

GILL'S  
TECHNOLOGICAL & MICROSCOPIC  
REPOSITORY;

OR,  
DISCOVERIES AND IMPROVEMENTS

IN THE  
**Useful Arts,**

BEING A CONTINUATION OF HIS TECHNICAL REPOSITORY.

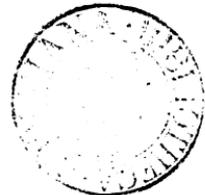
By THOMAS GILL, *Patent-Agent,*

AND DEMONSTRATOR IN TECHNOLOGY, ON THE APPLICATION OF  
SCIENCE TO THE USEFUL ARTS AND MANUFACTURES;

UPWARDS OF TWENTY YEARS A CHAIRMAN OF THE COMMITTEE OF MECHANICS IN THE  
SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES,  
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II.—*Recollections of his Father, the late Mr. THOMAS GILL. By the EDITOR.*

MR. GILL was the eldest son of a Lancashire watch and clock tool manufacturer, who removed with his wife and family from the neighbourhood of Prescott, the original seat of this manufacture in England, to Birmingham, where, however, he soon died, leaving his widow and six young children to lament his loss.

The Lancashire watch and clock tool manufacture was originally established in this country by a colony of Swiss Huguonots, who fled here to avoid a religious persecution, and brought with them the knowledge they possessed in many valuable arts and manufactures; and, indeed, it is to them that this country is also indebted for the introduction of some of its most important branches in the silk, woollen, and other trades; and there certainly were no persons so well calculated to afford instruction in the very difficult art of working steel in perfection. In fact, at this present time, the Swiss workmen possess superior methods of treating iron and steel, known only to themselves; and we daily see instances of their great skill, in the construction of their watches, musical seals and boxes, and other exquisite mechanical performances.

Educated in the knowledge acquired by the Lancashire watch and clock tool makers, Mr. Gill was thus enabled

to carry improvements into whatever articles he manufactured, and he possessed such an ardour, and so enterprising a spirit, that he succeeded in greatly improving the qualities of all those articles which bore the stamp of his name. The Editor well recollects, that in his infancy (now upwards of half a century since), his father was established as a tool, file, and saw manufacturer, and in the practice of employing both Lancashire and Sheffield workmen, in making the numerous articles comprised in those different branches. And, even at the present day, smooth files of his father's making, when but a youth, are yet in use, and are valued by their possessors at more than their weight in gold, from their superior quality of not clogging in their teeth, as such files generally do. So, likewise, the saws of his early manufacture, continued perfect to the end of their duration, and what had, perhaps, originally been a hand-saw, finally ended in becoming a key-hole saw, from the continual filing away of its teeth in sharpening it, thus narrowing its original breadth, and yet its quality continued perfect to the last.

It would be impossible for the Editor, at this distance of time, to recollect the manifold articles which his late father was in the habit of manufacturing in his early days; amongst others, however, he is able to mention steel elastic plated spurs, things then unheard of, the plated spurs usually made being clumsy heavy things, too stiff to bend; whereas his were light and pleasant to wear; and the test of their goodness was their branches being capable of springing or bending until their extremities met, and then flying back again to their original extent, when set at liberty.

In his business of saw-making, he had occasion to harden pit-saws of considerable length, and they being made of cast-steel, the greatest nicety was required in uniformly heating them from end to end previous to quenching them in the hardening liquid. This difficult task he accomplished by erecting a reverberatory furnace of sufficient

length, having a fire-place at one end of it, and the flame and heated air from which, passing along the horizontal flue or working part of the furnace, was then again returned in another flue, formed above the furnace, a thin layer of earthen tubes or quarries, supported upon iron cross-bars, forming the separation between the flues ; and from thence the heated air and flame passed up the chimney. In this way, and notwithstanding the fire was at one end of this long furnace, yet the flame being made to pass twice through it, the heat was rendered nearly uniform, and its equality of temperature was still further insured by means of small air-registers, built in the external wall of the furnace, towards that end of it where the fire was placed, and which had iron doors to them, and by opening which doors the excess of heat towards the fire-place could be abated when necessary, always however carefully shutting them again previously to heating the saws in the furnace, in order to prevent their oxidation by the air, which would otherwise have entered at the register doors. A hanging-door at the opposite end of the furnace to that in which the fire was made, could be raised and lowered when necessary, in order to place the saws in the furnace to heat them, and to withdraw them again to quench and harden them.

A reverberatory furnace of the above kind is useful in many other branches of manufacture besides saw-making, and indeed his father frequently employed it for uniformly heating other cast-steel articles ; in particular, he had made numerous steel ribs, intended to stretch the feathers forming the wings and tail of an artificial bird, made large enough to contain a man within its body, and who, by means of proper machinery, could put the wings and tail into motion. This contrivance was the work of a projector, previous to the use of balloons, and who thought he should thus be able to cause the bird to mount into the air, carrying the man with it. We need hardly say, that beyond making an exhibition of his bird at the Pantheon, in this metropolis,

and where it astonished crowds, who flocked to see it wave its wings, and move its tail, it totally failed in its object, and the projector, after endeavouring to ascend from the roof of a barn, and of course falling to the earth, fled away himself, leaving the costs of constructing his bird unpaid for! However, this afforded the Editor's father an opportunity of evincing his great skill in the difficult art of working, hardening, and tempering cast-steel, in the manufacturing of the above-mentioned steel ribs, some of the largest of which were upwards of nine feet in length, and yet weighed not more than nine ounces each! These ribs were made square, and tapered away gradually from their thickest parts, or where they were united to the machine, to their ends; and yet were so perfectly hardened and tempered, that they were as elastic as a waggoner's whip; and, in fact, his father frequently caused the trees in his garden to be beaten with them, to exhibit their wonderful perfection to his visitors, without in the least degree injuring their quality!

Mr. Gill was also one of the earliest improvers of the cotton-spinning machinery, and for some time carried on that business on his own account with great success, having at an early period spun cotton threads as fine as one hundred and eighty hanks to the pound. However, some of his early friends became desirous of uniting in partnership with him in this undertaking, and, in consequence, the machines were increased in number, and part of a large building, erected as a steam-mill, at Birmingham, was filled with them. The undertaking would, no doubt, have finally proved exceedingly advantageous to all the parties concerned; but, in consequence of some great failures taking place amongst the Lancashire cotton-spinners, his partners became alarmed, and insisted upon disposing of the whole of the machinery by auction. At the sale, it was purchased by the late celebrated Mr. James Watt, for his friend David Dale, and, no doubt, became the models for his celebrated Lanark cotton-works. Mr. Watt, after completing his

purchase, stated, that it was the finest machinery of the kind that he had ever seen in his life. A high compliment indeed from one so eminently qualified to judge of the value of machinery.

Mr. Gill was early honoured by the friendship of, and was continually applied to by, the late Matthew Boulton, Esq., the founder of that magnificent establishment, the Soho, near Birmingham, in all cases where his superior knowledge in the treatment of steel was deemed useful, and this before Mr. Boulton had united in partnership with Mr. Watt; and even after that event, he was constantly in the habit of furnishing the cast-steel, which was formed into springs by their workmen, suitable for their uses in their steam-engines, and which were afterwards hardened and tempered by him, and never failed to perform their destined offices. On one occasion he was employed to make the steel springs used in actuating a machine in the nature of the catapulta, and which was contrived by a Frenchman, named Loyaute, to throw hand-grenades. This machine was put to trial in Mr. Boulton's pleasure-grounds, at the Soho; and the Editor having placed himself behind it, in a convenient posture to watch the path of the grenade about to be thrown from it, was nearly killed by an iron compound pulley-block, or sheave, which was employed in drawing down the arm of the catapulta, by means of an iron chain; and the chain breaking, the pulley-block was projected with such force backwards, as to strike off the arm of a tree immediately above the Editor's head.

One of the most important pursuits which Mr. Gill ever engaged in, was his retrieving the reputation of English swords, which, in the year 1783, had fallen into such deserved ill-repute, that an English officer would not trust his life to the hazard of the probable failure of his English sword-blade, upon any consideration whatever; although, only a century preceding, James the Second passed an act expressly prohibiting, under severe penalties, the importa-

tion of swords from Germany, or any other nation ; a clear proof, that, at that period, the English swords were sufficiently good to be relied upon. However, in the year 1783, a petition was presented to the Lords of the Treasury, by the London sword-sellers, praying leave to import sword-blades from Germany duty free, under the degrading idea, that those of English manufacture were of an inferior quality. But as a friend to the manufactures of England, the late Duke of Norfolk, then Earl of Surrey, and one of the lords of that board, wrote a letter to a gentleman of Sheffield, Mr. Eyre, dated October 1, to the following purport:

“ You will please inform those whom it may concern, that a petition hath been this day presented to the Treasury, praying permission to import swords and sword-blades from Germany, duty free, on account of the inferior quality of English blades. I should be very happy that any ingenious manufacturer of Sheffield would supply me with such information, both as to price and quality, as would enable me to remove so disgraceful a reflection on English ingenuity.” The business of sword making being, however, more immediately within the province of the Birmingham manufacturers, Mr. Eyre sent Mr. Gill an extract from his lordship’s letter, who thereupon, in December of that year, presented a memorial to the Right Honourable the Lords of the Treasury, stating that sword-blades could be made by him of as good a quality as those from Germany, and praying that the comparative goodness of those of both countries might be examined into. In consequence of which, a letter was written by Mr. Sheridan, to his grace the master general, and board of ordnance, and in answer thereto it was remarked, “ that the board of ordnance does not furnish any swords to the regiments of dragoons ; but they apprehend the error has arisen from the application of colonels of regiments of dragoons, who supply swords for their own corps ; nevertheless, if their lordships wished an investigation of the matter, and they would direct a number of foreign swords to be sent to the

Tower, the board would give directions to have their goodness examined and compared with those of Birmingham."

This answer was sent the 7th of January, 1784, and there the business ended. No foreign swords were ever sent to the Tower for the above purpose, nor was any trial of their comparative goodness ever made; and it was not till the year 1786, that Mr. Gill obtained the object of his pursuit, though he had made repeated and fruitless attempts for that purpose. For, on an order for ten thousand horsemen's swords being issued by the East India Company, which was divided indiscriminately amongst English and German manufacturers, Mr. Gill, being still anxious for the comparative proof, presented a petition to the committee of shipping of the East India Company, requesting that all the swords of the different countries and manufacturers might be proved by a test, so as to ascertain the difference of their qualities. This produced an order for that purpose, and a resolution that none but such as on inspection and proofs stood that test, should be received.

Accordingly, when the swords were sent to the company's warehouse, they underwent an examination by a test or machine, recommended by Matthew Boulton, Esq., of the Soho, for trying the quality or temper of the sword-blades; namely, by forcing the blade into a curved state, and which reduced its length of thirty-six inches to twenty-nine and a half inches only, from the point to the hilt. The result of this trial proved, that Mr. Gill had two thousand six hundred and fifty swords received, and only four rejected.

That of the German swords, fourteen hundred were received, and twenty-eight rejected, being in the proportion of thirteen to one of Mr. Gill's.

And that of the other English swords, only two thousand seven hundred were received, and one thousand and eighty-four rejected!

It was owing to the parsimony of the London retailers of swords, that the English swords fell into disrepute; the fact was, they employed unskilful workmen, and bought

goods of an inferior quality. To corroborate this fact, it may be necessary to relate a case in point:—A London dealer having executed a commission for swords for General Harcourt's regiment of dragoons, prior to its going to North America, in the war of the revolution of that country, was called upon by the General on his return to England, and upbraided by him in the severest language of reproach, for having supplied his troops with swords of so base a quality, that they either broke to pieces, or became useless, in the first onset of an engagement, by which many of his brave soldiers were unworthily slaughtered, and his own person exposed to the most imminent danger. In this distressed predicament, the contractor applied to Mr. Gill, who had never before supplied him with any sword-blades, in consequence of another regiment wanting some at that time, to know at what price he could render swords of such a quality as to bear what he, the contractor, called a severe mode of trial, namely, striking the sword with violence upon a large flat stone. But Mr. Gill, in answer, told him he thought it by no means so severe as it ought to be, to determine properly the real quality of swords; and that he would engage to serve him with such as should stand a much severer test, at an advance of only nine-pence for horsemen's, and six-pence for small swords, more than was given to other makers for those of an inferior quality. In fact, besides subjecting his sword-blades to the test of bending them in the manner above-mentioned, he caused them to be struck flatways upon a slab of cast-iron, and edgeways upon a cylinder of wrought-iron, frequently a piece of a gun-barrel, which they often cut into two parts. Nay, so exceedingly tough were they, although made of east-steel, that, after cutting a gun-barrel asunder, he would frequently wind one of them around it in the manner of a ribband, without its breaking; and indeed the greater part of the blade would recover its original straightness, the part nearest to the point only remaining in a coiled state.

The result of this great success was, that he was very

frequently applied to for his superior sword-blades, even by German officers, who preferred them to those of the manufacture of their own country. Neither did he content himself with improving the quality of his sword-blades, but he likewise studied their embellishment, both by blueing and gilding them in the most elegant manner, and by embossing them, and in which he employed the talents of the first-rate artists.

Besides his business of a sword-cutler, Mr. Gill was also a large contractor for the supply of ironmongery stores to the office of ordnance, and which also included the supply of tools and materials for the use of the royal military artificers; and, in fact, in one year in particular, he supplied such to the amount of upwards of one hundred thousand pounds sterling! And, indeed, so voluminous were the accounts, that it cost the life of one of his most expert clerks to get through them. In fact, the ordnance granted him imprests to the amount of fifty thousand pounds, in one instance, and thirty thousand pounds in another, to enable him to execute those large supplies.

He was also the first gunmaker in this country who set up, as it is termed, or put together, musquets, carbines, and pistols, for government use, out of London. During the French revolutionary war, however, the ordnance finding the supply from the London gunmakers to be insufficient for the extensive demand for fire-arms, determined that they should likewise be set up in Birmingham, from whence indeed the locks, barrels, brass-work, &c., had always been procured; but the arms were set up under the inspection of viewers, in the Tower of London. And accordingly he wrote to the Editor at Birmingham, whilst he himself was in London, desiring him to wait upon the Birmingham gunmakers, and to apprise them of the wishes of government on this head, and likewise to inform them that he was determined government should not be disappointed, and that unless they would undertake the task, he would himself become a gunmaker. They, however, were so much

alarmed at the thoughts of setting up fire-arms under the rigid inspection of the view-masters, having merely been makers of musquets for the African trade, and the merchants, and of ordinary pistols and fowling-pieces, that although their workmen were out of employment, owing to the war putting a stop to their trade, yet not one of them would venture to embark in the undertaking. On this, Mr. Gill brought down into the country with him an inspector and view-masters from the Tower; a proof-house and view-rooms were constructed in the vicinity of Birmingham, upon the borders of a navigable canal, and he commenced the important object, in which indeed he was greatly assisted by the care and diligence of the inspector, and proof and view masters, his task being chiefly confined to the financial department; and after having thus readily fallen into this important pursuit, and succeeded for several years in affording complete satisfaction to the inspector and his officers, and consequently to the board of ordnance itself, the Birmingham gunmakers at length began to rouse themselves, and endeavour to share in the work; and with this intent, to endeavour to get back their workmen from Mr. Gill; this, however, government would not permit, and they were therefore under the necessity of procuring others. About this period also, the lease of a powerful forge and water-mills, situated in the midst of the gun-barrel welders, having expired, Mr. Gill took a lease of them, and thus completely established himself as a manufacturer of gun-barrels also. However, in process of time, the other Birmingham gunmakers entered into the business of setting up fire-arms, and, during the late wars, have rendered the most essential services to government.

The forge and mills above-mentioned were constructed upon the usual plan, of the water-wheels running as fast as the water could drive them, and, consequently, to the great waste of their power. They were, likewise, at the end of a long lease, in such a state of dilapidation, that they required nearly an entire renovation, and, accordingly, were taken upon a repairing lease for the long period of ninety-nine

years. The Editor then prevailed upon his father to adopt, in the construction of the new water-wheels, the scientific principles established by the experiments of the celebrated Smeaton; namely, that in overshot water-wheels, the peripheries should not move with a greater speed than three feet per second. This slow motion being however so very different from the usual speed of such water-wheels, it was determined that the novel experiment should be first tried by the removal of a small water-wheel, of only twelve feet in diameter, and over which, when the mill-pond was full and the head and fall was twenty feet, the greater part of the water was thrown, without much of it entering the buckets; in short, it was the most wasteful water-wheel in the works. In place of this, another water-wheel, of sixteen feet in diameter, was substituted; and instead of being an over-shot, it was what is termed in this country a back-shut, and in the United States, a pitch-back, water-wheel, the water being laid upon it behind, near to its top, and its motion being in the same direction with that of the water flowing from it, so that, in time of floods, it was less obstructed by the back-water, or tail-water. When this wheel was completed, it was found that all the water it required would have passed through a hole an inch square only, and that instead of moving at the rate of three turns per minute, as intended, it made two and a half revolutions only, and yet it performed its work, that of actuating two pairs of large forge-bellows, most perfectly. The success attendant upon this first experiment, led Mr. Gill to construct two other water-wheels, the one of sixteen feet in diameter, and five feet in breadth, with deeper buckets than usual; and another of the same diameter, and ten feet broad; and by dividing the work of boring and grinding gun-barrels, and grinding and polishing sword-blades, between these two water-wheels, the expenditure of the water was very greatly economised, and the mills also rendered much more powerful.

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XIX.—*Recollections of his Father, the late Mr. THOMAS GILL. By the EDITOR.*

ALTHOUGH the slow motion of the water-wheel answered most completely for actuating the large forge bellows ; yet, in the case of grinding and boring gun-barrels, grinding and polishing sword blades, &c., it was quite different ;

and, although the water acting by its gravitating power, produced a much greater effect than when wasted in the usual manner of applying it, yet, in increasing the velocity of the machinery, a part of its force was necessarily expended; and it therefore became an object of considerable importance, that as little friction as possible should be created, both in the toothed wheel-work, and in the bearings of the necks or pivots, which were made larger than usual, so as to allow of a sufficiency of grease to be applied, to prevent the wearing surfaces from coming into contact; and the bearings for them to run in were also made of chilled cast-iron. In consequence of these improvements, a single wooden tooth was never required to be added, during at least nine years; and indeed it was a long time before the marks of the chisel, used in accurately shaping the teeth of the cast-iron pinions, were obliterated, a clear proof that but very little rubbing or friction took place in their action. As, however, the water-wheels were capable, if allowed to run with the ordinary velocity, and therefore to place the workmen in danger from the bursting asunder of the grind-stones; so it became necessary to endeavour to guard against this possible evil, by placing a centrifugal governor to regulate the supply of the water to the wheels. The Editor, now thirty years since, invented the form which has since become commonly employed in the construction of the centrifugal governor; namely, that of raising the socket upon the stem of the governor, by short arms connected with it and the longer ones, upon which the weights or balls are applied, in the manner of an umbrella; and which had the advantage of acting in a quicker manner, than when the governor was constructed as usual. However, the rising and falling of the water in the mill-pond, produced such differences in the pressure under the various depths, that it was found impossible to counteract them, and the use of the governor was therefore abandoned; and a number of handles placed within the reach of the workmen, and each communicating with the main levers

of the shuttles, which admitted the water upon the wheels, were substituted instead thereof. The example thus afforded by Mr. Gill, for the first time in his neighbourhood, of economising the expenditure of the water, although at first ridiculed by those who were confirmed in their old habits; began at length to be copied, and has now introduced a better and less wasteful mode of employing it.

Possessed of a forge, actuated by water-power, Mr. Gill was now enabled to convert the ingots of cast-steel into bars under his own direction, and thus to prevent the great injury sustained by cast-steel from over-heating it, as usual. He thus insured its excellence, and particularly by heating the ingots in a hollow-fire, by the flame alone, without bringing them into contact with the pit-coal, to their great injury; and also carefully working them at the lowest heat possible.

In consequence of the French introducing the use of rifles into their revolutionary armies, it became an important object with government to adopt them likewise; and an application was therefore made to Mr. Gill, to enable them to do so. With his usual energy, he accordingly endeavoured to meet the wishes of government, and caused a machine to be constructed, which should be capable of rifling twenty barrels at once; and, indeed, he contemplated the idea of rifling every soldier's musquet! In this great undertaking he was, however, unfortunately for his country, cut off by the hand of death, and never lived to see the machine fully act! It was, however, so nearly finished, that the Editor, after his father's disease, completed it, and its performance surpassed every thing of the kind which had been constructed before.

The barrels had seven spiral grooves cut along their interior surfaces, the effect of which upon the ball, in passing through them, was to give it a whirl around its axis, which greatly tended to preserve a rectilinear direction in its flight. As, however, in the usual mode of rifling, these grooves were irregularly cut, so the ball experienced a considerable

resistance in passing through them, which greatly injured its effect. Now, in this improved machine, all the seven grooves were being cut at once, by the action of as many cutters; and no cutter passed more than once down and up the barrel in the same groove, its position being continually changed by the action of the machine, so that it passed into the next groove in succession, and so on continually. By this means, even supposing that each cutter did not act alike, yet, by their continually changing their places, their irregular actions were equalized, and the result was the most perfect similarity amongst the grooves, whereby the ball experienced no impediment in passing along them.

It is difficult to afford such particulars of a necessarily complicated machine, as may be sufficient to convey any accurate idea of its construction. We shall therefore only state, that the spiral movement of the cutters was obtained from a straight bar, mounted on one side of the machine frame, and which was capable of receiving any degree of inclination requisite for altering the obliquity of the spirals or twists in the grooves; that the rods upon which the seven cutters were mounted, had each a pinion of seven teeth affixed upon its end opposite to that upon which the cutters were placed; and that a toothed rack extended across the machine, the teeth of which acted in those of the twenty pinions, whilst the rods carrying the cutters were passing down and up the barrels; the rack being at the same time pressed into contact with the inner edge of the straight bar, or inclined plane above mentioned, by the action of a spring upon its opposite end, the end next to the bar being furnished with a friction roller. And that instantly upon the cutters being brought out of the barrels, the rack ascended upon two inclined planes, which lifted it up, out of contact with the twenty pinions; and whilst in that situation, by an ingenious contrivance, not to be understood by description alone, it was carried sideways, so as to enter the next teeth in succession in each pinion,

upon again descending the two inclined planes to its ordinary level, as before, and thus effected the important changes above mentioned, of the seven cutters in the grooves of each barrel.

As a proof of the perfect equality which existed amongst the grooves, a cylindrical plug of lead, ten inches in length, might be cast upon an iron bar placed within the barrel, whilst melted lead was poured into it, and which of course received upon its surface projecting spiral ribs, corresponding with the grooves in the barrel. This plug might be passed down and up the barrel without impediment, and be then passed into any other grooves at pleasure, in a similar manner. We need hardly say this could not have been accomplished but in consequence of this absolute equality in the grooves.

The fixed part of this machine also held the barrels firmly which were to be rifled; the cutters being mounted in a sliding carriage, which was carried backwards and forwards, by means of a crank, mounted upon a squared part of the outermost axis of one of the great water-wheels, and which crank had a friction roller, acting in a vertical groove, formed in a cast-iron plate, affixed upon one end of the sliding carriage, and thus moved it in an equable and most favourable manner. The sliding carriage was guided in its rectilinear movements by means of ledges, placed upon the sides of the fixed part of the machine, and furnished with friction rollers. The two inclined planes which raised and lowered the rack being mounted upon one end of the fixed frame. Each cutter was a kind of file, toothed upon its exterior face, and was held in a groove, cut in a proper spiral direction, in the cylinder which held the seven cutters; the ends of each cutter being thinned away, so as to lodge underneath a steel ferril or hoop, firmly affixed upon the cylinder; and also under another hoop, which could be removed, when it became necessary to change the cutters; each cutter being also pressed outwardly, by the action of a spring, placed within the groove

underneath it. The faces of each cutter were made rounding, or swelling in the middle, and tapered away towards each end, so as to enter either end of the barrel without catching. And as the ferrils required to be very strong, and yet but of little thickness, so it became exceedingly difficult to form them. And, in fact, it was only accomplished by raising them by degrees out of plates of cast-steel, frequently annealed, in sets of dies made on purpose, and which first raised the edge a little, so as to resemble a frying-pan in miniature, for instance; then another pair of dies raised it still more; and, finally, it was brought into a cylindrical shape. It was now only necessary to cut out the flat bottom, and the cast-steel ring or ferril was thus formed, without any joining, welding, or soldering.

The twenty rods which carried the cutters and the pinions upon their ends, were driven through the barrels by means of pushing-rods, made conical at each end; the one end of each being fitted into a hole formed to receive it, in the centre of each of the cylinders carrying the cutters; and the other end was received into another hole, formed at the end of twenty adjusting and binding screws, which were affixed into one end of the sliding-carriage.

The barrels were adjusted and firmly held in the fixed part of the machine, by means of saddles and adjusting screws; and when they were once adapted to any particular kind of barrel, it was easy to take out and replace them at pleasure, so that numerous barrels might have been rifled in a short period of time.

We believe that we have thus enabled a mechanic, and especially a gun-maker, to comprehend the principles of this excellent machine; and we wish it were in our power to add, that his surviving children were benefitted by their father's great exertions in constructing it. This, however, was by no means the case; for any one possessed of a barrel rifled in it, had only to cast a cylinder of lead in it, after the manner we have above described, and thus to be-

come possessed of a means of rifling other barrels, not indeed equally perfect with those executed in the machine, but much better than usual, and perhaps sufficiently good to answer the ordinary military purposes.

Mr. Gill, like too many other persons, had a great dislike to making his will, and unfortunately delayed it till it was out of his power to do it properly. The consequence was, that his large property was, after his death, disposed of by auction, at greatly reduced prices; and when the proceeds thereof were divided amongst his twelve surviving children, but little came to each one's share. Of these the major part are now dead. The Editor, and his two youngest brothers, being indeed all who have survived out of eight sons.

Mr. Gill was most deservedly a highly popular character in his neighbourhood, both from the great employment he was able to afford the various manufacturers and their workmen in his vicinity, and from the liberality with which he contributed to the support of the numerous establishments in Birmingham for alleviating their distresses and ailments. He was also, as we have shown, greatly esteemed by government, and particularly by that portion of it connected with the ordnance. During the period of the riots at Birmingham, his house, as well as that of his next neighbour, were threatened by the mob, as belonging to John Taylor, Esq., the respectable banker at Birmingham, and who had several houses either burnt, or otherwise greatly injured, by their excesses. In this predicament, however, so far from removing his own property, as he was repeatedly ordered by the mob to do, as they did not wish to injure him, but only the house he inhabited; he, on the contrary, filled it with the valuable effects of his neighbour, who was a dissenter; and the Editor, with others, kept an armed watch, both by day and night, for the space of a fortnight, over the joint property of both. At length, at the expiration of that period, the military arrived from Nottingham, and relieved them from their perilous situation.

Mr. Gill was thrice nominated high sheriff of the county of Warwick, and must then of course either have served the office, or have paid the usual fine. Shortly before the period arrived, however, a serious accident happened to him, which very nearly cost him his life, from the loss of blood it occasioned; and, indeed, for the space of fourteen days, his physician, the late celebrated Dr. Withering, could give his family no hopes of his surviving. At length nature, and an excellent constitution, prevailed; and the first use he made of his returning faculties, was to direct the Editor to write to his patron, the Duke of Richmond, master general of the ordnance, to inform him of the accident, and of his being thrice nominated to the shrievalty; that he had no vanity to feed, but a family of thirteen children; and that, under these circumstances, he prayed his grace to exert his influence with government, both to get him excused from serving the office, and also to remit the usual fine. His grace accordingly complied with his wishes; and he was not only excused from serving, without being fined, but the gentleman he recommended to government was chosen high sheriff in his stead.

Mr. Gill survived the effects of this accident several years, but it produced a lameness in one of his feet, which greatly lessened his activity.

XXX.—*Recollections of his Father, the late Mr. THOMAS GILL.* By the EDITOR.

IN order to afford our readers an idea of the wretched state to which the manufacture of English sword blades was reduced, previous to Mr. Gill's patriotic and successful endeavours to restore to his country this highly important branch of its manufactures, we shall make some extracts from a scurrilous paper, published by three of the principal London sword dealers, in the year 1787; in which they wisely labour to depreciate the character of the English sword blades, in order to exalt those of German manufacture.

*“ Important facts addressed to the Officers of the Army.”*

“ The superior excellence of the German sword blades has been attested by our officers for a century past, during which period many attempts have been made to bring the British to the same state of perfection. The first adventurer was a German, supplied with German materials, and assisted by German workmen. The manufactory was at Newcastle upon Tyne. From principles of policy, the government gave all the encouragement possible to the enterprize, and a prohibitory act was passed in its favour; but it proved abortive. Similar attempts were afterwards made by Englishmen, at Hounslow, and Lewisham; but with no better success. Convinced, by repeated trials, that the design was impracticable, the manufacturers, we mean those of integrity and skill, candidly acquiesced in the superiority of the German blades. But one GILL, of Birmingham, publicly declares, he can furnish the army with better blades than the Germans themselves. To establish this point, he appeals to a trial at the India house. But it is easily manifested that no credit is due to Mr. Gill, and that the proof at the India house, was an imposition on the

honourable company, and a flagrant act of injustice to his neighbours at Birmingham !

“ A copy of this imperfect test has been introduced into the public papers. But as the affair is of national importance, it is greatly to be wished that a Court of general officers would condescend to determine the relative excellence of German and British blades. For it is not doubted, that those who pay a professional attention to the form and temper of swords, and spend their lives in the use of them, will form the most respectable and disinterested Tribunal to which an appeal can be made \*.

“ That we cannot use the British swords in the field of action, but at the peril of the military glory of this country, and the lives of our bravest troops, is founded on the sacred and indispensable evidence of general ———, who solemnly avers (in his memorial to the Lords of the Treasury), that when he commanded the Royal Regiment of Horse Guards, in Germany, the broad swords which he received from Birmingham were so unfit for service, that several of them were absolutely broken in action ; that his own sword was in a very imperfect state, through the want either of honesty or ability in the maker, and that his men suffered greatly on the occasion.

“ Similar instances occurred frequently in America. And that the Birmingham people have not even now the power to remedy these defects, is evident from the case of one of the Regiments of Dragoons, lately quartered at York. It was furnished with swords at the commencement of the present year (not by Mr. GILL, however, EDITOR) ; a particular pattern was ordered, and as the time would not permit of an application to Germany, so the London tradesman was under a necessity of procuring them from

\* Mr. Gill had afterwards the *pleasure*, and the London sword dealers the *great mortification*, of having a comparative trial made of his sword blades with those of Germany, and of other English makers, by command of his late majesty, before a Board of General Officers, at the Horse Guards ; when the great superiority of those of his manufacture appeared still more manifest than upon the former trial.

Birmingham. At this moment, not one in ten remains unbroken!!!

“It is easy to conceive what carnage would ensue, if men were to charge an enemy with such weapons as these.

“The present experience of this regiment has not only destroyed their confidence in the Birmingham manufacture, but it may repress their ardour in the field of battle, even though they have a German blade in their hands. The very idea of being disarmed and exposed to the enemy after the first or second stroke, is sufficient to fill the bravest heart with terror.”

It is somewhat singular, and not unworthy of remark; that, in the year 1779, when a petition was presented to the Board of Ordnance, to supply them with German swords, under the fallacious idea that those of England were inferior; Mr. —————, father to one of the gentlemen whose signature is subjoined to the foregoing paper, was called to the Board of Ordnance, and his opinion of the swords of English and German manufacture desired; when he clearly proved to the entire satisfaction and conviction of the Honourable Board, that Mr. Gill's were equal in goodness to any foreign swords whatever; and the petition was rejected accordingly. What motives could influence the son, nine years afterwards, to decry his father's judgment, is left for the public to decide!

It having been hinted at the two comparative trials respecting the merits of Mr. Gill's sword blades and those of German and other English manufacturers, that the chief cause of his great superiority was the partial conduct of the person who struck his blades upon a cast-iron plate; he declared that he would make a machine to strike them, which could not, of course, be liable to such an imputation; and, accordingly, he invented and caused such a machine to be constructed. This machine had two powerful spiral springs similar to those of time-pieces, but much broader, and longer, of course; indeed each of them was twelve inches in breadth. The inner ends of these springs were

united to an axis, turning upon necks or pivots at its ends, which moved in holes or bearings formed to receive them, in the cast-iron frame of the machine. Between the two springs, a cast-iron substitute for the hands of the person who before struck the sword-blades upon the cast-iron plate, was affixed upon the axis; having two iron staples upon it, to receive the tangs of the sword blades within them, and which were firmly held therein, by two binding screws. One end of the axis of this machine projected beyond its pivot-hole, and had a ratchet-wheel affixed upon it, into the teeth of which a click, having a long handle affixed to it, was lodged. Upon winding up the springs, by means of a winch or handle, affixed upon the axis of the machine, the sword blade, held in the manner above mentioned, was brought from its horizontal position, when lying upon the cast-iron plate, and carried as far round, in an opposite direction, as was judged proper, or according to the kind of sword blade to be struck; the click retaining it in that position, until its handle being elevated, set the springs at liberty to strike the blade upon the cast-iron horizontal plate, with the requisite degree of force. This machine answered its purpose most completely, and entirely removed the chance of any unfairness being practised, in the proving of the quality of any sword blades tested by it; and all the sword blades made and warranted subsequently by Mr. Gill, were capable of enduring the severity of its strokes! The Editor recollects inscriptions being etched upon the upper surfaces of the springs, stating, that "all of Gill's warranted sword blades, are of the same excellent qualities of steel and temper as these extraordinary springs."

We would here appeal to our readers, and ask, what would have been the fatal consequences of our being obliged to procure our sword-blades from Germany, frequently occupied by the enemy, during the long continued wars in which we have since been engaged; and, as recommended by the worthies, who signed the above paper? And, con-

sequently, how greatly the British empire is indebted to the praise-worthy exertions of that individual, whose sole endeavours completely obviated the necessity of our being reduced to such a pitiable state, and who indeed, completely turned the scale of merit in our favour; and especially, since the introduction of the sword exercise, by Colonel Le Marchant, which has given such a decided superiority to this important weapon!

Should public circumstances require it, the Editor, who, in consequence of the death of all his brothers, excepting the two youngest, who lost their father in their infancy, is now the sole depository of his late father's great and successful practices in the manufacture of his superior articles, would be glad to have the opportunity of reviving those practices, with such additional improvements as he has added to them in the course of his great experience in the difficult art of treating steel.

In the progress of publishing the *Technical Repository*, and the *Technological Repository*, our readers must have frequently observed notices by the Editor of improved processes, followed by his late father and himself, in the working of iron and steel. These, although of high importance, can, however, convey but little knowledge, comparatively, of the actual methods of carrying them into practice; and which, indeed, nothing short of actual experience can possibly effect.

It is indeed true, that in consequence of the example afforded by the Editor's late father, the qualities of English sword-blades, made by other persons, were considerably improved, in order that they might be rendered capable of undergoing the increased severity of the tests to which they were subjected. Still, however, no one but one educated in the extensive knowledge possessed by his late father, can possibly be enabled to carry his improvements into complete effect.

exceed that of vegetable charcoal, in its anti-septic quality.

In his former experiments on filtering, Mr. Hawkins tried various animal and vegetable substances to form strainers or supports for his charcoal; horse-hair and wool were very soon decomposed by the action of the water; so also were linen, cotton, and other vegetable substances; so that he was obliged to discontinue their use. Silk alone he found to resist the action of water for nine months together; and, accordingly, he has now chosen this material to construct his new pocket filtres. He can carry them even whilst wet in his box, without any inconvenience whatever.

We may here remark, that Mr. George Field, now of Isleworth, found a silk Bandana handkerchief to be the best material to form the strainer of his excellent physeter, or filtre of; and for which invention, and others, employed by him in his business of a superfine colour manufacturer, he was many years since rewarded by the Society of Arts, for the benefit of the public; notwithstanding which, it has since been repeatedly attempted to monopolize it by patents; and indeed very recently a patent has been obtained for this old invention; such is the general ignorance respecting the law of patents.

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LXIX.—*Recollections of his father, the late Mr. THOMAS GILL.* By the EDITOR.

HOWEVER severe were the trials Mr. Gill subjected *his celebrated warranted sword-blades* to, such as bending them, striking them flatways on a cast-iron plate, and edgeways upon a cylinder of iron, and as described in our former articles; yet, in consequence of the suggestion of a military gentleman, he afterwards proved them in a still more severe manner. This gentleman, after witnessing the above mentioned trials, observed, that in the actual em-

ployment of swords, besides being used in attacking an enemy, they likewise served to defend the soldier himself, who warded off the strokes of his adversary by holding his sword blade in a perpendicular posture, either behind him, or one side or the other, or in front, as the occasion might require; and that in this case, it was liable to be broken by the strokes of his adversary's sword, and therefore he wished the blades of the swords he ordered, to be also tested in a similar manner. Accordingly Mr. Gill, whose object it always was, to expose his sword-blades to severer trials in his own hands, than they were ever likely to be exposed to in actual use, immediately constructed an apparatus to hold the sword-blades in the perpendicular position, and then caused them to be struck across by the edge of another very heavy sword-blade, applied with the utmost strength of a workman, so as to endeavour to break them. In this way, finding that several sword-blades, which had endured all his former proofs, failed in this still more severe one, he, without hesitation, immediately adopted it, and subsequently exposed all his sword-blades to that additional trial also.

Mr. Gill was the perfecter of those very useful fire-arms, the *spring-bayonet pistols*, or *blunderbusses*. Before he improved their construction, the bayonet was actuated, on being let loose from its first detent, by means of a spring affixed to its shoulder, which re-acted against the barrel of the pistol; but in case the bayonet struck against any obstacle in its way to attain its proper position for use, or to extend itself in a straight line with the barrel, it would hang down powerless, in a perpendicular posture, and could only be carried up to its destined situation, and secured by the second detent, by the hand of the party holding the weapon; but in this case, the only chance of the bayonet being useful, was perhaps lost, owing to the delay occasioned in its movement.

Instead of the spring above mentioned, Mr. Gill enclosed a stout watch-spring, in a neat cylindrical box,

affixed in the joint upon which the bayonet moved, and which spring was properly wound up, so as to possess strength enough to carry the bayonet up to its resting place, and detent it securely, even though it should be held back during the whole of its progress from its first position. The spring-bayonet pistol, or blunderbuss, now became a really serviceable weapon, either for the defence of a house, or of a traveller in a chaise, &c. ; the firing off its charge being always left to the last extremity, and in case the bayonet failed to repel the attack.

We may also mention a great improvement which Mr. Gill effected in that useful instrument, the snuffers. A Mr. Pinchbeck had, many years since, contrived a pair of snuffers, in which the snuff of a candle could be extinguished, after being cut off, by being pressed between the snuffer plate, or cutter, and another plate held in the box of the snuffers, instead of continuing on fire after being loosely lodged in the box as usual, and thus producing the usual offensive well-known smell occasioned thereby. This second plate was then to be raised by the application of the left hand, the snuff was to be pushed into the box by the action of the cutter-plate moved by the right hand, and the plate was then to be lowered by the left hand, in order to retain the snuff in the box. Now Mr. Gill contrived to render this second plate capable of being actuated solely by the hand which held the snuffers ; and, after snuffing the candle, and pressing the snuff between the cutter-plate, and the second plate to extinguish it, and then again opening the snuffers a little wider than at the first operation ; upon closing them, the second plate rose of itself, and again descended during the action of shutting the snuffers, and thus the complex movements required in using Mr. Pinchbeck's snuffers, were entirely dispensed with ; and, accordingly, Mr. Gill's patent self-acting and extinguishing snuffers, immediately became a favourite article of sale, and have now continued to enjoy the preference shown to them by the public for upwards of forty years !

Mr. Gill was much attached to riding on horseback, from the exercise which it afforded him, and the benefit he consequently derived in the improvement of his health, and he therefore always rode horses of considerable value. It so happened, however, that a favourite horse had the misfortune to have a tooth, which grew to such an extraordinary length, as totally to prevent it from chewing its food. In this predicament, it occurred to Mr. Gill, to remove this tooth, by excision, or cutting it off, a practice now beginning to be introduced amongst us as a novelty. In order to this, he caused a strong pair of cutting-nippers to be made, with handles each a yard long, and their jaws only an inch and a half, and the cutters also placed on the side, not at one end of the nippers. With this powerful instrument, he completely succeeded in cutting off the projecting part of the tooth, although it was situated in a part of the horse's mouth which rendered it difficult to reach it, and the animal was thus again enabled to chew his food readily.

Mr. Gill also considerably improved the manufacture of twisted gun-barrels. Instead of forming the ribands (as they are termed in the trade), of which they are composed, with square edges, as usual, he sloped one of them off, or bevelled it, and the consequence of that change in its form was, that in the act of being wound upon the solid cylinder, to form the barrel, it assumed a new shape, and fitted so accurately to the other sides of the coils, that instead of leaving a gap between them, as in the common way, they were applied so closely together as not to leave room enough even for spelter-solder to insinuate itself between them, in an experiment which was purposely made to determine the exact position in which they lay when thus coiled. Upon sawing the barrel in two lengthways, the coils were found lying in close juxta-position, and most admirably fitted for welding together. The ribands were formed of different thicknesses in grooved rollers, actuated by machinery, and were then welded together at their

ends, the thickest being intended to form the breech, and the thinner ones the other parts of the barrel. These were uniformly heated red-hot in a reverberatory furnace, and were then wrapped or coiled around an iron cylinder, which was also guided uniformly along, by being connected with a long screw, the flat threads of which were of an equal thickness with that of the ribands; and they were pressed into contact with the iron cylinder, by being passed underneath a cylindrical pressing roller. These barrels, thus coiled, were then ready to be welded as usual.

In order to render these twisted gun-barrels still stronger, he coiled another layer of ribands over the first layer, but in an opposite direction to them, and thus formed, as it were, a reticulated combination, the one layer crossing the other, and both thus effectually resisting the power of the gunpowder to burst them asunder, after being properly welded together.

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