

MANUFACTURE OF CAST STEEL AND HOMOGENEOUS IRON.

In treating puddled steel, raw steel and puddled iron, for the production of cast steel and homogeneous iron, the material to be treated has usually been (at great expense) balled and shingled to clear it from the cinder, and subsequently generally rolled into bars, cut up in pieces, and remelted. According to an invention recently patented by Mr. John Gjers, of Middlesborough, when crude iron or refined iron is caused through the action of iron cinder or other additional matter to boil and to come to nature, the material is transferred under treatment from the puddling even before the process of balling. By remelting or keeping fluid the material, it is caused to separate from the cinder and to attain a uniform quality ready to run into ingots. Thus Mr. Gjers melts crude pig iron, or refined iron, or recarbonized puddled iron, and works it in the usual way in a puddling furnace, and causes it through the action of rich pure iron cinder or other additional matter commonly used when making puddled steel—such for instance as manganese and salt—to boil and to come to nature in the manner adopted for making puddled steel or puddled iron. At or before the stage called top boil, just before the metal begins to thicken and to come to nature, but before the stage when it is fit or ready for balling up, the material under treatment is tapped with as much of the cinder as cannot at this period of the process be separated. It is transferred into a receptacle, in a reverberatory furnace on Siemens' regenerative principle. It may also be run on to the open hearth of a reverberatory gas furnace which may be either on Siemens' regenerative plan, or on the blowpipe plan in which gas is used in conjunction with a hot blast. The essential feature of the furnace to be employed is that it should be capable of producing a temperature sufficiently high to melt steel or homogeneous iron, and it is also important that the flame should be capable of regulation to either an oxidizing or a carbonizing flame.

Here, in the reverberatory furnace, Mr. Gjers allows the transferred metal in a fluid state to remain at rest for a length of time, exposed to a neutral or to a carbonizing or an oxidizing heat, according as the crude steel metal requires more or less decarbonizing; the heat being sufficient to keep it perfectly fluid until the metal has thoroughly separated from the cinder, which will float on the top, and until it has arrived at the requisite point of carbonization to form the steel or homogeneous iron which may now be tapped into ingot molds. Or the cinder may first be tapped or removed, and other flux (such as oxides of iron and manganese in the shape of pure ores of those metals) may if necessary be added to assist in decarbonizing and to protect the metal. To the metal may be added a certain quantity of either wrought or crude iron, of the shape of spiegel iron or other matter (manganiferous) so as to arrive at the point of carbonization and temper desired.

As far as possible the process is regulated, so that the transference from the puddling furnace may be made at such a period of the coming to nature, as will enable the metal after having been made thoroughly fluid and remained so sufficiently long to decarbonize in the reverberatory furnace, to be obtained without addition of malleable iron or ore at the degree of carbonization desired. If the proper precautions are taken to boil and to work the iron well in a suitable cinder in the puddling furnace, it will generally be pure enough for steel. At the last stage of fluidity, while it is yet fluid enough to run, and just when it is about to congeal or come to nature, it still contains about two per cent too much carbon. By transferring and exposing it, for three or four hours, in the reverberatory furnace in a liquid state to a neutral or slightly oxidizing flame under a cover of oxidizing cinder, this excess of carbon gradually works off; and when it is worked down to the point desired (which may be ascertained by testing samples), it is tapped into ingots. To temper and improve the steel or homogeneous iron, in most cases, before tapping the metal, a small proportion of manganese in some of its combinations is added.

It has been found beneficial to let the metal decarbonize to an extent slightly below the desired degree of carbonization of the steel or homogeneous iron, and then to improve and recarbonize the metal by adding a small proportion of spiegel iron, amounting to about 1 per cent of the whole. The carbon may, in some cases, be partly reduced by the addition of wrought iron, or, it may be, other malleable iron in any form containing less carbon than the desired steel. In practice, it has been found advantageous for this purpose to make use of scrap bars, blooms, or balls in a heated state, which are gradually introduced and melted with the fluid metal tapped from the puddling furnace. In some cases, cast steel or homogeneous iron is made by using ordinary puddle balls in combination with the fluid metal tapped from the puddling furnace, for which purpose it is found convenient to partially tap or transfer the contents of the puddling furnace just before the metal comes to nature, and to allow one half, less or more, of its contents to run into the reverberatory melting furnace. The rest may be allowed to continue working in the puddling furnace until it has thoroughly come to nature, and has become malleable, and the cinder has dropped, when it may be transferred either by shovels or in lumps and added to the fluid metal, previously tapped from the puddling furnace, on to the hearth of the reverberatory melting furnace.

The whole of the metal thus mixed, after being thoroughly fluid and brought to the desired point of carbonization in the reverberatory steel melting furnace, may then be run into ingots. Or four or more puddling furnaces may be employed to one melting furnace, and the entire contents of one or several of the puddling furnaces may be transferred before the period of coming to nature, while yet fluid, and

the contents of the remaining furnaces may be transferred after the contents have got into nature; the entire contents of the whole of the puddling furnaces may then be melted together in the steel melting furnace. Or the crude steel metal tapped from the puddling furnace, at the period named, may, particularly when it is desired to treat it in crucibles, be run into molds as flat cakes, which, being broken in pieces, may be remelted in crucibles (or in the reverberatory furnace), in conjunction with malleable iron or with iron ore, to form steel.—*The Mechanics' Magazine.*

Correspondence.

The Editors are not responsible for the opinions expressed by their correspondents

For the Scientific American.

VERSIFICATION BY AN ANTIQUARIAN OF THE HINDOO COSMOGENY OF THE TEN AVATARAS,

THEY BRING THE SACRED BOOKS AND TRADITIONS OF THE HINDOOS.

*The Fish denotes the fatal day
When Earth beneath the waters lay.*

*The Bull's the emblem of the God
Who raised again the mighty clod.*

*The amphibious Reptile marks the time
When it began the shores to cimb.*

*The Lion King and savage trains
Now roam the woods or graze the plains.*

*Next little Man begins his reign
O'er earth and sky and watery main.*

*Ram with ax then takes his stand,
Fells the thick forest—clears the land.*

*Ram with plow turns up the soil,
And teaches men for food to toil.*

*Ram with bow 'gainst tyrants fights,
And thus defends the people's rights.*

*Budha for reformation came,
And formed a sect well known to fame.*

*When Kalki mounts his milk-white steed,
Heaven, Earth, and all! will then recede.*

According to the Hindoo theology the duration of the universe consists of ten periods or Avataras, the first of which is 432,000 years, the second is $2 \times 432,000$, the third $3 \times 432,000$, and so on, and the tenth of $10 \times 432,000$ years. And the total duration from creation to destruction will be 23,760,000 years. Now it is not a little singular that the number 432 is considered in the East as a sacred or mystic number, and was so regarded by the ancient Chaldeans, Egyptians, and others. Again, if we add together the numbers 1, 2, 3, and 4, the sum will be 10 (or the ten avataras). Again, the earth has four magnetic poles, which revolve around the pole of the earth, approximately in the following periods: the first in 1×432 years; the second in 2×432 , 864 years; the third in 3×432 , or 1,296 years; and the fourth in 4×432 , or 1,728 years. The least common multiple of these numbers is 5,184, which multiplied by the half of ten, gives 25,920 years, which is very nearly the period that it takes the pole of the earth to revolve around the pole of the ecliptic, which gives rise to the precession of the equinoxes. Hence we may infer that the ancients were acquainted with these grand phenomena. I will now offer the following suggestions as to why the number 432 and its multiples and sub-multiples were considered sacred by the ancients. The following table will exhibit in part my explanation:

$$\begin{aligned} 432 &= 3 \times 144 = 3 \times 12^2 \\ 864 &= 6 \times 144 = 6 \times 12^2 \\ 1296 &= 9 \times 144 = 9 \times 12^2 \\ 1728 &= 12 \times 144 = 12^3 \end{aligned}$$

The number twelve is everywhere used in the Bible as a sacred or mystic number. Hence we have the 12 sons of Jacob, the 12 tribes of Israel, the 12 apostles of our Savior, the ten commandments delivered to Moses which were completed by the Lord by adding two more to them, thus making 12 in all; showing a completeness, a fullness, not represented by any other number. Again, the dimensions of the most holy altar in the temple of Solomon was four-square, and its measure was $12 \times 12 \times 4$. And the molten sea was supported by 12 oxen. The seventh chapter of Revelation says that 144,000 of the tribes of Israel were sealed with the seal of the living God, and in the fourteenth chapter, that 144,000 of the redeemed praised God before the 4 beasts and the elders, and in the twenty-first chapter we find a description of the New Jerusalem, which is 4 square, has 12 gates, and the length and breadth and the height thereof are all equal, and he found the measure to be 12,000 furlongs. Then the contents must be cube of 12,000, or 1,728,000,000,000. These analogies tend to show why the ancients regarded the number 432 as sacred. Again, the sacred tradition and prophecies of every race and nation were doubtless dictated by extatics long before the art of writing was invented. Is it to be supposed that their prophecies and visions were lost? By no means. They mapped them in the skies, among those fixed and unchangeable stars which glitter in the heavens above—a record that never changes and will last until time shall be no more. If we cast our eyes to the heavens we will see there illustrated the foregoing beautiful lines. Who cannot see the universal deluge when the earth was beneath the waters, in the water bearer who is pouring out a flood in which the fish do swim and the ship (Noah's Ark) is tossed by its tumultuous waves. These constellations are plainly mapped out. Again, the reptile crawling on the dry land is nothing more than the serpent that tempted Eve, and is represented in the heavens by a great serpent which is pursuing a woman to devour her. In the ancient charts she is represented with a child in her

arms and is flying into the wilderness. Is this not mother Eve, and is it not typical of the flight of the Virgin into Egypt, which is also strikingly told in the twelfth chapter of Revelation? Then follows the animal kingdom, which is also mentioned in our Bible, and they are represented in the heavens by the constellations of the lion, the bear, the bull, the goat, the horse, the dog, the sheep, the dove, the raven, the swan, the eagle, the wolf, etc. At length Man appears the master of creation. This is precisely in accord with our Bible. And it was for this reason that the ancients represented a man as surrounded by the 12 signs of the zodiac, each sign corresponding to one of his members. We see this figure printed in our common almanacs, which is probably older than the pyramids of Egypt, and as ancient as theology itself. Then Ram appears—"He fells the forest, tills the ground." (Ram is a Hindoo god, and his name is often found in ancient history as an affix or a suffix to proper names, as Ram-ises, Semi Ramis, etc.) This is doubtless an emblem of Cain. He too is represented in the heavens by the constellation of husbandman or Bootes, who is a cultivator of the vine. He is represented as holding a club, emblematic of his wicked disposition, for we are told that he slew his brother Abel. Abel is also represented in the heavens by the constellation of Auriga, who holds a kid in his arms. The position of these two constellation in the heavenly sphere are so nearly opposite each other that it is presumable that they were so mapped out to show how different in character were Cain and Abel, or in other words, good and evil. Then "Ram with bow" is an emblem of both Nimrod and Sampson, and are seen represented in the heavens by those beautiful constellations Orion and Hercules. Then Budha appears as a redeemer. Is this not another name for our Savior, who is also represented in the ancient charts of the heavens by a child in the arms of a virgin. And lastly, in the grand drama, Kalki appears, "mounted on his milk white steed." This can be no other than the white horse mentioned in the sixth chapter of Revelation, and called "Death on the pale horse." And again, in chapter xix., where the heavens are opened and a white horse appears, and his rider is called Faithful and True. This is also represented in the heavens by the constellation of Pegasus, on which Perseus rode to the rescue of the princess Cassiopeia, who was chained to a rock and about to be devoured by a great sea dragon. The first meridian of the heavens passes only 6 min. 26 sec., or $1^\circ 38' 30''$ to the eastward of the bright star Algeneb, one of the stars forming the Square of Pegasus. Now the precession of the equinoxes carries the first meridian to the eastward at the rate of about $50\frac{1}{2}''$ per year; consequently Algeneb must have been on that meridian about 117 years ago. The square city spoken of in Revelation is beautifully represented by the square of Pegasus. The first meridian has already entered that city, and is gradually advancing towards the citadel, the heart of Pegasus, which it will reach in about a thousand years. At the same time that it pierces the heart of Pegasus it will also pass through his rider, and then we may quote the prophecy of the ancient avatars:

"When Kalki mounts his milk-white steed,
Heaven, Earth, and all! will then recede."

Do we not see this illustrated before our eyes. Never has mankind made so much progress as during the last one hundred years (or since the first meridian entered into the square city). Faithful and True is preparing the white horse—he has already one foot in the stirrup—he will soon mount his milk-white steed. Kalki is beating the call to arms and knocking at the door of our hearts to rouse us to action. The city of the New Jerusalem is being adorned for the marriage with the brightest jewels of the minds and intellects of men. Her gates are standing ajar, and we can even now catch a glimpse into the glorious city whose fame is described in every sacred book ever written, and whose fair proportions are seen in the heavens represented by the Square of Pegasus. Thus we see that our Bible, the ancient Avatars, and the stars agree. And why should they not? Truth is one and universal. And I feel sure that if we could read the internal sense of all sacred books we would find them to agree perfectly. It is man alone who perverts them.

W. P. BUCKNER.

Center of Gravity in a Revolving Vertical Wheel.

MESSEURS. EDITORS:—On behalf of the members of this Institute, I take the liberty of asking you to say, through your able columns, whether the enclosed theory regarding a vertical wheel in motion is true; and if it is true whether it has now been introduced for the first time, as Mr. McCarroll of this city professes himself to be the discoverer of it.

O. J. SWEGLES,
President Buffalo Mechanics' Institute.

The theory and its attempted demonstration are given as follows, by Mr. James O'Riordan in a communication to some newspaper, the name of which our correspondent has withheld.

We have no recollection of seeing this theory before, but in a paragraph attached to the slip containing the communication of Mr. O'Riordan, we find a statement that it was formerly submitted to us, and a charge that we treated the subject in a way that seemed to show want of appreciation of its merits. There is no doubt that we should have dismissed the subject as unworthy serious discussion, had it come to us in the way of ordinary correspondence. We would do so now had it come from a private source, as we deem it of no practical value, and we exceedingly dislike to cumber our pages with purely theoretical discussion. We will however for this once make an exception in favor of this communication, and endeavor to show the entire fallacy of the doctrine, as therein set forth.

MATTEAWAN, Aug. 20, 1868.

In reply to your query of the wheel, viz., "Whether the weight of a vertical wheel, when in motion, rests on the same point as when in repose." It does not. The point on which the weight rests—the center of gravity—recedes from the center and approaches nearer to the periphery of the de-

ascending half of the wheel, and the greater the velocity the nearer it approaches to it, but can never reach to or beyond it.

Proof. When the wheel is at rest, and of uniform density, by the laws of gravitation each particle of which it is composed is of equal weight. Then equilibrium is produced—the center of gravity coincides with the center of the wheel—and on all sides there are equal momenta.

Now let us see whether such is the case when the wheel is in motion. It is evident that as the wheel revolves each particle has a tendency, owing to centrifugal force, to fly off in tangents to the circles they describe. This eventually would occur were it not for the attractions of cohesion and gravitation; the former keeping the mass or particles of matter together, and the latter drawing them towards the earth, and consequently giving them weight.

Again, as each particle revolves in succession from the lower to the upper point of the periphery, or through the ascending half of the wheel, they lose a portion of their weight equal to the centrifugal force given to them in opposition to gravitation. Each particle having a tendency to fly off in opposition to gravitation at one hundred and seventy-nine different angles, which undoubtedly causes them to be relatively lighter than when at rest. While on the contrary, as the particles revolve from top to bottom, or through the descending half, they have, in addition to their original weight (given by gravitation) when at rest, the centrifugal force given by the motion of the wheel, which proves clearly that the descending portion of the wheel is actually heavier than the ascending half. So what the ascending half has lost by motion, the descending half has gained to the same amount. And so to preserve the laws of mechanics—equilibrium and momenta—the center of gravity must part from the center of the wheel and approach the descending, the heavier periphery leaving a number of its particles to the lighter side to compensate for what it lost by centrifugal force.

As I have said, the greater the velocity the further the center of gravity departs from the center of the wheel, for the greater the centrifugal force the greater the difference between the weights of the ascending and descending parts of the wheel, and consequently the nearer it must approach the heavier periphery to equalize this difference and to produce equilibrium. But as the wheel is retarded, or the velocity ceases, the center of gravity approaches nearer and nearer, till finally it coincides with the center of the wheel, the motion ceases; then the wheel is at rest, and I will rest too.

Yours truly
JAMES O'RIOURDAN.

This so-called proof is open to criticism, upon use of terms as well as incorrect reasoning; but as we wish to discuss this matter in a spirit of candor, and to avoid anything that should seem like ridicule, we shall confine ourselves entirely to the point at issue.

The *reductio ad absurdum* is a method of reasoning that has been considered of great service in mathematical investigation, and is equally valuable in the determination of mechanical principles. If, then, the theory that the center of gravity in a vertical revolving wheel is moved from the center of revolution towards the descending half of the wheel, conflicts with established facts, the theory itself must be erroneous, or the facts are no longer to be considered as facts. Nothing in mechanics, however, has been more surely established than the facts with which this theory conflicts, and as facts are dearer to us than any theory, however plausible, we are perforce compelled to deny the truth of the proposition in question.

By this theory one side of a vertical wheel, when revolving, is always heavier than the other side, provided the wheel be balanced when at rest. This being admitted, of course the centre of gravity is always outside the center of revolution; and as long as the wheel revolves in one direction, it is always on the same side of the center of revolution. Like causes always produce like effects. The shifting of the center of gravity, outside the center of revolution, will, when a wheel is at rest, cause it to turn, provided the increased weight of one side, aided by the diminished weight of the other side, is sufficient to overcome the friction of its bearings. If this is constantly kept up, the wheel will constantly turn with increasing velocity, until it reaches the maximum velocity that can result from the given loading of one side. This occurs upon the common overshot water-wheel, the motion of which is kept up by constantly keeping the center of gravity outside the center of revolution upon one side in the continuous application of a weight of water to, and the discharging it from, that side. In a heavy wheel a slight change of the center of gravity to one side of the center of revolution is sufficient to turn it if nicely balanced. We were once employed to balance cylinders weighing 300 pounds each, intended to revolve 1,200 times per minute. With this speed the balancing had to be performed with the utmost nicety, and the bearings were so constructed for the purpose of accuracy, that the friction was the slightest possible. A difference of two ounces between the sides of these cylinders was sufficient to render them useless, and in balancing the weight of a tenpenny nail would set one of them in motion. Now these nicely balanced cylinders, according to the above theory, ought to have been perpetual motions. The weight of a nail would turn them, and it would be difficult to conceive of a shifting of the center of gravity so slight that it would make a less difference in weight upon one side of a wheel weighing 300 pounds than the weight of a single tenpenny nail. These cylinders, when set in motion, after being thus balanced, ought to have continued revolving for ever when the belts were run off; but they did not, they always ceased moving as soon as their momentum had been exhausted by friction. The geniuses who have heretofore expended their time and money upon the problem of a perpetual motion, have—if this theory be correct—been altogether on the wrong track. Instead of attempting to throw wheels constantly out of balance, they should have endeavored to balance them perfectly. We might, as the lawyers say, rest here, but we will discuss the matter somewhat further, lest we should again be accused of not fully appreciating the merits of the case.

The error in the so-called proof of the theory, so positively asserted, lies in the assumption that the centrifugal force acts in opposition to the earth's attraction on the ascending side of the wheel and cooperates with it upon the descending side. It is true, as Mr. O'Riordan affirms, that the centrifugal force is opposed by two forces, the attractions of gravitation and cohesion; but the attraction of gravitation which thus assists cohesion is the gravitation of the particles of the wheel towards its own center of gravity, and not the earth's attraction upon those particles. The earth's attraction upon the differ-

ent parts of the wheel is the same except the difference which results from variations in their distances from the earth's center, which may be left out of consideration as it does not affect the present question; and until motion should be increased so that the wheel would be thrown to pieces, it would not affect the motion of any of the parts, its entire force being concentrated upon the bearings and neutralized thereby. Thus it gives equal weight to both sides of the wheel, provided the sides are symmetrical and homogeneous, and as it is an established principle in physics that a force acts upon any body without regard to its being at rest or in motion, the earth's attraction would not affect the center of gravity in the mass, which does not depend upon the earth's attraction at any time or in any condition. The center of gravity in a mass is the point around which all the parts of the mass will, in any position, balance themselves, and its position would be the same were there no earth, or sun, or planets, and the vertical revolving wheel had the infinitude of space all to itself. It is true that the application of the earth's attraction, is the experimental test for determining the position of the center of gravity in a mass, but it is no less true that the position of the center of gravity is entirely independent of the influence of any external attraction.—EDS.

Solar Heat—Ericsson's Solar Engine.

MESSRS. EDITORS:—Your correspondent, "A," erroneously supposes that the subject of solar heat, as a mechanical motor, has not attracted due attention. Captain Ericsson at the centennial celebration of the University of Lund, in Sweden, last spring, forwarded to that ancient institution essays relating to the sun, showing that perfect uniformity of the rotation of the earth, is incompatible with solar influence and that solar heat may be so employed as to furnish an infinite amount of motive power for practical purposes. As the first part of the essay does not bear directly on the subject under consideration, I will pass over its contents merely observing that the philosophical faculty of the Swedish University at the centennial celebration alluded to, conferred on Captain Ericsson the degree of Honorary Doctor of Philosophy. Before presenting to the readers of the SCIENTIFIC AMERICAN a translation of the latter part of the essay, it will be proper to state that I have witnessed the operation of one of Ericsson's solar engines, to be actuated by atmospheric air heated by the direct intervention of concentrated solar heat. Your mechanical readers will be surprised on hearing that the working piston of the model engine makes upward of 300 strokes per minute.

The simplicity and moderate cost of the means devised to concentrate the solar heat are such that no practical difficulties present themselves to prevent the construction of solar engines of any desirable power. Much might be expected from the versatility of the constructor and his extraordinary mechanical resource; yet, the facility with which the radiant heat of the sun may be collected and concentrated from acres of surface, by the means contrived, will alike surprise and interest the mechanical and commercial community.

The following translation of the essential part of Captain Ericsson's communication to the philosophical faculty of Lund, cannot fail to interest your readers:

"I have, of late years, spent much time and considerable means on experiments to ascertain if the radiating heat of the sun can be concentrated in such a manner as to render it available for the production of motive power.

"Sir John Herschel's and Mr. Poulet's experiments relating to the radiating heat of the sun, although interesting, are not satisfactory as they only deal with low temperatures, showing how much ice may be melted, or what elevation of temperature of water under the boiling point may be effected in a given time on a given surface. The purpose of my investigations and experiments, on the other hand, has been to ascertain what amount of heat can be developed at the high temperature obtained by concentrating the solar rays, viz., bringing their power to bear on a reduced surface, and to devise the most efficient means for effecting such a concentration of the radiating heat. Apart from these preparatory experiments, I have also, at the commencement of the present year, constructed three different motors which I term *Solar Engines*. One of these is actuated by steam formed by the concentration of the heat of the solar rays, while the other two are actuated by the expansive force of atmospheric air heated directly by concentrated radiant heat. Time will not permit, nor is it my purpose on the present occasion, to present a description of these solar engines or the means adopted for concentrating the radiant heat in order to obtain the necessary high temperature. I will therefore limit my essay to the consideration of the essential part of the subject, viz., the motive force itself. With regard to this, I have briefly to state that my experiments show that, at the high temperature requisite for steam engines and calorific engines, the heating power of the sun on a surface 10 feet square will, although in itself too feeble, evaporate, on an average, 489 cubic inches of water in the hour, by means of my mechanical contrivance for effecting the necessary concentration. The importance of this result cannot be overestimated when we reflect that such an amount of evaporation demonstrates the presence of sufficient heat to develop a force capable of lifting 35,000 pounds one foot high in a minute, thus exceeding one horse power. As an incontrovertible evidence of the capability of the sun to develop a great amount of heat at high temperatures, this result is probably of greater importance than any other physical truth practically established.

"The mean distance from the center of the sun to the earth being 214,44 times greater than the radius of the former, it will be found by squaring this sum, that one superficial foot of the sun's surface must heat 45,984 superficial feet of the earth. In other words, the sun on an equal sur-

face throws off 45,984 times more heat than the earth receives. We are therefore enabled, on the strength of the practical result now positively established, to infer, that an area of 10 feet square on the sun's surface develops heat enough to actuate a steam engine, not a theoretical one with its small consumption, but a real steam engine of 45,984 horse power, demanding a consumption of more than 100,000 pounds of coal every hour. But this estimate, based on the evaporation effected by the concentrated radiant heat, is far below the actual development of heat by the sun. Fully one half of the heat conveyed by the solar rays is lost during their passage through the atmosphere and through the apparatus by which the temperature is elevated to the necessary high degree. The actual development of heat, on the supposed 10 feet square of the surface of the sun, will therefore equal the amount of heat generated by the consumption of 200,000 pounds of coal per hour. The mind cannot conceive the intensity which must accompany such an inordinate consumption in so small a space. Still less can we form an idea of the nature of the combustibles or their sufficiency, when such an intense heat is perpetually kept up on the entire surface of a globe the diameter of which is more than a hundred times greater than that of the earth. But it is not my intention on this occasion to lay before the philosophical faculty my speculations regarding the properties of this wonderful orb; I have only designed to discuss the question as to the sufficiency of the radiant heat notwithstanding the enormous distance, and the use we can make of it as a mechanical motor. The result of my experiments, as already stated, having established the fact that without an inconvenient extension of the mechanism which I have devised for concentrating the radiant heat, sufficient power can be obtained for practical purposes, it will now be proper to point out what amount of mechanical power may be obtained by occupying a Swedish square mile with solar engines. Assume that one half of the area is set aside for necessary roads, houses, etc., an available area would remain of 18,000 x 36,000—648,000,000 superficial feet on which the radiant heat might be concentrated. My several experiments having shown that the concentration of the solar heat on 100 square feet of surface is more than sufficient to develop a horse power, it follows that 64,800 engines, each of 100 horse power, may be kept in motion by the radiant heat of the sun on a Swedish square mile.

"Archimedes enthusiastically exclaimed that his favorite device, the lever, had power enough to heave the earth out of its path. It may be more truly said, that the concentration of the radiant heat of the sun furnishes sufficient force to stop the earth in its course.

"I cannot omit adverting to the insignificance of the dynamic energy which the entire exhaustion of our coal fields would produce, compared with the incalculable amount of force at our command, if we avail ourselves of the concentrated heat of the solar rays. Already Englishmen have estimated the near approach of the time when the supply of coal will end, although their mines, so to speak, have just been opened. A couple of thousand years, drops in the ocean of time, will completely exhaust the coal fields of Europe unless, in the meantime, the heat of the sun be employed. It is true, that the solar heat is often prevented from reaching the earth. On the other hand, the skillful engineer knows many ways of laying up a supply when the sky is clear and that great store house is opened where the fuel may be obtained free of cost and transportation. At the same time a great portion of our planet enjoys perpetual sunshine. The field therefore awaiting the application of the solar engine is almost beyond computation, while the source of its power is boundless.

"Enough, I trust, has been said to enable the philosophical faculty to judge of the importance of the subject; but who can foresee what influence an inexhaustible motive power will exercise on civilization and the capability of the earth to supply the wants of our race?"

The foregoing translation is sufficiently explanatory to enable the reader to understand clearly the general features of the subject. I will therefore merely add, that Captain Ericsson is pushing the stupendous scheme with such vigor, that, before the termination of the present season, bread will be prepared from flour ground by the power of his solar engine.

Yours very respectfully,

C. H. DELAMATER.

Removing Chuck Cement from Lathe Work.

MESSRS. EDITORS:—I notice one of your correspondents is troubled about removing the "wax" or "lac" from his work, after taking it from the lathe.

With an experience of many years, perhaps I can relieve your correspondent of his trouble by giving him my method. On removing the piece from the lathe, I warm it over a spirit lamp, then tap it with a stiff brush, lightly; the wax will adhere to the brush. By repeating the operation, there is but little left for the alcohol to do. If in a great hurry a few seconds' boiling in alcohol will remove the balance, or it can be put in alcohol, without boiling, a few minutes, while the time is employed on other parts of the watch, when the piece is cleaned with ease. Hoping the above will benefit some of my brother "chips," I remain,

Eufaula, Ala.

S. S. BARNABY.

PROF. GAMGEE has made a report to the effect that one-fifth of the meat eaten in Great Britain, whether beef, mutton, veal, or lamb, is diseased. Prof. Gerlach states that half the meat consumed in Berlin is diseased. How about the United States? The butchers in New York say the demand for beef has largely diminished in consequence of popular doubt upon this point.