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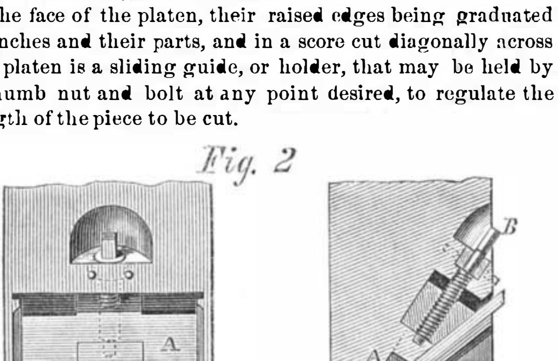
Improved Machine for Mitering Frames.

The joints of rectangular frames as picture, looking glass, window, and other frames must be cut at the proper angle before being put together; and to make perfect joints they should be planed as well as sawed. Usually, these two processes are performed on separate machines, and sometimes the fitting is done by a hand plane. The machine, however, which is herewith illustrated performs both these operations at one time, perfectly and with great rapidity.

The machine is an iron frame carrying a sliding platen, also of iron, on the top, and having two saws and cutter heads mounted on a single central shaft. This shaft, with its combined saws and cutters, is driven by a belt running on a small pulley on it, driven by a belt running from a larger pulley at the rear of the machine and near the floor, the shaft of which carries a fast and loose pulley. On this shaft is also a worm engaging with a worm gear on an upright shaft, having on its upper end a pinion engaging with a rack fixed to the under side of the sliding platen. This combination is the feed of the platen. The upper journal of the vertical shaft runs in the end of a lever pivoted to a brace under the platen, the other end of the lever being a handle projecting beyond the forward end of the platen. A slight transverse movement of this handle throws the pinion out of gear with the platen rack, and by pressing lightly on the handle of another lever, pivoted to the platen, the under face of the lever being covered with leather, it engages with the top of the saw shaft under the platen and the revolving of the shaft carries the platen rapidly back ready for another forward movement, which is obtained by the action of the pinion and rack thrown into gear. If the automatic feed is not desired, the pinion and rack may be left disengaged, and the platen moved simply by pushing with the hand, as on ordinary sawing machines.

For guiding and holding the stuff to be sawed there are three frames, formed at an angle of 90°, secured to the face of the platen, their raised edges being graduated to inches and their parts, and in a score cut diagonally across the platen is a sliding guide, or holder, that may be held by a thumb nut and bolt at any point desired, to regulate the length of the piece to be cut.

Fig. 2

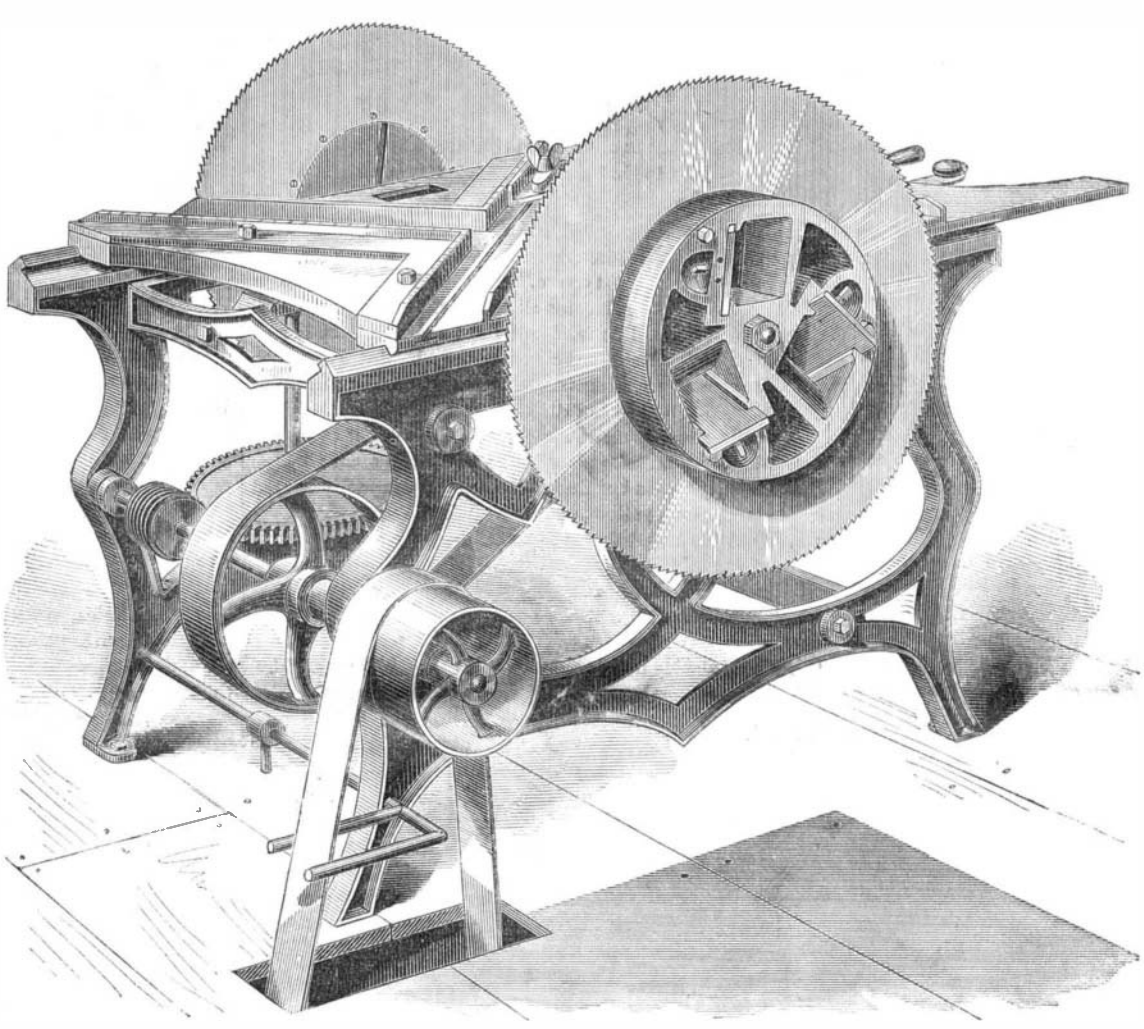


The saws are not ordinary circular saws, but annular, the blades being secured to turned wrought iron flanges insuring stiffness and perfect truth. These flanges are bolted to hollow heads, which are formed to receive two, three, or more planing bits, or cutters, that finish the joint of the stock after it passes the edge of the saw. The method of setting and securing these blades is peculiar and very effective. It is shown in detail in Fig. 2.

These hollow heads are divided into as many radial compartments as there are planing bits. The sides of these compartments have planed ledges on their sides, which hold the edges of one side of the bits. They are seen in perspective, in Fig. 1. These ledges are planed or filed perfectly smooth and straight. On the other side of the bits are wedges, A, Fig. 2, with planed surfaces meeting the back of the bit. These wedges are moved by means of screws, B, the heads of which are seated in semi-circular recesses in the head, as seen, and turned by means of a socket wrench. The edge of the bit being set at the proper distance from the inner face of the head, a slight turn of the screw brings the wedge down upon it and hugs it with great force against the ledges.

This method of securing cutters (which may be also applied to any tenoning or grooving machine) leaves a clear throat for the discharge of chips, unimpeded by bolt head or other devices, and does not necessitate the slotting of the bit, which is simply a plain plate.

This device was patented through the Scientific American Patent Agency, May 26, 1868, by John J. Sanders, Jr., who may be addressed for the purchase of the entire right, or for other information relative to the patent, at 257 Hudson street, New York. He will also sell the right to hold planing irons, etc., by his method, to plane makers, wood workers, and others wishing to use it.



SANDERS' PATENT MITERING MACHINE.

NATURAL SELECTION--THE DARWINIAN THEORY.

The theory of the origin of species as first enunciated by Darwin, and which has been so widely discussed, has undoubtedly been gaining ground among the most celebrated naturalists. The basis of that theory is, first, that variations, so slight as not to form distinctive features of classification, are constantly occurring in the reproduction of both plants and animals; second, that these variations of form are capable of transmission to progeny, and that the peculiar characteristic resulting from the variation is generally intensified in its transmission; third, that whenever the variations give their inheritors peculiar advantages in obtaining sustenance, etc., over that possessed by their fellows, they will live longer, will procreate more, and consequently, in the lapse of ages, will extinguish the weaker types. The author of the theory called this process natural selection, and supported his theory by the results of numerous experiments, in which, by artificial selection, he produced similar results to those which he claimed for the natural selection. He experimented mainly with animals which propagate very rapidly, as pigeons, rabbits, etc., and thus was enabled to produce between generations widely separated, very astonishing differences in form, color, and habits. He produced such marked changes in the descendants of wood pigeons, that he truly said, that had they been found at large by a naturalist, they would not have been classed with the same genus. They ate meat, had hooked beaks, and talons, and were both in appearance and habit similar to the family of hawks.

When this theory was first propounded, it met both vehement opposition and ridicule. It was attacked by philosophers and wits, and formed the subject of many a lampoon and satire. It was denounced as opposed to the teachings of revelation, as a system of guesses, which were not sustained by either facts or logic. But there was a vitality in the theory, and the conclusions of a man who fortifies his opinions with such a host of facts as Mr. Darwin brought to sustain his, are not easily put aside. One after another the thinkers of the entire world have slowly been accepting the theory, until it may fairly be doubted whether any hypothesis is more nearly established upon a permanent basis.

Dr. J. D. Hooker, in his recent address to the British Association at Norwich, thus reviews this subject:

"Ten years have elapsed since the publication of 'The Origin of Species by Natural Selection,' and it is hence not too early now to ask what progress that bold theory has made in scientific estimation. The most widely circulated of all the journals that give science a prominent place on their title pages, the *Athenæum*, has very recently told it to every country where the English language is read, that Mr. Darwin's theory is a thing of the past; that natural selection is rapidly declining in scientific favor; and that, as regards the above two volumes on the variations of animals and plants under domestication, they 'contain nothing more in support of origin by selection than a more detailed reasseveration of his guesses founded on the so called variations of pigeons.' Let us examine for ourselves into the truth of these inconsiderate statements.

"Since the 'Origin' appeared ten years ago, it has passed through four English editions, two American, two German, two French, several Russian, a Dutch, and an Italian; while of the work on 'Variation,' which first left the publisher's house not seven months ago, two English, a German, Russian, American, and Italian edition are already in circulation. So far from natural selection being a thing of the past, it is an accepted doctrine with every philosophical naturalist, including, it will always be understood, a considerable proportion who are not prepared to admit that it accounts for all Mr. Darwin assigns to it. Reviews on 'The Origin of Species' are still pouring in from the Continent, and Agassiz, in one of the addresses which he issued to his *collaborateurs* on their late voyage to the Amazon, directs their attention to this theory as a primary object of the expedition they were then undertaking. I need only add, that of the many eminent naturalists who have accepted it, not one has been known to abandon it; that it gains adherents steadily, and that it is, *par excellence*, an avowed favorite with the rising schools of naturalists: perhaps, indeed, too much so, for the young are apt to accept such theories as articles of faith, and the creed of the student is also too likely to become the shibboleth of the future professor. The scientific writers who have publicly rejected the theories of continuous revolution or of natural selection, or of both, take their stand on physical grounds, or metaphysical, or both. Of those who rely on the metaphysical, their arguments are usually strongly imbued with prejudice, and even odium, and, as such, are beyond the pale of scientific criticism. Having myself been a student of moral philosophy in a northern university, I entered on my scientific career full of hopes that metaphysics would prove a useful Mentor, if not quite a science. I soon, however, found that it availed me nothing, and I long ago arrived at the conclusion, so well put by Agassiz, where he says, 'We trust that the time is not distant when it will be universally understood that the battle of the evidences will have to be fought on the field of physical science and not on that of the metaphysical.' (Agassiz on the 'Contemplation of God,' in the *Kosmos. Christian Examiner*, 4th series, vol. xv. p. 2). Many of the metaphysicians' objections have been controverted by that champion of natural selection, Mr. Darwin's true knight, Alfred Wallace, in his papers on 'Protection' (*Westminster Review*) and 'Creation of Law,' etc., (*Journal of Science*, October, 1867), in which the doctrines of 'continual interference,' and the 'theories of beauty,' kindred subjects, are discussed with admirable sagacity, knowledge, and skill. But of Mr. Wallace and his many contributions to philosophical biology it is not easy to speak without enthu sism; for, putting aside their great merits, he, throughout his writings, with a modesty as rare as I believe it to be unconscious, forgets his own unquestioned claims to the honor of having originated, independently of Mr. Darwin, the theories which he so ably defends.

"On the score of geology, the objectors rely chiefly on the assumed perfection of the geological record; and since almost all who believe in its imperfection and many of the other school, accept the theories both of evolution and natural selection, wholly or in part, there is no doubt but Mr. Darwin claims the great majority of geologists. Of these, one is in himself a host, the veteran Sir Charles Lyell, who, after having devoted whole chapters of the first editions of his 'Principles' to establishing the doctrine of special creations, abandons it in the tenth, and this, too, on the showing of a pupil; for, in the dedication of his earliest work, 'The Naturalist's Voyage,' to Sir Charles Lyell, Mr. Darwin states that the chief part of whatever merit himself or his works possess has been derived from studying the 'Principles of Geology.' I know no brighter example of heroism, of its kind, than this, of an author thus abandoning, late in life, a theory which he had for forty years regarded as the very foundation of a work which had given him the highest position attainable among scientific writers. Well may he be proud of a superstructure raised on the foundations of an insecure doctrine, when he finds that he can underpin it, substitute a new foundation, and, after all is finished, survey his edifice, not only more secure, but more harmonious in its proportions than it was before; for assuredly the biological chapters of the tenth edition of the 'Principles' are more in harmony with the doctrine of slow changes in the history of our planet than were their counterparts in the former editions."

A NEW TREATISE ON STEEL.

We are in receipt of a new treatise upon the theory, metallurgy, properties, practical working, and use of steel, translated from the French of M. H. C. Landrin, Jr., C. E., by A. A. Fesquet, Chemist and Engineer, with an appendix on the Bessemer and the Martin processes for manufacturing steel, from the report of Abram S Hewitt, U. S. Commissioner to the Universal Exposition, Paris, 1867.

Among the many claimants to public favor, which have appeared upon this subject, we have met with none which appears to us better adapted to the universal necessities of all directly or indirectly interested in the metallurgy of steel. The mechanic will find here the information he requires, conveyed in a simple and practical form unburdened with unnecessary verbiage, and arranged in convenient form for reference and condensed without neglect of important principles. A good specimen of the work is the following extract, upon the tempering of steel. The temperatures are given in degrees of the centigrade scale. The reader can easily convert them into degrees of the Fahrenheit scale, by the following simple rule: Multiply the degrees expressing any temperature in the centigrade scale by 2. Subtract one tenth of the product from the product itself, and add 32 to the remainder. The result will be the number of degrees of the Fahrenheit scale, expressing the same temperature.

"Notwithstanding what has been said, and the so-called experience of some practical metallurgists, pure water is the best liquid for hardening steel. It is a mistake to believe, with the ancients, that certain waters are more adapted to this operation than others. The only difference lies in their temperature. A workman of Caen, Mr. Damesme, who has published a diffuse work on steel, has tried the hardening of steel in the juices of vegetables, and has ascertained that there is comparatively no advantage over hardening in water. Mercury has no other property than that of being cold, and of producing a hardness which can be obtained with water at the same temperature. Tallow and oils, where carbon is one of the constituent elements, produce an imperfect hardening, but prevent a loss of carbon. When by over heating, steel has been burned and decarburized, the oils and fatty matters are useful, because they give back to the steel a part of the carbon lost in the fire. Some acids, such as sulphuric, are justly considered as imparting more hardness to steel, by dissolving a film of iron from the surface and exposing the carbon. As for urine, alcohol, brandy, and a thousand other liquids extolled by ignorant workmen, they are not worth as much as water, which has the advantage of being abundant everywhere, cheap, and adapted to all changes of temperature.

"Steel should be hardened to the point corresponding to its nature and its use. Indeed, it is possible to correct the quality, either by increasing the hardness by a very cold dipping liquid, or by producing more elasticity when tempering; but these corrections are left too much to the judgement of the workman to be considered efficacious. For instance, in fine cutlery, and principally in the manufacture of surgical instruments, every instrument must have its peculiar hardness and tenacity. Very few men always succeed in the operation, which, generally, is left to chance.

"Hammers, cold chisels for iron, drills, engraving tools, require a strong hardening, a great hardness; sabres razors, straw cutters, etc., do not require to be dipped into very cold water; table knives, scissors, and springs, require less hardness.

"We readily understand, that if the temperature the most proper for the degree of hardness and tenacity of the instrument were known, it would be sufficient to raise the instrument to that temperature, and to immerse it afterward in water. Some workmen heat the steel which is to be hardened, much above a cherry redness, allow it to cool slowly in the air, and wait until it has taken a certain color, previous to plunging it in water. This is a very bad practice, because by an excess of heat, there is a loss of carbon, and an alteration of the steel, which has then large grains, and is without tenacity at the edges. In order to graduate the heat, and to bring the instruments to various and distinct temperatures D. Hartley, in 1789, thought of using a pyrometer, when hardening. This process, very good, indeed, was difficult in practice. Sir Parkes was more successful, by determining in advance the various points of fusion and of perfect liquidity of certain metallic alloys. These temperatures being known, steel is plunged into the molten alloy, the same as into a forge fire, and when thoroughly heated, is dipped into cold water.

"Although this method has not been generally employed, for the sake of its ingenuity, we will take from the compositions of Sir Parkes, those which most nearly correspond with the various colors and temperatures necessary for certain instruments.

"The temperatures are in degrees centigrade:—

Lead.	Tin.	Temperature of fusion.
7 parts.	4 parts.	213.40°
7½ "	4 "	221.11°
8 "	4 "	225.50°
8½ "	4 "	232.22°
10 "	4 "	240.90°
14 "	4 "	251.90°
19 "	4 "	262.35°
30 "	4 "	273.90°
48 "	4 "	284.90°
50 "	4 "	289.20°

Linseed oil boils at 312.40°.
Lead melts at 319°.

"The metallic baths above named are certainly not for heating steel previous to hardening, but for tempering steel already hardened.

"Hardened steel is generally harsh and brittle; so is chilled iron, probably for the same cause. If, after a strong hardening, which will be the type of extreme hardness, steel is heated again to redness, it loses all the hardness it had gained, becomes soft, and will be rendered hard again only by a new hardening. Between these two extremes: hardness and softness, there are several degrees which are as many shades of the qualities adapted to certain uses.

"These degrees are made apparent by the color of the metal when reheated, and take place in the following order:

"1. Being put upon burning fuel, the steel gradually heated becomes tarnished, yellow, and *straw yellow*.

"2. The heat increasing, the color deepens, and reaches a gold yellow, *full yellow*,

"3 Afterward, the steel takes several shades, rapidly following and blending with each other; they are purple, pigeon's throat, copper, *brown purple*.

"4. These shades become deeper until they become *violet*.

"5. Afterward, they pass rapidly to indigo blue, *full blue*, *dark blue*.

"6. This color becomes weaker, and gives a *sky blue* more or less pure.

"7. The blue takes a greenish tint and produces shades which are gray and *sea-green*.

"8. At last, the steel *reddens*, and will no longer give distinct colors.

"The shades of these eight colors, which are called tempering colors, and perfectly distinct, very apparent, and easy to recognize; but they take place only after hardening and on clean steel. The metal which has not been hardened, will not show these colors so plainly; the shades are mingled, blended, and less in number.

"The colors, during the tempering, are a sure guide for the workman, of the degree of hardness or tenacity he desires to obtain. Dark blue indicates a great tenacity, straw yellow produces a greater hardness, and is the tempering shade for razors. Bistouries, lancets, penknives, erasing knives, some scissors, and generally blades requiring body, are reheated to full yellow. The strong blades for table knives and gardening tools are tempered to a brown or purple brown. Purple is the proper color for large shears. Violet and dark blue are for springs; with a violet color, the spring will be very elastic but brittle, a blue shade will make it very resisting. It is very difficult to break a spring reheated to the color of water; but its elasticity is a great deal lessened.

"The temperatures (centigrade) corresponding to these colors, and best adapted to the tempering of various instruments are seen in the following table:

Lancets	210°—215°
Other surgical instruments	220
Razors	225
Penknives, erasers	230—235
Scalpels, cold chisels for iron	240
Shears, sheep shears, gardening tools	250
Hatchets, axes, plane irons, pocket-knives	260—265
Table knives, large scissors	270—275
Swords, watch springs	285
Large springs, daggers, augers	290
Saws, some springs	310—315
Various other instruments requiring less hardening	320

"The hardened instruments are reheated in or upon a live fire, easily regulated, and without the help of bellows as far as practicable. An intelligent workman will cease blowing as soon as he perceives that the metal begins to change its color. The proper shade must come by itself without increasing the fire, and must be regular all over, before the piece is plunged in cold water. Sometimes this last dipping is omitted.

"The small pieces, such as penknives, erasing knives, etc., rest upon a wire cloth put into the middle of the fire; when they have reached the proper color they are cooled in water.

"A lancet requires a special tempering: the shank must be blue; from there the color will be first purple, next brown, and at the point, full yellow. These various shades upon one blade are a necessity, on account of the degree of hardness and tenacity required by this instrument. Full yellow will produce the proper sharpness, but would not be suitable to the rest of the blade, which, instead of hardness, must have tenacity and elasticity.

"A good workman, willing to give the greatest perfection to an instrument, will be very careful when tempering it, in order to obtain the various shades which are necessary. A knife, for instance, must be brown purple at the cutting edge, purple in the middle, and sea green at the back, to unite the hardness of the cutting edge, with a certain amount of resistance which will prevent its breaking under a strain.

"This is obtained by using certain precautions, and above all, by not going beyond the proper degeee, because it is very difficult to retrace the steps. If the fire is too strong or irregular, part of the edge may be purple brown, while the other is only straw yellow; then, by pinching the blade between red hot tongues, at the place which should be more heated, the temperature rises rapidly, and the instrument is brought up to the proper tempering point. Certain scraping and burnishing tools, and steels for sharpening, do not require any tempering, because they cannot be too hard.

"It happens though rarely, that steel bars which have been and left for some time in store rooms, will break with a noise and will project to a distance, pieces of steel from the corners. This phenomenon does not take place with small pieces, such as smooth or even bastard files, but will happen with large rubber files, mostly those of cemented steel. By hardening too quickly, the same effect is sometimes produced; the workman receives a shock in his arm at the moment of dipping: part of the piece breaks off with a noise, or the steel splits along its length"

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STEAMER FOR COMMON ROADS—VULCANIZED RUBBER TIRES.

We noticed some time ago an adaptation of rubber to wheel tires for traveling over rough and uneven surfaces. We copy the principal points of an account given in one of our Scottish exchanges—the Edinburgh *Scotsman*—of an experiment made with R. W. Thomson's patent road steamer in Edinburgh, Scotland. "It drew four loaded wagons each of which weighed, when empty, 2¾ tuns and carried a load of 5¼ tuns of coal, making the gross weight of the wagons 32 tuns. The road steamer weighs 8 tuns. Thus a total of 40 tuns was in motion. The road steamer had drawn the train from Newbattle Collieries, eight miles from Edinburgh, over a very hilly road, with rising gradients of 1 in 16. The hill from the Pow Burn up to Minto Street is both long and steep, but the road steamer drew its train to the top with the most perfect ease. It was very curious to watch the behavior of the patent india-rubber tires of the road steamer as they passed over the various descriptions of road surface. In the outskirts of the city, where the roads are macadamized, there were many places where broken stones had just been spread on the surface. Over these sharp loose stones the india-rubber tires of the road steamer passed without crushing or in fact disturbing them in the least. The roughest and sharpest bed of broken stones sank gently into the elastic cushion of india-rubber, which rose from the contact with the most jagged fragments of stone without any trace or mark of injury. The perfect command which the conductors of the train had over its movements enabled them to control both its course and speed with the utmost precision. The line of streets through which it passed—viz., Minto street, Clerk street, Nicolson street, South Bridge, North Bridge, Princes' street, Leith street, and Leith Walk—are always the most crowded streets in the city, but at the time the train passed through these thoroughfares there happened to be an unusually great current of traffic passing in a contrary direction towards the South Side Gymnasium, where some games were going on, which gave rise to a great stream of omnibuses, cabs, and conveyances of every description, in addition to a great crowd of pedestrians. Notwithstanding all these obstacles, aggravated by the streets being at some points under repair and closed for one-half of their width, no difficulty was experienced in steering clear of every impediment. The crowd of spectators increased with such rapidity that by the time the train was passing the University thousands were trying to catch a glimpse of the novel sight, and when crossing the High street the swarms of idlers who give such a busy aspect to that locality rushed in vast numbers to see how the train would descend the steep incline from the High street to the Bridge. This was done with as much ease and quietness as if there were no hill at all. The extremely curious way in which the whole four wagons follow, snake like, in the track of the road steamer was clearly seen in passing out of North Bridge into Leith street. First, the road steamer had to turn to the right, and before the last wagon was round the corner to the right, the road steamer had already turned sharp to the left to go into Leith street—thus the train actually assumed the form of the letter S. every wagon going over the same ground as the road steamer with the most perfect accuracy. The very steep and crooked descent of Leith street, which has a gradient of probably 1 in 12, was managed with perfect ease, and the train pursued its way down Leith Walk, along Junction street, and up Bonnington Road to the works of T. M. Tennant & Company, where it had to deliver the coals. In passing out of Junction street into Bonnington Road there is a sharp acute angle, so that the train had actually to double back on itself; however, it rounded the corner without the smallest difficulty. The final maneuver was one which the conductors of the train did not expect to be able