motor car accessories. On 20 May 1904 he patented his Horstmann Self-Variable Gear. This was an automatic gear box for motor cars which involved a complex series of expanding pinions and which, due to the weakness of available components, never seems to have got further than bench tests. In an echo of Gustav's clock, the lack of suitable materials for construction caused failure and similarly the company he had formed for it, Horstmann Gear Co. However, as the dreams of gearbox making faded, the development of the solar dial by

his brothers, required a company to market it. So, with the intention of keeping the concerns of the timeclock-making separate from the tried and tested clock repairing, the Horstmann brothers adopted Sidney's abortive company as a shell. Hence the name of the industrial clock making company which survives to today.

By 1908 the company had contracts to supply 15 municipal gas companies in Britain, including Liverpool, Stratford on Avon and Ilfracombe. Enquiries were being received from around the world as well. By 1909 details were being sought from Australia, Canada, India and New Zealand. More improvements were taken out on the timeclocks and the associated solar dials. Dials could now be made to light and extinguish as many times as required during a 24-hour period and special models were being made to vary the lighting period to allow for night-shift workers to make their way home in the small hours. In addition, the enquiries from other parts of Britain and other parts of the world required different lighting/extinguishing schedules. Models were available for each line of latitude, involving many hours examination of astronomical data and timeclocks were made with special features to deal with hostile climates. For example, special provision for self-lubrication had to be made for the desert climate of Australia.

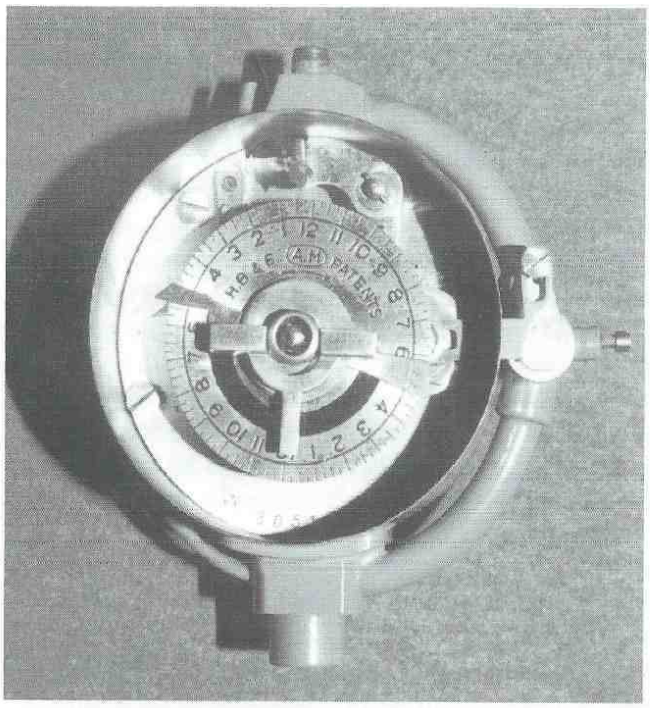
The application of the solar dial combined with the refinement of accurate timeclocks made Horstmann a 'household' name. With contracts from the government by 1910 and the acquisition of new premises at 56 Walcot Street, production of the timeclocks surged ahead and eventually, in 1925, the Union Street shop and the domestic servicing of clocks ceased. Meanwhile, the Horstmann brothers would refine the solar dials and timeclocks to run with synchronised electricity supply, control bird-scarers, naval mines and all manner of other applications. Sidney Horstmann, whose abortive company had given the solar dial a company name, returned to automotive engineering and resulted, in 1913, in production of the first Horstmann Cars and the setting up of his own operation, Horstmann Cars Ltd in the same year. The subsequent history of the activities of the various Horstmann brothers and sisters would constitute a number of further articles. Suffice to say that by 1910 the company had established a name for inventive genius and a quality product.

References

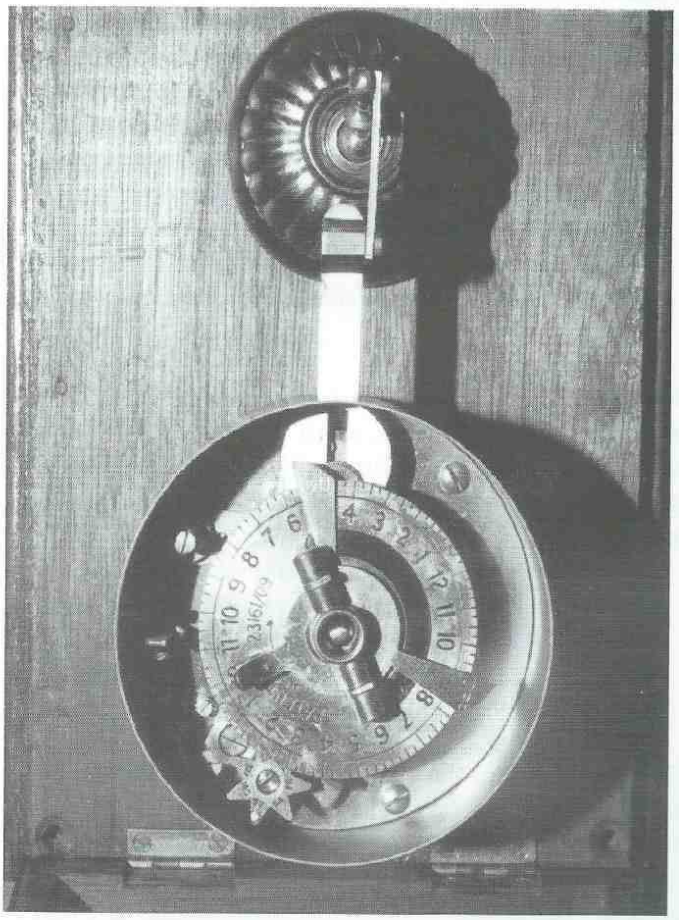
1 The early history of the family and business has been compiled from Bath directories and family sources.
2 *English Mechanic*, 20 August 1856
3 Patent Specification No 2353, 13 Sept 1866
4 Bath Industrial Heritage Centre, Company Correspondence
5 Bath Industrial Heritage Centre, Bowler Collection Archive
6 Patent Application No 27849, 20 December 1904
7 *Bath Evening Chronicle* 15 September 1906

Acknowledgement

This work would not have been possible without the help of members of the Horstmann Family, in particular Mr Bevan Horstmann and Colin Horstmann and the present business, Horstmann Timers Ltd.



Early hand-wound timeclock for gas-lighting



Early hand-wound dial for electric shop-lighting control