preserves it. If the pens are to be plated with bronze, silver, or gold, these operations are performed while the pen retains its bright polish.

The pens are now ready to go to the boxing room, where they are "counted" by weight. It will be found impossible to put a gross of pens in the box intended for them unless they are laid parallel. In order to do this quickly and easily, they are put in a half-cylinder and shaken. This quickly places them in a parallel position, and by a very quick move of the operative they are dumped into the boxes, which are then ready to be labeled and packed.

There is a story widely copied by newspapers that the introduction of the typewriter had diminished the use of steel pens. This is not only untrue, but strange as it may seem, the typewriter has benefited the steel-pen business. It has done this, by increasing the volume of correspondence a hundredfold, and called forth return correspondence that would never have been sent.

Capt. Amundsen's Voyage and the Magnetic North Pole.

Capt. Amundsen's recent return from his Arctic expedition has prompted Fridtjof Nansen to publish his views on the importance of the achievement in Morgenbladet, a Norwegian daily newspaper. Because of the careful preparation of every detail, both scientific and practical, and the excellent manner in which everything has been carried out, in spite of the limited means at the disposal of the explorer, this voyage, in the opinion of Nansen, ranks among the most remarkable of polar expeditions. The most important aim of the daring Norwegian, viz., to locate the magnetic north pole, has been realized as successfully as could be hoped.

Our earth, as is well known, may be regarded as a rotating magnet, the poles of which (viz., the magnetic north and south poles) do not coincide with the geographical poles. In fact, the magnetic North Pole is situated about 30 degrees south of the geographical North Pole, toward Canada, somewhere in the neighborhood of the meridian 100 degrees west of Greenwich. The magnetic South Pole presumably lies at the antipodal point, at a similar distance from the geographical South Pole, in some unexplored Antarctic region. No expedition has thus far been able to advance to the vicinity of the magnetic South Pole. For this reason, as well as for the reason that it is nearer to ourselves, the magnetic North Pole has been more accessible.

Whether the magnetic North Pole constitutes a single point or several points, or even an extensive region, has not yet been ascertained. Amundsen's excellent observations, after having once been worked out, will however afford the most valuable material for solving this problem.

In the neighborhood of the magnetic North Pole the magnetic force, as is well known, is directed toward the interior of the earth, at right angles to the surface. The inclination is just 90 degrees, that is, a magnetic needle, suspended by a thread so as to be free to move in all directions, will adjust itself vertically with the northern end pointing downward, or else at an angle of 90 degrees to the horizontal plane.

For this reason, an ordinary compass proves quite inefficient at the magnetic North Pole or its neighborhood, the downward-working magnetic force being unable to direct the compass needle in any given horizontal direction. For the same reason, compasses will gradually become "lazier" as they approach these parts of the earth's surface. Magnetic studies carried out in the course of time under different latitudes have shown the magnetic forces and the deviation of the compass needle to be subject to highly remarkable and quite enigmatic variations, which are either of short duration (e. g., daily variations, and what are called magnetic storms) or of long duration, extending over many years. From these observations the magnetic poles themselves have been found to move in the course of time. To explain this fact, many theories have been advanced, which, however, are far from affording a solution of the problem, as with all our endeavors to arrive at a better understanding of these phenomena, we have not had trustworthy systematic observations at the neighborhood of the magnetic pole itself. This gap has now been filled by Amundsen's work, which was crowned by exceptional success, and which may be said to constitute the most valuable scientific material ever secured by any North Pole expedition, having been derived from the most interesting part of the Arctic regions, the neighborhood of the magnetic pole itself.

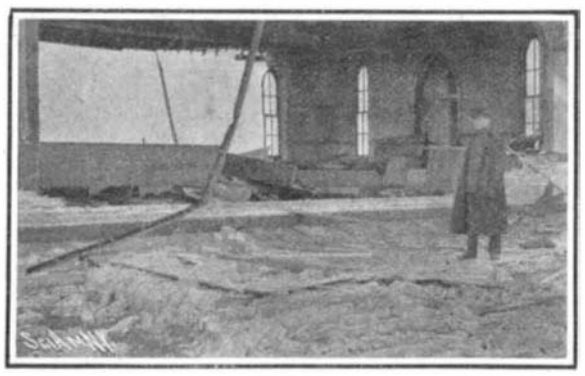
While the theory of terrestrial magnetism will thus be indebted to the voyage of the Norwegian explorer for a most valuable addition to its scope, other scientific branches as well are likely to benefit by it, because of the intimate connection existing between terrestrial magnetism and the electrical phenomena of the atmosphere, as well as the physical and other conditions of our earth.

A CHURCH BLOWN UP BY NATURAL GAS.

The town of Bunyan is located in the petroleum-producing district of western Ontario, and a number of the buildings are heated and lighted by natural gas, which is piped from wells in the vicinity. One of these buildings is the Baptist church at Bunyan. The edifice was constructed with heavy brick walls surmounted with a roof of shingles, while from the front section extends a brick tower with a shingle top. The church was heated by a large gas stove. The pipe conveying the gas became strained from the pressure, and the odor of the escaping gas caused a search to be made for the leak along the pipe which was laid under the flooring. To examine the pipe, one of the searchers lit a match, with the result that an explosion took place so violent that the side walls were almost entirely blown out, as shown in the illustration. Although as already stated they were composed of brick, all but a small portion of the rear and front walls were completely demolished, the material being scattered over the ground a distance of nearly fifty feet from the building.

Strange to say, the roof was but little damaged, the main injury being caused by settling in the center, where the supporting wall had been carried away. The front section and tower were uninjured, but a chimney in the rear was partly demolished from the shock.

The accident presents an interesting illustration of the direction of the explosive force, which appeared to



The Ruin Within the Church.

The Walls Blown Out.

A CHURCH BLOWN UP BY NATURAL GAS.

be almost entirely lateral, not even a hole being blown in the roof.

After-Burning in the Gas Engine.

According to the Engineering Times, Prof. Hopkinson, of Cambridge University, England, has used platinum resistance thermometers to investigate the explosions of homogeneous mixtures of coal gas and air at atmospheric pressure and temperature. The mixture was placed in a cylindrical vessel and fired by an electric spark at the center. The platinum wire used for the thermometer was exactly 1-1000 inch in diameter. When the flame approached the wire there was a sharp rise in its electrical resistance, and this could be easily measured, for the wire was placed in series with a battery of constant potential. When a thermometer was placed near the spark it was found that on ignition of the mixture there was a sudden rise of temperature to 1,200 deg. C. It was found that if the gas was fired in a closed vessel, whose volume did not alter, the differences of temperature in various parts of the vessel at maximum pressure after an explosion of this kind varied as much as 500 deg. C. With weak mixtures of gas and air it was found that the spread of the flame was much slower. With one volume of gas mixed with twelve volumes of air it was found that 2½ seconds elapsed before all the gas was burnt. With a mixture of one volume of gas and nine volumes of air the flame spread rapidly from the spark, and all of the gas was completely burnt within 1-40 second. The results are used to explain the phenomena of "after-burning" in the gas engine; and it is argued that the observed specific heat of the products of combustion, together with the loss of heat during the passage of the flame through the compression space, accounts for all of the peculiarities of the gas engine diagram.

Science Notes.

A realistic idea of the trade that is prosecuted in the imitation of old masters by unscrupulous dealers, especially for would-be collectors, is afforded by the recent discovery that has been made in the Art Gallery of Bath, England. Upon his death Sir William Holbourne bequeathed his extensive art collection to the civic authorities, and a building was especially erected to house the bequest. For some years this collection has been considered one of the most comprehensive and valuable extant. Recently, however, the pictures were minutely examined by an eminent expert, as doubts concerning their genuine character had been circulated, despite the fact that other experts had carefully investigated the collection and pronounced the pictures to be genuine. As a result of this last examination, however, no less than two hundred have been proved to be spurious, and worthless except as remarkably clever forgeries. The result of this discovery has aroused skepticism as to the *bona fide* nature of many of the art treasures possessed by other art museums and private collectors, not only in England but in other parts of the world as well. The majority of these imitations are the product of Continental artists, and are so cleverly and skillfully executed as to be almost impossible of detection.

In determining the difference between the longitudes of two places, the comparison of their time, as is well known, plays an important part. While this comparison has so far been carried out by use of the telegraph, telephones have recently been advantageously employed in determining the longitude of Brest as compared with that of Paris. According to the Elektrotechnische Zeitschrift, two chronometers striking half-seconds were used, of which one indicated mean time and the other astronomical time, thus allowing the coincidence process to be used. On the glass plate of each of the two chronometers was arranged a Hughes microphone inserted together with a battery in the primary circuit of a transmission coil, while the secondary winding was connected to the long-distance telephone circuit. The operators installed at Brest and Paris respectively could thus watch the stroke of the two chronometers while being in a position to communicate by telephone. A variable resistance inserted in the primary circuit of one of the two stations enabled the two chronometers to be synchronized, and the operator perceived the two strokes with the same ear and with equal intensity, thus seizing the coincidences with far greater accuracy than in the event of the stroke of the near and distant chronometers being detected with different ears. It was possible to reach results within 1/100 of a second of perfect accuracy.

A survey of the field of technical education shows, first, a group of high-grade engineering schools preparing young men for the leading positions in professional, industrial, and educational callings. These schools are increasing their laboratory facilities, year by year, and are steadily improving their instruction in mathematics, physics, and chemistry, as a basis for good engineering practice. The development in this field will be the extension of the work beyond the requirement for the bachelor's degree or the engineering degree. Just as medical schools add a year or more of post-graduate study, so engineering schools in the near future will extend their work into the realm of post-graduate work. The need of engineering education beyond the stage reached to-day in the ordinary college was apparent to such a far-sighted educator as the late President William R. Harper, of the University of Chicago. No engineering college has yet been organized in the university, but the plans contemplate a school that shall tower above all other schools of its kind as the university itself towers above the small college. A further survey of the field discloses a number of "cut, fit, and try-on" schools. These do not devote their energies to any one subject or stratum of education. They may teach art, high school studies in general, engineering, photography, stenography, cooking, dress making, library economy, or any other subject for which there is sufficient demand to form a class. These schools form an essential link between the older and the newer phases of education; they show the tendency of the age; in them the experimental educational work is done and later special schools are founded to carry on the work begun here in a small and tentative manner. As evidence of this, witness the course in library economy established by Armour Institute of Technology in 1893 and after a few years of successful life adopted by the University of Illinois; also the numerous schools of domestic economy following on the heels of the successful courses given at Armour.

The new Cincinnati waterworks are now ready to furnish about 12,000,000 gallons daily to the high service system of the city. This supply is not filtered, as it will be some time before purification works are built,

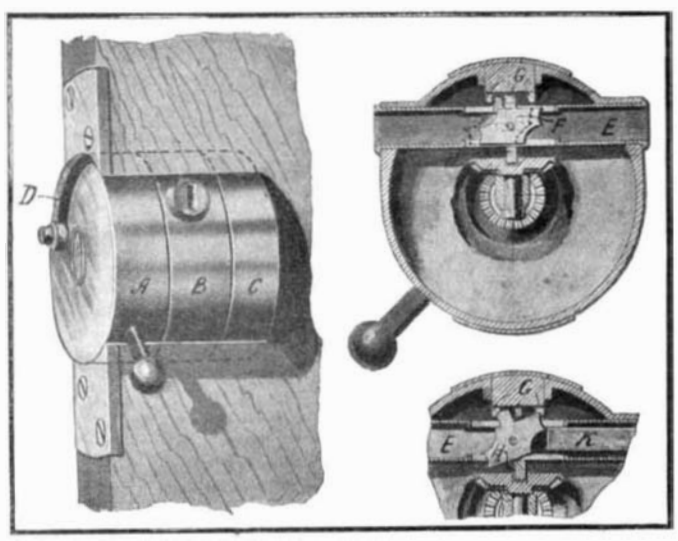
A New Flexible Steam Packing.

The modern practice of using steam at high pressures and temperatures has brought with it certain problems which did not confront the engineer of ten years ago with his low-pressure plant. The chief of these problems is undoubtedly the question of suitable packings, a question which grows rapidly more serious as steam pressures are increased. Practically the only high-pressure packings hitherto available have been either metallic, hence rigid and unyielding, requiring constant regrinding, or of rubber, which is not absolutely impervious to steam, has not the necessary wearing qualities, and cannot withstand high temperatures. Recently, a new type of packing has been invented by Mr. Frederick M. Ekert, which seems to overcome the defects of previous packings. The material is very tough and tenacious, and it is sufficiently flexible or plastic to conform itself to all irregularities, thus absolutely preventing leakage. It is composed principally of rubber and asbestos fibers with which certain pore-filling substances are mixed. The packing is absolutely impervious to water or steam, and is a non-conductor of heat. Furthermore, it is self-lubricating, owing to the presence of graphite in its composition. It is made into valve disks, which will withstand any pressure up to 450 pounds continuous service, and also in sheets for use on pumps, cylinders, steam chest covers, manhole covers, and the like. In addition to these, a nickel-protected disk is made for superheated steam, which is adapted to withstand temperatures up to 900 deg. Fahrenheit.

A similar material, in which cotton fibers are used in place of asbestos, Mr. Ekert provides for the manufacture of puncture-proof automobile tires, mattings, and the like.

A NOVEL DOOR LOCK.

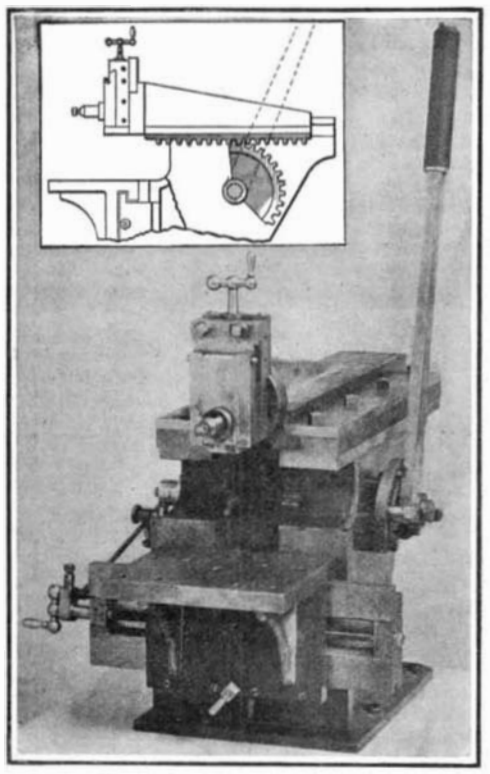
A door lock of decidedly unique form has recently been invented by Mr. Peter Ebbeson, of St. Paul, Neb. While the construction of this lock is not complicated, yet it has been ingeniously designed to prevent operation with a false key. Furthermore, it comprises a latch of such form as to prevent shaking or rattling of the door. As shown in the accompanying engraving, the lock consists of three disk-like sections, *A*, *B*, and *C*, the disk *B* being stationary and the others revoluble. The disks are mounted in a socket in the door and project from opposite sides thereof. The latch is operated by a pair of knobs at opposite sides of the door, which are respectively secured to the disks *A* and *C*. In the face of the disk *A* is an eccentric slot *D*, adapted to receive a stud projecting from the door frame. By operating the knob of disk *A* the latter may be turned to engage the stud in the eccentric slot, thus locking the door. The disk *C* is connected with the disk *A* by a series of bevel gears, so that by operating the knob of disk *C*, it is possible to rotate the disk *A* to latch or unlatch the door. In order to lock the door, a novel mechanism has been provided in the central disk *B*. As shown in the cross-sectional view, a barrel *E* is mounted in this disk. This barrel is provided with a bolt *H*, which is adapted to engage a slot in one of the bevel gears, and thus prevent rotation of the other two disks. In the barrel *E* is a tumbler *F*, which is carried on a short shaft mounted to slide in slots in the barrel. This tumbler is provided with a projection at its upper end adapted normally to register with the central one of three flanges *G*, projecting from a block above. Now, in order to unlock the latch, a key is inserted in the barrel *E*, and this presses the tumbler *F* to the position shown in dotted lines, when the projection thereon clears the central projection *G*, and the barrel may then be rotated to move the bolt *H* clear of the bevel gears. The tumbler is held in normal position by a pair of springs which bear against its shaft. It will be observed that the ends of the tumbler are of odd form, which the key must fit to prevent the tumbler from tilting on its axis when being pushed clear of the projection *A*. If a false key is introduced, as shown at *K* in one of the section views, the tumbler will be tilted up into engagement with the outer projections *G*.



A NOVEL DOOR LOCK.

HAND-OPERATED SHAPER.

The advantages of the shaper for finishing small work are well known in all machine shops. To provide these same advantages for small shops which cannot afford power-driven machines or even for large shops in which a shaper is only occasionally used, Mr. S. N. Malterner, of Canton, New York, has invented the hand-operated machine illustrated herewith. The machine consists of the usual frame provided with guide shears at the top to receive the carriage which is formed with the usual head, carrying an apron tool post of common form. Below the tool post is the table on which the work is clamped. The carriage is formed on its under side with a rack which is engaged by a gear segment rigidly attached to a transverse shaft mounted in the frame. At one extremity this shaft carries a hand lever whereby it may be rocked back and forth and thereby cause the carriage to reciprocate in the usual manner. On the frame of the machine is a curved bracket formed with a slot in which a pair of adjustable bolts are secured. These bolts project in the path of the hand lever and serve as stops to limit the stroke of the tool. If it should happen that the position of the work upon the table is such that the lever does not reciprocate at a convenient point, which is generally the uppermost or approximately vertical position, it is only necessary to remove either of the stop bolts so as to enable the gear segment to be moved entirely out of mesh with the rack. Then the carriage may be adjusted to the desired position and after the gear segment has again been moved into mesh with the rack, the stop bolt may be secured at the proper adjustment.



A HAND-OPERATED SHAPER.

Physical Constitution of the Heavenly Bodies.

Some of the noteworthy of the numerous conclusions arrived at by T. J. J. See in an article on the physical constitution of the heavenly bodies, published in Astronom. Nachr., are the following:

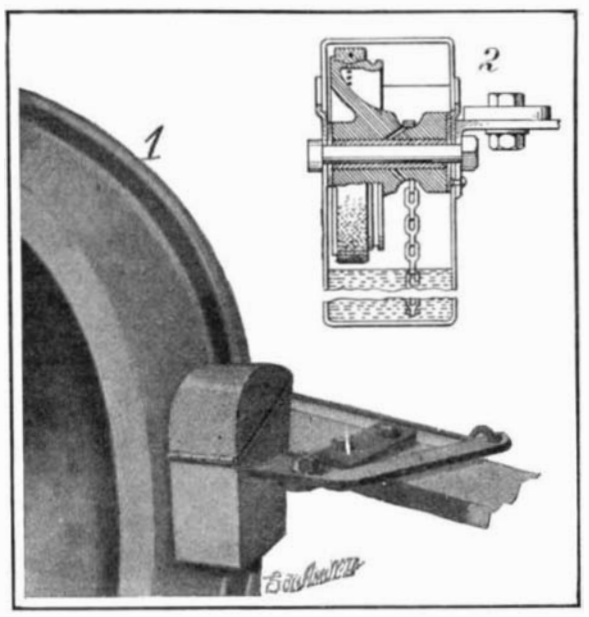
The mean specific heat of the sun must lie between 0.5 and 6.8; it could reach the latter value if all the elements present were as simple as hydrogen. The heat and light from the sun are held to be obtained from the interior solely by radiation, and not by convection currents; the gases in the interior are very transparent, but on the photosphere some elements, such as carbon, can give rise to clouds which are non-transparent to light. Based chiefly upon the density at the solar surface, the heat supply of the sun is held to be sufficient to last 10 million years at the present rate; or taking contraction into consideration, 30 million years. As regards the earth before it had a solid crust, the temperature probably was never sufficiently high for it to be self-luminous. On the major planets the surface temperatures are considered to lie between 300 deg. and 800 deg. abs., so that the surface can neither be thought of as rigid nor self-luminous; these planets are not cooling down at present, but are even becoming hotter. Prof. See considers the monatomic theory, as applied to the sun's condition, to be the only one which gives results which are in accord with known facts.

The Standardized Staircase.

A system of standards is the order of modern life, and in many directions standards are convenient if not, in some cases, indispensable. We have, for instance, standard gages for railways and tramways, standard threads for various screws, standard sizes for boots, shoes, and gloves, standard qualities for articles of food, standard weights and measures, coinage, and so on. But there are still some directions in which the need of a standard is not only indicated but is urgent. The desirability, for example, of standardizing the steps of all staircases is seen in the fact that so often a fall on the staircase is due to the irregularity in the height of the steps. A common cause of accident on the staircase is the kicking of the edge of a stair when ascending. In descending, also, an irregularity in one step may easily upset the equilibrium of a person. To the aged and infirm the descent of an irregularly stepped staircase is a source of terror. Yet how many staircases are constructed absolutely alike as regards the height of the steps? We should say very few; and not only is there little uniformity existing between different staircases but the steps themselves in the same staircase are often irregular. Staircases and the steps in them should be standardized; there should be uniformity of height and breadth, and in regard to the latter there should be room enough on the step to accommodate the whole foot from toe to heel, so that there is no undue call on the energies when ascending, as by going on tiptoe, so to speak, or any feeling of insecurity when descending by reason of there only being room for the heel. Serious falls on staircases are by no means rare and a common cause of such accidents is the fact that staircases are not standardized. Even in dark places the staircase, if standardized, would be more safely negotiated than a well-illuminated but irregular stairway. The perils of an ordinary ladder would be enormously increased if the rungs were placed at irregular intervals.—Lancet.

WHEEL-FLANGE OILER.

The curves of street railways are usually so sharp that it is necessary to keep them well lubricated in order to prevent undue wear and screeching of the wheels as they grind against the tracks. Aside from the expense of keeping the curves lubricated, the practice of greasing them is extremely objectionable to pedestrians who are liable to soil and ruin their clothing by contact with the oily substance. The accompanying engraving shows a method of obviating this objection which consists in oiling the flanges of the wheels instead of the tracks. The oiling device is arranged to be brought into operation at the will of the motorman so that the lubricant is applied only when needed and where needed, because it is on the flanges that most of the friction occurs. This oiler is not limited to street railways, but is also applicable to the curves of steam railways where much power has been uselessly spent because heretofore it has not been the practice to oil these curves. The device comprises an oil chamber in which a wheel is mounted to rotate. The wheel is provided with a wick which is seated like a tire on the outer rim. Oil holes lead through the rim of the wheel to the wick. The wheel does not touch the oil in the chamber, but a loose chain which hangs in the oil is turned by the wheel and serves to feed the lubricant to the rim whence it passes through the holes to the wick. In use the device is mounted on a bracket in such position that it can be swung against the wheel flange by the operation of a lever.



DEVICE FOR OILING CAR-WHEEL FLANGES.

A portion of the oil chamber is cut away permitting contact of the wick with the flange, and thus causing the wheel in the oil chamber to rotate and feed the oil to the wick. The inventors of this improved oiler are Messrs. F. S. Baird and E. W. Carroll, of Congress, Arizona.