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A NOVEL ARRANGEMENT OF COG WHEELS.

Our engraving shows a train of wheels in which the driving shaft is formed with a crank handle, and the last driven shaft with a pointer. While the handle is making one complete revolution, the pointer is making one revolution in one direction and nearly four in the opposite; also the velocity of the pointer varies in each instance. the time consumed by it in making the single revolution being about equal to that required to make the four.

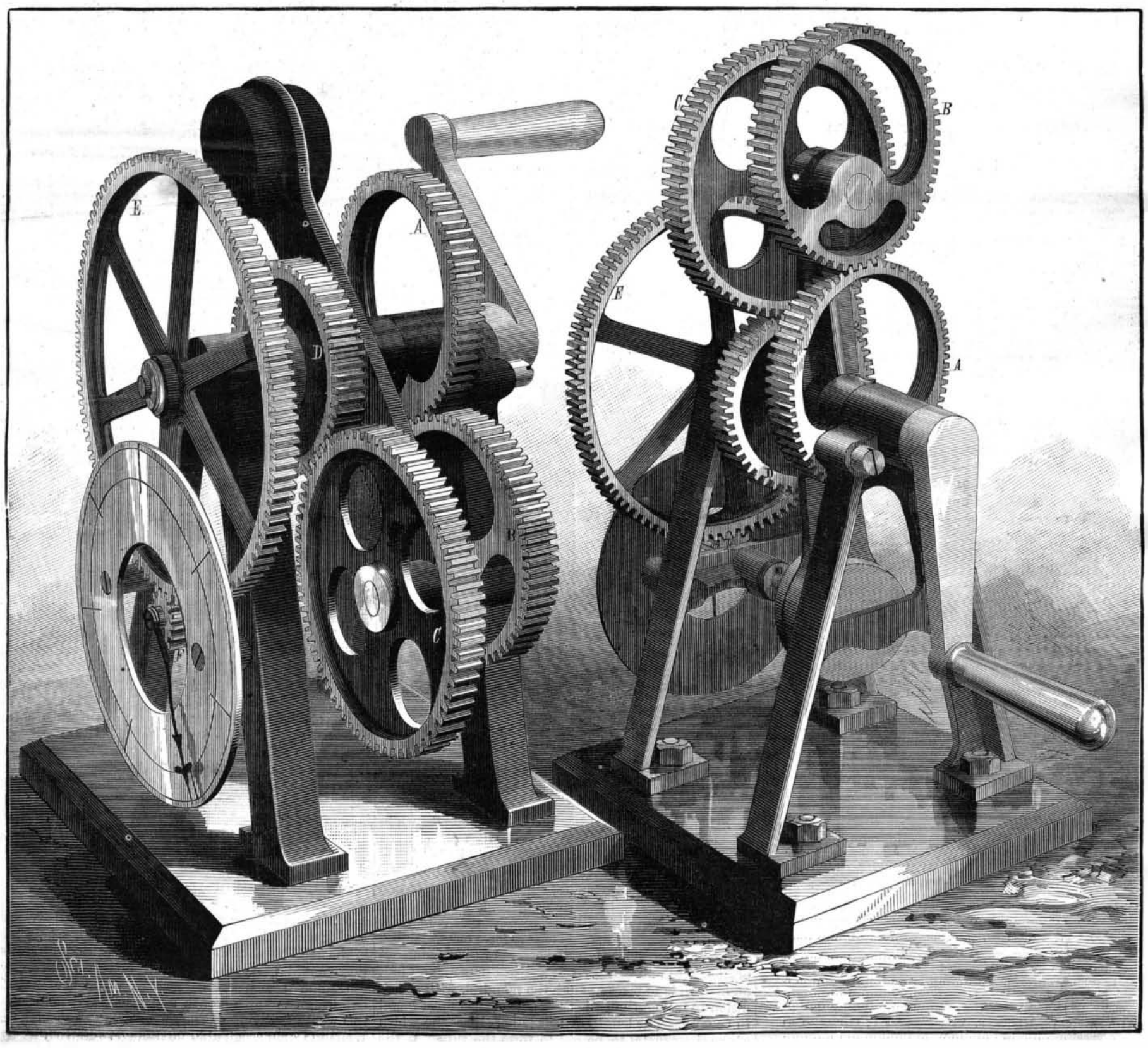
Two views of this planetary wheel train, designed by Professor C. W. MacCord, are shown in our frontispiece; the outline drawing, Fig. 2, is a side elevation, which clearly illustrates the way in which each wheel is mounted. With this train many peculiarly interesting results may be reached, and, considered as a new mechanical movement, it will undoubtedly be found to be particularly applicable to some practical pnrpose. Professor MacCord has devoted much time to this branch of science, and the train we are describing affords an original and unique illustration of the depth of research, the store of mathematical knowledge, and the skill in application which have marked all his labors in this line of thought.

The elliptical wheel, A, is rigidly secured to the frame, its major axis being vertical. Extending through the lower focus of this wheel is a shaft whose outer end is provided with a hand crank, and whose inner end carries a planetary arm, T (Fig. 2). One end of the arm is weighted, and the opposite end is journaled to receive a shaft which carries the second elliptical wheel, B (*a*, Fig. 2), on one end and the circular wheel, C (*f*, Fig. 2), on the other end, both wheels being rigidly mounted. The circular wheel gears with the pinion, D (F, Fig. 2), the shaft of which also carries the large circular wheel, E (all the figures), these being rigidly mounted also. This shaft is journaled in the rear standard of the frame, and is in line with the crank shaft. The large wheel meshes with a pinion on a shaft carrying a pointer moving in front of a dial plate. The relative sizes of the circular wheels and pinions will be understood from the engravings.

It is manifest that when the crank is in the position shown in the right hand view in the frontispiece the elliptical wheel, B, and the circular wheel, C, will attain their maximum velocity of rotation; this will decrease until the crank assumes a diametrical position, when the minimum rate will be reached. In the first mentioned position of the crank the wheel, D, will also assume its maximum rate of revolution, as will also the pointer. The axial motion of this wheel will decrease, and finally cease when the extremities of the minor axes of the elliptical wheels are in contact, the angular velocities of the axial and orbital motions of the pair, C D, then being equal. The crank handle will then be slightly below the center. The same result is reached when the opposite ends of the minor axes are in contact, the crank handle then being on the opposite side and slightly below the center. As the crank passes downward from either of these points, the pointer moves in a direction opposite to that in which it moved when the ends of the axes were approaching each other from above.

Beginning the revolution with the crank handle down, we obtain the maximum rate of the pointer; this diminishes, and the pointer rests when the handle has reached the position a little below the center. The direction of revolution of the pointer is then reversed, and it travels slowly while the handle is making a little more than the upper half of its revolution. When the handle passes the second contact point of the axes

(*Continued on page* 164.)



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the pointer stops, and then moves in the direction it first assumed as the handle approaches the lowest position. In the model before us the pointer makes about 3⅞ revolutions while the crank is moving downward between the two contact points, and makes about one revolution when the crank is moving upward between the points. It will be understood that the rate of motion of the pointer increases from nothing each way from each contact point, the two maximum rates being attained as the handle passes the vertical line above and below the center.

Those of our readers who are interested in these subjects will find it a fascinating but by no means easy task to ascertain the speed of the pointer when passing a certain location, having, of course, assumed sizes for the wheels and a certain rate for the crank. Or perhaps it would be more satisfactory to calculate the two curves which would represent the direction and velocity of the pointer. Those who are attracted because the device accomplishes a novel mechanical movement will find their best skill taxed to construct such a train of wheels.

Slate-Tar Roof.

Some years since we had occasion to examine a very curious roof in Burlington, Vermont, designed and put on by Mr. C. C. Post, of that place. It combined most if not all of the essentials of a good roof, and as it was not a patented design, and was free to all who wished to use it, we took some pains to investigate its construction and ascertain its durability. The pitch was as flat as is usually seen. The material was slate laid in a compound of coal tar and slate dust or coal tar and Portland cement. The roof was first covered with matched boards in the usual way. The tar was then prepared by adding Portland cement to the tar till it became thick enough when cold to stick to the slate, and at the same time not stiff enough to chip or crack. Where slate dust can be obtained, this is quite as good. The mixture is made so stiff that it will not flow in the hottest weather, and at the same time will not crack in cold weather. Lime would be a valuable ingredient, as it would neutralize the acid of the tar. If more convenient, a ready prepared roofing tar, like that of the Warren Chemical Company, may be used. When the tar is ready, a strip of roof is covered, and a line of slates bedded in it very much as tiling would be laid, but having from ½ to ¾ of an inch between their edges. In this way each slate has its full surface exposed to the weather. When the whole roof has been laid, all the seams or joints are paved with the tar. The slates are laid so as to break joints like bricks in a wall, the horizontal lines, or those running across the slope of the roof, being continuous. In this method of construction the slate forms the wearing and weather surface, protecting the tar bedding, while the thickness of the tar at the joints and the small quantity exposed to the weather make it apparently as durable as could be wished. The roof of which mention has been made has been on for several years, and is as sound and perfect as when first laid. It has during this time needed no repairs, and bids fair to last for many years longer as sound as when first laid. Apparently, there is no reason why such roofs, should not last as long as plain slate. They bear walking over without damage, and if from any cause a slate is broken or cracked, it can be easily repaired. Cracking of the slate does not always cause a leakage. This style of roof will probably not take the place of all other kinds of roofing material, but it will no doubt be a very valuable addition to the different methods of roof covering, since it gives a flat roof with the generally desirable characteristics of slate.—*Nat. Car-Builder.*

Safe Loads on Iron Columns.

Navier gives one-fifth of the breaking weight as the safe load in practice. Francis, an American engineer, also gives one-fifth, while Morin adopts one-sixth. My present opinion is that cast iron pillars supporting loads free from vibration, such as water tanks, will safely carry one-fifth of their breaking weight. In factories or stores, where moderate vibrations occur, the working load should not exceed one-sixth; and if the pillar be liable to transverse strains, or severe shocks like those on the ground floors of warehouses, where loaded wagons or heavy bales are apt to strike against them, the load should not exceed one-tenth of the breaking weight, or even less in some cases, where the strength of the pillar depends rather on the transverse strain to which it is liable than the weight it has to support. For instance, the effect of wind on a light open shed supported by pillars may produce a transverse strain which will be very severe in proportion to the weight of the roof. The same thing may occur if heavy rolling goods, such as provision kegs or loaves of sugar, are piled up in such a manner as to cause horizontal pressure, like that of a liquid. It is also necessary to take into consideration the foundations on which the pillars rest, for if these yield unequally, one pillar may sustain much more than its proper share of load.—*B. B. Stoney, in the Architect* (*London*).

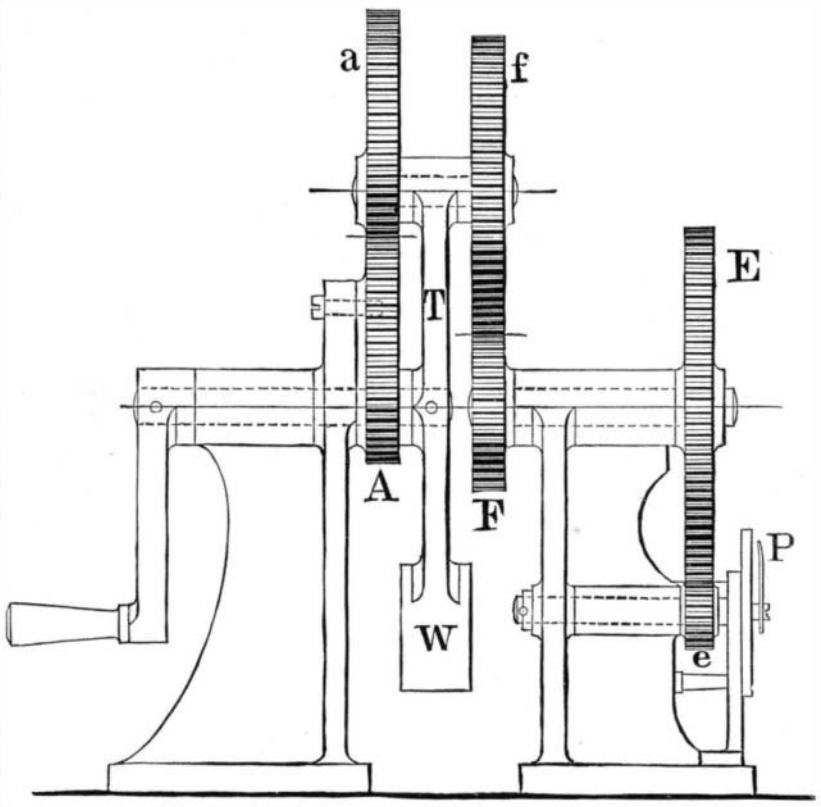
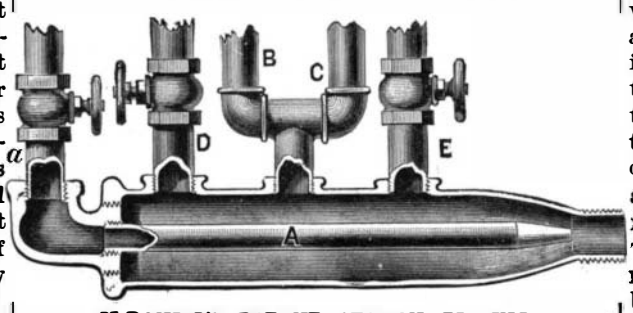


Fig. 2.—A NOVEL ARRANGEMENT OF COG WHEELS.

A SUCTION FITTING FOR STEAM HEATING APPARATUS.

The illustration herewith shows a recently patented device to apply to steam heating apparatus, either in connection with a steam trap or otherwise, by which the circulation is increased, and the heat obtained is augmented in a corresponding ratio. A represents the feed or suction pipe which works the fitting and creates a vacuum; *a* is the steam pipe from coil getting steam nearest the boilers, supplying the steam to work the fitting, and should always connect direct with the strongest coil or radiator, to have as dry steam as possible, which coil should also be the one most constantly in use. B and C may be said to represent one floor of a building, or the waste pipes leading from it, all of which should be collected to come into the fitting at one point, D and E being pipes from other floors, all coils being so connected as to have a fall into the fitting.

This fitting obviates the snapping and cracking noises so often heard in steam pipes, and when used with a trap it operates by sucking all the water of condensation out of the pipes and forcing it into the trap; it is also of great benefit where the condensation water is returned to the boiler, a check valve being used between the fitting and the boiler. Where a building is already piped to return the water of condensation to the boiler, the returns must be connected to come into the suction fitting, and the strongest coil used to work the fitting by creating a vacuum and forcing the circulation. The fitting may be set either vertical or horital, but should have as few turns as possible between it and the steam trap.



McDANIEL'S PATENT SUCTION FITTING.

In many cases where the present steam apparatus is insufficient, the use of this fitting will supply the desired increase and give more heat. This has been found true in a marked degree where the fitting has been employed in drying houses where a high and sustained degree of heat is one of the necessities of the business, and woolen manufacturers who have used it speak in high terms of its efficiency. It is not expensive, cannot easily get out of order, and is highly recommended as a standard fitting attachment in all steam heating work. It is manufactured by Messrs. Watson & McDaniel, No. 248 North Eighth Street, Philadelphia, Pa.

A PASTE formed of whiting and benzine will cleanse marble from grease, and one made of whiting and chloride of soda, spread and left to dry, in the sun if possible, on the marble, will remove stains.

The California Whale Fishery.

Few people are aware of the extent of the whale fishery on this coast. There are many little coves along the coast of California where the hardy and daring whale catchers live in an unobtrusive manner, with no particular expense except cheap, strong clothing and plain and wholesome food. They have no operas to attend, few or no taxes to pay, no fences to build, or streets to grade, or lands to plow. Their home is on the sea, with brief stays on the shore, where their duties consist in changing blubber to oil, which they put in barrels till they obtain enough for a shipment, when they lash the barrels together in the form of a raft, signal an empty lumber schooner, and float the raft of barrels of oil to the schooner, where they are hoisted on board and taken to San Francisco, where they are turned into gold.

Already during the present season nine whales have been caught off the Los Angeles coast and taken into Portuguese Bend, a quiet cove about eight miles west of San Pedro, where about thirty men are constantly employed in harpooning these monster beasts of the ocean, or in towing them ashore, cutting up the carcass, rendering the blubber into oil, and putting the same into barrels, extracting the whalebone, and sending the refuse of the animal out to sea to avoid pestilence on land.

Probably not a thousand persons in this section of the State have any idea of the magnitude of the business of whale fishing on this coast, so quietly is it carried on, with no public announcement and no quarrel with the railroad company about the price of freight. The company at Portuguese Bend have six large whale boats, besides yawls and the usual rowboats needed on such occasions. One of the nine whales recently taken out of a school of whales passing by Portuguese Bend going south was what is called a "cow whale," and yielded ninety barrels of oil. The whales going south yielded about four hundred and fifty barrels of oil, and the same school in their northern trip may yield as much more.

At San Diego six whales have been taken that yielded 300 barrels of oil, and the whalers expect to capture a large number from the school or troop of whales now moving north. There are about eight other stations on the coast of California where these quiet hunters of the sea are engaged in their arduous but profitable duties. All the stations appear to be doing well this year, but the stations south of Point Conception appear to have smoother water and better fortune than those farther north.—*Los Angeles Herald.*

Ancient Use of Vermilion.

Native cinnabar, or vermilion, a sulphuret of mercury, was first prepared by Kallias, the Athenian, five hundred years before the Christian era. There was a minium or cinnabar wrought in Spain from stone mixed with silver sand; also in Colchis, where they disengaged it from the fronts of the high cliffs by shooting arrows at them. Pliny and Vitruvius call it minium, and Dioscorides observes that it was falsely thought by some to be the same as minium. Vermilion is the color with which the statues of the gods were painted. It was abundant in Caramania, also in Ethiopia, and was held in honor among the Romans. Their heroes rode in triumph with their bodies painted with vermilion, and the faces of the statues of Jupiter were colored with this pigment on festal days. The monochrome pictures of the ancients were wrought with it. There was also an artificial kind of cinnabar, a shining scarlet sand, from above Ephesus. Vitruvius and Pliny say that vermilion was injured by the light of the sun and moon. To prevent this result, the color was varnished by a mixture of wax and oil. Sir Humphry Davy found vermilion in the Baths of Titus.—*William Linton.*

Habits of the Abyssinians.

Mr. F. Villiers, the well known artist of the London *Illustrated News*, accompanied the English Commissioners to Abyssinia, and he gives an interesting account of the customs of the people. He states that they are great consumers of milk, but never use it in a fresh condition. They do not artificially sour it, but the vessels in which it is placed are never cleaned, and thus immediately when the fresh milk is poured into these, fermentation commences. Meat, of which the Abyssinians are great consumers, they eat raw, and when guests are invited to sit down at a feast a bullock is slaughtered in an adjoining apartment as they wait, and strips are cut off while the flesh is still hot—sometimes, indeed, before the animal is absolutely dead. In eating, the native puts one end of a strip of meat into his mouth, holding the other in his left hand, and with his sword or dagger cuts off piece by piece close to his nose, cutting from left to right.

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