A GLASS GLOBE FROM WHICH THREE HUNDRED WATCH CRYSTALS WERE CUT.

Our illustration shows a hollow sphere of glass now in possession of L. Royer, in Paris. The diameter is not stated, but the size can be judged from the fact that three hundred watch crystals have been cut out of it. The cut is taken from Ackermann's *Gewerbe Zeitung*, and is from an actual photograph.

THE AUTOMATON CHESS PLAYER.

A few days ago the newspapers announced that the police of Bordeaux had forbidden the exhibition of the automaton Az Rah, one of the attractions of the Exhibition Theater, because it had been discovered that the manikin was set in motion, not by mechanical arrangements, but by a youth of eighteen years, inclosed within a cavity behind the wheelwork, and whose health was gravely compromised by this daily torture.

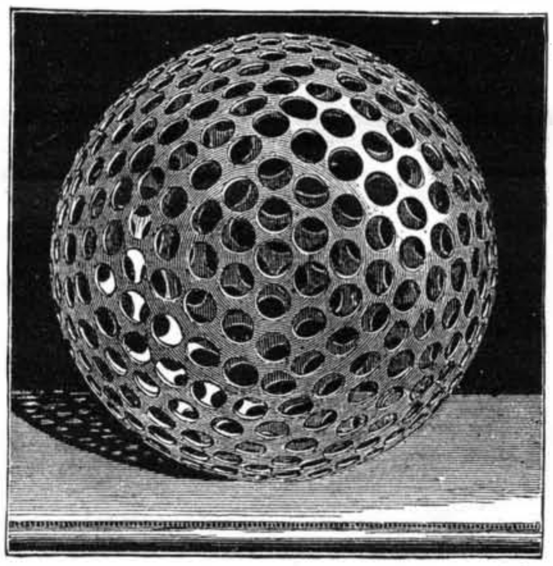
This automaton recalls the famous Turkish chess player that was constructed in Hungary by Baron Kempelen in 1769, and exhibited in Germany, Russia, France, England, and America, without the public succeeding in ascertaining its mechanism. In 1819 and '20 a man named Melzer showed it anew in England. Robert Houdin saw it in 1844 at the house of a mechanician of Belleville, named Cronior. Since then its fate has been unknown, and it is very probable the Az Rah of Bordeaux is nothing else than the Turk of Vienna. Our readers who have seen it at the exhibition will be enabled to decide the question after reading the description that we shall give. Baron Kempelen, a Hungarian nobleman and an Aulic Councilor of the royal chamber of the Domains of Hungary, being at Vienna, was called to the court to be present at a seance of magnetism that a Frenchman named Pelletier was to hold before the Empress. Kempelen was known as an ingenious amateur of mechanics, and the persons present having asked his opinion in regard to the experiments which he had witnessed, he happened to say that he believed that he could make a machine that would be much more astonishing than anything that he had just seen. The Empress took him at his word and expressed a desire that he should begin the work. M. De Kempelen returned to Presbourg, in his own country, and, in six months, produced an automaton which played a game of chess against any one who offered himself, and nearly always won it.

This automaton was a human figure of natural size, which was dressed in the Turkish style, seated on a chair, and placed behind a wooden chest on which was laid the chessboard. He took the pieces up with his hand in order to play them, turned his head to the right and left in order to see them better, and nodded his head three times when he checkmated the king, and twice on attacking the queen. If his adversary made a mistake, he shook his head, removed the wrongly played piece, deposited it outside of the chessboard, and played his own. The showman, who stood near the automaton, wound up the mechanism after every ten or twelve moves, and occasionally replaced certain wheels; and, at every motion of the Turk, were heard noises of moving wheelwork. To show that there was nothing within but mechanism, doors were opened in the chest and body. There was also a magnet lying on the table to make believe that magnetism, then in great vogue and as yet full of mystery, played a preponderating role in the affair. M. De Kempelen was accustomed to say: "The machine is very simple, and the mechanism appears wonderful only because all has been combined with great patience in order to produce the illusion."

Many hypotheses were put forth on the subject; and two books, one published in 1785, and the other in 1789, were devoted to a discussion of them. Those that appeared to be most likely were, on the one hand, that the Turk's body contained an extraordinarily small dwarf, and, on the other, that the showman acted upon the automaton from a distance by the aid of magnetic influences. These two explanations gave a very imperfect account of the facts, and it was not until some years ago that the trick was unveiled in an anonymous book.

The following is an exact description of the apparatus and the successive operations performed by the exhibitor:

The chest was 3½ feet long, 2 feet wide, and 2½ feet high, and was provided with doors and drawers whose use will presently be seen. The front part of the chair seat was affixed to the chest, and the back part rested on the floor by two legs which, as well as the four legs of the chest, were provided with casters. The right hand of the manikin was movable on the upper part of the chest that formed a table, and, at the beginning of operations, held a pipe, which was afterward removed, and it rested upon a cushion lying in a certain definite position. The chessboard in front of the player was 18 inches square. The exhibitor, provided with a light, begins by allowing the interior of the apparatus to be examined by the spectators. He opens the door A (Fig. 1), and allows to be seen a series of gearings that occupy the whole width of the chest. Then he passes behind and opens the door B (Figs. 2 and 8), opposite the door A, and introduces a light into the interior to show that it is empty. The spectators standing on the other side can, in fact, see the light shine through the different pieces of mechanism



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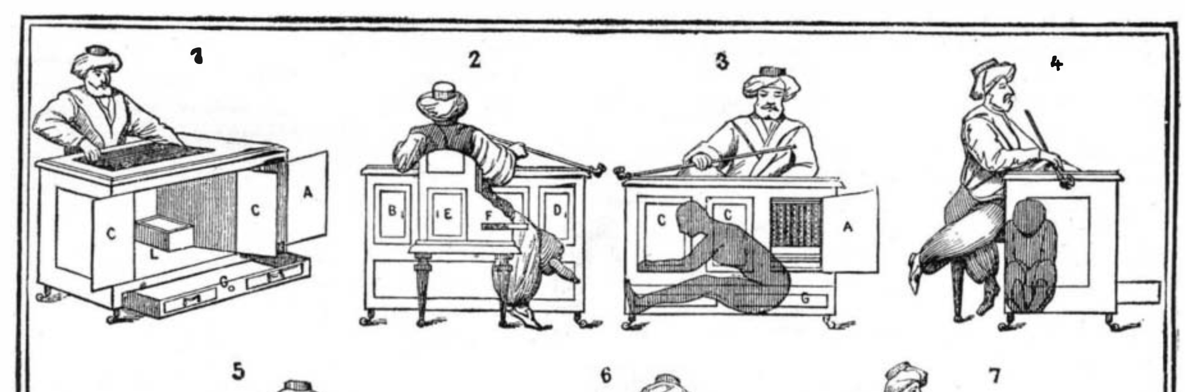
through the door A, that remains open. He afterward locks the door B, and comes in front of the chest and opens the drawer G, from which he removes the chessmen, and a cushion which he slides under the left arm of the automaton. This draw appears to serve no other purpose than the preservation of these objects. Finally, he opens the two doors, C C, in front of the chest, and shows a large closet lined at the sides with dark drapery, and containing two boxes, L and M, of unequal size, and a few belts and pulleys that seem to be designed for putting in motion the mechanism contained in the boxes. Passing behind again, he opens the door, D, and introduces a light into the interior of the chest to show that it has not a false bottom. Then he



THE AUTOMATON CHESS PLAYER.

closes this door again, and also the doors A and C, by means of the same key. Next he turns the apparatus around so as to show the public the other side (shown in Fig. 2), and raises the clothing of the Turk, and opens the apertures, E and F, in the back and thigh to show that no one is hidden within. These doors remain constantly open afterward. Finally, the showman turns the Turk back to his former position facing the spectator, removes the cushion and pipe, and then the game may begin.

We shall explain as clearly as possible how the game was directed by a man who succeeded in hiding himself by a series of movements when the different doors of the apparatus were successively opened:

The drawer, G G, when closed, does not reach the back side of the chest, but leaves between it and its back an empty space, O, measuring 14 inches in breadth, 8 in height, and 2 feet 11 inches in length (Figs. 9, 10, and 11). This space is never shown to the spectator. The little closet extending from A to B is separated into two parts by a dark hanging, S (Fig. 8), which is raised when the door, B, is opened, and lowered when it is shut. The front part of the closet is entirely filled with the wheels that are thought to move the automaton. The back part is empty and is separated from the large closet that the doors, C, form by a thick curtain, R, which hangs freely, being only fixed at its upper part. A part, Q, of the bottom partition of the large closet, C C—the part in front of the Turk—is movable around a horizontal axis, and is provided with a weight toward the interior of the closet sufficient to cause it to fall always in a vertical position. The box, L, is movable and serves to hide an aperture in the floor of the closet; and the box, M, is stationary, but has no bottom, and covers likewise a corresponding hole in the lower floor over the space, O. The interior of the Turk is arranged as indicated in Figs. 8, 10, and 11. Finally, the end of the chest to the right of the Turk slides in horizontal grooves (properly hidden) in such a way as to give access to the space, K. It will now be seen that if a man of small stature introduces himself on this side into the chest, he will be able to thrust his legs into the empty space hidden behind the drawer, and to place the rest of his body in the space, K, as may be seen in Fig. 5, and by pushing the curtain before him and removing the movable box, L, he will be able to assume the position shown in Figs. 3 and 4. It is in such position that he awaits the beginning of the exhibition. The box, M, serves for receiving the extremity of his feet.

It will be remembered that the first operation of the exhibitor consists in opening the door, A, at which time the public sees only the mechanism, and, behind it, the dark curtain, S, whose distance cannot be estimated. The exhibitor next passes behind the chest, and, opening the door, B, introduces a light behind the mechanism, which is believed to occupy the whole width of it. The curtain, S, being raised, it is seen by the light that shines through the different pieces that they cannot serve to hide any one. He then closes and locks the door, B, and, returning to the front, opens the drawer and performs the operations already described, in order to give his confederate time to take the position shown in Fig. 5. The box, L, having been put back in place, as well as the curtain, R, the public sees only an empty space when the doors, C, are opened. The curtain, S, which has fallen, hides the back of the confederate, although the door, A, remains open; and it is then that on introducing the light through the door, D, the exhibitor shows that the large closet has not a double bottom. The doors, C, being again closed with the same key, so as to make believe that these different closings are due to the necessity of removing this key at every operation, the chest is turned around, the two doors, E and F, are opened before the public to show that the body of the Turk is empty, and finally the machine is wound up slowly, the wheelwork making considerable noise the while. During this time the confederate raises the movable partition, Q, takes his legs from behind the drawer, introduces the upper part of his body into a portion of the manikin, which is so arranged as to give his loins a convenient support, and seats himself on the box, L, as shown in Figs. 6 and 7. The game may then begin, the hidden player following his moves through the sufficiently transparent fabric that forms the Turk's clothing. In order that the confederate may easily introduce his arm into that of the manikin, it is necessary to give the latter a certain position, this being the reason for the addition of a pipe in the hand and a cushion under the elbow, both of which are removed when the game begins. A simple cord permits of moving one of the manikin's fingers so as to pick up or drop the chessmen The left arm of the confederate, which remains in the machine, is employed in moving the head and in producing the noise of wheelwork at every motion.

In reality, in M. De Kempelen's automaton, it was the left arm that moved the pieces. It is said that this peculiarity was due to the fact that the chess player who operated the automaton was left handed. There has even been a touching romance related on this subject, to the effect that the hidden chess player was a Polish officer who, having been compromised in the revolt against Catharine the Great, and having lost his two legs in fighting, was received by Kempelen, who thus hid him so well from the searches of the Russian police that he could go to conquer his sovereign in the game in the midst of her court.

The figures which accompany this article are a reproduction of those that were inserted in the anonymous book that we have mentioned. They were very imperfect and not on the same scale, and we have corrected them slightly to render them intelligible.—*La Nature.*

Boots vs. Shoes.

The *Shoe and Leather Reporter* calls attention to the remarkable change that has taken place in men's foot gear during recent years, and attributes to it some notable changes in the leather trade. Less than thirty years ago, the man who wore shoes was an exception. It was heavy boots, common boots, and light boots—boots for the field, the workshop, the drawing room, or the dancing saloon, but always boots. In very hot weather low shoes were sometimes admissible, but the tailor would always insist that no gentleman should wear shoes in full dress, since without the boot legs the pantaloons could not sit well. It would seem, in fact, that boots came in as knee breeches went out; for in the days before Blucher and Wellington buckle shoes and small clothes were the rule. The return to shoes began shortly before our civil war, the first styles being button or laced shoes coming to the ankle.

In the early part of the war, the prescribed army shoe was pretty generally rejected by officers and men, who soon learned, however, that for long marches and heavy campaigning the despised shoes were the best. After the second year boots were a rarity in the army, except, of course, among the cavalry.

There is no doubt, the *Reporter* thinks, that the general change from boots to shoes was hastened if not largely brought about by army experience. At the West the boots held out longer, but at present they form a very inconsiderable feature in the stocks of most retail stores. An ordinary average of sales is six pairs of men's shoes to one of boots. In the cities the proportion of boot sales is even smaller, and the man wearing boots is almost looked upon as an old fogy.

According to the recent census report, the total product of boots in the United States for 1880 was 30,590,876 pairs, and of shoes, 94,887,615 pairs. Under the heading of boots, however, is included all goods for men, women, or children that are button or lace fastened. This would reduce the number of regular men's boots to probably not to exceed 15,000,000 pairs out of a total of 125,478,511 pairs of all kinds of boots, shoes, and slippers, according to the census figures.

Aside from the curious feature of the change in styles, the *Reporter* notices a practical question for tanners as to how far the decreased manufacture of boots affects the consumption of leather. The ordinary boot leg above the ankle takes from one and one-half to one and three-fourths feet of leather, or not less than three feet to the pair, which is about as much as is required for the foot portion of the boots. In round numbers we might say the consumption of upper leather for shoes is only one-half as much as would be required for boots. Thus considering the subject, it appears that a production of upper leather that would be sufficient for, say, 15,000,000 pairs of boots in 1870 would still be ample for 30,000,000 pairs of shoes in 1880. The increase in the production of upper leather since 1870, while it has not been in proportion to the growth of boot and shoe manufacturing, has unquestionably been somewhat in excess of the actual demand for the leather, so that the buyers have had the advantage. Whether there is still an overproduction or not is an open question, but from the small stocks of upper leather, including calfskins, now offering in the principal markets, it looks as though the point of equilibrium had at last been reached. If this proves to be the case, and the business of the coming season will develop it, then any further growth of the boot and shoe manufacturing must have a direct effect on the leather markets, and the demand will have to be met by a corresponding increase in the activity of tanners. It must also be borne in mind that, although boots are on their last legs, so to speak, just now, there is no certainty that they may not again come into favor. Fashions have a curious way of repeating themselves, and if boots were the style we would all wear boots, irrespective of considerations of comfort or convenience, just as we now wear shoes. The tanners can, therefore, look forward to great possibilities.

The Earth a Great Magnet.

This was the title of a lecture recently delivered by Professor Silvanus P. Thompson at Glasgow, under the auspices of the Glasgow Science Lecture Association. Professor Thompson traced the history of magnetism from the time of Dr. Wm. Gilbert, one of the physicians of Queen Elizabeth, by whom it was raised from the region of superstition and fable to that of true science, remarking that in Gilbert's book he had found the title of his address, "The Earth a Great Magnet." According to *The Electrician* (London), from which we copy, he showed by experiment the properties of the loadstone, of the magnet, and of the mariner's compass, and pointed out the various modes in which a magnet might be formed. He illustrated the declination of the magnetic needle, and explained the difference between the magnetic and geographical poles. The magnetic pole, he stated, was at present near Boothia Felix, more than a thousand miles to the west of the geographical pole. In 1657 the position of the needle showed the magnetic pole to be due north. It had been eastward before that. It then began to point westward, and the westward variation increased till 1816, when the maximum was attained. It had since steadily diminished, and in 1976 it would again point to the true north. The changes which had been observed, not only in the direction but in the strength of the earth's magnetism, showed that the same causes which originally magnetized the earth were still at work. Strangely enough these changes did not occur at long intervals in the course of centuries, but were going on from day to day, from week to week, and from year to year. This was illustrated by those magnetic storms which interrupted telegraph operations, rang telephones, and, as was reported lately, kept one of Edison's lamps alight, though he would have liked to have seen it.

These magnetic storms were most frequent in the month of May and fewest in June, again reaching their maximum about October. It had also been observed that the more violent the magnetic storms the more numerous were the spots on the sun, and the more brilliant were the auroral displays around the poles. The phenomena of the aurora were among the mysteries of science, of which no explanation had been given; but it was certain that the aurora was an electrical discharge passing from the equatorial regions through the upper air and descending at the poles, where a condensation of vapor was continually taking place. The earth was thus continually surrounded by electricity, and here, he thought, was to be found the answer to the question, How did the earth become a magnet? That it was not always a magnet he regarded as certain, seeing that there were good geological grounds for believing that it was once a molten mass, and that nothing destroyed magnetism like heat. Faraday had found that by taking a bar of iron, spinning it on its axis, and carrying a current of electricity round it from the center to the poles, a magnet was formed. As, therefore, there was a current of electricity continually flowing from the equatorial regions to the poles and returning again to the equator, he put forward as a guess that in this way the earth revolving continually on its axis had been converted into a magnet. This theory, of course, involved that the magnetism of the earth had been growing, was growing, and would continue to grow.

Contracted Feet and Proper Shoeing.

Contracted feet are more commonly the consequence of lameness in horses than the cause. Any diseased condition inside the hoof giving rise to an unusual degree of heat leads to a more rapid evaporation from the surface of the horn, to drying and shrinking of the hoof, and to absorption of the soft parts within. The shrinkage or narrowing takes place especially at the heel, where the foot has not a long, but only an elastic, cartilaginous internal support, which yields easily to any pressure from without. A second condition, which always coincides with this drying due to disease, is the disease of the heel caused by the animal standing on its toe, or removing the weight from the entire foot. When the foot is planted on the ground and the weight thrown upon it, the soft parts descending within the hoof tend to press it outward, and as a matter of fact the hoof does actually expand at the upper part, next the hair, and thus the natural tendency of the unused elastic horn to contract is to a great extent counteracted. Disease is, therefore, a more common cause of contraction, and in all cases of contracted feet it is well first to look for some existing disease, such as corns, bruises, pricks, and other wounds, graveling, thrush, inflammation from uneven bearing of the shoe, from the nails being drawn up too tight, from navicular disease, from ringbone affecting the second or third phalanx, and so on.

Apart from any disease sufficient to cause lameness, contraction of the feet sometimes goes on to an extreme degree, until, indeed, one heel may meet the other; yet lameness is not induced. Yet, if contraction takes place with rapidity, as under the influence of a long period of rainless weather following a wet spring, the compression of the soft parts by the drying and shrinking horn will cause inflammation and lameness. During the past dry summer this was not uncommon, and the lameness thus started bade fair, if neglected, to go on to serious structural disease and a permanent lameness. Contraction caused in this way may be counteracted and corrected by measures calculated to soften and expand the horn, followed by such as will retain its natural moisture and give proper bearing on the shoe. To soften the contracted foot, keep the unshod animal standing every day for sixteen hours in a stream of water coming up to the hair around the top of the foot, or in a soft muck of clay puddle closing in around the foot to the same level. In frosty weather a warm poultice placed in a strong bag drawn over the foot is preferable, the more so that it can be kept applied night and day. At the end of a fortnight the foot will usually be found to have expanded to its natural dimensions.

If there is much lameness, it will be desirable to apply a blister on the front and sides of the pastern during the period of poulticing. This may be repeated and the poulticing continued, if lameness remains at the end of a fortnight. As a blister, the following may be rubbed into the skin on the front and sides of the pastern: Powdered cantharides, one-half drachm; oil of lavender, ten drops; olive oil, one ounce. It may be repeated the second day if heat and tenderness have not been induced by the first application, and also as soon as the effects of the first application have passed off and the resulting scabs have dropped off. When lameness has disappeared, and the foot has been sufficiently expanded, it should be dressed carefully, going the same height to the wall at all corresponding points on the inner and outer sides, and paring heel and toe in proper ratio with each other, the sole being left as far as possible to come to the heel with the hoof wall at all points, and furnish with it a surface of bearing for the shoe.

The shoe should be perfectly loose and smooth, and when applied should press evenly at all points. It should be drawn only moderately tight, and on giving its final dressing the use of the file should be as far as possible avoided. The horn is formed of a series of pus tubes with an intertubular cellular structure, and when the rasp or file is used so as to expose the open ends of these tubules the contained moisture exhales, the horn withers, and the soft parts may be injuriously pressed upon. For this reason the use of the file on the front of the hoof is to be severely deprecated. It should only be used on the lower edge of the hoof wall, where it projects over the shoe, and when the sharp edges might otherwise split up. For a similar reason, the sole should never be pared down into the tough, elastic horn, though all scaly masses on the surface may be safely removed. After shaving, the use of hoof ointment will serve to prevent evaporation and drying, and is absolutely needful after the foot has been softened by poulticing. A mixture of equal parts of wood tar and sweet oil will answer admirably. This brushed daily over the entire surface of the horn—wall, sole, and frog—will usually preserve a sufficiency of moisture and the natural elasticity and toughness of the horn.—*Prof. J. Law, in Irish Farmer's Gazette.*

Crow and Snake.

While riding down through Occum, Conn., on May 26th last, we noticed a crow on a level garden bed killing a snake, which was not less than eighteen inches long. The snake seemed fully conscious of what was going on and tried to get away, but showed fight every time it was seized. It was interesting to see the crow bite him, lift him up, and throw him to the ground, keeping one eye on us the while. This went on for some time, the snake getting weaker every bout.

The crow evidently not liking the nearness of myself and carriage, seized the snake within a few inches of its head and flew with it into the large trees beyond the Wequonock River, where we could not watch its further operations. The snake hung down its full length while being carried over the river. Crows are great scavengers, especially while they have young in the nest, and during this time they will carry off more very young chickens than any hawk in North America.—*Ornithologist.*

Pearl Patterns on Cloth.

Flexible mother-of-pearl patterns are produced on cloth stuffs, according to a recent German patent, as follows: On a soft elastic base is placed thin caoutchouc as large as the pattern, and upon this a thin plate of copper, with the pattern cut through. Over the copper is placed the cloth on which the mother-of-pearl pattern is to be produced. A heater is now passed over the whole, with the result of melting the thin caoutchouc, and causing it to be pressed up against the cloth, in form of the pattern. The cloth is now removed with its adhesive pattern, and powdered mother-of-pearl is sprinkled on it; then a heater is passed over it, and any superfluous powder is removed with a soft brush. A fine crape-stuff, moistened with gum solution, is next laid on the mother-of-pearl pattern, and, after drying, adheres to it with protective effect, while the varying color of the mother-of-pearl is but little affected.

Rum in Switzerland.

Among other matters discussed at the Congress of Hygiene which recently met at Geneva, was that of intemperance, which M. Roulet showed to be making rapid progress in Switzerland. He desired heavy duties on the sale of drink, especially distilled liquor, severe surveillance of it, and energetic repression of drunkenness. He insisted on the utility of temperance societies, and said, in closing, that the war against intemperance would not succeed till all alcohols, except ethylic, were removed from beverages. It is necessary to find a reagent enabling to determine accurately and quickly the quantity of those other alcohols in the drink. M. Alglave advocated monopoly of the sale of alcoholic liquors by government. The Congress passed a resolution calling on all Governments to abolish legislative obstacles to the practice of cremation, and urging the advantages of this practice in the case of serious epidemics.

Lightning in January.

Lightning began its work early this year. On the last day of January a brilliant flash lighted up this city, attended by a loud peal of thunder. In Brooklyn a dwelling house was struck and materially damaged. A mother and child were hurt, and shocks were felt in streets and houses for several blocks around. Telephone bells were set to ringing, and in most of the telegraph offices startling electric effects were experienced. The superintendent of the police telegraph department said that the current came into headquarters with fearful volume, all the annunciators were knocked down, and a relay was burnt. Fortunately no one was using the telephones at the time.