Even if practically water-proof at the outset, the rats and land crabs soon destroy their integrity, and what they commence the action of the tides accelerates, and thus the necessity of constant watchfulness and repair arises. The want of an impenetrable core which should defy the whole tribe of borers, individually or unitedly, has caused the failures in the science of draining which have hitherto marked its progress.

The iron dike invented by Mr. S. B. Driggs, of New York, seems to put an effectual barrier in the way of these destructive agents. It is constructed by driving iron plates into the soil and joining them end to end, thus presenting an unbroken and impenetrable iron wall, which may be extended to any required length, and the durability of which is unquestionable. If, from causes not taken into account, repairs should ever be needed, the replacing of one of these plates is an operation quickly and easily effected.

The invention of iron dikes seemed to be singularly applicable to the drainage of the Newark meadows. Accordingly, Mr. Driggs, purchased and secured, notwithstanding difficulties arising from the various owners and the opposition of the Tide Water Co., of New Jersey, 5,000 acres of these lands. This Tide Water Co. had most exclusive and oppressive privileges granted to them by charter; one of which was the power to reclaim any land at will, and to tax the owner twelve dollars per acre in perpetuity. Mr. Driggs fought this scheme of extortion until he obtained the entire abrogation of their iniquitous charter. At this stage of proceedings, Mr. Driggs secured the hearty coöperation of Mr. Samuel W. Pike, of opera house fame, who saw sufficient promise in the system to give it his most earnest and hearty support. The work was now prosecuted with great vigor, and the result has been that owners of land only a few months since valued at fifty dollars an acre, have in some cases recently refused offers of enormously increased prices. The accompanying description, together with the cuts, will give a good idea of the nature of this improvement.

We have already said that these dikes are constructed with iron plates driven into the soil. The plates are so constructed and driven as to form a continuous wall. They are of cast iron, as thin and sharp at the bottom as the metal will run They are made of sufficient width to reach both the high and low water marks, and are pressed or driven into the soil by any convenient power. The weight of workmen transferred by means of an ordinary fence rail, or blows upon the tops with stones, is sufficient in very soft mucky soils, while in stiff soils some superior force might in some cases prove necessary. The plates are so joined to each other as to prevent their overlapping, and the earth forced into the joints renders them sufficiently tight. When the turf is too tough and unyielding to drive these broad plates with facility, it is cut by a process called chiseling. After the plates are driven to a sufficient depth, a large and deep ditch is excavated on the inland side, into which other cross ditches empty. The earth thrown up over the iron wall forms a fine substantial embankment, covering the portion of the iron left exposed in driving. The bank is protected from the action of weather by grass and such creeping plants as have long interlacing roots.

To prevent oxydation, the iron used is refined so little as to be scarcely changed in character from the crude metal. It is well known that refining iron increases its tendency to oxydize, and it is claimed that the iron used for these plates will at least rust so slowly as not to materially affect their durability.

It is claimed that this improvement is applicable not only to dikes, but to banks of canals.

There can be little doubt as to its applicability to the reclamation of the large tracts of waste swamp lands to be found in Mississippi, Louisiana, Arkansas, Missouri, Tennessee, and other parts of the United States. Experience has proved the extraordinary fertility of lands thus reclaimed, and the benefit of iron dikes may thus prove to be a boon not only to our own country, but to the world at large.

POWERS OF THE COMMISSIONER OF PATENTS.

A singular case has lately arisen in the Patent Office, which from the frequent opportunities of its occurrence involves consequences of considerable general importance.

The owner of a patent applies to the office for a reissue, and is met by the answer that there appears upon the records of the office an assignment of the whole patent to another party, who has already obtained a reissue. To this he replies that the assignment is a forgery, and at the request of the office, substantiates his statement by satisfactory proofs, and claims that the Commissioner should at least again reissue the patent, and place him upon an equal footing with the forged assignee.

The Commissioner rejoins, that this is impossible. First, because he has no power judicially to consider the question as to who is the owner of the patent, aside from the records of his office, and, second, because the original patent having been surrendered by the fraudulent assignee, it has now no existence to be again surrendered for a reissue, and that the only remedy for the rightful owner is in the courts.

It becomes our duty to consider these questions in their order:

First—What are the powers of the Commissioner of Patents in determining who *is* the assignee of a patent upon the application by a person of that class for a reissue?

The provisions of the Patent Law upon the subject of reissues, in this instance, are as follows:

After detailing the prerequisites of a reissue, the act continues, "and in case of his (the patentee's) death, or any assignment by him made of the original patent, a similar right shall rest in his executors administrators, or assignees." Act of 1836, §13.

The power here conferred upon the Commissioner to reissue a patent to the assignee thereof, necessarily invokes the power to determine who is an assignee. Of this there is no dispute, indeed the objectors in this case concede the right, though they insist that the Commissioner can have resort only to the records in his office for information.

Let us inquire, then, whether such is the limitation of evidence in this instance.

The powers of the Commissioner of patents are largely judicial. Questions of novelty, utility, adequate compensation, equivalent devices, and construction are under his constant supervision.

In no single case is he expressly limited by law to the information on hand in his office. Indeed by far the greater number of classes of questions presented to him, depend upon information wholly outside his records.

The Act of 1836 (sec. 11), provides, "that every patent shall be assignable in law, * * which assignment * * shall be recorded in the patent office within three months from the execution thereof."

What was the purpose of this enactment? Was the recording for the information of the Commissioner? Judge Story in a leading case in Massachusets, where the effect of not recording an assignment was fully discussed, supplies us with the answer. The learned judge there says, "Why should an assignment be recorded at all? Certainly not for the benefit of the parties or their privies, but *solely* for the protection of *purchasers* who should become such *bonâ fide*, for a valuable consideration, without notice of any prior assignment." (Pitts *vs.* Whitman, 3 Story, 609). And this is the settled law to day. If, then, "Every assignment shall be recorded" "*solely* for the protection of purchasers," under what color of right can the Commissioner say that the enactment impliedly limits him to the record itself for evidence.

But again, the Act says, in case of the patentee's death, or any assignment by him, a similar right shall rest in his *executors, administrators*, or assigns.

Suppose a patentee dies, and his administrator applies for a reissue, must not the Commissioner determine if the party applying *is* the administrator; and in order to do this is he confined by any requirements of the Patent Law to any records in his office to determine the fact? Manifestly not, for there are no such records, the whole range of legal evidence which might be adduced in a Court of Justice is at hand to aid him in his decision. Primary and secondary evidence of all kinds in their appropriate places is open to his inspection. And if this is the case with an executor or administrator, why should we apply a different rule to the assignee who is mentioned by the Act in the same breath.

And again, many assignments are incapable of record, and yet it seems hard that such assignees, the legal owners of a patent, should be precluded from the benefit of a reissue by the fact that their assignments are not recorded, which will be the case if the Commissioner is limited to his record, such as assignees in bankruptcy, insolvency, or receivers. Or a veritable assignee may have lost or been deprived of his assignment, and may be unable either to procure a copy or a new original, yet it can hardly be the policy of the law to deny to him the whole benefit of his patent, by refusing to admit other legitimate proof of his ownership as a foundation for an application for reissue.

This very objection of being limited to the records of his office was made by the Commissioner in the analogous case of *ex parte* Dyson, decided on appeal from the patent office in 1860, and Judge Dunlop then held that "the legislature has not said by what proof the applicant shall show that his invention claimed on reissue is the same invention made and intended to be patented on his original application. He is not limited by the statute to prove it by the specification, models or drawings, any legal proof to show it to be the same invention, whether found *in the record or aliunde*, ought to be received and weighed by the patent office. No authority is given to the patent office to limit the applicant's proof, if it is such as upon the law of evidence is held sufficient to prove facts before other legal tribunals." If, then, the applicant for a reissue is not limited to his specifications, drawings and model, upon the question of identity, why should he be confined to the record of assignments upon the question of ownership.

If, then, these authorities and illustrations have any weight, it would seem to be an undeniable proposition, that upon an application for a reissue of a patent, the Commissioner is not confined to the record alone to determine the legal ownership of the patent, but may resort to all those ordinary departments of evidence which afford themselves to every one charged with the decision of judicial questions, indeed, any other constuction would lay the Patent Law open to the charge of depriving citizens of their right to a reissue (which is their *property*), without "due process of law."

This view is strengthened by referring to the provision of the law of 1861, (chap. 88), which provides "that the Commissioner of Patents may establish rules for taking affidavits and depositions required in cases pending in the patent office," supplying him with ample facilities for satisfying his mind of any doubts in this or similar cases, a provision evidently intended to apply to proceedings before the office different from the "contested cases" mentioned in section 12 of the Act of 1839, or the subsequent clauses of the Acts of 1861. It remains then, only to consider under this head the question whether the record can be *contradicted* by evidence *aliunde*.

The evidence being admissible as above shown, there is no rule which will prohibit its use in the correction of the record.

The rule of the common law which prohibits the contradiction of a writing by parol evidence is one of interpretation merely, when the only question at issue is one of construction, but has no applicability to cases where the existence or authenticity of the instrument is disputed. (Greenleaf on evidence, §284. Act of 1839, or the subsequent clauses of the Act of 1861.)

We come, therefore, to the second question proposed, as an objection to the reissue under consideration.

Does the fact that the original patent has been surrendered by the fraudulent assignee form any obstacle to its reissue?

It is satisfactorily proven that the patent had been surreptitiously obtained from the owner for the purpose of surrendry. The surrender, therefore, was made by a person having no authority to make it, and was of consequence a nullity. It is one of the greatest absurdities to allege, that any person can, by falsely simulating another, rightfully deprive him of his property. But if no valid surrender of the patent was made, the proceedings upon the reissue to the fraudulent assignee were void, for a reissue can only be granted after a valid surrender (Act of 1836, sec. 13), and the original patent, therefore, still continues in force. In the case of French *vs.* Rodgers, decided in Pennsylvania, in 1851, Judges Grier and Kane held that "if a reissue was invalid for want of authority to make it, the surrender is ineffective for want of authority to accept it." Indeed, it has frequently been adjudged in the analogous case of the surrender of a patent, upon an insufficient basis of fact for a reissue, and the reissue being void in consequence, that the original patent continued in force, notwithstanding its delivery to the patent office. (Woodworth *vs.* Edwards, 3 Woodbury & Minot, 127.) The mere fact of possession by the office is nothing unless there was a valid surrender.

We have now seen that the surrender of a patent by a fraudulent holder is no bar to the legal title of the true owner. And that the Commissioner of Patents is not restricted to the records of his office in determining who is the assignee.

It would appear, therefore, to be his duty, upon being satisfied of the fact of the forgery of the assignment, by means of those ample provisions for securing evidence in cases before him, contained in the acts of 1839 and 1861, to reissue the patent to the party whom he is convinced is the rightful owner, thereby remedying the wrong that has been done him, at least so far as to place him on an equality with the wrong doer.

There are some badges of fraud upon the face of the forged papers in the particular instance before us, which need not be adverted to in this discussion of the general principles of the case; we will only remark in conclusion that it seems peculiarly appropriate, that where, as is at present the case, the door is left wide open for the perpetration of frauds of this nature, by the lack of any provision of the Patent Law for the identification of grantors and grantees of patents, prior to their assignments, that there should be a simple and summary method of correcting errors resulting from so manifest a defect.

THE GREAT AERONAUTICAL EXHIBITION.

The much talked of Aeronautical Exhibition, opened at the Crystal Palace, London, the 25th ult., with a large number of machines immediately and remotely connected with the subject of air navigation. Machines with wings, screw propellers, and tails, more or less in imitation of the structure of birds, seem to form the foreground of this collection of mechanico-ornithological devices. It is not our intention to reiterate the opinions in regard to the practicability of aeronautical machines, which have often been published in our columns. The exhibition inaugurated by the Aeronautical Society is a very good representation of the progress thus far attained. The secretary of the society in a communication to "*The Engineer*" says:

"It should be borne in mind, in the event of any ridiculous theory being illustrated in some of the objects now to be seen, that the study of aeronautics has been hitherto left to a class for the most part uneducated in mechanical laws, who have in consequence been wholly unable to give practical effect to their views, since they could neither themselves construct the apparatus they required, nor did there exist any organized scientific society from whose published proceedings they could gather confirmation or condemnation. Eminent naturalists, for instance, ignoring mechanical laws, have recognized as the main feature in the buoyancy and flight of birds, air cells and other peculiarities which render them of the same specific gravity as the atmosphere. The attempt to elucidate such a theory by any model would be quite as ridiculous as anything likely to be shown at this exhibition." Still it is hoped "if the ideas enunciated in some of the excellent papers read before the Society, do not result in some mechanical arrangements which shall to some extent be effective, that they will otherwise lead to more promising investigation."

The machines and devices exhibited are divided into seven classes: Class I. includes light engines and machinery.

In this class we notice

Rotary engine made of steel, one-horse power; dimensions, two feet by eighteen inches, and one foot high; weight about sixty pounds. Motive power, gun cotton.

A one-horse power turbine injector steam engine, weighing less than twelve pounds, with inclined vanes showing its adaptation for aerial purposes, with rudder and gear for working.

Light engine and machinery for aerial purposes, about half-horse power. Cylinder two inches in diameter, three-inch stroke; generating surface of boiler, three and one half feet; starts at one hundred pound pressure in three minutes, works two propellers of three feet diameter about three hundred revolutions per minute. With three and a half pints of water

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and eighteen ounces of liquid fuel, works about ten minutes. Weight of engine, boiler, water, and fuel, sixteen and one fourth pounds.

Aluminum steam engine.—Viscount de Pouton d'Amecourt, 36 Rue de Lille, Paris.

Working model of the Brighton oil engine (Dr. Money's patent). In this engine power is derived from explosion within the cylinder of inflammable gas or vapor mixed with atmospheric air, The vapor is produced by volatilization of certain liquid hydrocarbons, the heat resulting from the explosion being made available for this purpose.

CLASS II.—*Complete working aerial apparatus.*

Flying machine, which, being attached to the body, enables a person to take short flights.

Complete working aerial apparatus by muscular power.

CLASS III.—*Models.*

Model of a balloon, with a ring or belt attached which, in ascent or descent, is placed in an inclined position, relative to the axis of the balloon, the current of air rushing through the open side of the bell, urging the whole in that direction.

Model of the framework of a car, adapted to receive the machinery described in a drawing (class 5), the object of which is, by a system of levers, to raise the car two or three or more inches, according to the force required, which suddenly dropped on to its supports, produces a rapid succession of jerks, thereby effecting descent without loss of gas.

Model of an improved balloon. By this model it will be seen that the car is done away with, and that a structure of bamboo or wicker work is to be built round the balloon, which is used as an ascending agent only.

Model of the aeromotive, constructed for rising in and steering through the air by the rapid rotation of a screw (one on each side of the machine), which, by creating a reaction in the air, overcomes gravitation, and thus rises. Fixed to the top is a parachute for gradual descent in case of accident The aeromotive is propelled by a screw and guided like an ordinary vessel. The principle of the screw is the same as Rennie's conoidal.

Model of an aerial steamship, propelled by four wings, giving alternate stroke, and two screw fans, one of which is placed vertically for assisting in ascension, the other placed horizontally for propelling ahead, with internal space for gas.

Small model of a steam or hot air engine, chiefly constructed of vulcanized India rubber for aerial purposes.

Experimental model of a balloon, dispensing with gas and ballast.

Model in demonstration of a proposition to omit ballast in balloon ascents. By this proposition gas would be withdrawn from the balloon by an air pump, which would compress the gas into a chamber carried in the car when a descent becomes necessary. An ascent will be obtained by opening a tap, and thus allowing the compressed gas to escape from the chamber by a tube into the balloon. The advantages of this would be that the natural balance used by fishes would be applied to balloons, gas being reserved for use instead of escaping as now obtains.

Model of an aerostat or aerial float, eight inches long, twenty inches broad, and two inches deep, rendered rigid by inflation. When the two shorter ends are doubled together it assumes the form of an open boat or canoe, and will then balance itself in the air, and can be used as a parachute, for it will always descend with its convex side downwards, and in doing so may be propelled and steered in any direction. It is expected, however, that when made on a large scale, inflated with gas and propelled horizontally, it will support itself. The engine intended to be employed is an ammoniacal one.

CLASS IV.—*Working Models.*

INSIDE.

Working model to illustrate a mode of flying vertically by direct action on the air, without any screw motion in the wing. This machine will ascend in a vertical line.

Working model to illustrate natural flying, the wings being used to propel and sustain, the tail to sustain only. This model will fly horizontally for a short distance.

Working model of an air ship, lifting itself by motive power, and capable of being governed in every direction, based upon a system supposed to be not hitherto known, which enables it to work against any lesser currents of air; therefore a certain horizontal direction can be pursued, inasmuch as the cubic contents of the apparatus are comparatively little in proportion to its carrying powers. Each cubic foot of the space occupied by the apparatus is capable of carrying half a pound (Vienna weight).

CLASS IV.—*Outside the Main Buildings.*

A working model of an aerial machine, raising and sustaining itself in the air for several minutes, being worked by a power evolved from the combustion of materials similar to those used in the original fire annihilator, steam and gaseous products of combustion being intermixed within the boiler, and forced at high pressure into a rotary engine, turning, lifting, or driving fans.

CLASS V.—*Plans and Illustrative Drawings.*

In this class we notice only the following, chiefly on account of its absurdity. The expectation that a body floating in a current of air, and propelled by no other force, could be guided by sails, is a folly which our readers will appreciate without further remark.

Drawing and plan of an aeronautic machine. — This machine consists of an oblong frame of light wood, which supports a platform and tent for the aeronaut. To this frame are attached two spherical balloons, fastened at their center to the frame in the usual way. A light shaft supported on the lower side of the frame gives motion to the steering apparatus, which is worked by hand, and by which the aeronaut can change the position of the machine at will. There are sails attached at the forward end of the machine by which it is expected an oblique course can be given to it.

CLASS VI.—*Separate Articles connected with Aeronautics.*

CLASS VII.—*Kites or other similar Apparatus proposed to be used in cases of Shipwreck, Traction, or in the Attainment of other Useful Ends.*

INSIDE.

A rough kite made of materials most likely to be found on board ship, suggesting to the unprovided mariner in peril of being driven upon a lee shore, a ready way of making a kite to be flown with 'two strings.' When about one third out, attach a small wooden weight to the second line; pay out again until the kite reach the distance required; then cut and let go the second line, which will swing to the shore, and communication is accomplished. On an uninhabited coast, attach the second line to the man swimming thereto. The inventor, John Neale, a working man, freely gives this very simple, rough, and common invention of "two strings to the kite" for the benefit of maritime populations of all nations, humbly requesting of all persons interested therein to extend, translate, and further advance the knowledge of the same.

Model apparatus for throwing a line of communication to persons in danger, either from fire or water.

OUTSIDE.

Rogers' patent projectile anchor and block, for launching life boats, etc, in rough weather, and for other life saving and useful purposes. Working model, scale $\frac{1}{16}$, with diagrams, to effect direct communication with a wreck on shore, or between a ship and the shore, or between two vessels at sea, or for assisting boats to leave the ship's side, when at anchor or in a rough sea, or for use in club hauling a vessel off a lee shore; also as a means of aid in case of fire occurring in high buildings.

An arrangement of kites showing Cordner's application to the saving of life, etc., from shipwreck, and to other purposes This consists in applying to the saving of life and property from shipwreck, etc., a set or succession of kites, or several combined sets, so arranged that the power exerted by the several kites of a set shall be at one point or upon a single line, the line of the first or uppermost kite being attached to the adjacent kite, and the line of this to the next adjacent, and so on through all the series.

A patent kite and apparatus showing, by experiment upon a smaller object, how it is possible for a man to ascend the line of a kite by the draft power of another kite attached to a car. The exhibitor has himself ascended by these means to the hight of several hundred feet.

The exhibition only confirms our doubts in regard to the practicability of aeronautic machines.

One difficulty which seems not to be fully appreciated by inventors in this field, we will briefly notice. It is the extraordinary velocity of air currents in proportion to the density of the medium. Did currents of equal velocity in proportion to density occur in water as occur commonly in air, no method at present known would enable us to navigate water. In extreme cases, birds, albeit adapted to flying as no human device can ever be, are driven miles by the force of winds, or compelled to take refuge from its fury.

MECHANICAL NOTES.

TO MAKE A "KNURL."

The "knurl," beading or milling tool, as it is variously named, is often called into requisition by the mechanic for the purpose of ornamenting the beads or swells of the work he is engaged upon. These knurls are generally purchased at some of the hardware stores, and are used by inserting them on the end of an iron shank, where they are free to be rotated by any moving body being held in contact with them, and if they be held rigidly enough they will make upon it a figure the reverse form of that upon their periphery. Knurls are generally made with about three forms of face—straight, hollow, and rounding—and these forms are cut with straight or beveled teeth, or designs of different degrees of coarseness.

If at any time the mechanic has one of these forms, a hollow for instance, which is suitable for beading a swell, and he wishes to produce the opposite of this, or a round faced knurl, he can turn up a steel blank of the required form and hold the hollow knurl against it until the form of its teeth is fully impressed in the surface of the blank. This then can be hardened and tempered ready to be used for the production of its reverse. In this way a sharp knurl may be used to produce a great number of others, or when they become dull by usage they can be restored by it to their original excellence.

But as it is often desired by the mechanic to make a knurl the teeth of which are required to be coarser or finer than any he possesses or can purchase, he can readily do it by first turning a blank to the form required, and then cutting a small screw with the same pitch of thread that the knurl is wanted to be, then cut grooves across it the same as a hob is made for cutting screw-chasers. Temper this screw and fit it to revolve in the lathe. Attach the blank knurl to a shank, the same as it is used in actual work, and hold it in a vertical position so that it will revolve by the action of the screw as it is held against it. The rotation of the screw will cause the blank to revolve, and a serrated surface will be formed upon it at the same time. While doing this it will be necessary to support the shank that carries the blank upon a T-rest.

If the blank knurl be made with a hollow face, the screw to cut it must of a necessity be of a size proportionate to the hollow; but if the blank be made with a flat or rounding form then it must be moved in such a manner that the screw will cut every portion of the face evenly and alike, and this can be done by moving the handle that carries the shank, as it lays upon the rest up and down, and by so doing presenting the blank correspondingly to the cutting surface of the screw.

If ornamental knurls are wanted, the services of the die-sinker must be brought into requisition, who will produce a reverse of the ornament needed, and then reverses of this can be made in the manner mentioned, or they may be so made that they can be used upon the work without the necessity of using them as patterns to form working tools.

HOW TO MAKE METAL TUBES.

Tubes of metal are used for a variety of purposes, and in all large cities and towns are easily obtained of almost any size; but there are times when the mechanic finds it an impossibility to obtain what he wants of this kind of material, and he must manufacture a tube for himself. If the tube is required to be of two inches diameter inside, a narrow strip of metal is cut off and bent close about a mandrel or spindle of that size, until the ends just meet; this slip when straightened out gives the breadth of the piece which is to form the tube. Cut a piece of this breadth from the metal, taking care that the edges are exactly straight and the breadth uniform; brighten the surface for about a quarter of an inch by filing it at the opposite edges on the same side. Then place the piece of metal upon a spindle and with a mallet bend it round it until the edges come in contact and lie very close and even together, the brightened parts coming together on the inside and presenting a clean surface for the reception of the solder.

If the tube be exposed to the fire for soldering in this state, especially if the metal be thin, the heat would cause the suture to open, and it would be impossible to solder it: to prevent this, place loops of small wire, at an interval of about an inch or so apart, around the entire length of the tube, and twist them so as to bring the edge of the metal in close contact.

The tube so prepared is ready for soldering, and borax and spelter must be used for that purpose. The borax being previously burned or made to swell into a friable mass by exposure to heat upon an iron plate, is triturated with water to the consistency of cream, in which state it is rubbed along the inside of the tube upon the seam; upon the borax a portion of spelter solder must be laid. Place the tube over a good charcoal fire with the suture downward, until it becomes slightly red hot; at a cherry-red heat the borax will melt, and presently the solder will fuse, and as this fusion proceeds draw the tube along so as to expose every part of the line or joint to the action of the heat.

When finished remove the wires, and put it in a pickle of sulphuric acid diluted with water; after half an hour remove it, wash and scour it clean, and it is ready to be wrought as may be desired.

GRINDING CYLINDRICAL SURFACES.

The turning of long and slender rods in the lathe, so as to have them of a true cylindrical form, is quite difficult even when a back-rest is used; irregularities which are unobservable by the eye are easily detected by passing the rod between the fingers. Even short and thick rods, that are too rigid to spring under the action of the turning tool, are found to have slight irregularities, which may be accounted for by imperfections of the lathe or by the wearing of the tool, or from hard or soft places in the metal. It will be observed, then, that to produce a perfect cylindrical surface in the lathe is a matter of some difficulty, and the only method seems to to be to turn the work as true as possible, and then complete it by grinding with some abrasive substance, as powdered emery, moistened with water or oil, which is the material generally employed.

The application of emery as an abrasive means for producing cylindrical surfaces is quite simple, as it is evident that the cylinder must be confined between surfaces the counterpart of those to be produced, and then well supplied with the abrading material; it is quickly revolved and operated upon until the requisite surface is produced. If a block of metal, as iron, steel, or brass, be bored with a hole of the size to which the rod is to be reduced, and one end of the rod made to enter this hole, both rod and aperture being supplied with oil and emery, it is evident that by moving the block in which the rod is inserted over the length of the work, it will be reduced so that it will correspond to the diameter of the hole. A block of lead or tin may be cast around the rod and supplied with emery and oil and operated as mentioned. This perhaps is the readiest way of forming a block, as it is easier to melt and recast the soft metal than it is to prepare and accurately drill the iron or steel block. The latter is useless unless of the proper size, but the former can be often remelted and used as as first.

For the use of the amateur an adjustable tool which may be recommended, consists of two cast iron or brass shells, cylindrical in form, and of a length sufficient to keep them steady upon the work. These shells have ears upon each side, and screws pass through these ears and confine the two parts or halves together. Two middle ears may be made with set screws to prevent the shells being closed beyond a certain point. To each of these shells handles are attached, so as to enable the operator to hold the tool and also to enable him to traverse it over the rod to be ground. The interior circles of the shells are made so that when the tool is placed around the rod it is much larger than its circumference, and this space is filled with molten tin, lead, or babbit-metal. If a difficulty should present of the soft metal not retaining its place, several small holes may be drilled a little distance in the shells, and the metal filling these holes when cast will form a sufficient hold to retain it. By slacking the

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