Artisan and Artist.

A critical writer in an English magazine (the *Cornhill*) finds a potent cause for the separation between artistic and industrial work in the rapid growth of the manufacturing system in Northern Europe.

"During the Middle Ages the painter, the sculptor, and the wood-carver were all higher handicraftsmen whose handicraft merged insensibly into that of the decorator, the joiner, the jeweler, and the potter. These lower trades still gave an opportunity for the display of individual taste, of artistic fancy, of that capricious quaintness which forms, perhaps, the greatest charm of mediæval workmanship. But with the employment of machinery the separation became broad and pronounced. Steam-woven patterns and calico prints have superseded the hand-made embroidery and rich brocades of earlier times. Cheap moulded crockery and stamped designs have taken the place of jars turned upon the wheel and painted decorations. Wall papers hang where tapestry hung before, and chintzes cover the chairs that were once covered by delicate needle work. Electroplate teapots, machine-made jewelry, and ungainly porcelain vases replace the handicraft of humbler Cellinis, unknown Ghibertis, or inglorious Palissies. Under the influence of this cause, industrialism became frankly cheap and ugly, while æstheticism retreated into the lofty upper region of the three recognized fine arts.

"In proportion as the industrial system was more or less developed in each European country did the divorce become absolute. In Italy and the south, where the manufacturing spirit never gained a firm footing, individual workmanship survived and still survives. Florentine mosaics, Roman cameos, Genoese filigree work, Venetian glass, are all of them relics of the old artistic handicraft which has lived on unmoved among the quiet Italian towns. In France, more manufacturing than Italy, but less so (at least during the eighteenth century) than England, we find a sort of intermediate stage in Sèvres porcelain and Gobelins tapestry, in Louis Quinze marquetry and Dieppe ivory-carving. But in England the gap was truly a great gulf. Between the Royal Academy and the Birmingham or Manchester workshops there was no common term. Most of English manufactures were simply and unpretentiously utilitarian. They had no affectation of beauty in any way. Whatever art furniture existed in the country—mosaic tables or buhl cabinets in a few noble houses—was brought from those southern lands where industrialism had not yet killed out the native art faculties of the people. A piece or two of Chinese porcelain, a stray bit of Indian carving, an Oriental rug or embroidered cushion here and there carried the mind away to Eastern countries where steam and factories were yet wholly unknown. But in England the stereotyped uniformity of manufacturing ugliness bore undivided sway, and if a solitary Wedgwood at rare intervals had originality enough to set up some attempt at artistic industrial work his aspirations naturally cast themselves in the prevailing classical mould. From these tendencies two evil results inevitably flowed. In the first place, art came to be looked upon by the mass, even of the middle classes, as something wholly apart from everyday life. The æsthetic faculty was a sense to be gratified by an annual visit to the Academy, an occasional perambulation of the National Gallery, and perhaps a single pilgrimage during a lifetime to Rome and Florence. For the lower classes art ceased to exist at all. Their few sticks of furniture, their bits of glass and crockery were all turned out on the strictly manufacturing pattern, with the least possible expenditure of time and money. Only the extreme upper class, the landed aristocracy and very wealthy merchants, could afford to live in an atmosphere of pictures and statues, of Italian art furniture and Oriental porcelain."

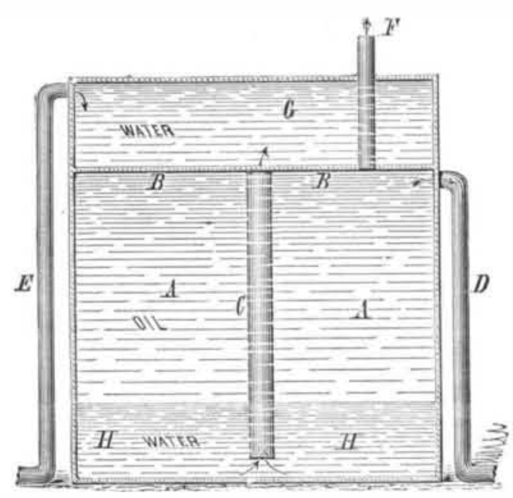
The only fault to be found with our critic's statement of the case lies, we take it, in the assumption that "industrialism" is essentially and of necessity unartistic. It would be nearer the truth to say that when manufacturing began in the north of Europe the working people were grievously deficient in artistic taste, and so were the multitude who furnished a market for the manufacturer's wares. They had no "native art faculties" for manufacture to destroy. It was with them a step upward—from nothing to something—even though that something was cheap and ugly. The pottery and other wares turned out by English manufactories were not beautiful at first, not so much because of the necessary limitations of the scope of power machinery and large production, as because of the general lack of taste on the part of the makers and users of the wares. With the social and intellectual elevation of the masses the level of popular taste has risen, and our large factories have steadily improved the artistic character of their work to meet the rising demand. Meantime, while our artisans have been developing as artists, marrying beauty with utility, it has become the cant of the picture makers and their followers—artists *par excellence* in their own estimation—to associate æsthetics solely with inutility, and to deny the artisan's right to consider himself an artist, except when he makes or imitates something that the world has no longer any use for.

There is no portion of the community more pitifully destitute of genuine art sense than those who declaim most loudly about the necessary ugliness of modern manufactured products, and simper over the "exquisite loveliness" of such bits of ancient or oriental stuff as it is the current fashion to call artistic. Next year the same things and styles may be out of fashion. Those who rave over them now will then pronounce them vulgar and ugly, and torture their æsthetic sensibilities over some other antique novelty; all the time fondly imagining that the soul of art dwells exclusively with them. It never occurs to them that their followers a hundred years hence will rave in the same way over the works of the artistic artisans of to-day.

LIGHTNING-PROOF OIL TANK.

The enormous losses that have been incurred of late years from tank fires, the danger which threatens from the ignition of stored oil to whole towns and cities, have excited the attention not only of oil men, but scientists at large to the means of securing effectual protection. It is evident that the methods of storage ordinarily adopted have proved ineffectual; the precautions taken against lightning, or from conflagration of the contents of tanks from others that have caught fire, have proved worthless. The means of securing immunity from lightning have been studied philosophically and scientifically by Col. E. A. L. Roberts, of Titusville, Pa., and by the aid of a diagram we will explain it for the benefit of our many readers connected with the oil business. The principle on which it is based is that oil will not catch fire until vaporized, in other words, until it is blended with a certain proportion of the oxygen of the atmosphere. A ton of glycerine has been exploded in oil wells in Pennsylvania without setting them on fire, simply because the oil was under conditions that did not allow of the immediate blending with it of air or oxygen. Exclude these agencies and one might as well attempt to set fire to water.

Col. Roberts accordingly conceived the idea of so constructing tanks that they would not allow of evaporation; in other words, tanks with which no air could come in contact. His tanks, constructed as follows, completely compass this purpose: A A, space in tank for oil; B B, diaphragm; C, balance pipe; D, filling and drawing-off pipe for oil; E,



OIL TANK PROTECTOR.

overflow and inlet water pipe; F, vent pipe; G, water reserved on top of diaphragm; H, water in bottom of tank.

It is easy to show by reference to this diagram that there can be no possible liability to conflagration. Instead of the roofs now used the surface of the tank would be covered with a diaphragm. This diaphragm is of iron, and is so placed as to leave a space of a few feet between it and the top line of rivets. An eight inch pipe termed the balance pipe passes from this diaphragm down the middle of the tank to within eight inches of the bottom. The tank is filled with water by means of the pipe, D, which enters the tank immediately under the diaphragm. As the water fills up, it ascends the balance pipe, forcing the air completely out of the tank through the vent pipe, F, and the pumping is continued till it reaches up to the rim of the tank. The process of filling the tank with oil now commences by means of the pipe, D, which is also the filling and drawing off pipe for oil. Thus the oil is pumped through the same pipe through which the water has been forced. As the oil settles upon the top of the water, immediately under the diaphragm, the force which the pump gives to the oil then presses the water, as the heaviest substance, downward, and it passes up the balance pipe into the space marked G, the surplus passing away through the overflow pipe to the left of the tank in the above diagram, and marked E. On the space reserved for oil being entirely filled from under the diaphragm to the lower end of the pipe there remains about six inches of water, while the diaphragm and the sides of the tank being air-tight, no air whatever can mingle with the oil, which will also be protected above by its overlay of water above the diaphragm. Thus situated the oil may be said to be hermetically sealed when the top cock at the head of the vent pipe is turned off. It is obvious that in running the oil out no air can get access to the interior. To force it out by the pipe, D, water is pumped in by the overflow pipe, E, the water exerting the necessary pressure. In running down the balance pipe from the reserve tank above the diaphragm the water fills the exact place of the discharged oil.

Instruction in Industrial Art.

THE American Carriage Builders' Association, in convention at Chicago, October 21, adopted a resolution for the establishment of a school of technology in this city, especially devoted to the art of carriage building.

The trustees of the New York Metropolitan Museum of Art had expressed a willingness to add a branch to the museum devoted to art instruction and original designing, in connection with carriage building, if a fund of $1,000 a year for three years were guaranteed. More than this sum was promptly subscribed. The aim of the trustees of the museum is, we believe, to establish industrial art schools for the benefit of American artisans in all the trades.

MR. EADS' SHIP RAILWAY FOR THE AMERICAN ISTHMUS.

For many years the popular idea has been that whenever the genius and energy of man should overcome the barrier to commerce which nature has placed at the American Isthmus, it would have to be accomplished by a ship canal. For many years exploring parties, supported by private munificence or by government appropriations, have been searching for the most favorable lines for transisthmian commercial routes, always contemplating the ultimate construction of a ship canal. And so persistently have the advantages and disadvantages of the different canal routes been insisted upon by their respective admirers and opponents, that there are few engineers of high rank, who have considered the question at all, who have not pronounced in favor of one or other of the several canal routes that have been surveyed.

Accordingly, when a new man enters the field with a novel plan, confidently offering to make a dry way for the world's commerce over the Cordilleras, in a quarter of the time and at a quarter of the cost of a ship canal such as Mons. De Lesseps proposes, the natural inquiry is, "Who is he? and what has he done to justify so bold a traversing of the opinions of the world's best known engineers?"

The world's best engineers do not need to have that question answered for them, though the general public may. The engineering world have already admitted Mr. Eads to an honorable place in the front rank of scientific and practical engineers. They know him as a man quite as remarkable for the soundness of his views, in great engineering emergencies, as for the boldness and originality of them. They know him, too, as a man whose professional career has been marked by grand successes as well as grand undertakings—successes achieved in more than one instance by methods as original as they were scientific and simple, accomplishing results of unequaled magnitude with the least delay and the greatest economy.

When the exigencies of civil war called for the immediate and speedy creation of a new order of war vessels, suitable for river navigation, yet capable of successfully assailing land batteries protected by earthworks, it fell to Mr. Eads to supply the need; and his fleet of "improvised ironclads" played a vital part in opening the Tennessee and the Mississippi.

When the requirements of peaceful commerce demanded an iron way across the Mississippi at St. Louis, a bridge which should offer no impediment to the commerce of that broad river, the same bold and practical spirit not only planned the structure, but saw it built, a work requiring the highest engineering and financial capacity, for the problems presented were in many respects not only novel in character, but involved operations of a magnitude never before undertaken.

Still more recently, when the general commerce of the great artery of the continent required a freer outlet below New Orleans, and when the government engineers were committed to a costly canal, Mr. Eads came forward with a solution of the problem directly contrary in its principles to that which had been proposed, and vastly less expensive in time and money. Still more, he was willing to stake his private fortune on the event, confidently undertaking to open the Mississippi in his own way at his own risk, asking no pay for his work until his scientific and official opponents should certify that the task had been successfully accomplished. Our readers do not need to be reminded of the magnitude of the work undertaken at the mouth of the Mississippi, the severity of the engineering problems it involved, the vast economy of the jetty system, or the marvelous celerity and certainty with which it overcame the barriers which nature had placed at the outlet of the great river.

In place of a doubtful channel admitting only vessels of less than eight feet draught, the Mississippi now offers a broad free entrance to the largest ocean steamers; and to emphasize the fact, which the commercial world is slow to realize, the merchants of New Orleans are arranging for a visit to their wharves by the Great Eastern.

These great achievements are referred to here simply as evidence that Mr. Eads is not a novice in engineering and finance, nor a speculative adventurer, but a scientific and notably practical man, whose large and varied experience in the planning and conduct of great enterprises gives pertinence and weight to any proposition which he may lay before the world. Whatever problems of engineering, mechanics, or finance may be involved in the planning and construction of a ship-canal or a ship-railway across the Isthmus, and no one will question their multiplicity and magnitude, they have already been met and successfully overcome by him elsewhere, on a scale not out of comparison with those of the new undertaking. In laying before the world a plan of a ship railway, like that which we illustrate on our first and fourth pages, Mr. Eads offers no speculative project, but the well-considered design for a capable and experienced engineer, a working plan which can be carried out with absolute certainty.

At first thought most persons unfamiliar with the resources and practices of modern engineering are apt to look with incredulity, if not with amazement, upon a project contemplating the hauling of great ships over land from one sea to another.

A ship, they say, is a structure made to float in the water, buoyed up by a mobile substance, the nature of which not only prevents unequal strains upon the ship from her general weight, but also helps her to resist the internal or bursting strain of her own cargo. Out of her proper element, they argue, all these conditions are reversed. The uniform support of the water is replaced by detached supports, subjecting the vessel to unequal and unpremeditated strains which she cannot safely endure. Accordingly, even if it were feasible to build a carriage strong enough to sustain a ship's huge bulk, or a roadbed firm enough to bear the weight of both ship and carriage, the proposed system of Isthmus transit must be a failure through the lack of adaptability of ships for that sort of handling.

In answer to these apprehensions it is enough to say that they are founded in a view of the case which every ship builder knows to be altogether inconsistent with fact. A ship afloat is not uniformly buoyed up by the water. On the contrary, especially where there are waves of any magnitude, a ship's support is not only unequal, but incessantly variable as to position. This fact is so well recognized by shipbuilders that every sea-going vessel is so built as to be able to bear her entire weight when supported only at the ends, or to withstand the strain of being held up wholly at the middle, with both ends unsupported in the air. If a ship is unable to endure these severe tests she is unfit to battle with the waves. As for the bursting strain of a cargo, with or without a counter pressure of water outside, every ship at sea has to withstand it, more or less completely, with the passage of every large wave; while at the same time she is buffeted with heavy seas, which strike with blows like those of a battering ram. Indeed it would hardly be possible to devise an apparatus capable of subjecting a ship to so frequent and severe horizontal, lateral, and tortional strains as a ship endures in every gale. In comparison with them the strains that would be put upon a ship in transit over a properly constructed railway would be as nothing. On the railway carriage the ship would rest on an even keel, uniformly supported from stem to stern, and as secure from lateral and twisting strains as when cradled in a dry dock; while the forward motion of transit over easy grades would be less trying even than that which ships are constantly subjected to in well-known marine railways connected with ship-yards.

In fact the ship railway proposed by Mr. Eads consists of nothing more novel than two marine railways of superior construction joined by a few miles of many-railed roadbed of easy grades. Every element of the system, as well as the ability of ships to endure out-of-water handling safely, has been practically familiar to engineers for half a century. The grades of the proposed railway, it will be remembered, need nowhere be steep, and the change at the summit is made by a tipping table, which prevents any lengthwise strain upon the vessel. At no other point of the road can such a strain occur except by the yielding of the road bed; a contingency which practical engineering is easily able to avoid.

If further assurance of the ability of ships to safely endure out-of-water handling were required, it might readily be found in the every-day handling of loaded canal boats at portages. In staunchness a sea-going vessel compares with a canal boat about as a well-made beef barrel does with a cracker box; and the capacity of canal boats to endure railway carriage was amply demonstrated forty years ago on the Portage Railroad of the Allegheny Mountains. To connect the canal systems of Eastern and Western Pennsylvania, a system of gravity railways with ten inclined planes was constructed between Hollidaysburg and Johnstown, thirty miles or more apart "as a bird flies"; and up and down these steep inclines the large boats of the "Pioneer Packet Line" made regular trips until the Pennsylvania Railroad was built.

In length of route and severity of grades, the Isthmus routes certainly offer nothing worse than was overcome on that Portage road; and it is absurd to say that modern engineering cannot do for ships what was then done for canal boats. Besides we have the direct evidence of some of the most experienced ship builders—among them the Hon. E. J. Reed, formerly Chief Constructor of the British Navy—to the effect that the transport of ships by rail is not only feasible, but that the plan is highly economical in comparison with a ship canal.

The essential features of his projected railway for transporting ships across the Isthmus were described and discussed by Mr. Eads before the Canal Committee of the House of Representatives last March. So many of the illustrative plans and drawings used by Mr. Eads on that occasion as are necessary for a clear understanding of his plan are reproduced in the engravings herewith. The large illustration on our front page gives a general view of one of the shore ends of the proposed road, with a large man-of-war just entering upon the transisthmian journey.

Fig. 1, at the bottom of the front page, shows a section of the basin, which constitutes the real terminus of the railway. To avoid extending the track out into the harbor, this narrow basin, 3,000 feet long, is excavated inland at right angles to the shore line of the harbor. At the harbor end the basin is deep enough to place the railway thirty feet below the surface level of the water. From that point the track rises one foot in the hundred, so as to reach the surface level at the shore end of the basin. This basin, and the corresponding one at the other end of the railway, will be lined with substantial masonry. The outer end will be provided with a caisson gate, or lock gates, so that the basin can be pumped dry for repairing the track under water. At all other times the gates will be open.

Fig. 2 shows the basin railway with a ship on the cradle. In transferring a ship from the harbor to the upland track the cradle or ship-car will have to be backed dowr to the harbor end of the basin, under water, by means of a stationary engine. The ship will then be floated in from the harbor, so that her keel will rest over the cradle. Then the various supports on which the keel and bilges will rest will be moved into place.

Fig. 3 shows, in cross section, a ship resting on the cradle in deep water, and illustrates the manner of supporting her, substantially as is done in every dry-dock. Her weight rests mainly on the keel, a portion being sustained by the opposing bilge blocks, which also serve to keep her from toppling over. A similar cross section near the shore end of the basin is shown in Fig. 4. In the latter cut the vessel has been drawn nearly out of water. When entirely out the stationary engine will be detached and two powerful locomotives will be hitched on to haul the massive load to the opposite sea. It is expected that the transit will be made at the rate of ten or twelve miles an hour, and an additional hour will be consumed in placing the ship in cradle and in discharging her at the overland journey's end.

As will be seen in the engravings, the railway will be composed of twelve rails, spaced four or five feet apart. The locomotives will be five times as large and powerful as ordinary freight engines, and the whole twelve rails will be used by the two locomotives and their tenders. The ship cradles are intended to be of suitable lengths to receive all classes of vessels, and will have wheels about three feet apart on each rail, making a total for large steamers of from ten to twelve hundred wheels.

The maximum pressure allowed to a wheel capable of sustaining twenty tons will be five tons, or considerably less than the ordinary pressure upon the driving wheels of a large locomotive, which is usually six and a half tons. The weight of the largest merchant ships fully laden is about 6,000 tons. This weight distributed over 1,200 wheels—one hundred on each rail—will make the pressure on the rails and road-bed quite moderate: The proportion of the strength of one wheel to the strength of the whole number of wheels is so insignificant that the failure of any wheel could have no serious effect on the rest. Each wheel will be independent of the rest and readily removable. The possibility of derailment, as well as the pressure upon the tracks, is obviously diminished by the number of rails. Indeed, any six rails could carry the whole weight, so that any probable breakage or displacement of rails would not endanger the stability of the load upon the cradle.

As will be seen in the detail drawings, 5, 6, and 7, two strong steel springs surmount each wheel, so that the ship will in reality rest upon an elastic cushion, which still further lessens the liability to strain. Each spring is so fixed that it can be removed by unfastening two bolts, and the wheel under it can then be taken off with ease. Another advantage of the multiplicity of rails and wheels is the great reduction of the liability to jolting or oscillation. When a speed of twelve miles an hour is maintained on a railway so constructed the ship's motion would scarcely betray itself. To derail a car carrying a ship in this way would be an utter impossibility. To provide for the passage of ships going in opposite directions on the single line of track, there would have to be stationed at different points transfer or turn tables for moving cars sideways. By such means it is now common to shift trains of cars from one track to another.

The easiest grades for a ship railway across the Isthmus are found at Panama, Nicaragua, and Tehuantepec, and a mean grade, not exceeding thirty or forty feet to the mile, can probably be found at each place. The cheapest line could be built at Panama, where the distance as well as the grade is least. The harbor improvements there, however, would involve a great deal of cost. These would be less at Tehuantepec, and much less in the Chiriqui route, which presents steeper grades, but offers superb natural harbors. The maximum cost of a road at Panama, including harbors, is estimated by Capt. Eads at $50,000,000.

Touching the relative economy of a ship railway compared with a ship canal, Mr. Eads is confident :

"That upon any route where it is possible to build a canal, it is equally possible to build and equip a substantial and durable ship railway for one-half the cost of a canal, if it be built with locks; and for one-quarter of its cost, if it be at tide level.

"That such a ship railway can be built in one-third or in one-quarter of the time needed for the construction of the canal.

"That when built, ships of maximum tonnage can be moved with safety at four or five times greater speed on the railway than in the canal.

"That a greater number of vessels per day can be transported on the railway than would be possible through the canal.

"That the capacity of the ship railway can be easily increased to meet the demands of commerce, without interruption to its business, whether it be to meet an increase in the size of the ships or in the number of them.

"That the cost of maintenance of the roadway and rolling stock will be much less than that of the maintenance of the canal.

"That the cost of maintaining and operating the railway, taken together, will be less than that of operating and maintaining the canal.

"That the railway can be located and successfully operated at localities where it is not practicable to construct a canal.

"That it is possible to estimate, with great accuracy, the cost of a ship railway, and the time needed to build it, because the work would be almost wholly upon the surface of the ground, whereas the canal is strictly a hydraulic construction, involving control of water and the execution of works under water, or liable to be submerged or interrupted by water, thus rendering anything like an accurate estimate of the time and cost of its construction an impossibility. Hence capitalists cannot know, with certainty, the amount of money and time required, or what the canal will probably pay when finally finished."

These are bold and significant assertions truly; the nonprofessional reader may pronounce them startling and extravagant. Coming from a speculative adventurer they would be; but Mr. Eads is no adventurer. He is an engineer who has shown his practical skill as a builder of ships of heavy tonnage, railway bridges of the boldest construction, waterways of the most extensive scope, and in every great undertaking he has demonstrated a financial ability not less remarkable than his engineering capacity. Not a few of the ablest and most experienced engineers and shipbuilders of the world have pronounced this plan of a shiprailway entirely practicable, and far more economical than a canal for the same work. Indeed, the cost of one canal such as Mons. De Lesseps proposes at Panama, would build a ship railway at four or five places along the Isthmus equal in capacity to the canal and several times more speedy in its operation. Again, the interest on the excess of capital required for the construction of a ship-canal for a given traffic, over the cost of a ship-railway of equal capacity, would duplicate the road every ten years. With capital supplied as fast as needed, the railway could be put in operation without difficulty in four years from the time of beginning its construction. The working expenses of the road need not exceed 40 per cent. of its revenue, against 50 or 60 per cent. on ordinary railways.

This superior economy would be due to the fact that the work would be more compact; there would be but one roadway to keep up, everything would be built in the most substantial manner, and all the freight would be handled in mass by steam-power. The liability to accident to shipping in transit would be less than on a canal. With the estimated traffic of 5,000,000 tons a year, a charge of two dollars a ton would yield a revenue of $10,000,000. Allowing 50 per cent. for operating expenses, the net revenue would give 10 per cent. on the capital invested. A tariff of eight or ten dollars a ton would have to be charged to make a canal at water level pay as well, and such a tariff would be practically prohibitory.

MISCELLANEOUS INVENTIONS.

An improvement in the class of targets which are constructed of movable parts and connected in an electrical circuit with an instrument which is located at or near the place where the shots are fired, and is adapted to indicate the portions of the target struck by balls or bullets, has been patented by Mr. Morris Ullman, of Alexandria, Va.

A machine for bending shafts or thills for buggies and other vehicles, has been patented by Mr. John H. Smith, of Bluffton, Ind. The invention consists in a novel construction and arrangement of straps and formers, a screw, a cam lever, and a frame or table, whereby provision is made for simultaneously bending the heel and the point of both of the shafts of a pair.

An improved window and door screen has been patented by Mr. Albert F. Demorest, of Muscatine, Iowa. The object of this invention is to furnish window or door screens so constructed that they can be readily adjusted into and secured in place.

Mr. Henry Schlimme, of Wiconisco, Pa., has patented a simple and durable tuyere for blacksmith's forges and the like. It consists in a bored cylinder provided with water chambers, longitudinal blast opening, a blast pipe and sliding valve, and water feeding pipes.

An improvement in fences has been patented by Mr. Joel D. Olinger, of Water Valley, Miss. The object of this invention is to construct fences so that they can be readily moved from place to place, and to make them strong, durable and less expensive in construction than fences made in the ordinary manner.

An improved thill coupling has been patented by Mr. James S. Welch, of Dodge City, Kansas. In this invention the conical bolt which holds the thill iron is considerably longer than the width of the thill iron, and the latter is constantly pushed toward the larger end of the bolt by a U-shaped spring.

Mr. Isaiah A. Clippinger, of Plainfield, Ill., has patented an improved spring for bed bottoms, which will facilitate and cheapen their attachment to the supporting slats of the bed bottom and the attachment of the springs to each other, and effect continuity of the bearing surface.

An improvement in dynamo-electric machines, which Mr. Charles J. Van Depoele, of Detroit, Mich., has patented, consists in the peculiar construction of the revolving armature, and in the arrangement of the same in the magnetic field and the bearings carried by projections from the sides of the case.