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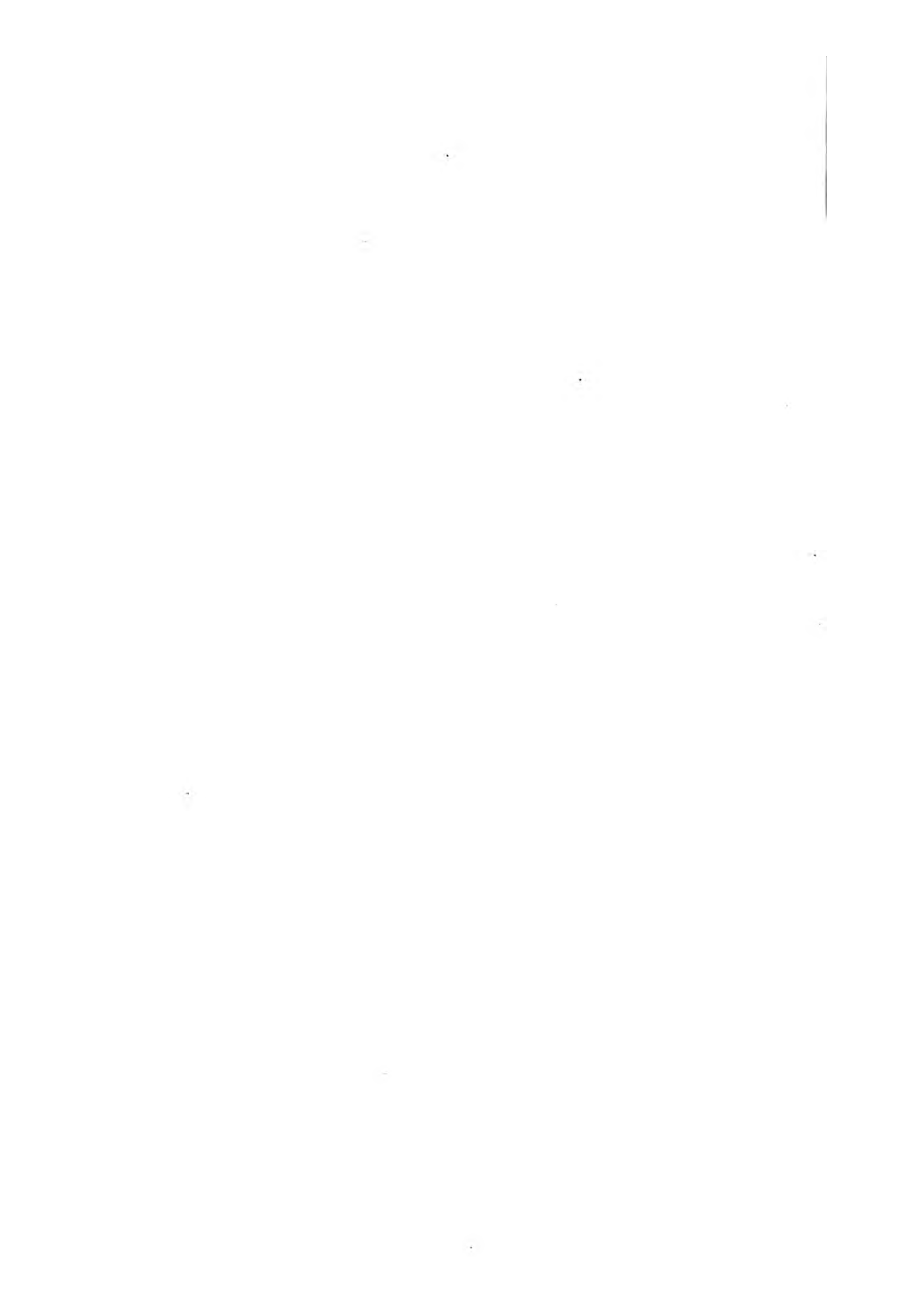
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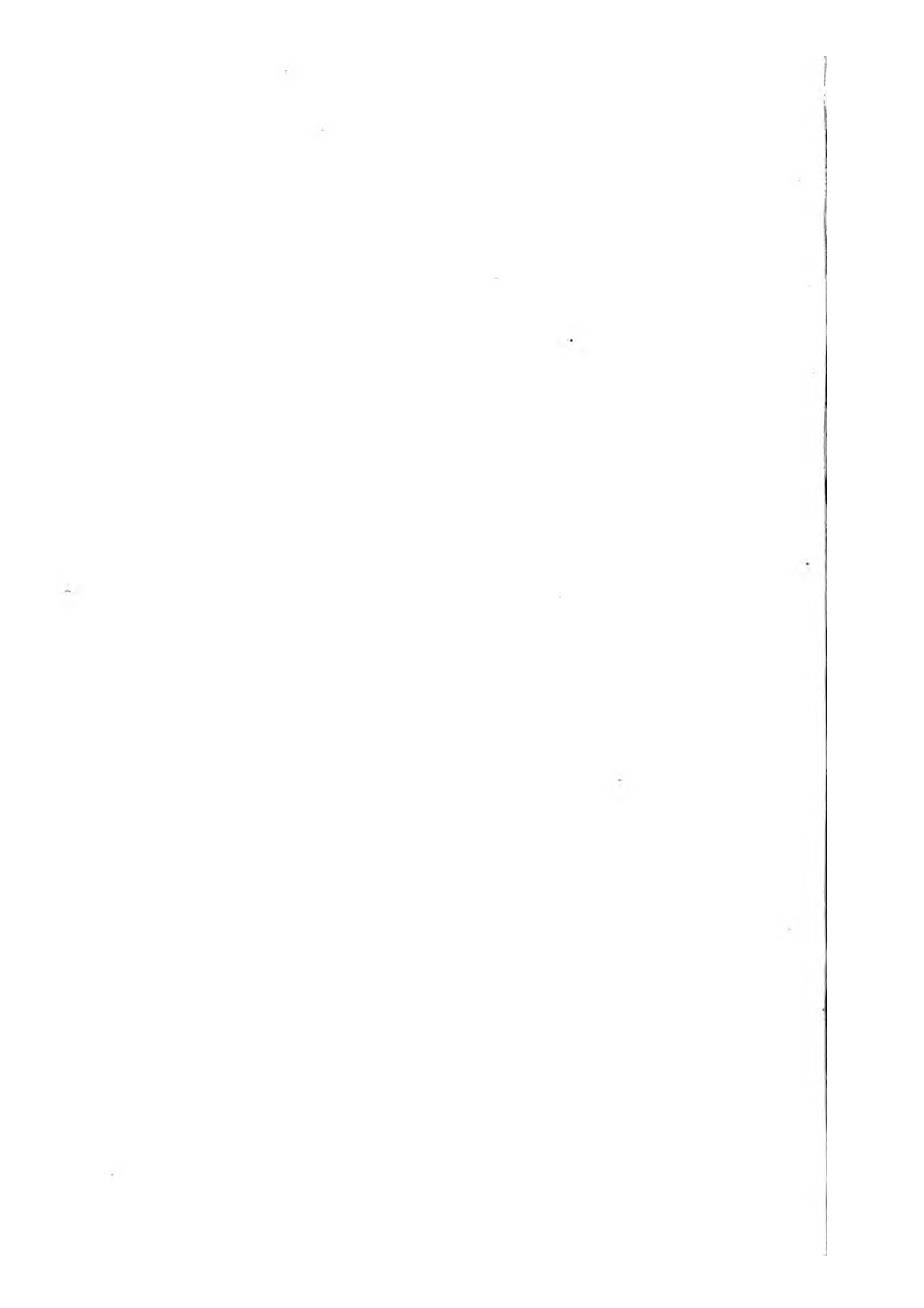


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A
COURSE OF LECTURES
ON
NATURAL PHILOSOPHY,
&c.

VOLUME II.—PLATES.

A
COURSE OF LECTURES
ON
NATURAL PHILOSOPHY
AND THE
MECHANICAL ARTS.

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ROYAL INSTITUTION OF GREAT BRITAIN.

A NEW EDITION, WITH REFERENCES AND NOTES,

BY THE

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DESCRIPTION OF PLATES.

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Fig. 146. The strongest form for a beam cut out of a vertical plank, and sup-

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PLATE XI.

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Fig. 157. A spherical dome, of which the lower parts are made thicker, in order that they may be of equal stability throughout. From A to B the dome is of equable thickness : below C and D the thickness cannot be increased sufficiently to procure an equilibrium, without the application of a chain or hoop, of which the section is represented at C, D. If the thickness were not at all increased, a hoop would be required at E, F, or still higher. P. 127.

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PLATE XIII.

Fig. 166. Joints for a tie beam. The joints at A and B cannot be more than half as strong as the entire beam, supposing the adhesion, produced by the pressure of the bolts, as strong as could be required. The joint at C is called a dovetail joint; its strength is a little less than that of A and B, but the adhesion is more easily secured, since a force tending to separate the beams must tighten the joint. P. 128.

Fig. 167. Joints for a tie beam. The joint A, if sufficiently tight, may possess of the strength of the beam. The joint B may be as strong as the beam, if the adhesion were great enough, but it would be difficult to apply sufficient pressure to create such an adhesion, and if the beam were subject to be much shaken, the joint would be a very bad one. P. 128.

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P L A T E X I V .

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Fig. 188. A compound frame, for keeping two rods A B, C D, in a direction very nearly parallel. E F is 36 parts of the scale, F G, 64, G H and H I each 80, E H and H K 20, G L $\frac{64}{3}$ G K, or $106\frac{2}{3}$, K M $33\frac{1}{3}$, and L M and M N each $133\frac{1}{3}$. P. 134.

PLATE XV.

Fig. 189. The form of a wheel or pulley, on which a broad strap runs, the surface being convex: the wheel which drives it is of a similar form, but its upper part only is shown in the figure. P. 135.

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Fig. 196. An eccentric contrate wheel, acting on a long pinion. P. 137.

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Fig. 198. A chronometer for measuring minute portions of time. The axis A B being turned, either by the handle A or by the weight C, the balls D, E fly out, and carry the weights F, G further from the axis; in consequence of which the increased effect of friction retards the motion, when it becomes too rapid. The barrel H is turned in the mean time, with the axis, and is allowed to descend as the thread at I is uncoiled, so that the point K, which is pressed against it by a spring, describes on it a spiral, which is interrupted whenever the pin K is touched. P. 147.

Fig. 199. The fusee of a watch or clock, the general outline of which forms part of the hyperbola A B, in which the distance of each point from the axis C D is inversely as its distance from the line D E. P. 148.

P L A T E XVI.

Fig. 200. A fusee with an auxiliary spring, for continuing the motion when the watch is wound up. The action of the main spring turns the fusee in the direction A B; the fusee acts on the ratchet wheel A B C by means of the click B, and this wheel impels the toothed wheel D E by the spring C B A, which is supposed to be seen through it. When the watch is wound up, this spring forces back the wheel A B C against the click F, which serves as a fixed point, while the other end continues to act on D E, and to maintain the motion. P. 148.

Fig. 201. The scape wheel A B, moving in the direction A C B, impels the pallets D, E of the crutch or anchor, alternately in contrary directions. P. 149.

Fig. 202. A is the scape wheel, B and C the pallets of the common watch scapement. P. 149.

Fig. 203. The dead beat scapement. The teeth are first received on the flat or rather cylindrical surfaces A, B, on which they rest until the pendulum arrives near the middle of its vibration, when the teeth begin to act on the inclined surfaces terminating the pallets. P. 150.

Fig. 204. The horizontal scapement, for a watch. The tooth A rests first on the external surface of the cylinder, B C, and then impels it by its inclined face, in the direction B C; it afterwards falls on the concave surface D E, and lastly impels the cylinder in the contrary direction. P. 150.

Fig. 205. The duplex scapement. A B is the pallet, through which the cylinder, and the tooth which rests on it, are supposed to be seen, the point of the tooth being about to escape from the notch towards C. The short tooth D next impels the point of the pallet, and the long tooth E falls on the cylinder. It first rests on the convex surface, and then drops into the notch, which causes a slight recoil in the wheel, and passes by, the tooth F being beyond the reach of the pallet; but on its return, the tooth falls again into the notch; and when it escapes, the pallet is impelled as before. P. 150.

Fig. 206. Mr. Mudge's watch scapement. A, the scape wheel, and one of the subsidiary springs, seen from above; B, a general view of the balance, with both the subsidiary springs, seen from one side. The point of one of the teeth rests at C on the end of the pallet, which is bent so as to detain it until the pin D, which is attached to the balance, sets it a liberty, by striking against the arm E; this arm is then carried on by the balance, to the end of its vibration, and impels it in its return, until the pallet meets the next tooth. The other spring acts alternately in the same manner, but in a contrary direction. P. 151.

Fig. 207. An improvement on Mr. Cumming's scapement for a clock. The tooth A is seen resting on a flat surface at the end of the pallet B: it is disengaged by the descent of the opposite pallet into the position in which it is represented, the pallet B being impelled by it at C. This pallet continues resting on the flat end of the tooth, until the pin D of the pendulum strikes against the arm E, which is carried before it, and impels the pendulum in its descent, until the pallet B acquires the situation in which the opposite pallet is represented, and sets that pallet at liberty from the tooth E, which has raised it. The situation and magnitude of the weights G, H, may be adjusted at pleasure. P. 151.

Fig. 208. Mr. Arnold's watch scapement. The pin A, projecting from the verge or axis of the balance, moving towards B, carries before it the spring B, and with it the stiffer spring C, so as to set at liberty the tooth D, which rests on a pallet projecting from the spring. The angle E of the principal pallet has then just passed the tooth F, and is impelled by it until the tooth G arrives at the detent. In the return of the balance, the pin A passes easily by the detent, by forcing back the spring B. The screw H serves to adjust the position of the detent, which presses against it. P. 151.

Fig. 209. Mr. Earnshaw's scapement. A is the unlocking pallet, B the spring on which it acts, C the detent, holding the tooth D by a pin; E is the point of the principal pallet first impelled by the tooth F, G is the tooth next locked, and H the adjusting screw. P. 151.

Fig. 210. A gridiron pendulum, consisting of three bars of iron, and two of a mixture of zinc and silver. P. 154.

Fig. 211. A compensation balance, as employed by Arnold. The outside of the

hoops A, B is of brass, the inside of steel : the weights C, D are screwed backwards and forwards, in order to obtain the requisite degree of compensation. The weights E, F are employed to regulate the mean rate of the watch, and G, H, and I, for adjusting it to all positions with respect to the horizon. P. 154.

Fig. 212. The compound plate A B rests on two supports, which are adjusted to a proper distance by turning the double screw C, the flexure of the plate by heat raising the bar D, which supports the pendulum, while its effective length is determined by a fixed clip, which is seen below the plate. P. 154.

PLATE XVII.

Fig. 213. A jack for raising weights by the alternate motions of a lever, the clicks on each side being detained in the teeth of the ratchets by the assistance of the springs in which they terminate, and which are connected together. P. 157.

Fig. 214. The mode of supporting a tackle for raising stones in building; the summit of the triangle, which is composed of three poles, being raised or lowered by means of a rope and pulleys. P. 159.

Fig. 215. A method of raising weights obliquely, by means of a rope passing over a pulley, which is drawn along horizontally. P. 159.

Fig. 216. A B, a section of an inclined plane, belonging to the Duke of Bridgewater's canal; the boats are drawn into the locks at A, which are then filled with water; C is the plan of the windlass, by which the descending and ascending boats are connected together, and which is turned by a winch; D and E are the locks. P. 159.

Fig. 217. A crane, with an oblique walking wheel, for oxen or horses. The wheel is taken from a mill of Leupold. P. 161.

Fig. 218. A crane with a wheel and break like Mr. White's. The man walks at any required distance from the axis of motion, and pushes forwards the lever A, which moves the bar B C, connected to the same axis, and removes the break C D from the circumference of the wheel. P. 161.

Fig. 219. A lewis, for raising stones. P. 161.

Fig. 220. When the centre of gravity A is twice as far from one of the porters B, as from the other C, the first bears one third of the weight, the other two thirds. P. 162.

Fig. 221. When the centre of gravity A is above the line joining the points of support B, C, the load is divided in the ratio of the segments C D, B D, terminated by the vertical line A D; but it may be supported by two equal forces in the directions B E, C F, found by making G H equal to B G, and joining C H; the angle G B E being equal to G H F; the forces and the weight may then be represented by the lines C I, I K, and C K. P. 162.

Fig. 222. A roller with two wheels fixed on its ends, by means of which the slab resting on it may be moved to a considerable distance without leaving the roller behind. P. 164.

Fig. 223. Mr. Garnet's rollers for diminishing friction: their axes being loosely connected by a ring, in order to keep them in their places. P. 164.

P L A T E XVIII.

Fig. 224. A pair of friction wheels, supporting one end of the axis of a wheel. P. 164.

Fig. 225. The centre of the wheel A B, passing over the obstacle C, describes the path D E; that of the larger wheel F G, the path H I, which is less steep. P. 164.

Fig. 226. The centre of the wheel A B describes the curved path C D, in passing over the obstacle E, while that of the larger wheel F G has an angle at H. P. 164.

Fig. 227. The wheel A B, moving on a soft road towards B, has to overcome the resistance of the earth at C. P. 165.

Fig. 228. A section of the wheel of a carriage, a little dished, or inclined outwards. P. 166.

Fig. 229. A B and C D being the straps or braces by which a coach is suspended, if the centre of gravity be at E, F, or G, it must move, when the carriage swings, in the curve passing through the respective point. P. 167.

Fig. 230. The mode of harnessing two horses, so as to make them draw conveniently together: when either horse advances so far that the bar A B assumes the position C D, the foremost horse has the disadvantage of acting on a lever equivalent only to E F, while the other horse acts on E C. P. 167.

Fig. 231. A sugar mill. The axis A is turned either by animal force or by water: the liquor is collected in the trough B, and runs off in the channel C. The openings D are for the purpose of adjusting the axes of the rollers. The canes are supplied by the hands of the workmen. P. 170.

Fig. 232. A glazier's vice. The vacuity in the middle shows the form of the section of the lead which is drawn through it. P. 171.

Fig. 233. A forge hammer, elevated by the plugs, projecting from an axis, either at A, or more conveniently, at B, and thrown forcibly against the wooden spring C. P. 171.

Fig. 234. An engine for driving piles, on Vauloué's construction. The horses, drawing at A, B, raise the weight C, held by the tongs D, fixed in the follower E, which are opened, when they reach the summit, by being pressed between the inclined planes F, G, so as to let the weight fall. At the same time the lever H is raised by the rope I, and presses on the pin K L, so as to depress the lever M N, and draw the pin O out of the drum P Q; the follower then descends, and uncoils the rope, its too rapid motion being prevented by the counterpoise R, acting on the spiral barrel Q. The motion is regulated by the fly S, the pinion of which is turned by the great wheel T. P. 173.

Fig. 235. The rollers of the slitting mill. P. 174.

Fig. 236. A simple plough. A is the coulter, for dividing the ground; B the share, fixed on the mould board C, for turning it to the right hand; D is the rest, and E, F, the handles. P. 175.

Fig. 237. Section of a threshing mill. The corn is drawn in by the rollers or feeders A, B: it is beaten by the revolving beaters C, D, and the straw is drawn out by the rakes E, F, which discharge it at G; the grain falling through the arched bottoms H I, I G, which are formed like sieves. P. 178.

Fig. 238. A corn mill, with some of the improvements made in America, by Mr. Ellicott and Mr. Evans. The corn being poured into the funnel A, is conveyed by the revolutions of a spiral B C, to C, whence it is raised, by the chain of buckets C D, to be cleaned by the revolving sieve E, and the fan F; it is then deposited in the granary G, which supplies the funnel or mill hopper H; this being perpetually agitated by the iron axis of the upper mill stone, shakes it by degrees into the perforation of the stone; it escapes, when ground, at I, and is conveyed, by means of the carrier K L, and the elevator L M, to the cooler N, where it is spread on a large surface: it passes afterwards to the bolter O, and is received in the binn P, from whence it is taken to be packed in sacks or barrels. Q represents the surface of a mill stone, cut into furrows, in order to make it act more readily on the corn. P. 179.

PLATE XIX.

Fig. 239. The surfaces of the fluid in the bent tube A B remain on the same level, in the same manner as if the tube were absent, and the fluid made a part of that which is contained in the reservoir C D. P. 197.

Fig. 240. The bucket A being suspended by the rope B, and made to revolve rapidly round its axis, the surface of the water assumes a parabolic form. P. 198.

Fig. 241. A heavier fluid being contained in the upper part of the bent tube A B, which is immersed in the lighter fluid, filling the vessel C D, the fluid in the tube remains in a state of tottering equilibrium, when its surfaces are in the same level. P. 198.

Fig. 242. The fluid A B C presses on the bottom of the vessel B C with the same force as if the vessel were of the form B C D E. P. 199.

Fig. 243. The portion A B C D of the fluid being supposed to be congealed, and then to form a part of the vessel, the pressure on the bottom would remain unaltered. P. 199.

Fig. 244. The weight A may be supported by the pressure of a small quantity of fluid, either by making the surface of the vessel B C very large, and the height of the tube D E moderate, or, while the vessel F remains of a moderate size, by making the height of the tube G H very great. P. 199.

Fig. 245. The pressure on any small part of the side of the vessel A B, at C or D may be represented by the line C E, D F, and the whole pressure on the side by the triangle B G, of which the centre of gravity is at H; and if the side A I be supported by a single prop, it must be placed at the point K, the height of which is equal to that of H. P. 200.

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* Ph. Tr. 1665, p. 231.

P L A T E X X .

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PLATE XXI.

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P L A T E XXII.

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PLATE XXIII.

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P L A T E XXIV.

Fig. 324. The cupping instrument of Hero. The cavity A was partly exhausted by applying the mouth repeatedly to the pipe B, the stopcock B being turned after each application. When the stopcock C was opened, the air at D in contact with the skin was also rarefied, and the effect of suction was produced. P. 260, 276.

Fig. 325. Mr. Cuthbertson's air pump. When the piston rod A is depressed, it leaves the piston B a little behind it, so as to make an opening between two conical parts which are ground together, and the air escapes from the lower part of the barrel into the upper part; when it is elevated, the whole piston is raised, and a wire, which slides through the axis of the rod, raises a small valve at the bottom of the barrel, which leads to the receiver C, by the tube D E: the air is forced from the upper part of the barrel through a valve in the oil vessel F, whence the oil runs back, when it overflows, by a tube leading to the mouth of the barrel; and if this tube be stopped by turning its cock, the air may be condensed into a receiver fixed at G. At H is a long gage, with a barometer immersed in the same basin of mercury. The piston rod, which is hollow, has a perforation a little above A, to admit the oil, in order that the wire may work freely in it. P. 261.

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Fig. 332. Mr. Watt's gasometer. The pressure is regulated by the magnitude of the weights A and B, which act by the spiral fuseses C, D, so as to sustain a part of the weight of the inverted vessel, represented by the exterior dotted line. The gas is admitted at E or F, and is delivered at G. G H is a gage for showing the height of the water within and without the moveable vessel. I is a cock for letting off the water. P. 263.

Fig. 333. The shower bellows. The stream A, passing through the strainer B, carries with it a quantity of air through the pipe C, which rises to the upper part of the air vessel D, and is discharged by the pipe E. P. 263.

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Fig. 335. The original steam engine of Savery. The vessel A being filled with steam from the boiler B, and the stopcock being turned, the steam cools and is condensed, and water is forced into its place by the pressure of the atmosphere, through the valve C: the steam is then readmitted, and forces the water to ascend through the valve D and the pipe D E. The vessel F acts alternately with A. P. 266.

Fig. 336. The common steam engine of Newcomen and Beighton. The steam being admitted into the cylinder A below the piston, the weight B is allowed to descend: a jet of water is then admitted by the pipe C, which condenses the steam, and the pressure of the atmosphere then depresses the piston: a part of this water is admitted by the pipe D into the boiler, in order to keep it sufficiently full. P. 266.

Fig. 337. Mr. Watt's steam engine. The steam, which is below the piston, is suffered to escape into the condenser A by the cock B, which is opened by the rod C, and at the same time the steam is admitted by the cock D into the upper part of the cylinder; when the piston has descended, the cocks E and F act in a similar manner in letting out the steam from above and admitting it below the piston. The

jet is supplied by the water of the cistern G, which is pumped up at H from a reservoir: it is drawn out, together with the air that is extricated from it by the air pump I, which throws it into the cistern K, whence the pump L raises it to the cistern M; and it enters the boiler through a valve, which opens whenever the float N descends below its proper place. The pipes O and P serve also to ascertain the quantity of water in the boiler. The piston rod is confined to a motion nearly rectilinear by the frame Q; the fly wheel R is turned by the sun and planet wheel S, T; and the strap U turns the centrifugal regulator W, which governs the supply of steam by the valve or stopcock X. P. 267.

Fig. 338. Mr. Symington's steam boat. A is the boiler, B the cylinder, C the piston, D the condensation pipe, E the air pump, F stampers for breaking ice. P. 267.

Fig. 339. An air gun. The air is forced by the syringe A into the cavity surrounding the barrel, whence it is discharged by the valve B, which is opened either immediately by the action of the trigger C, or by a spring, which is bent by cocking the gun, and set at liberty by the trigger. P. 269.

PLATE XXV.

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Fig. 344. A vibration compounded with another smaller vibration, three times as frequent, in a transverse direction, the separate vibrations being such that the points may be always opposite to a point moving uniformly in a circle. Thus the vibrations in the lines A B and A C compose the complicated figure D E. P. 299.

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Fig. 348. A square plate divided into a diversity of vibrating portions. From Chladni. P. 300.

Fig. 349. The small bones of the left ear, nearly three times the natural size, supposed to be seen through the membrane of the tympanum, by looking directly into the auditory canal. A B is the membrane of the tympanum, C the hammer, D the anvil, E its attachment to the surrounding bone, F the stirrup, G the round aperture in the bone leading to the cochlea. P. 302.

Fig. 350. A view of the vestibule of the left ear, with the semicircular canals and the cochlea, seen with the eye a little more depressed than by looking straight through the canal, and exactly in the direction of the stirrup. A B C is the vestibule, immediately behind the oval aperture, which is covered by the basis of the stirrup, D are the canals, E the cochlea, the upper spire terminating in the vestibule, the lower in the round aperture at B. The projection of the membrane of the tympanum is marked by an oval line. P. 302.

Fig. 351. The structure of the left ear, seen from above, the upper part of the canal being supposed to be removed. A is the auditory canal, B the membrane of the tympanum, C the hammer, D the anvil, E the stirrup; F the place of the canals,

which are higher than the parts represented, G the place of the cochlea, H the round aperture. P. 302.

Fig. 352. A, B, C, a representation of the joint effect of two equal vibrations variously combined, the middle line being always half way between the two outer ones, and showing the compound vibration reduced to half its real extent: D shows the mode of finding the joint effect of vibrations, by cutting a surface into sliders, which are retained in their places by a screw. P. 305.

Fig. 353. The uppermost and lowermost curves represent a series of vibrations, of which 12 occupy any given period of time: the third and sixth lines two series of which 15 and 16 occupy respectively the same time: the joint effect of each pair is shown by the dotted curves which are interposed between them, the middle one representing the effect denominated a beat. P. 305, 306.

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Fig. 356. The trumpet of Marigni, with its bridge, which is supported by the string A B nearly in contact with the sounding board; this string being either stretched by a pin at B, or by a cross string B C. The places at which the string is to be touched, may be marked by frets fixed under them, as they are here shown by points. At D, the scale of this instrument is exhibited, resembling that of the trumpet and the French horn. P. 312.

PLATE XXVI.

Fig. 357. The right half of the human larynx. A B C is the outline of the cricoid cartilage, D E F G H of the thyroid, and I K L of the arytaenoid cartilage; M is the epiglottis, N K the upper ligament of the glottis, O P the lower ligament, and Q the trachea. P. 313.

Fig. 358. A view of the ligaments of the glottis, seen from above, the larynx being divided by a horizontal section a little above them. P. 313.

Fig. 359. Sections of the pipes employed by Kratzenstein for producing the sounds of the different vowels; in general by means of a larynx resembling the mouth piece of a reed organ pipe, but in the case of the vowel I by simple inflation through the tube B. The pipe for U produces the sound O, except when it is very nearly shut up. P. 313.

Fig. 360. The vox humana organ pipe, with the mouth piece common to reed pipes in general; the lower part in contact with the tongue being nearly semicylindrical; the tongue being adjusted to the proper pitch by means of a sliding wire, which regulates the length of the part that is at liberty to vibrate. P. 314.

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Fig. 363. A front view and section of the open diapason organ pipe of metal. It is tuned by opening or contracting the upper orifice. P. 314.

Fig. 364. A a front view of the flute organ pipe, of wood, which is tuned by a plug. B a section of the pipe. P. 314.

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Fig. 368. A the form of a cromorn pipe, B, of a trumpet pipe, both having reed mouth pieces. P. 315.

Fig. 369. A ray or pencil of light A B, C B, falling on the surface D E, a portion of the light is reflected, and another portion is transmitted, in the direction B F, B G, so that B G is equal to B C, and B H to B I, C I K and G H L being

lines perpendicular to DE at any such distances, that BK may be to BL in a certain proportion, which is that of the sines of the angles of incidence ABM , CBM , to those of the angles of refraction FBN , GBN . BO and BP are the reflected portions of the rays. P. 322.

Fig. 370. A mode of determining the position of a refracted ray, which is particularly convenient in the case of refractions at spherical surfaces. ABC being any circle, either touching the refractive surface at A , or being itself a section of the refracting substance, if another circle DEF be drawn on the same centre, having its diameter to that of the first as the sine of the angle of incidence to that of refraction, and a third circle GHI , which is less than the first in the same proportion as the second is greater; and if the direction of the incident ray KA be continued to D , and LD be drawn from the centre cutting GHI in G , AG will be the direction of the refracted ray; and if this ray pass again out of the denser medium at B , its direction BM may be found by drawing LIF , and FBM will be thus truly determined. P. 322.

Fig. 371. A ray or pencil AB , refracted at B to C , and there reflected by a perpendicular surface into an opposite direction CB , will return also in the direction BA , a portion of it being reflected in the first place to D , and in the second to E . P. 323.

Fig. 372. A pencil AB passing through a substance CD contained between parallel surfaces, continues its course in the direction EF parallel to AB . P. 324.

Fig. 373. The ray AB , entering the medium CD through the transparent substance EF , contained between parallel surfaces, acquires the direction GH , parallel to IK , into which LI is at once refracted. P. 324.

Fig. 374. The appearance of a prism, of which the lower surface is divided into a bright and a dark portion, separated by a coloured arch ABC . P. 324.

PLATE XXVII.

Fig. 375. A is an actual focus of diverging rays, B an actual focus both of converging and of diverging rays, C a virtual focus of converging rays, and D a virtual focus of diverging rays; A and B , B and C , and C and D are foci conjugate to each other, with respect to the refractions of the three lenses. P. 325.

Fig. 376. The image of the point N , formed by the plane mirror AB , is at an equal distance behind the mirror; and in this manner the whole image of the word is formed in an inverted position. P. 325.

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PLATE XXVIII.

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* Ph. Tr. 1777, lxvii. 789.

† Ibid. lxvii. 799; and Hell's Ephemerides, Anni 1780, Viennæ.

P L A T E XXIX.

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PLATE XXX.

Fig. 436. A section of the human eye. A is the cornea; B the aqueous humour, in which the uvea hangs; C the crystalline lens; the ciliary processes being between it and the uvea; D the vitreous humour; EFG is the choroid coat, lined by the retina; HIK the sclerotica, and L the optic nerve. P. 350.

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PLATE XXXI.

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PLATE XXXII.

Fig. 471. A representing the sun, B the earth, and C the planet Mars; supposing Mars and the earth to set out together from D and E, the angle D A C was determined by Kepler from calculation, and the angles B A D and A B C by observation; whence it was easy to construct the triangle A B C, and to find the proportion of A B to A C. P. 402.

Fig. 472. The solar system, representing the form and proportions of the orbits of all the primary planets, and of three of the comets. The parts of the orbits represented by entire lines are on the north of the ecliptic, the dotted parts on the south: the letters A and P denote the aphelion and perihelion. The point in the centre, which ought to be only $\frac{1}{700}$ of an inch in diameter, represents the sun. The figures of the respective planets show their comparative magnitude, that of the sun being represented by the innermost of the graduated circles which inclose the whole: they are placed according to their actual situations on the 14th June, 1806. The letters M D show the mean distance of the comet of 1759, being placed at the extremity of the lesser axis of the ellipsis in which it must be supposed to revolve. P. 408.

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* Hist. et Mém. 1771, p. 458.

PLATE XXXIII.

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Fig. 479. The appearance of Saturn, with his ring, from Dr. Herschel. P. 408.

Fig. 480. The appearance of the moon, in an inverted position. The figure is copied from Mr. Nicholson's plate, the references from Cassini and Lalande. Eq. is the place of the moon's equator. P. 408.

Names of the spots, according to Riccioli, and Hevelius.

1 Grimaldus or	Palus Mareotis	26 Hermes	Mons Bodinus
2 Galileus	Mons Audus	27 Dionysius	
3 Aristarchus	Mons Porphyrites	(d) Albategnius	
4 Keplerus	Loca paludosa	29 Plinius	Promontorium Ache- rusia
5 Gassendus	Mons Cataractes	30 S. Theophilus	Mons Moschi
6 Schikardus	Mons Troicus	31 Fracastorius	Lacus Thospitis
7 Harpalus	Insula sinus hyper- borei	32 Censorinus	Promontorium acu- tum
8 Heraclides	Caput mulieris	33 Messala	
(b) Vulcanus		34	Promontorium Som- nii
9 Lansbergius	Insula Malta	35 Proclus	Mons Corax
10 Reinoldus	Mons Neptunus	36 Cleomedes	Montes Riphæi
11 Copernicus	Mons Aetna	37 Snellius	Mons Paropamisus
12 Helicon	Insula erroris	38 Petavius	Petra Sogdiana
13 Capuanus	Regio Cassiotis	39 Langrenus	Insula major
14 Bullialdus	Insula Creta	40 Taruntius	Sinus Phasianus
15 Eratosthenes	Insula Vulcania	A Mare Humororum	
16 Timocharis	Insula Corsica	B Mare Nubium	
17 Plato	Locus niger major	C Mare Imbrium	
18 Archimedes		D Mare Nectaris	
(a) Aratus		E Mare Tranquilli- tatis	
19 Insula sinus medii		F Mare Serenitatis	
20 Pitatus	Mare mortuum	G Mare Foecundita- tis	
21 Tycho	Mons Sinai	H Mare Crisium	
22 Eudoxus	Mons Carpathes		
23 Aristoteles	Mons Serrorum		
24 Manilius	Insula Berbicus		
25 Menelaus	Byzantium		

Fig. 481..483. The satellites of Jupiter, Saturn, and the Georgian planet, at their proper distances, in proportion to the diameters of the planets, shown on the same scale. P. 408.

Fig. 484. The figure of the tail of the comet of 1680, represented in the plane of its orbit, from Newton. A B is the earth's orbit, C and D are the first and last appearances of the tail, and E F is the line of the nodes. P. 408.

Fig. 485. A, B. Two successive appearances of the comet of 1723, from Lord Paisley. P. 408.

PLATE XXXIV.

Fig. 486. The gravitating body $A B C$, being supposed to revolve on the axis $A C$, the fluid column $B D$ must be longer than $E D$, in order to support its pressure. P. 412.

Fig. 487. If A represent the place of the sun, B that of the earth, and C that of the moon, taking $A D$ to $A C$ as the square of $A C$ is to the square of $A B$, $A D$ will represent the sun's attraction acting on the earth, and $C D$ the disturbing force, which, together with $A D$, makes up $A C$, the force acting on the moon; and it is obvious that, when the nodes are in any oblique situation, as $E F$, the force being directed to some point D , between B and A , while the moon moves from G to H , the force $C D$ will tend to lessen the inclination, while the moon is ascending from E towards C , and to cause the node E to move back towards G , and, when it is again descending towards F , the inclination will be increased, and the node F made to recede towards H , until the moon arrives at H , and the force becomes directed to a point on the other side of B ; the nodes only advancing while the moon is between H and F , or between G and E . P. 413.

Fig. 488. A body attracted towards the centre A , and descending from B in the ellipsis $B C D$, has the inclination of its orbit to the revolving radius $A B$, $A C$, $A D$, perpetually changed, until at D it becomes perpendicular to it: but when the force increases more rapidly, the radius does not become perpendicular to the orbit till it arrives at E , and the line of the apsides $A D$ moves forwards to E . P. 414.

Fig. 489. A represents the position of the limit of light and darkness on the earth's surface at the vernal equinox, B at the summer solstice, and C at the winter solstice; $E Q$ denotes the equator, N the north pole, and S the south. P. 417.

Fig. 490. $N E S W$ being the horizon, and Z the zenith, $E A W$ shows the sun's apparent path in London at the time of the equinoxes, $B C D$ at midsummer, and $F G H$ at midwinter, projected orthographically, as if the circles were described on the surface of a globe, and viewed from a great distance. The circle $I K L$ is the boundary of twilight, supposing it 18° below the horizon, and its intersections with the sun's path show the beginning and end of twilight, as at I and K . P. 418.

Fig. 491. The rays of light, coming in the direction $A B$, are bent by the atmosphere so as to arrive at C , and to illuminate a part of the atmosphere there, which is visible, by means of a second refraction, to a spectator at D , and occasions the first and last twilight. P. 527.

Fig. 492. Venus is at her greatest elongation or angular distance from the sun A , when situated as at B , with respect to the earth at C ; and she is stationary at D , when she is moving with the same velocity as the earth, with respect to the direction of the earth's motion, the line $E D$ being then more oblique, with respect to a fixed line, than either before or after. P. 418.

Fig. 493. $A B C D$ is the apparent path of Venus for the year 1806, supposing the sun E to revolve round the earth F . The place of the sun and planet is marked for every four weeks. P. 418.

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Fig. 495. The small figures represent the phases of the moon in different parts of her orbit. The smaller detached figures show the appearance of the moon, as seen from the earth; the larger ones, those of the earth at the same times, as seen from the moon, which are always the reverse of the moon's appearance. At A the moon is new; B is the first quarter, C the full moon, and D the last quarter. A and C are sometimes called the syzygies, and B and D the quadratures. P. 419.

Fig. 496. A , the moon passing through the earth's shadow; which is distinguished into three parts, the perfect shadow, the true shadow, and the penumbra. At B and C the moon is shown passing through the section of the shadow. P. 420.

Fig. 497. The path of the moon's shadow passing over the earth, in the solar eclipse of 1764, the earth being supposed at the same time to revolve on its axis. The line $A B$ is the part in which the eclipse appeared annular, $C D$ being the breadth of the whole shadow or penumbra. P. 420.

Fig. 498. The shadow of the moon falling on the earth. The true shadow not

extending here to the earth, the cone formed by the continuation of its outlines marks the extent of the parts in which the eclipse appears annular. P. 420.

Fig. 499. The termination of the moon's disc in a solar eclipse. From Dr. Herschel. P. 420.

Fig. 500. The apparent magnitudes of the planets, that of the sun or moon being supposed equal to a circle a foot in diameter: where there are two figures, one of them shows the mean apparent magnitude, and the other the greatest. P. 422.

Fig. 501. The apparent magnitude of the sun, as seen from the different planets; for Mercury, the magnitude is shown by that of the earth in fig. 497. P. 424.

PLATE XXXV.

Fig. 502. AB being the earth's axis, the circle ACB is the meridian of the place C , and CD represents the plane of its horizon. P. 426.

Fig. 503. The effect of the obliquity of the ecliptic in the equation of time is shown by the difference of the angles ABC and DBE , subtended at the pole B by equal portions of the oblique circle AE . P. 427.

Fig. 504. AB being parallel to the earth's axis, the 12 planes passing through it, at equal angular distances, mark, on the circle CD perpendicular to it, the hour lines of an equatorial dial, and on the horizontal surface EF those of a horizontal dial. P. 427.

Fig. 505. A method of constructing a dial on any given plane. ABC is the elevation of the pole, or more generally, the angle which the surface makes with the gnomon AB . The circles are divided into equal parts, and 1, 2, 3, 4, 5, 6 are the hour lines, B being the place of the gnomon. The reason of this construction will appear by comparing the circle in the last figure with the ellipsis which is formed on the horizontal surface. P. 427.

Fig. 506. A dial for a pointed gnomon, or obelisc, drawn on a horizontal surface. P. 427.

Fig. 507. A mural quadrant, with its telescope; AB is the plumb line, for adjusting the instrument, and C the counterpoise for the telescope. P. 429.

Fig. 508. A portable transit instrument. A and B are screws for adjusting the axis by a vertical and a horizontal motion; CD is a spirit level, which may occasionally be hung on the telescope by the pins E and F . G is a small graduated arch, to be viewed through the microscope H , for taking elevations of a few degrees. P. 429.

Fig. 509. A transit circle, resembling Mr. Wollaston's, with a horizontal circle, by means of which both altitudes and azimuths may be measured. A is a microscope for viewing the plumb line, B another for reading off the divisions of the horizontal circle; C and D are spirit levels. P. 429.

Fig. 510. A zenith sector, with its telescope, which has usually a reflecting prism, like that of the Newtonian telescope, for its eyeglass. P. 429.

Fig. 511. The marine octant, introduced by Hadley. The mode of taking the common or front observation, is shown by the lines drawn to the sun and moon: the back observation by the two stars. A is a dark glass to be used in observations of the sun, and which may be fixed at B , when required. P. 430.

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* Ph. Tr. 1757, p. 329. Account of Methods, 4to, 1758.

† Churchman's Magnetic Atlas, 1794.

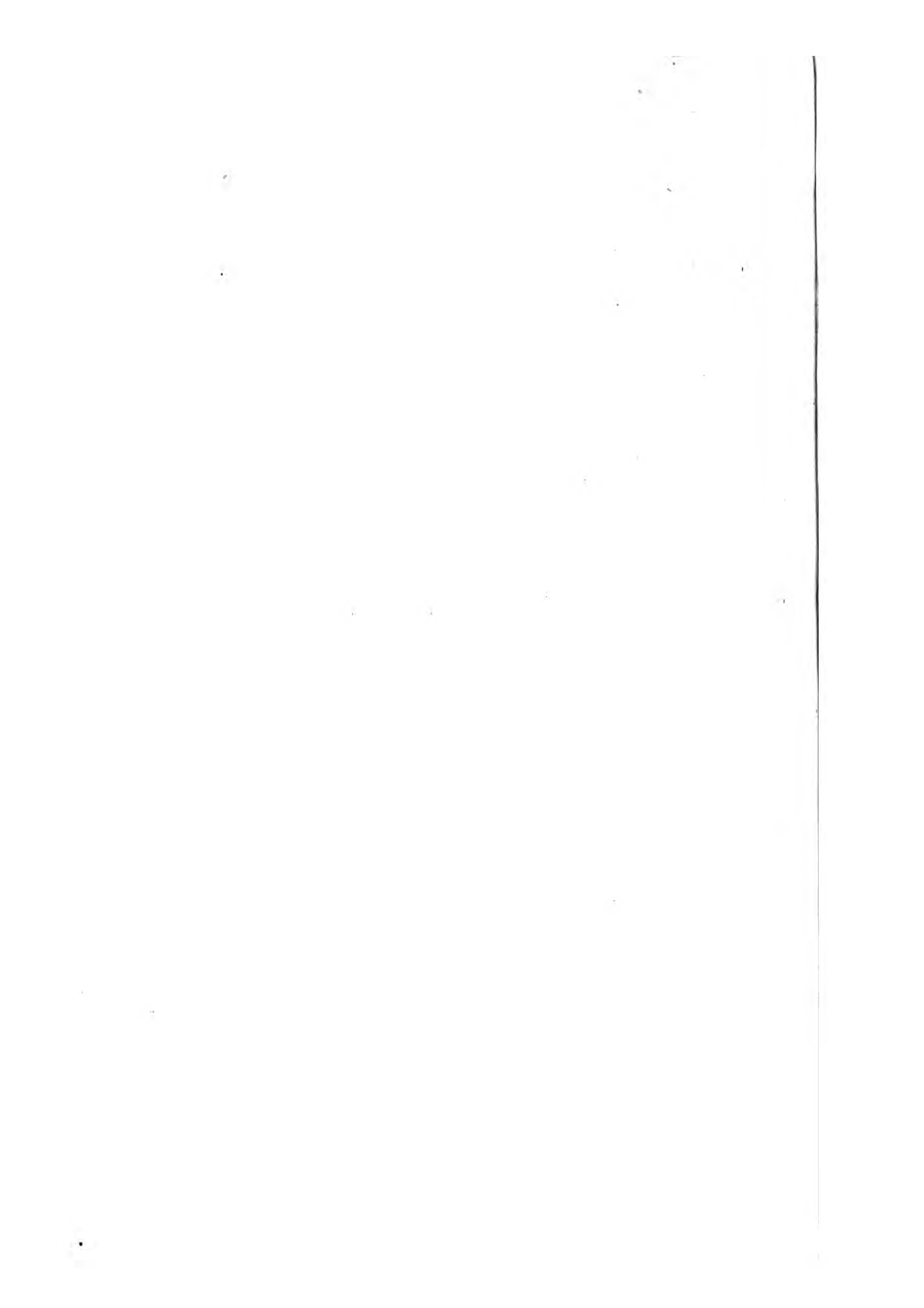


PLATE I.

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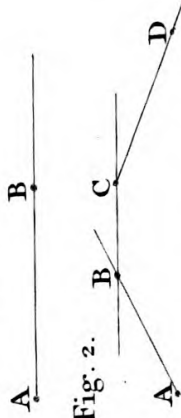


Fig. 2.



Fig. 3.

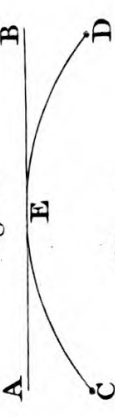


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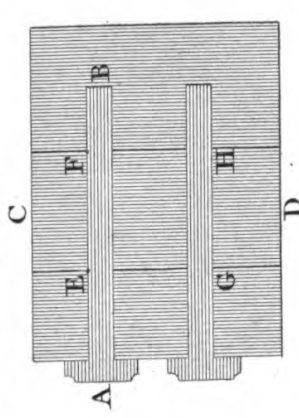


Fig. 8.



Fig. 9.

Fig. 5.

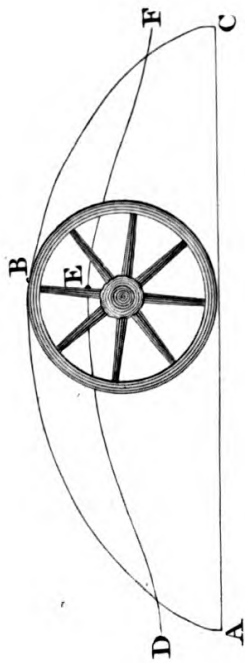


Fig. 6.

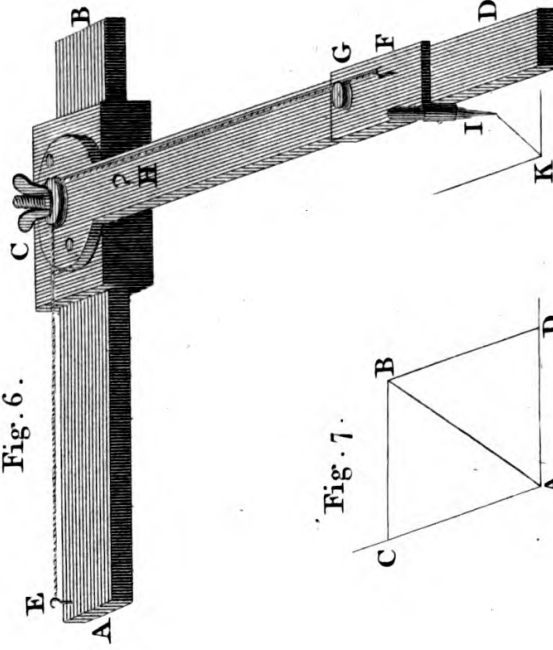


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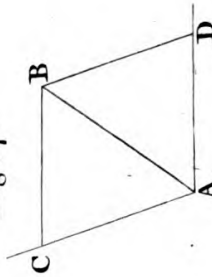


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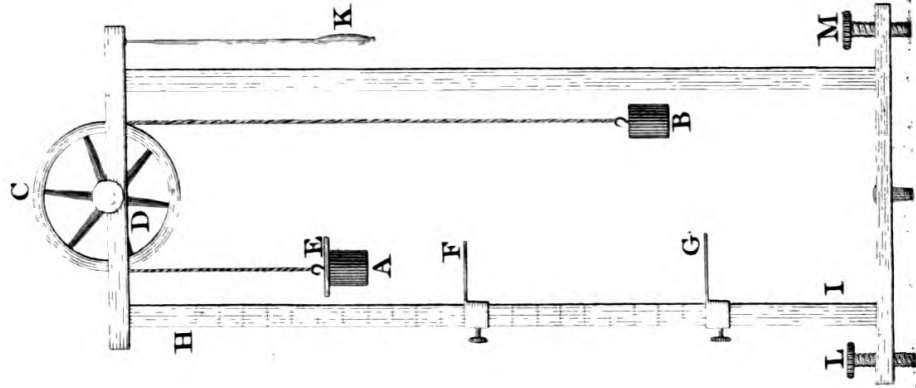


Fig. 13.





Fig. 9.

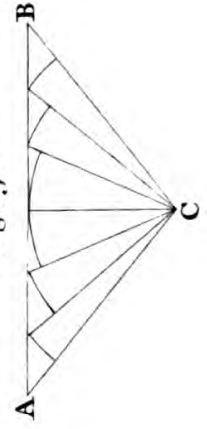


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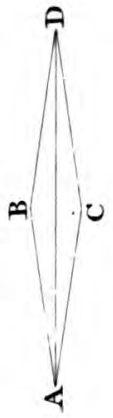


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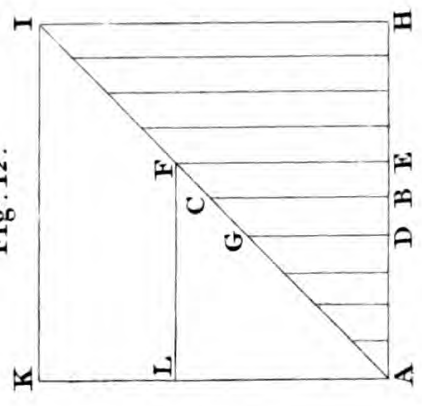


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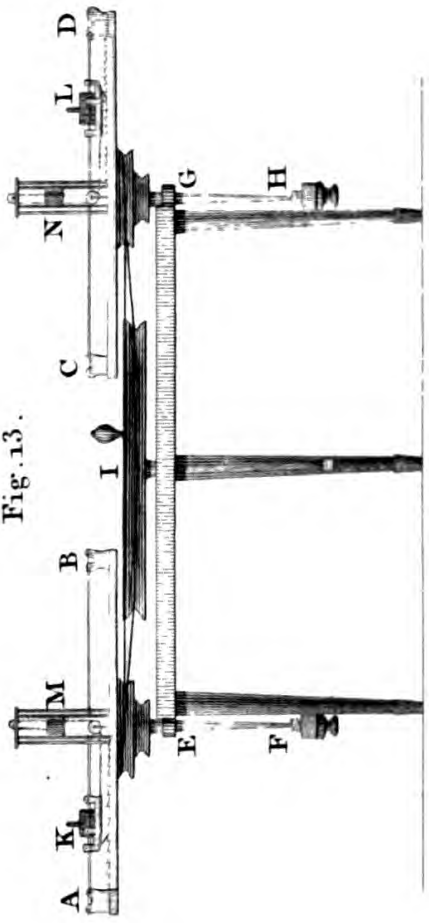
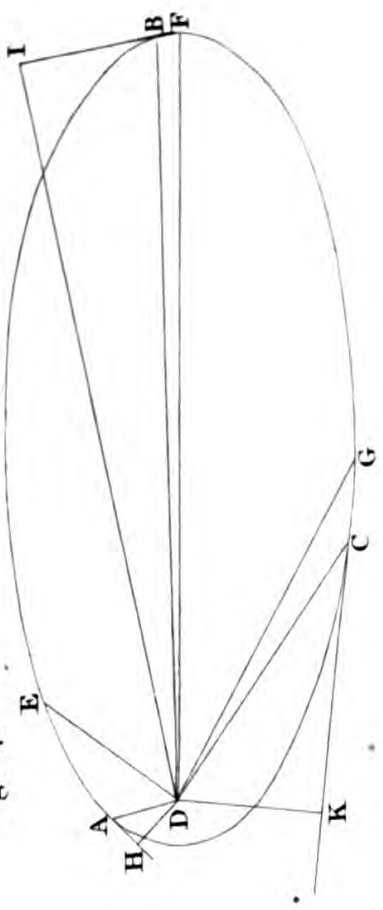


Fig. 14.



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PLATE II.

Fig. 15.

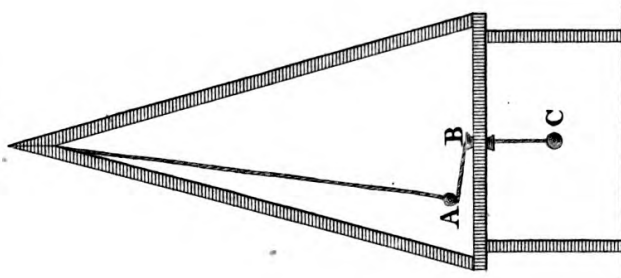


Fig. 17. G

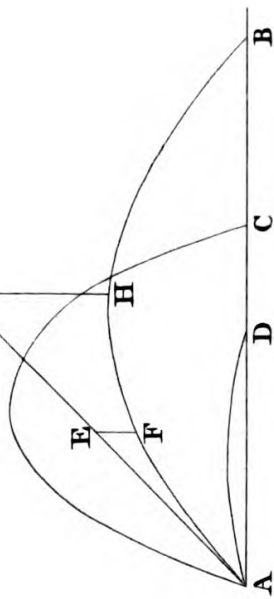


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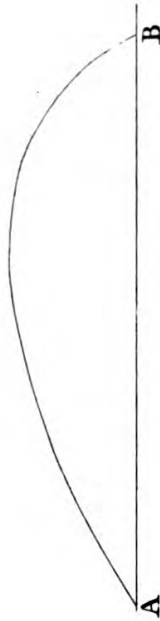


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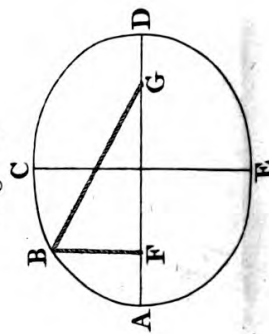


Fig. 20.



Fig. 21.



Fig. 24.

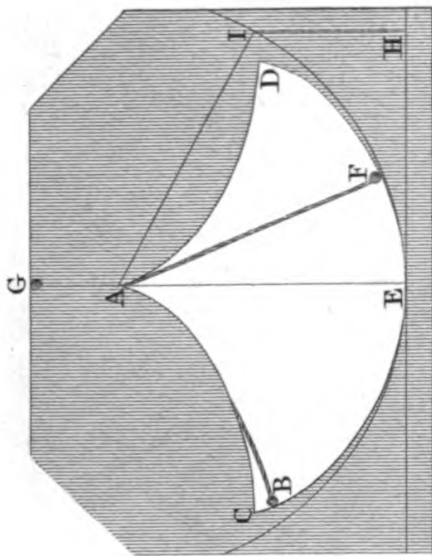
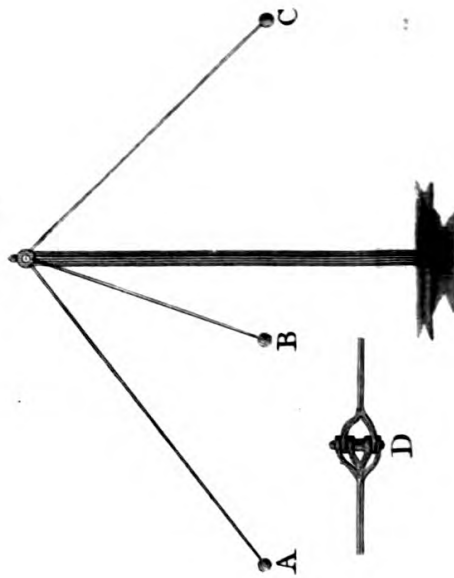


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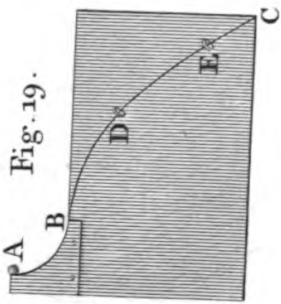


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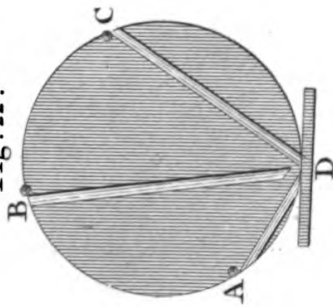


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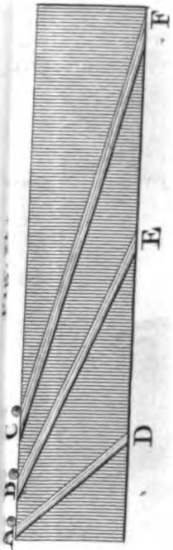
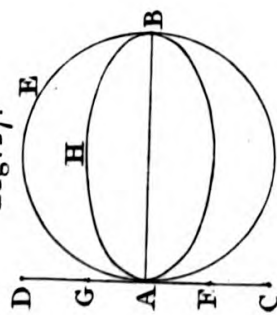


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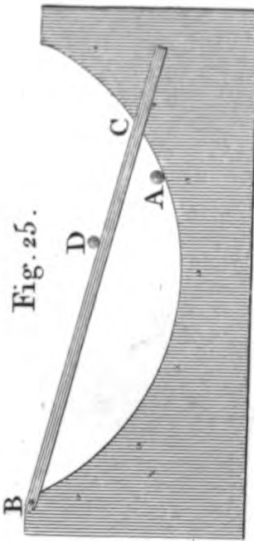
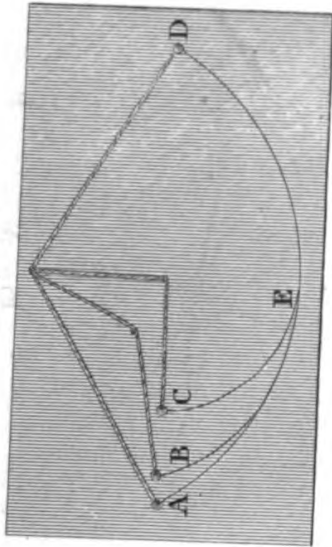


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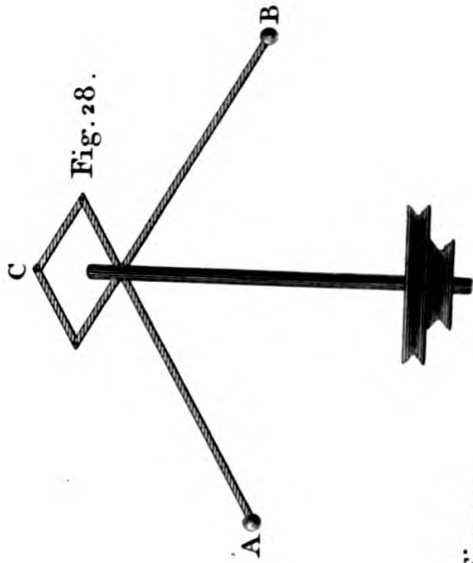
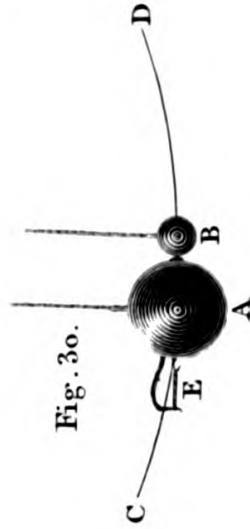


Fig. 28.

Fig. 29.



Fig. 30.



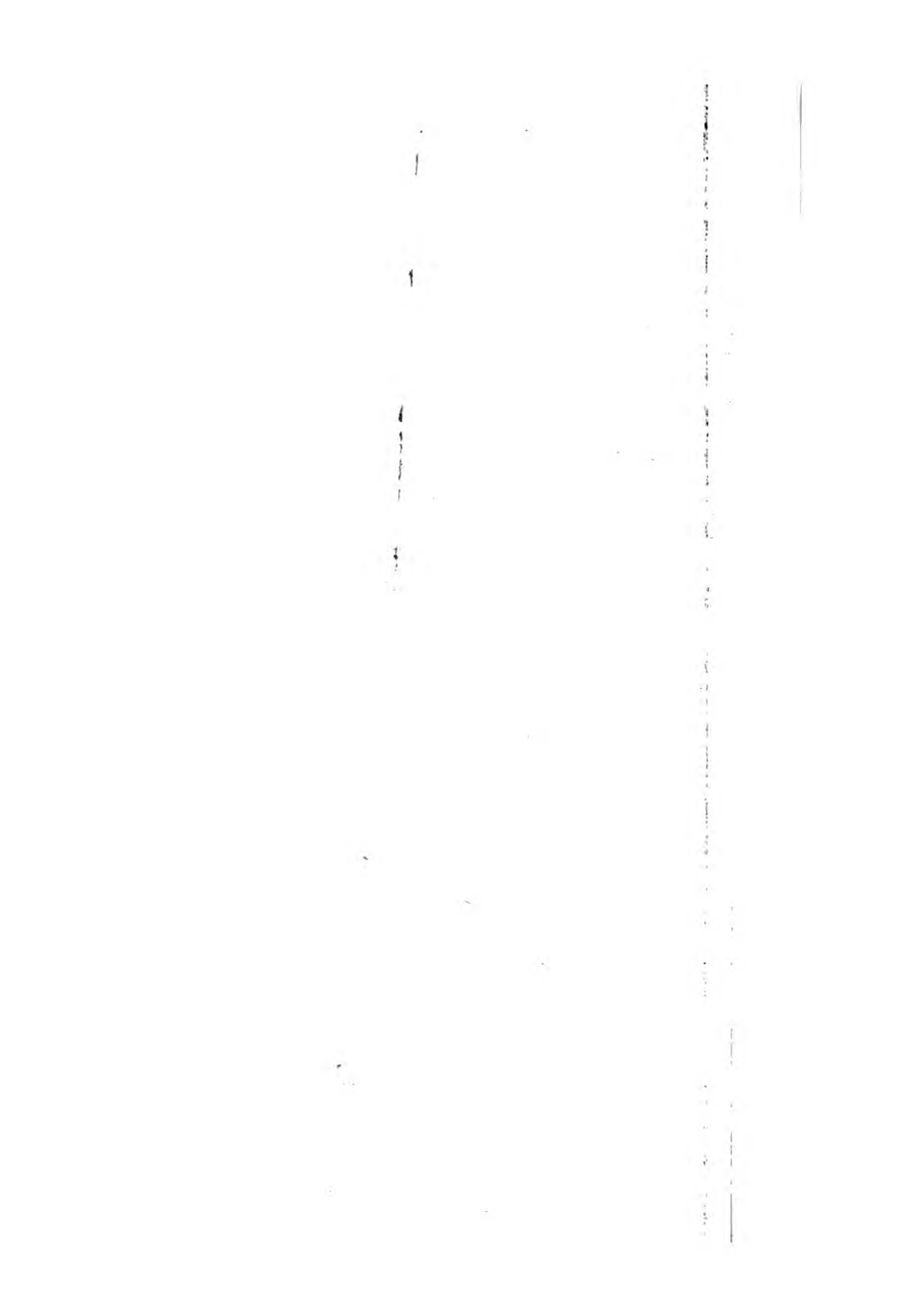


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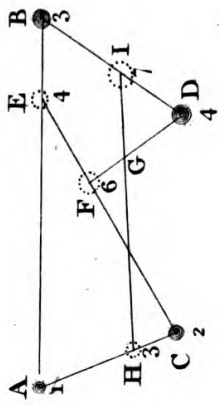


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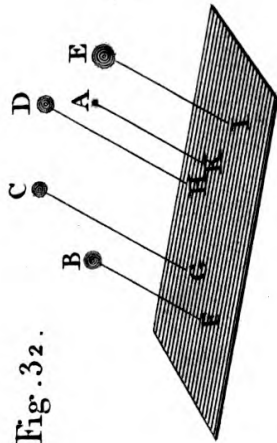


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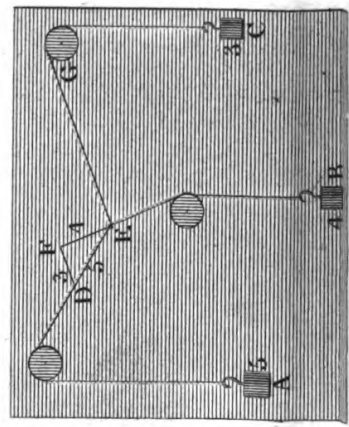


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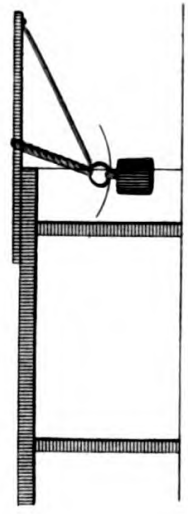


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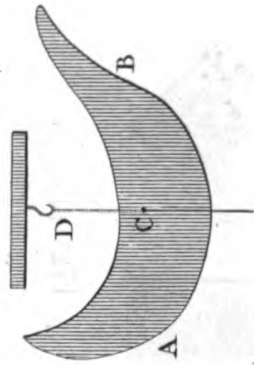


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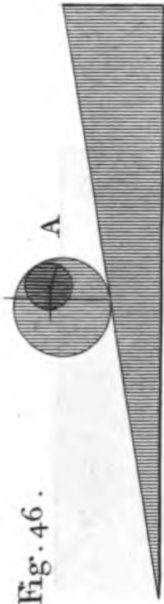


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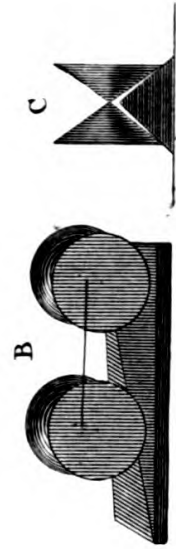
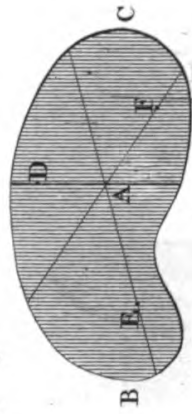


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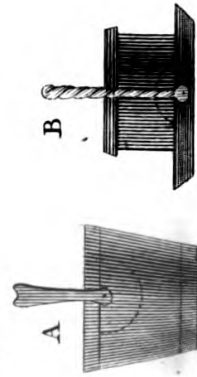


Fig. 47.



Fig. 41.





Fig. 34.

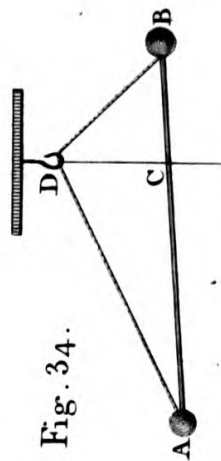


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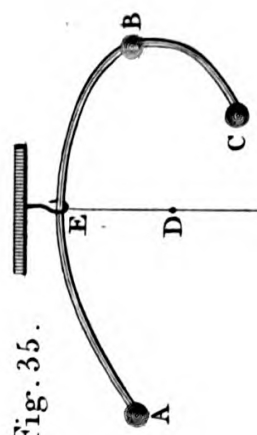


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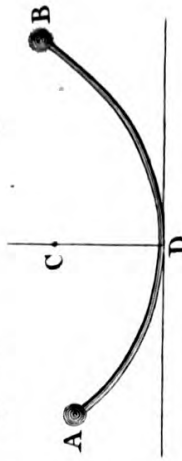


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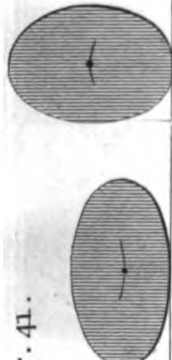


Fig. 42.

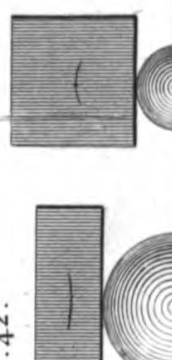


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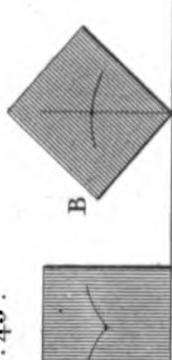


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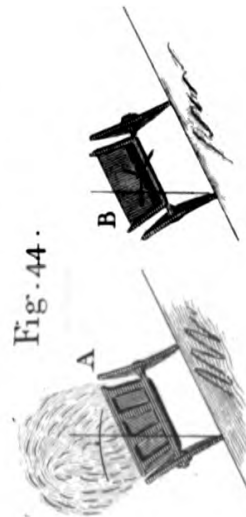


Fig. 46.



Fig. 47.

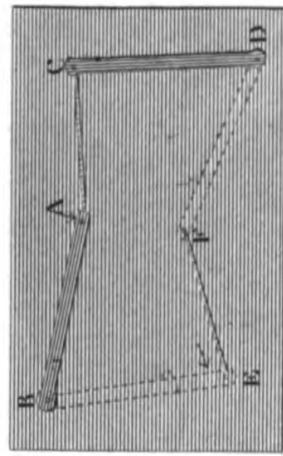
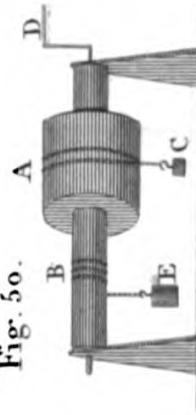


Fig. 48.



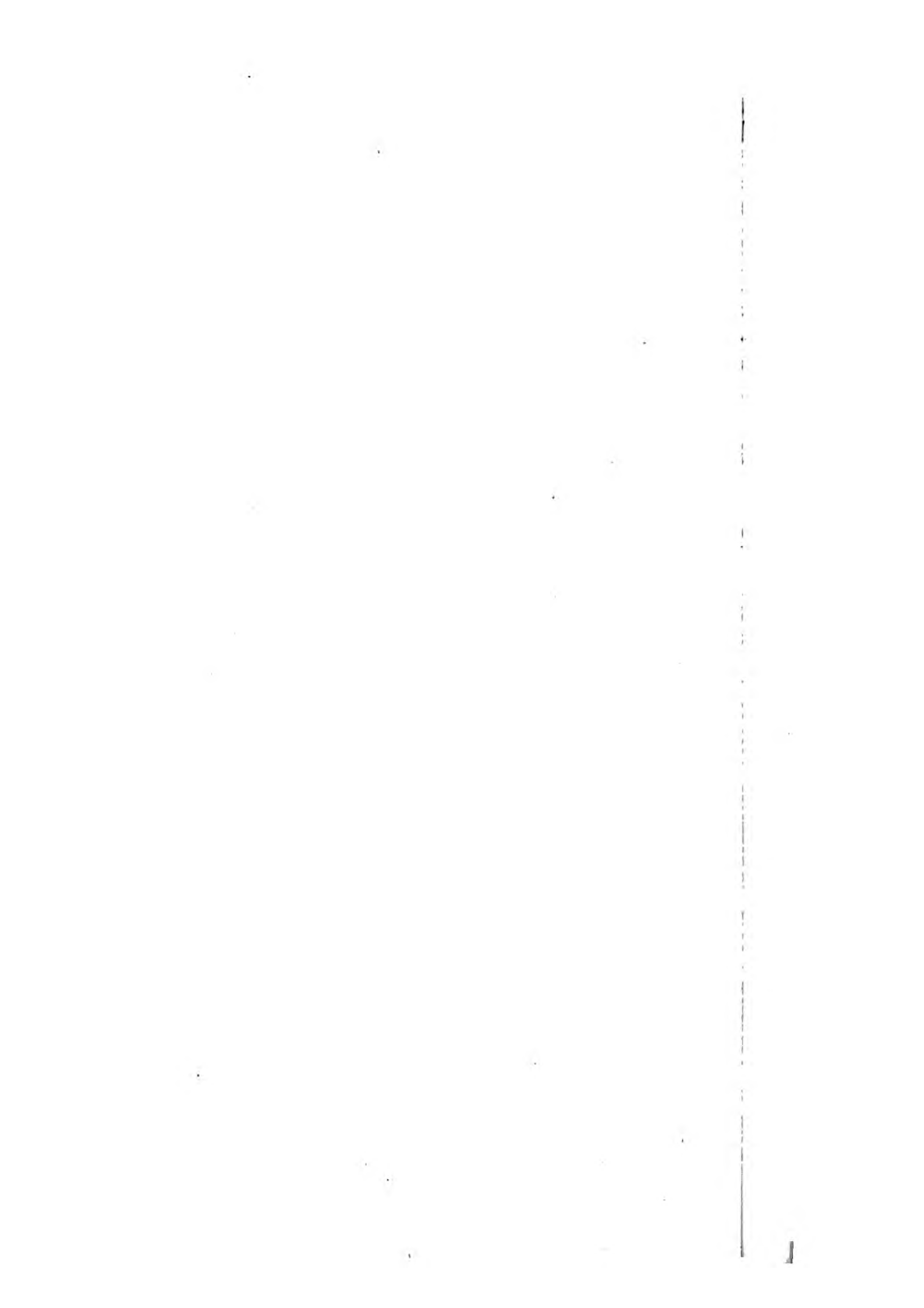


PLATE IV.

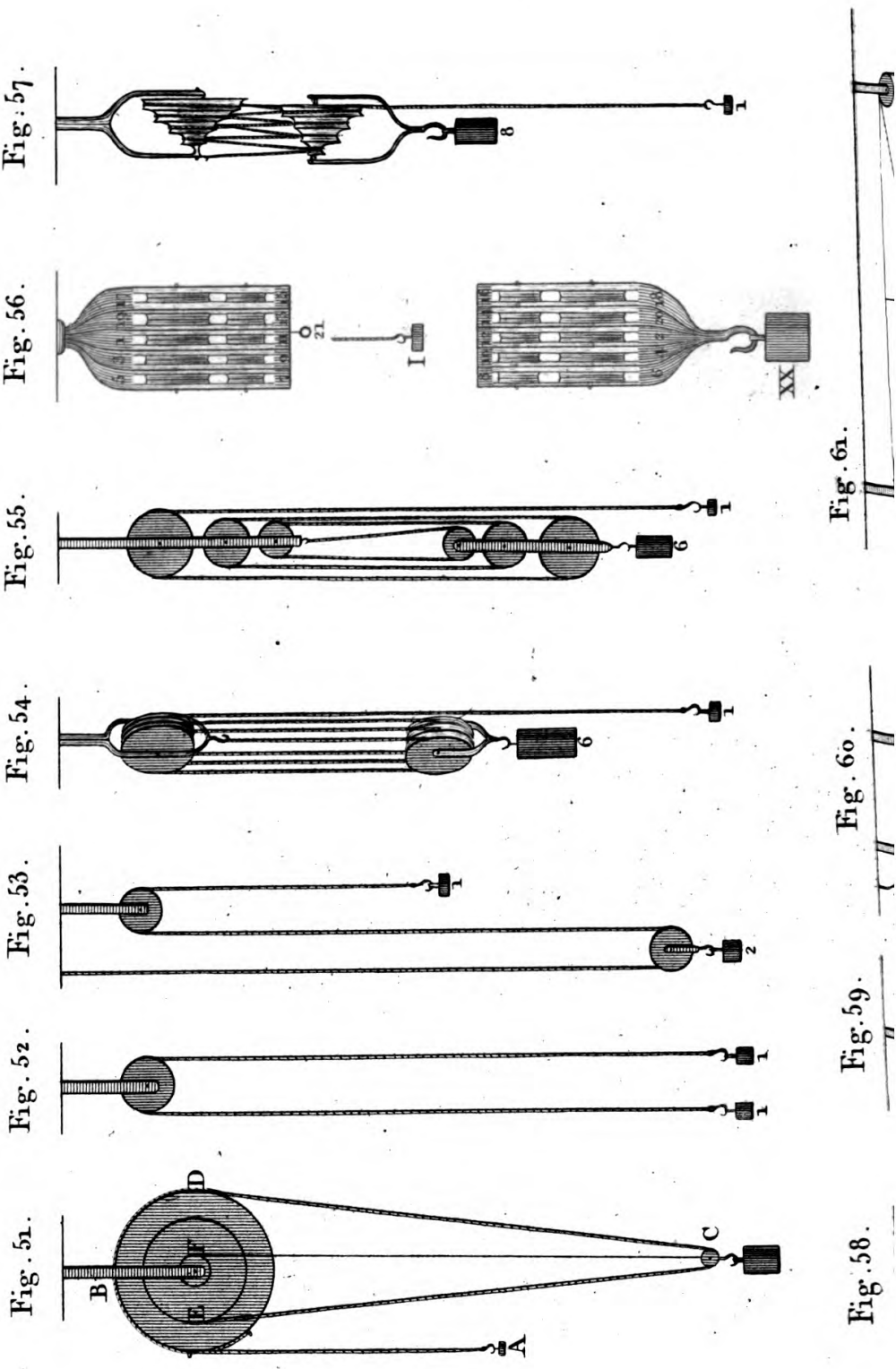


Fig. 51.

Fig. 52.

Fig. 53.

Fig. 54.

Fig. 55.

Fig. 56.

Fig. 57.

Fig. 58.

Fig. 59.

Fig. 60.

Fig. 61.

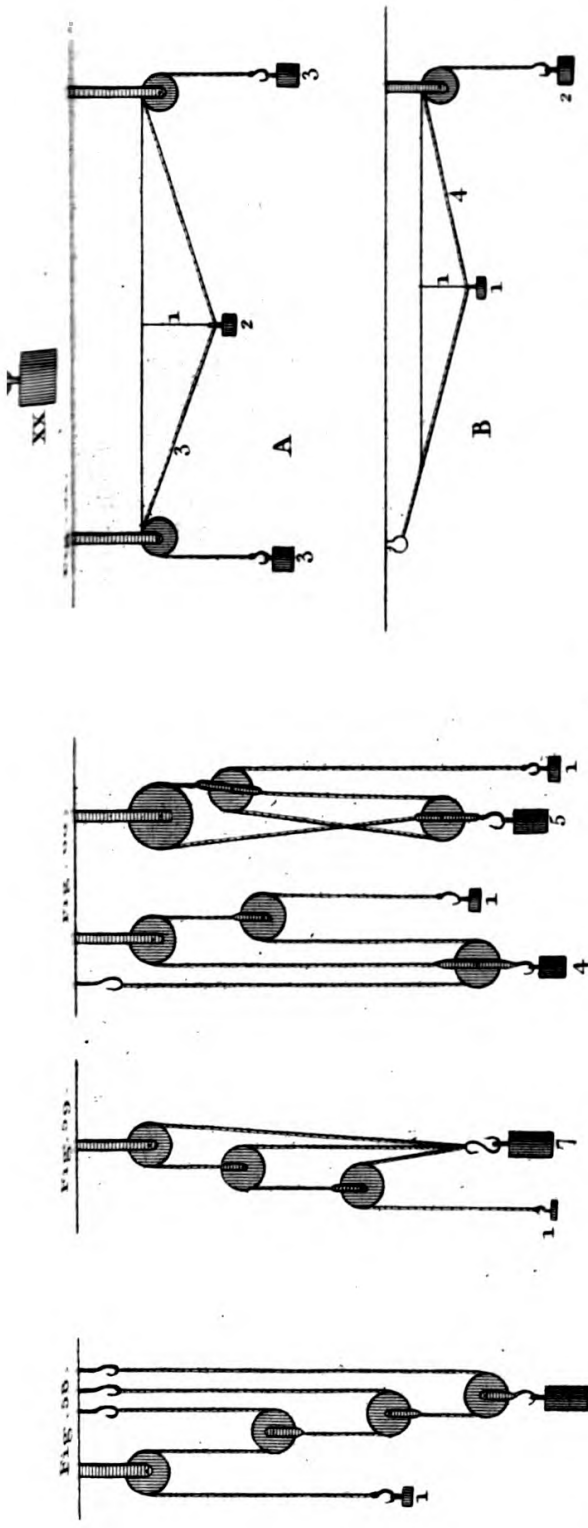
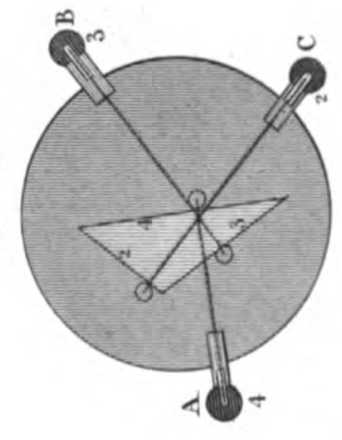
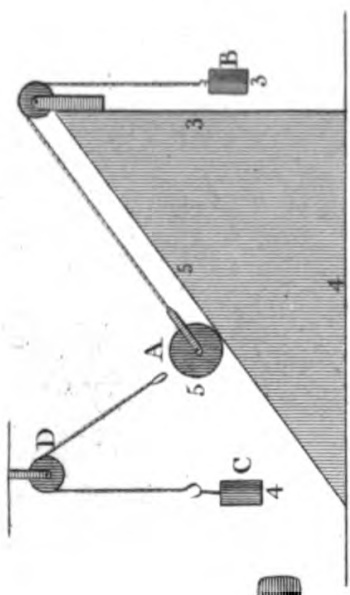
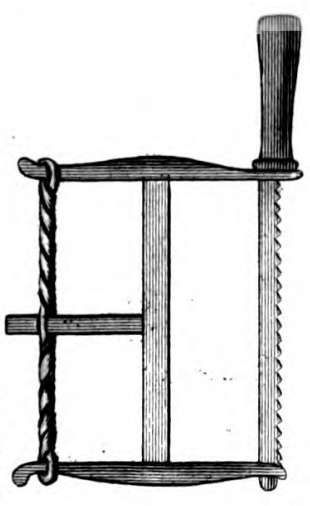
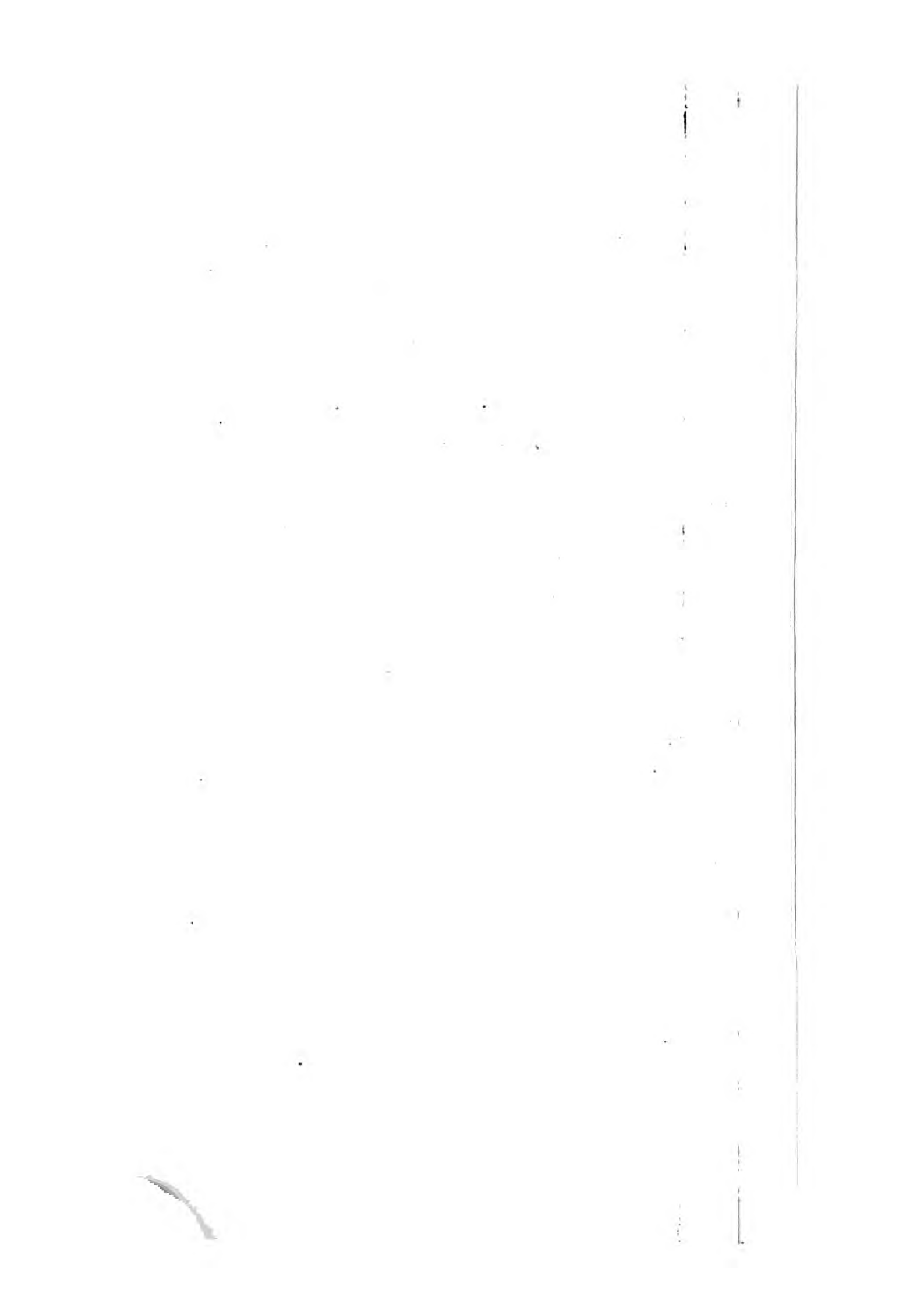


Fig. 64.

Fig. 63.

Fig. 62.





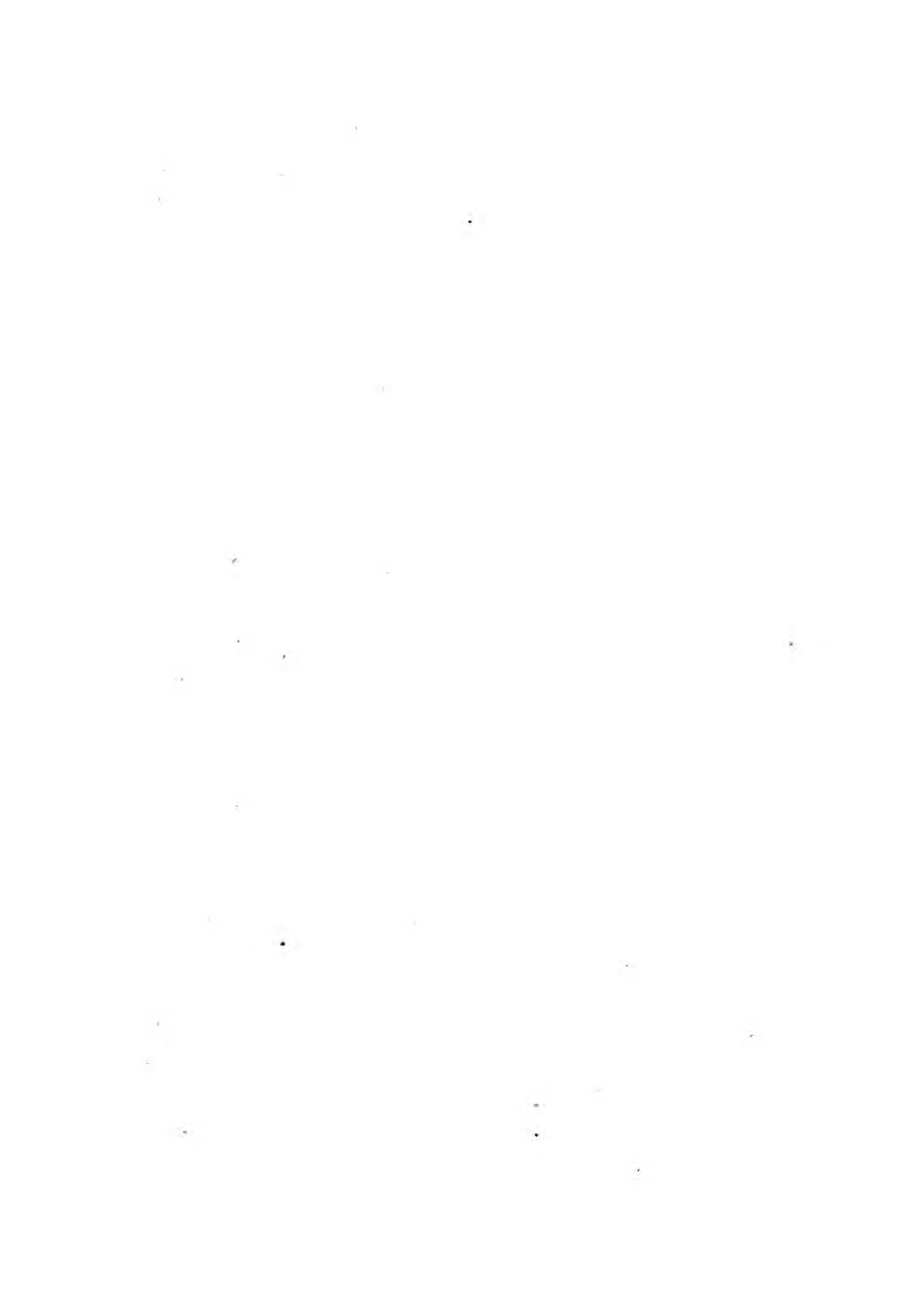


PLATE V.

Fig. 65.

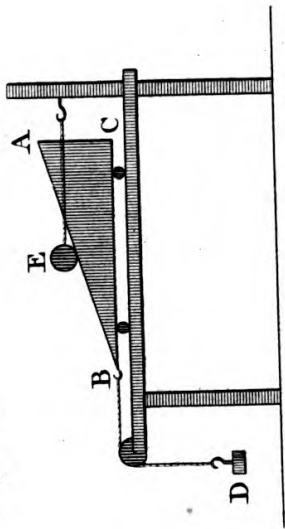


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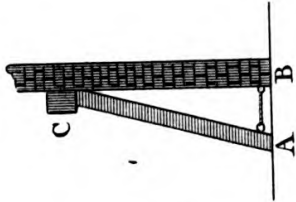


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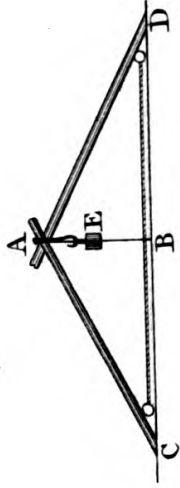


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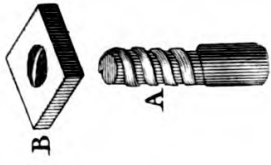


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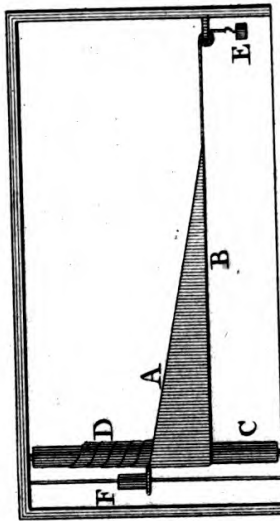


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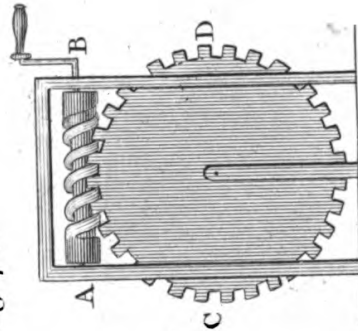


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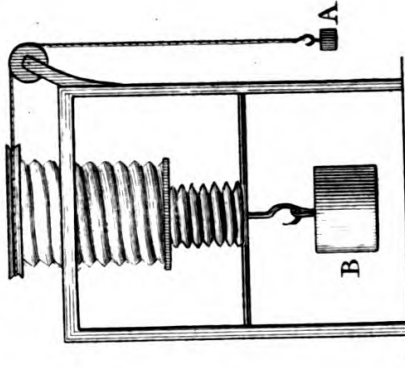


Fig. 75.



Fig. 72.

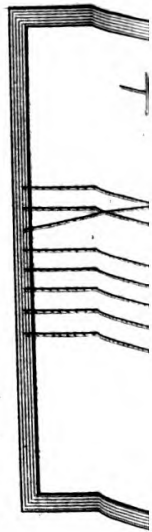


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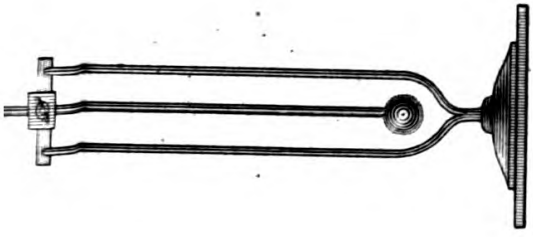


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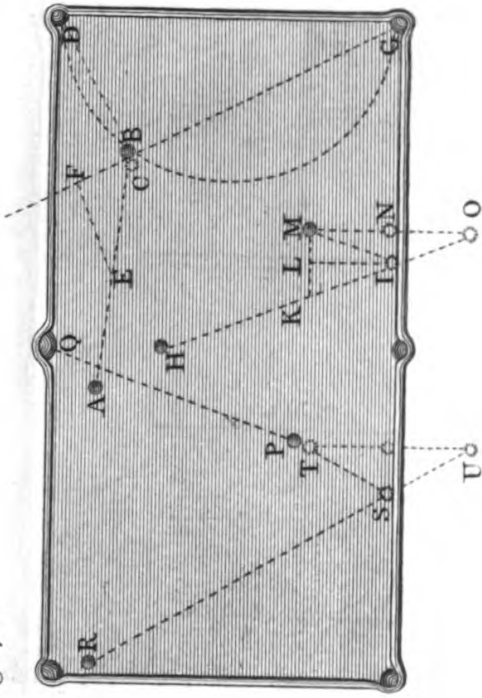


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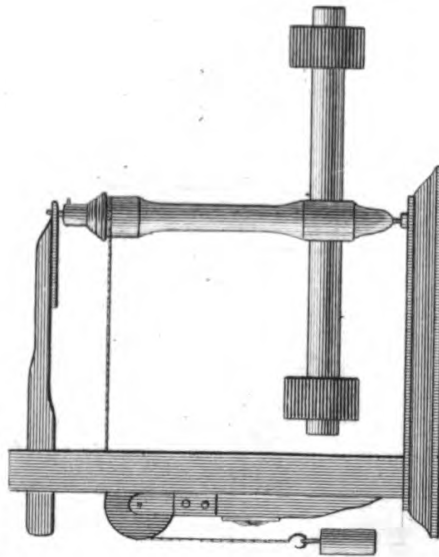
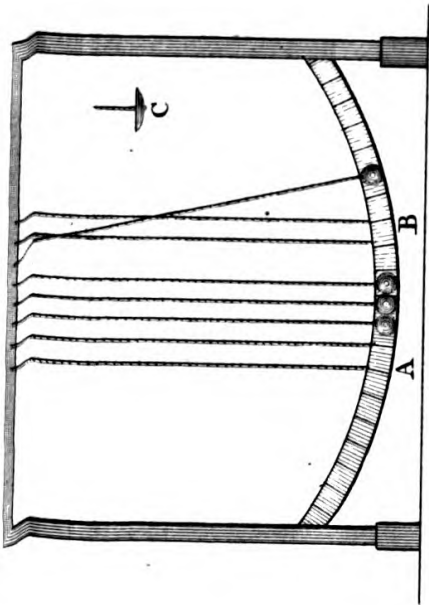
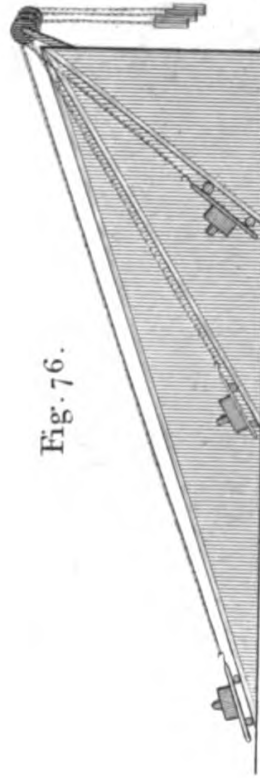


Fig. 76.



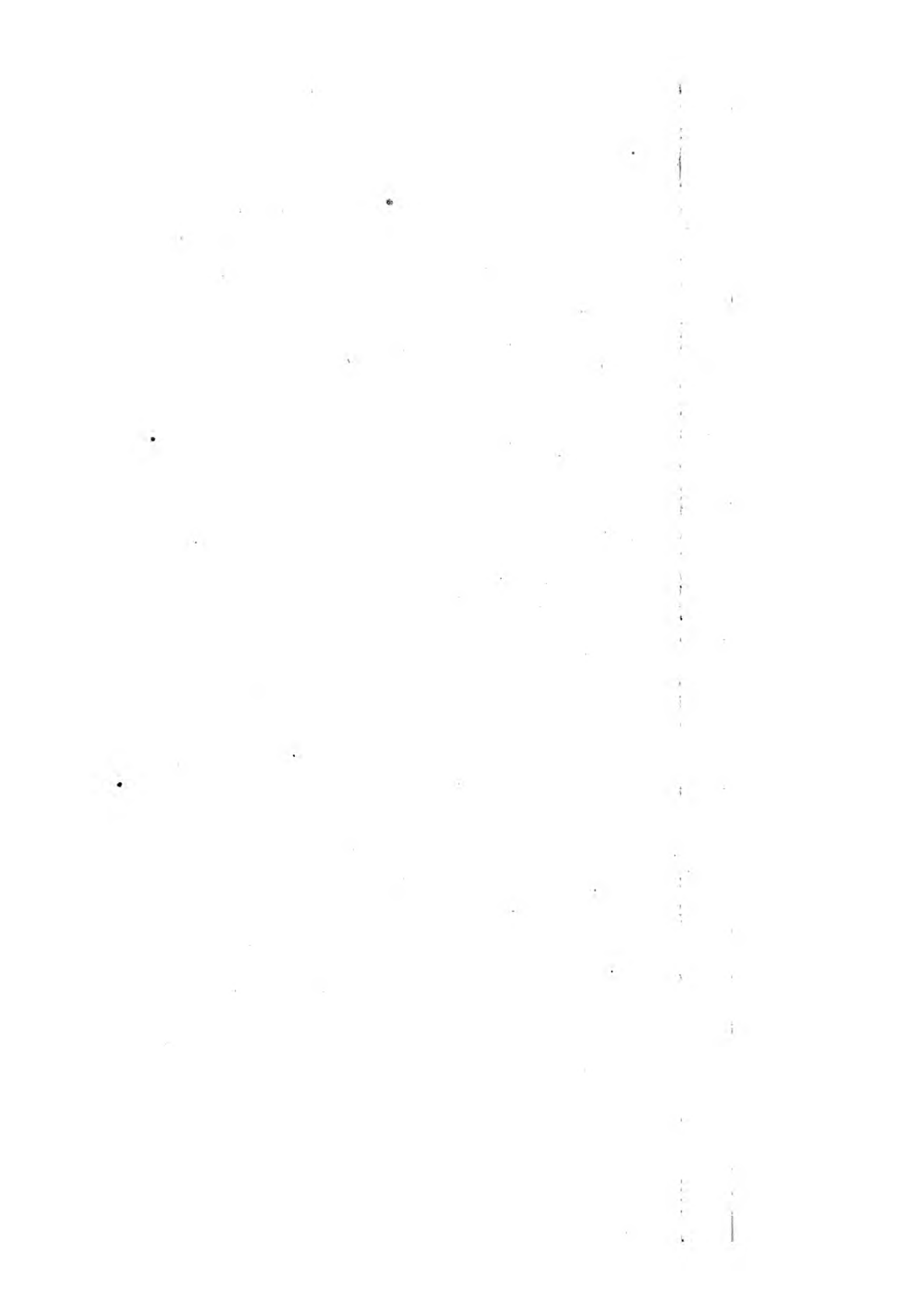




PLATE VI.

Fig. 77.

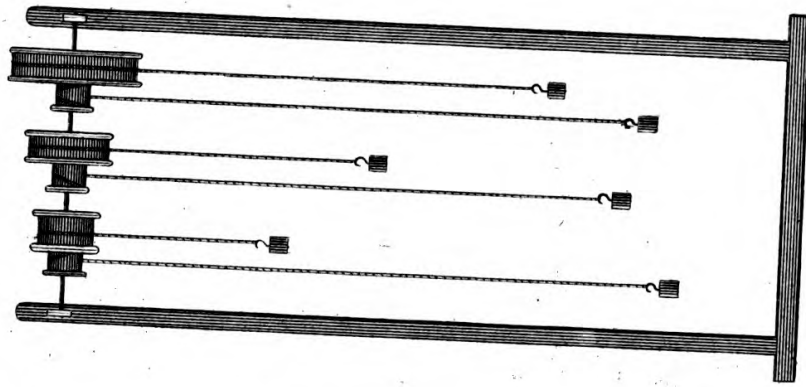


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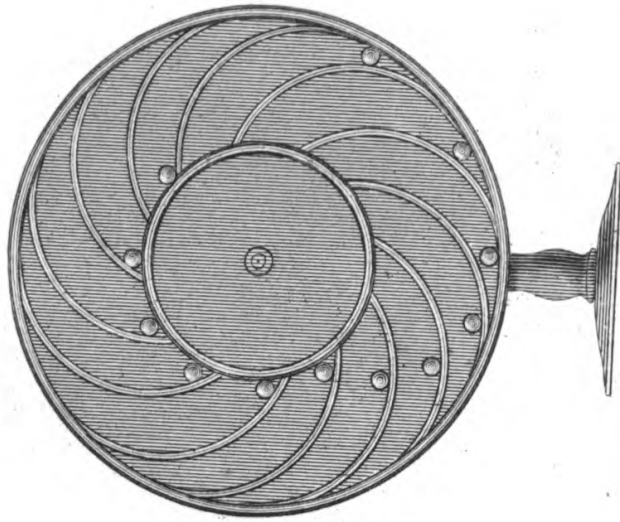


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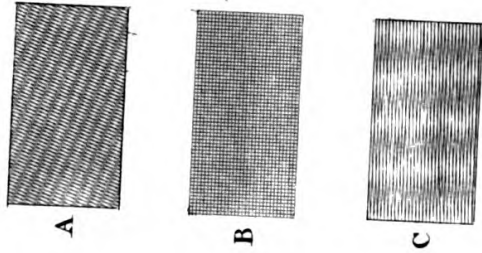


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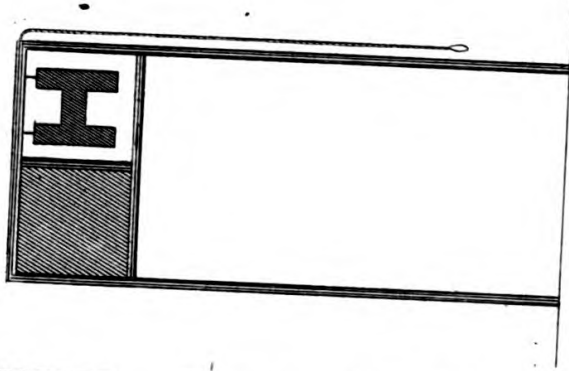


Fig. 81.



Fig. 82.



Fig. 83.



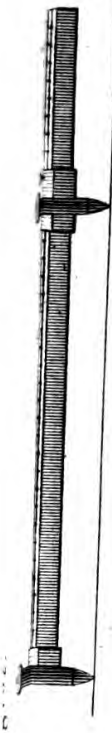


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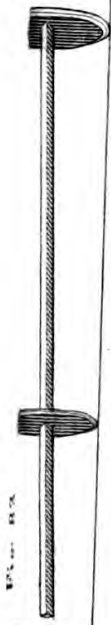


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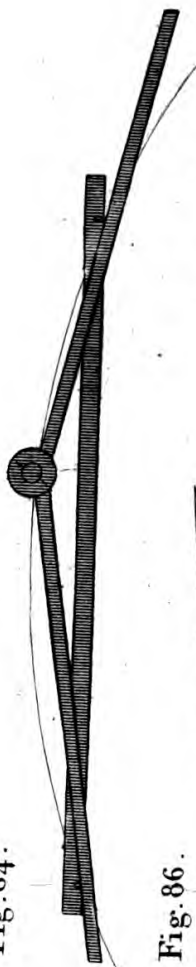


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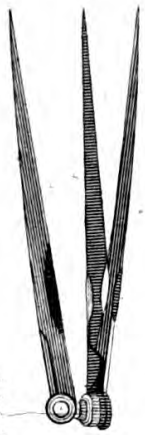


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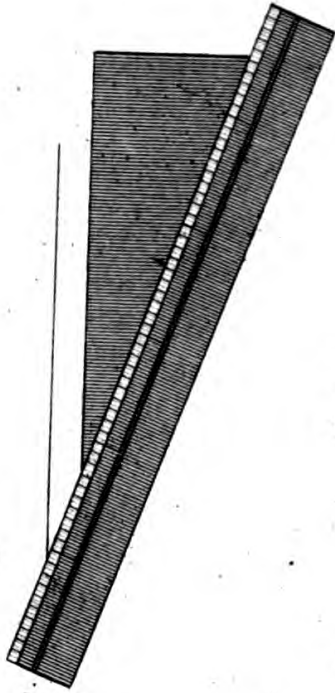


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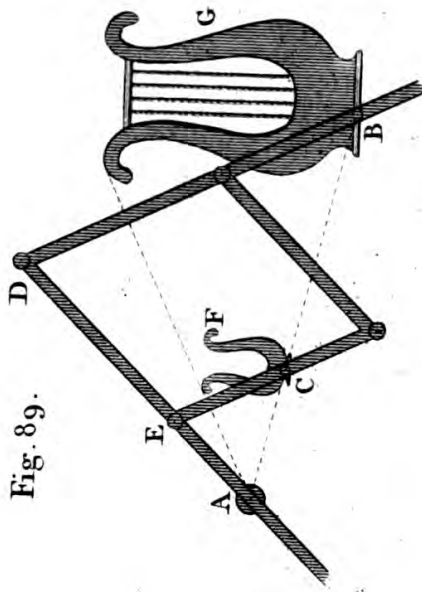


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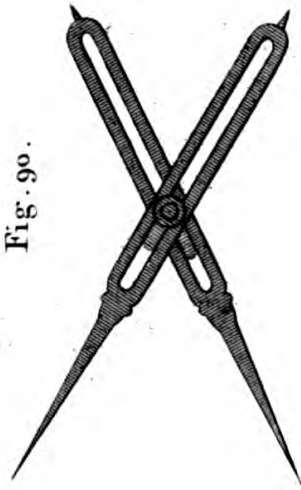


Fig. 90.

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PLATE VII.

Fig. 91.

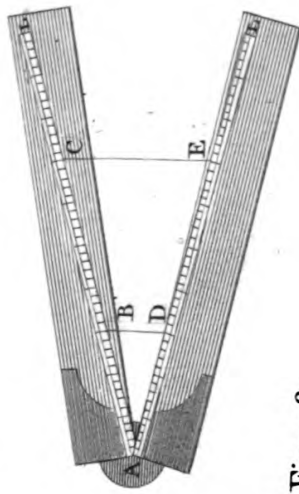


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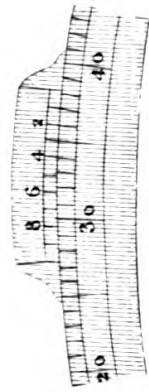


Fig. 93.



Fig. 94.

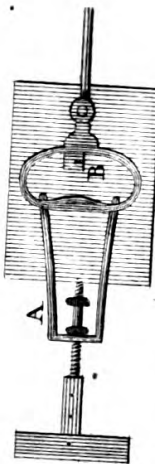
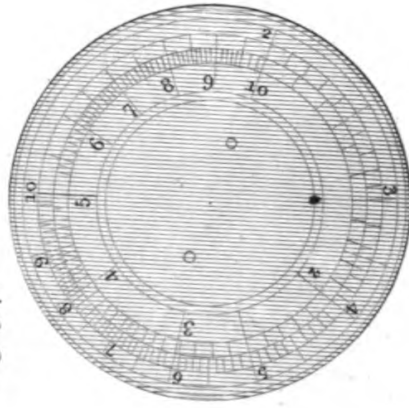


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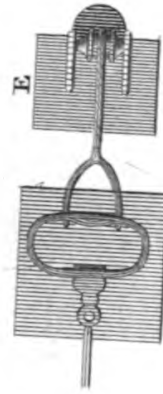
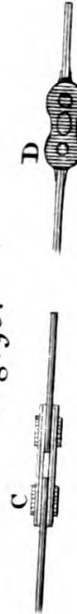
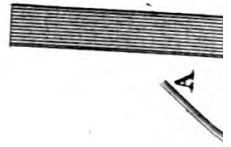
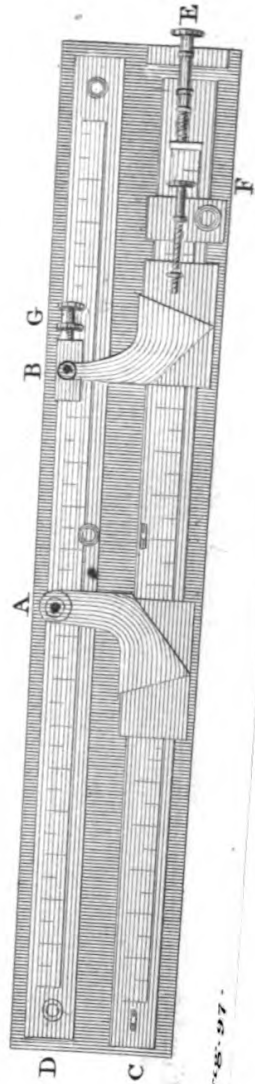


Fig. 96.



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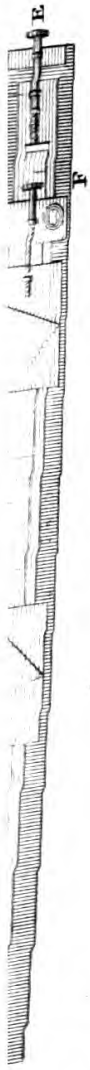


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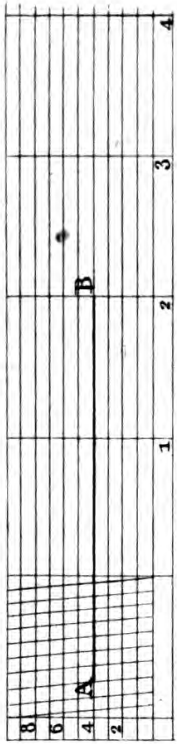


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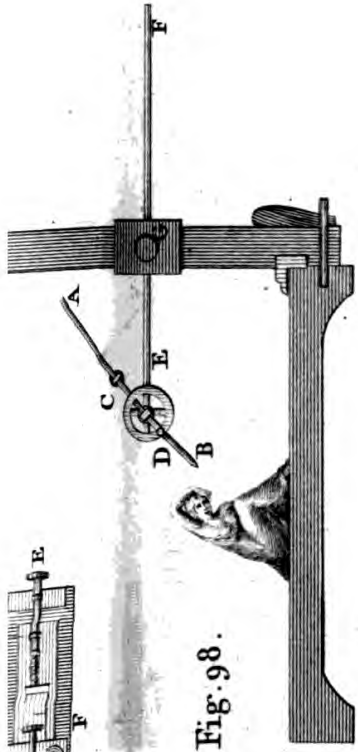


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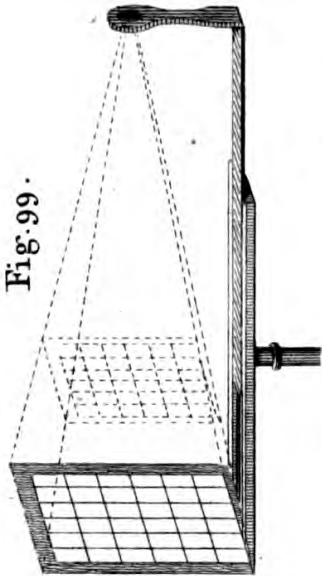


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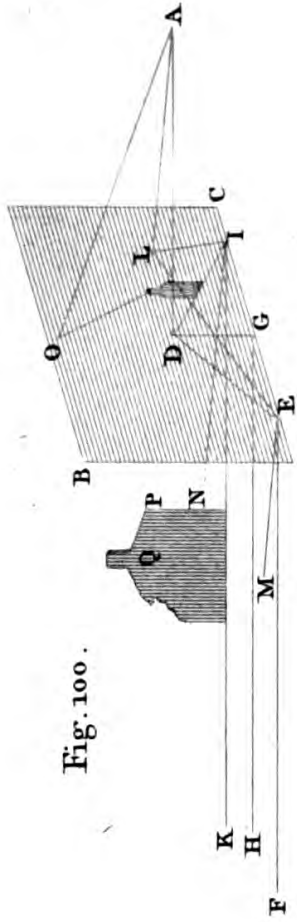


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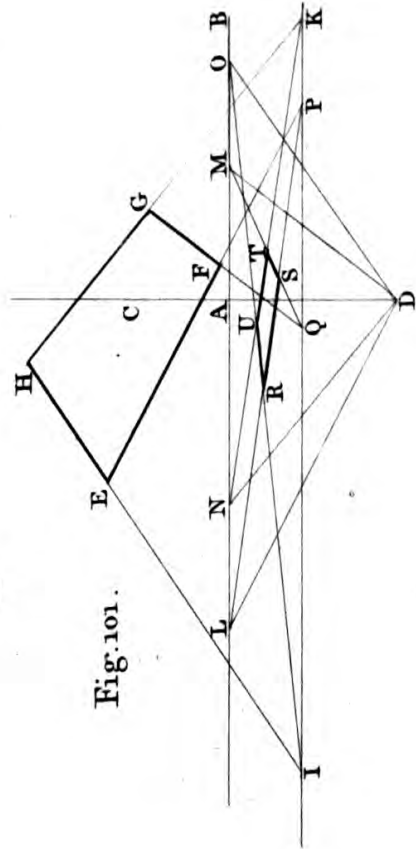


Fig. 102.

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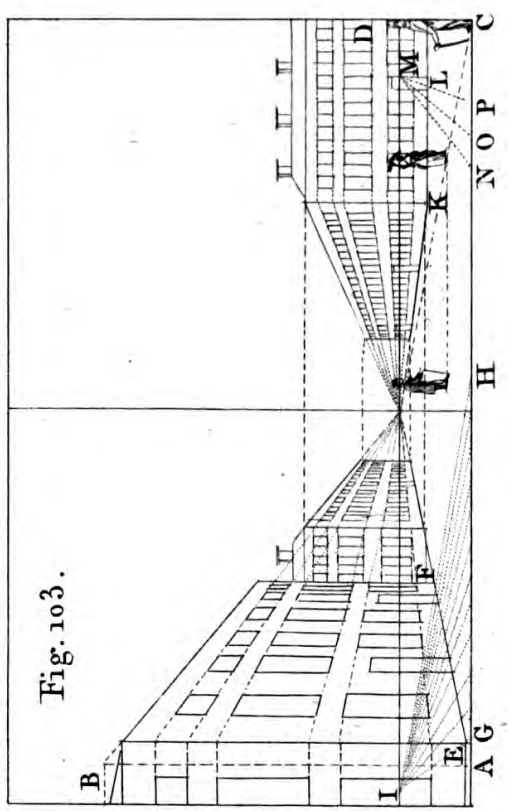


Fig. 103.

Fig. 104.

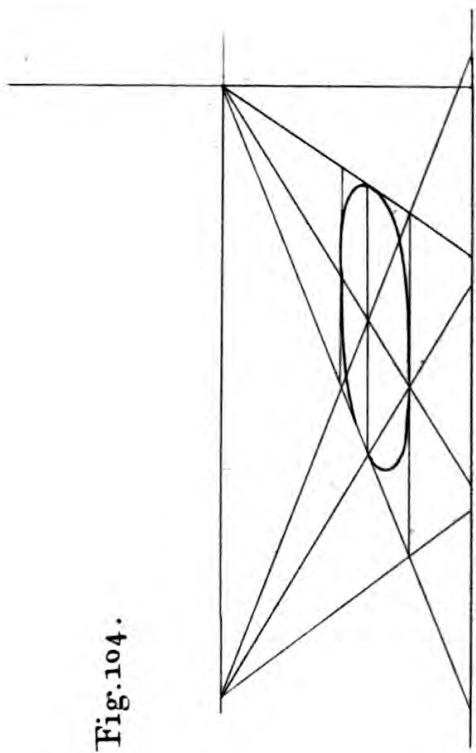


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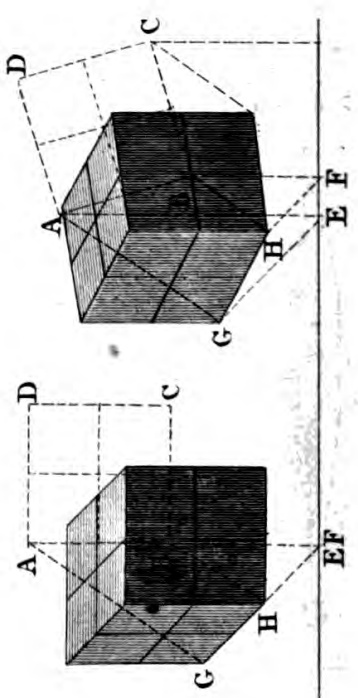
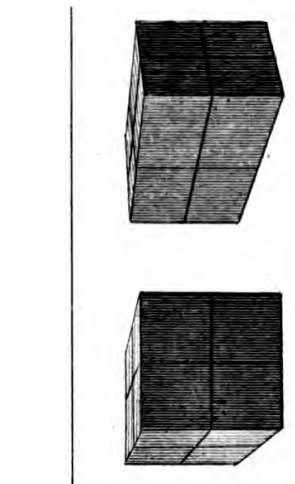


Fig. 107.



Fig. 106.



Fig. 106.

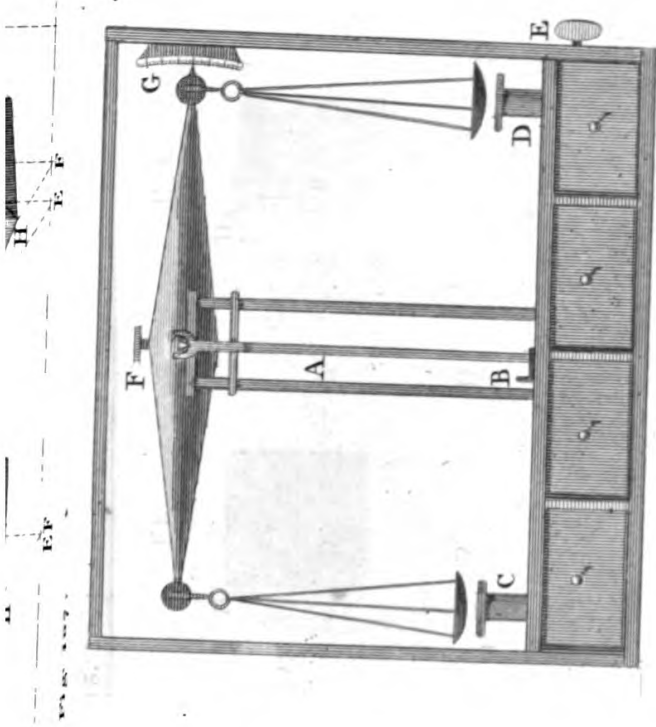
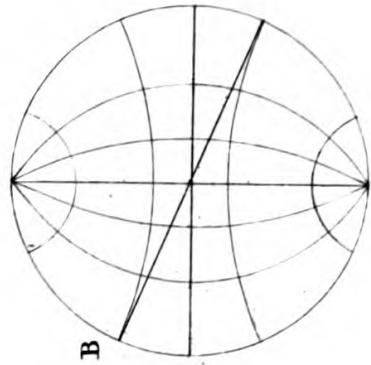
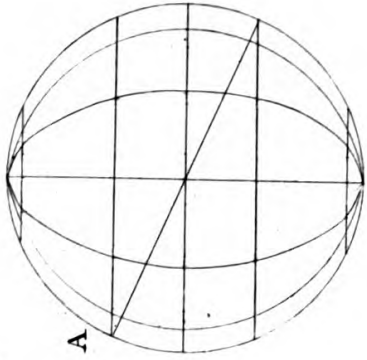


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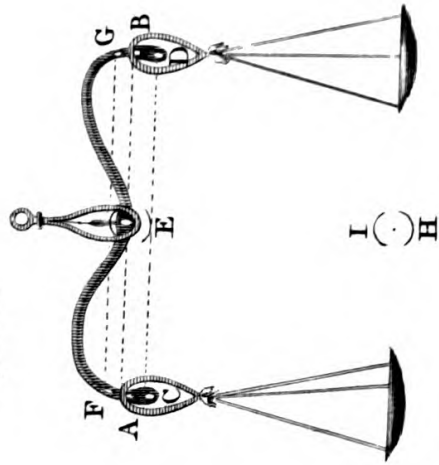


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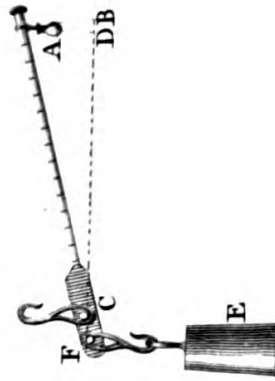
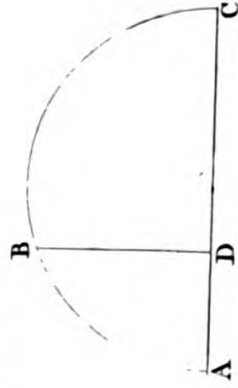


Fig. 110.



Joseph Skelton sculp.

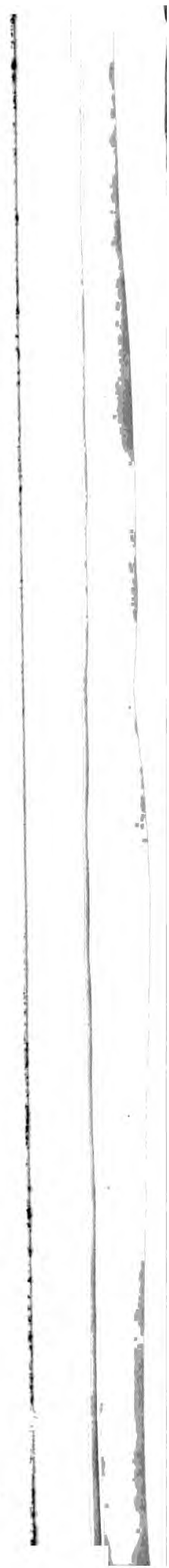


Fig. m.

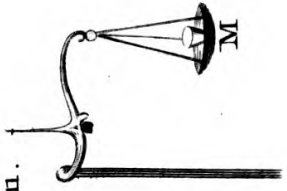


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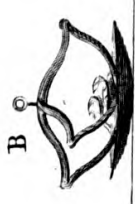
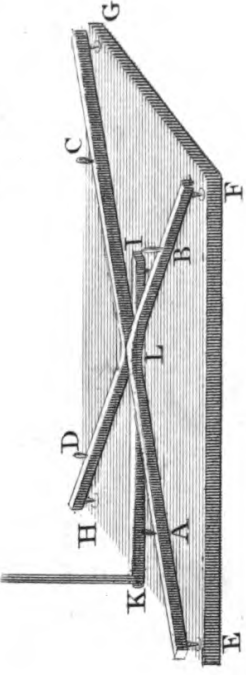
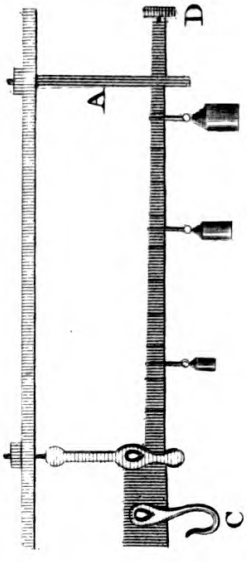


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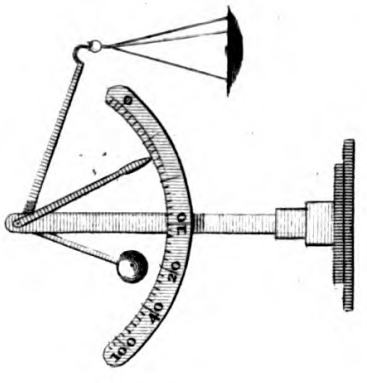


Fig. n4.



Fig. n5.

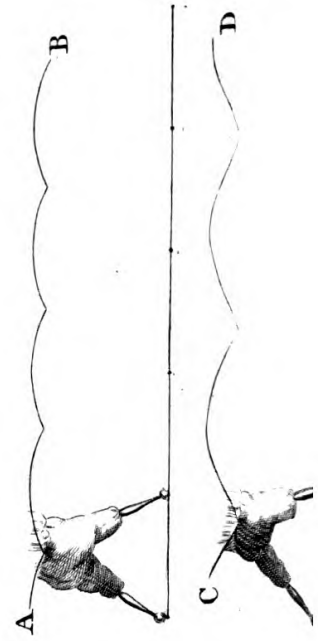


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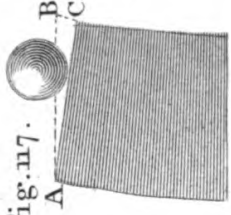


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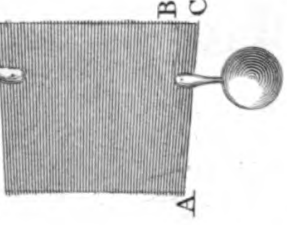


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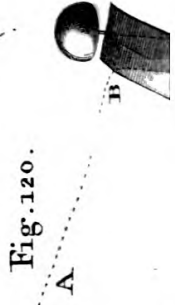


Fig. n9.



Fig. 121.



Fig. 116.

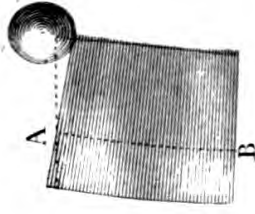


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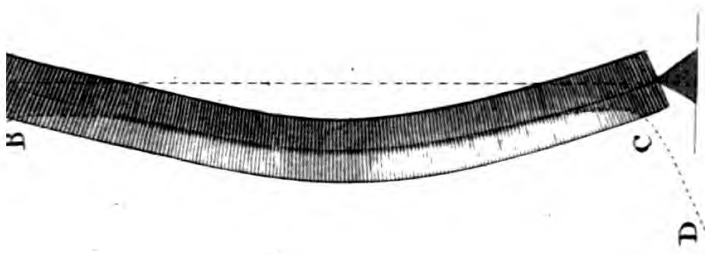


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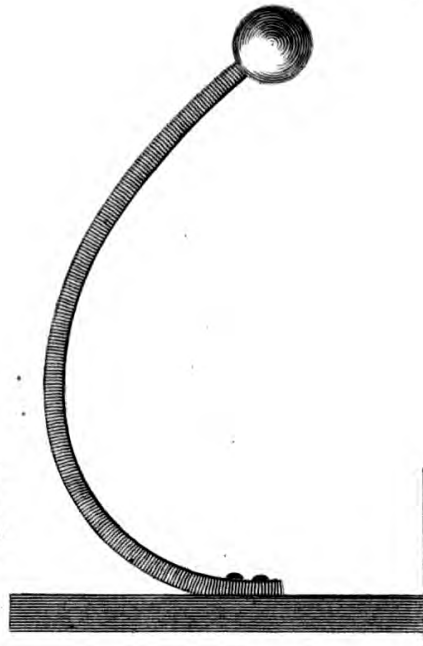


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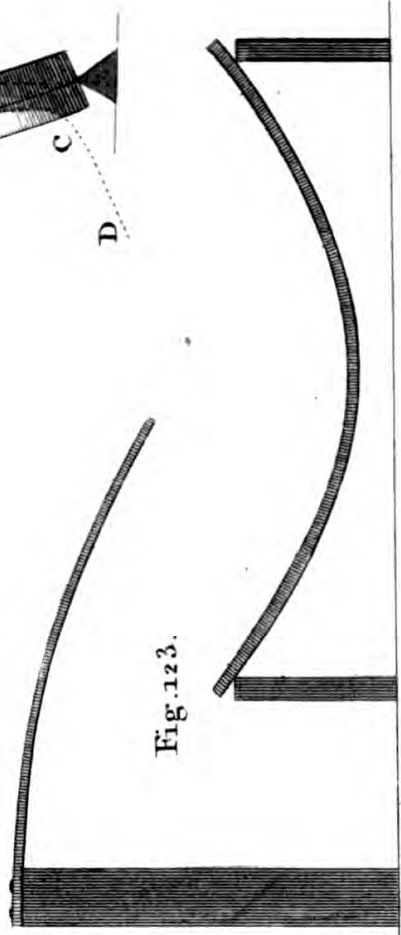


Fig. 123.

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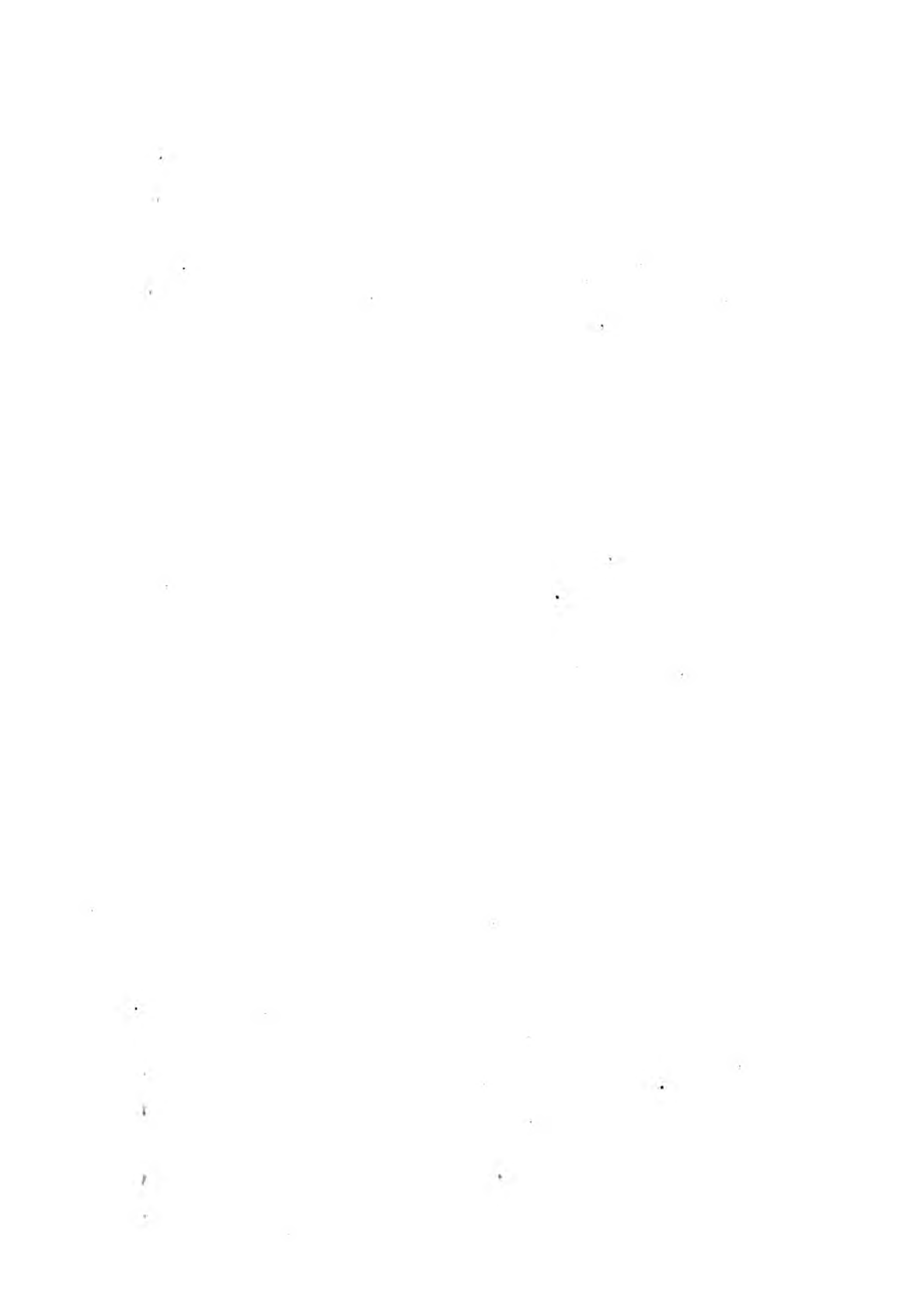


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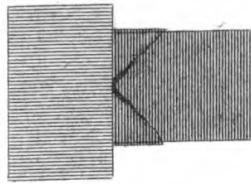


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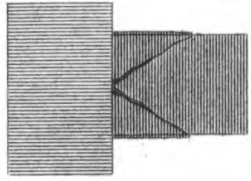


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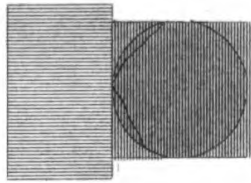


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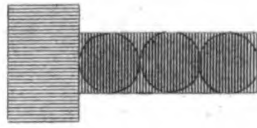


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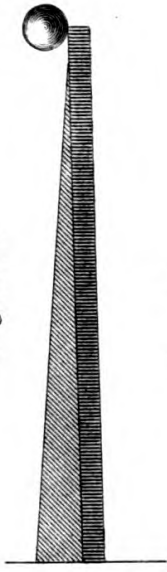


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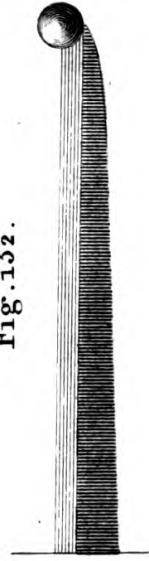


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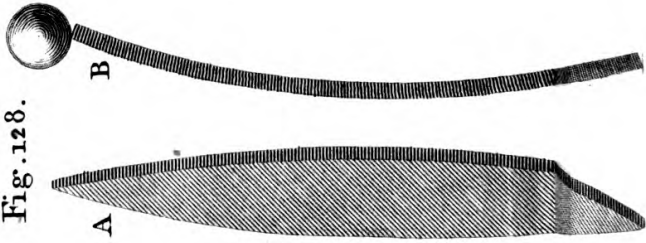


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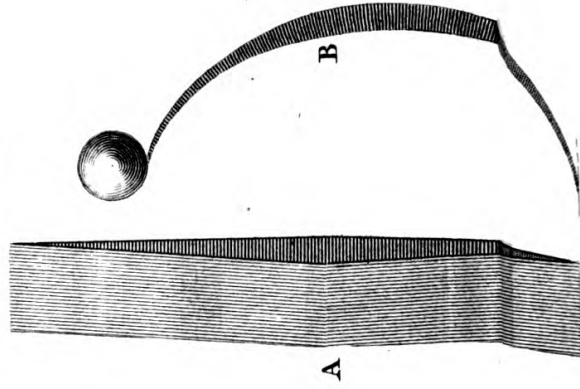


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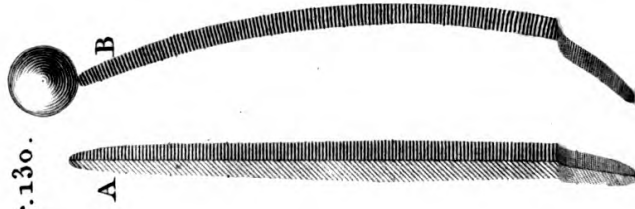


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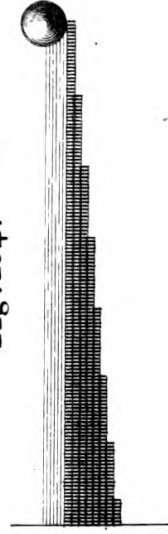


Fig. 133.



Fig. 135.



Fig. 136.



Fig. 137.

Fig. 136.



Fig. 136.



Fig. 137.

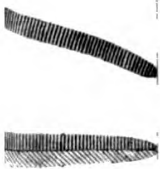


Fig. 138.



Fig. 139.

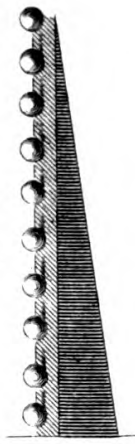


Fig. 140.

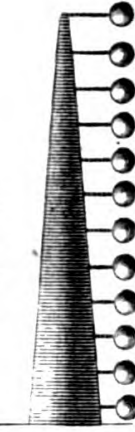


Fig. 141.

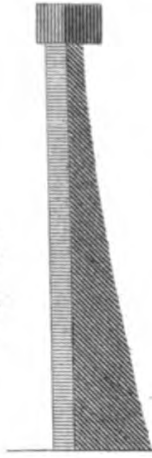


Fig. 142.



Fig. 143.

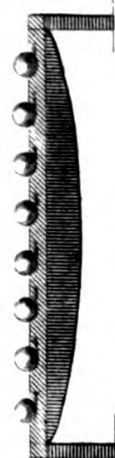


Fig. 144.



Fig. 145.



Fig. 146.

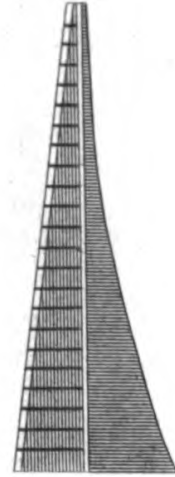
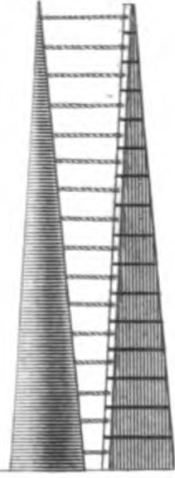
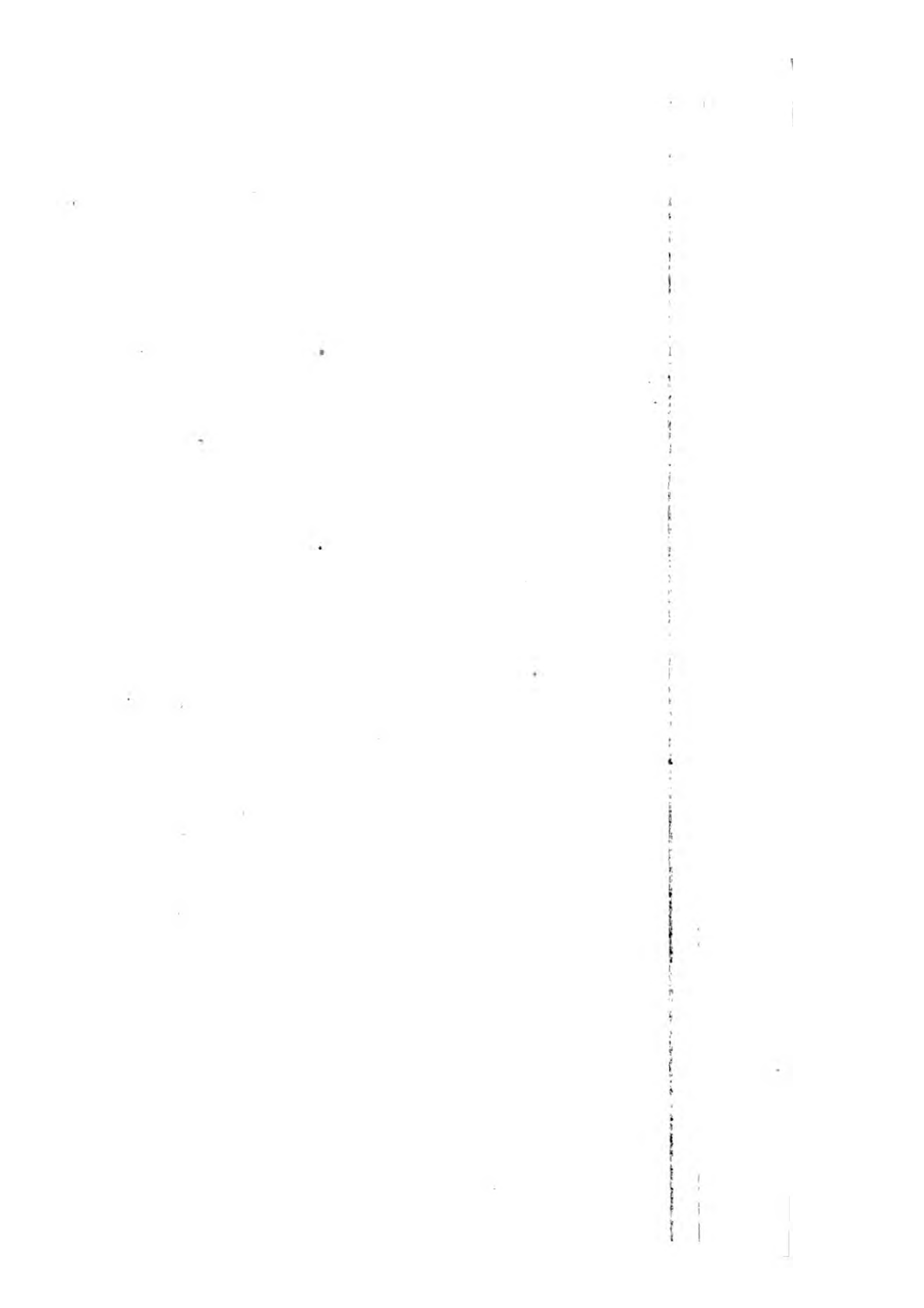


Fig. 147.





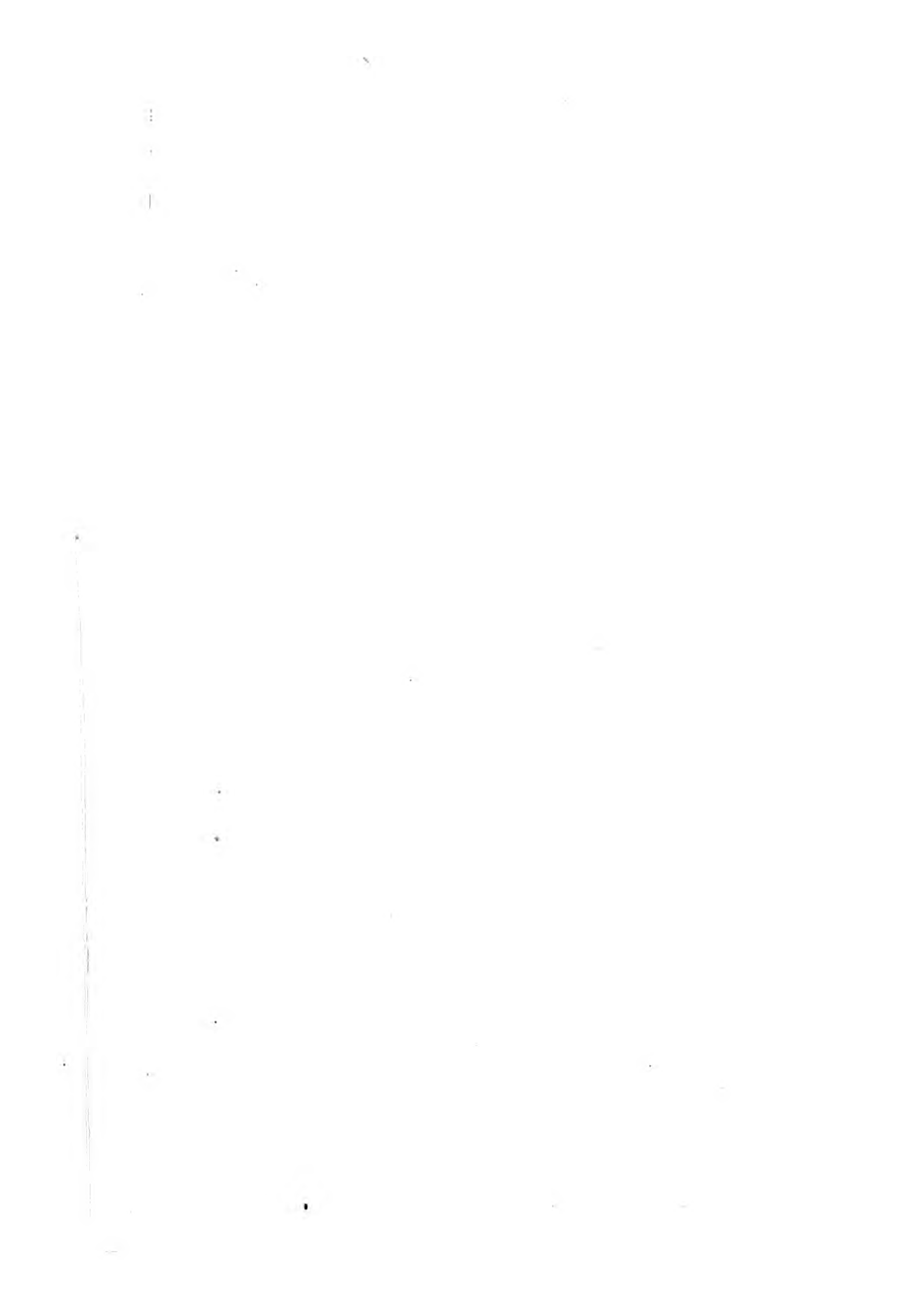


PLATE XI.

Fig. 148.

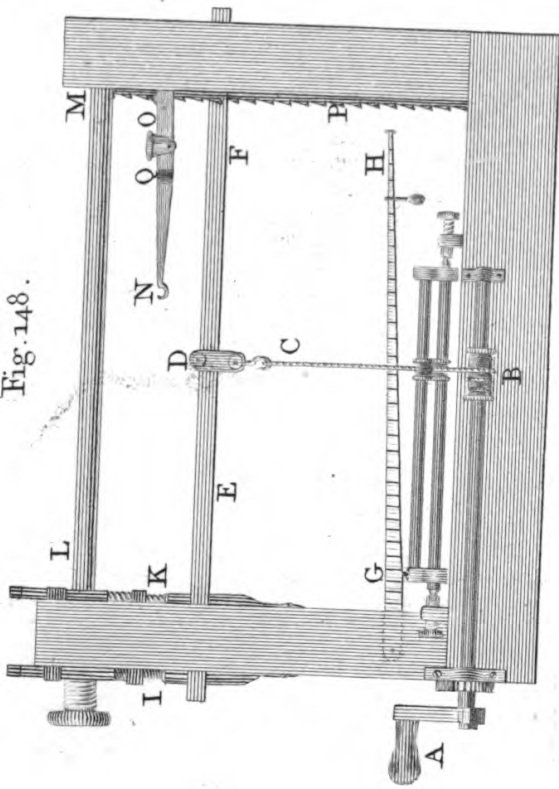


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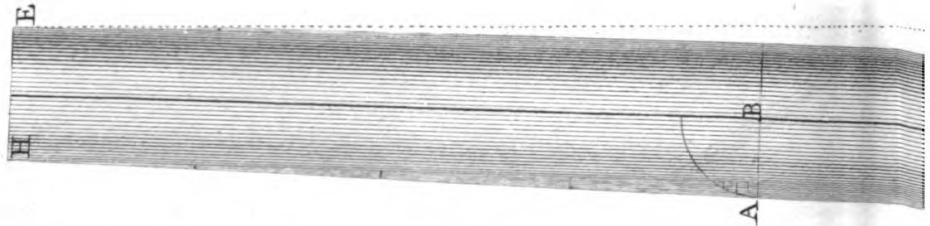


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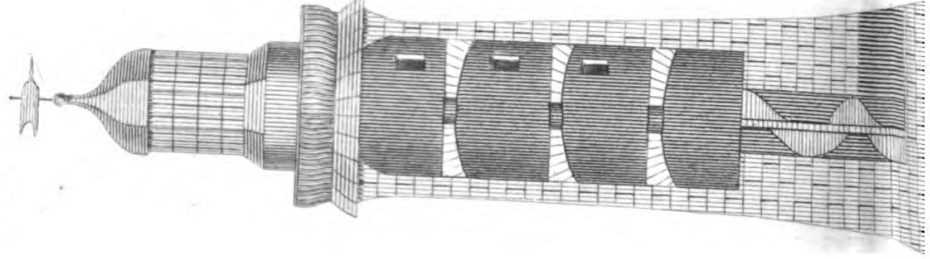


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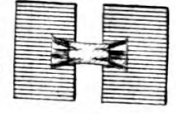


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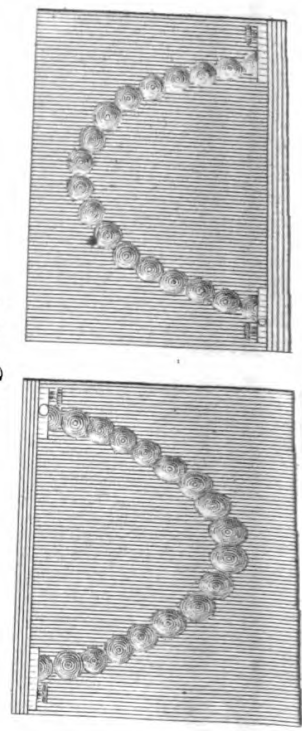




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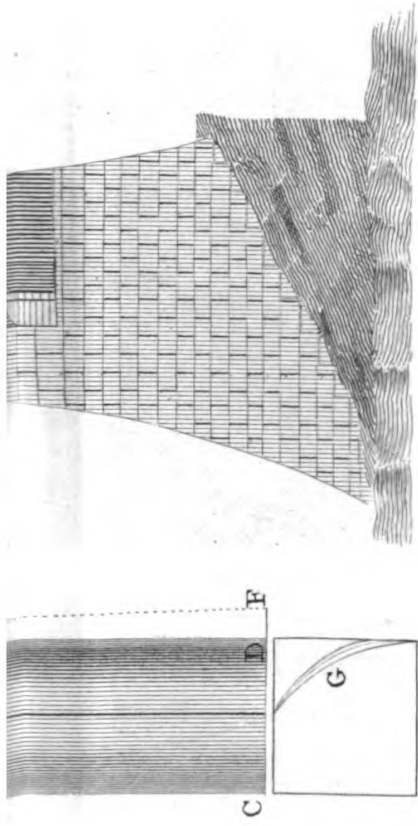
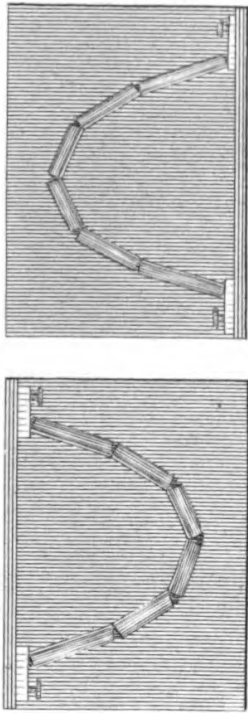
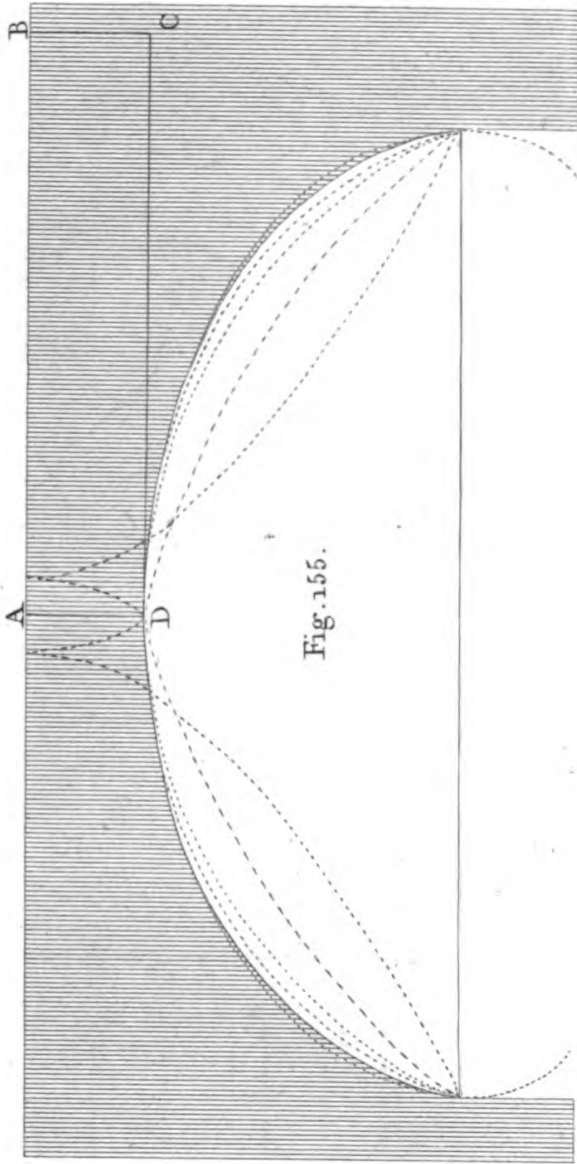
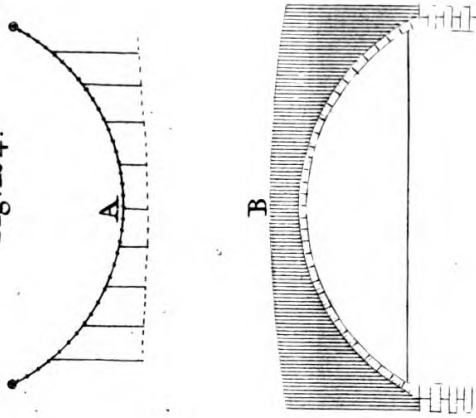


Fig. 154.



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Fig. 156.

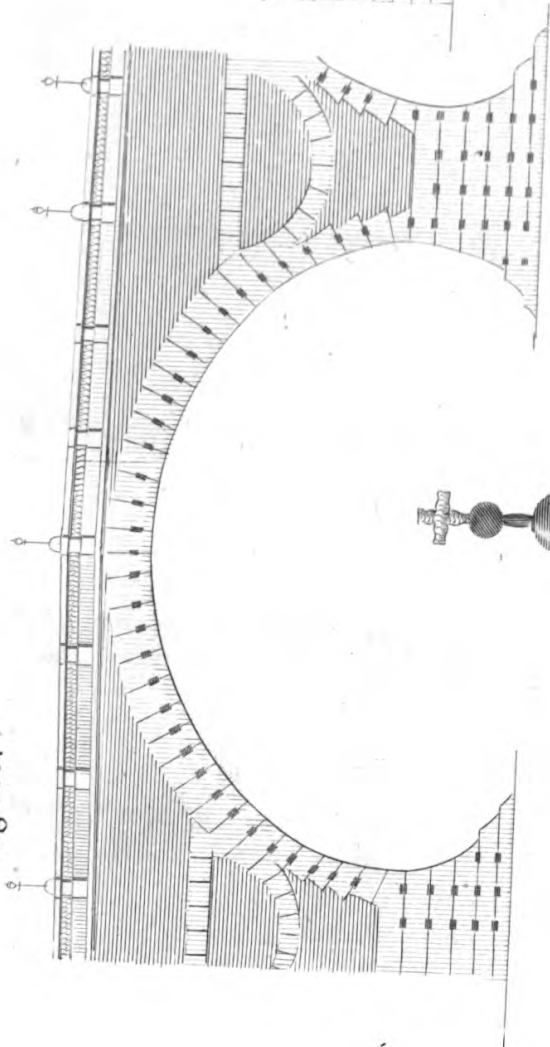


Fig. 157.

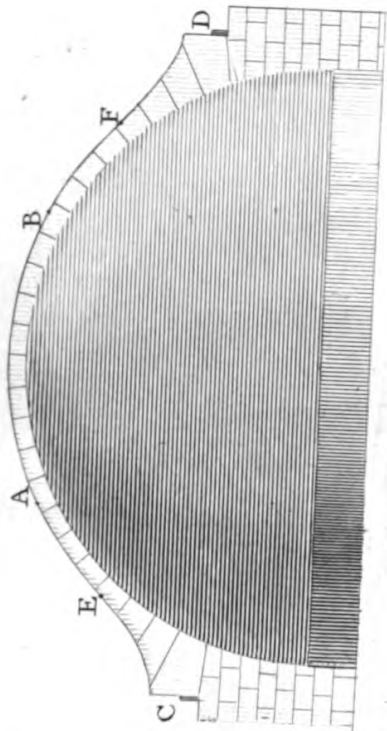


Fig. 159.

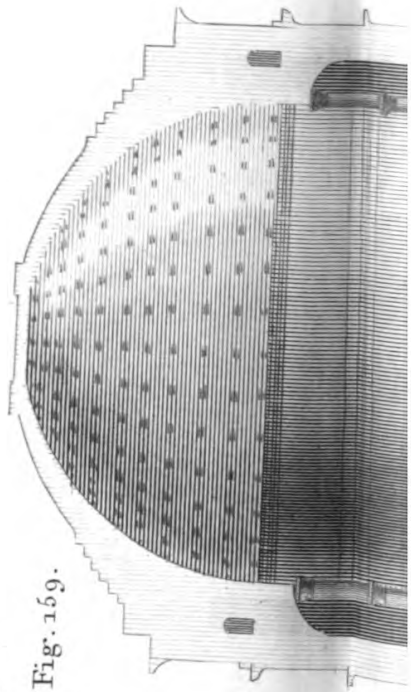
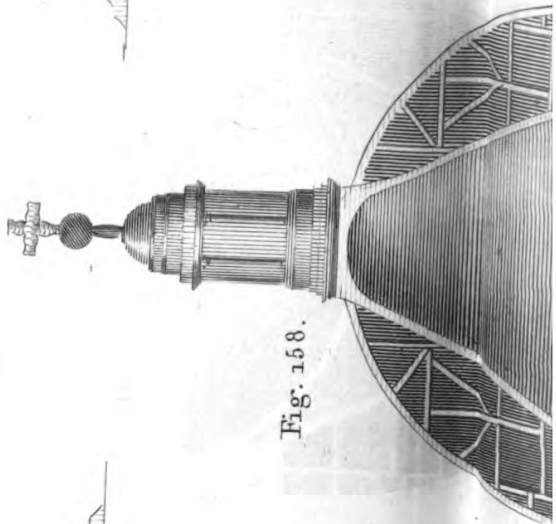


Fig. 158.



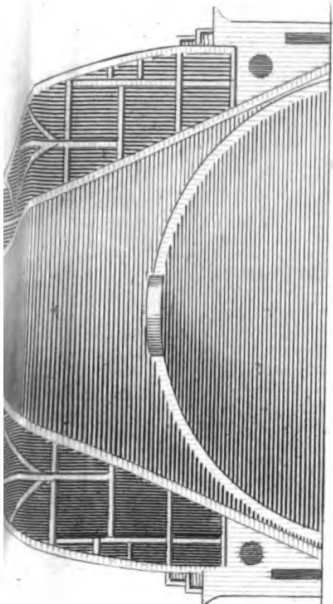
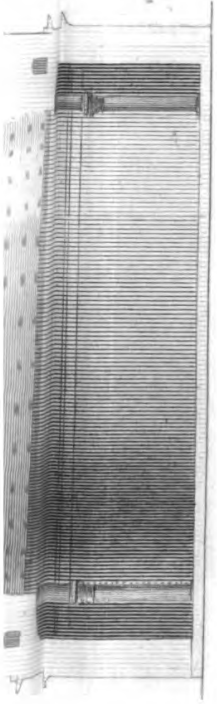


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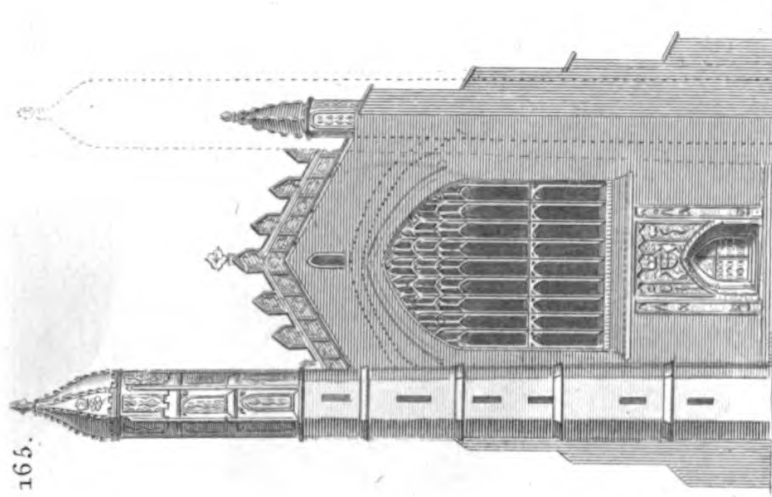


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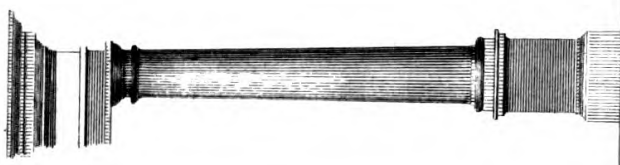


Fig. 161.



Fig. 162.



Fig. 163.



Fig. 164.



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Fig. 100

Fig. 172.

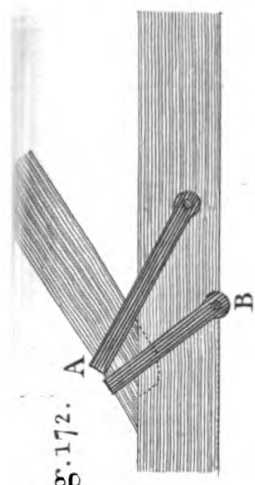


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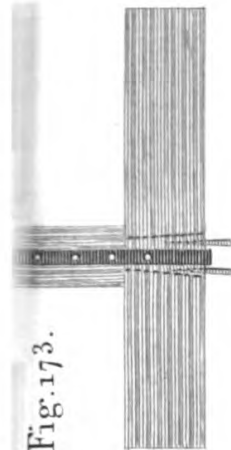


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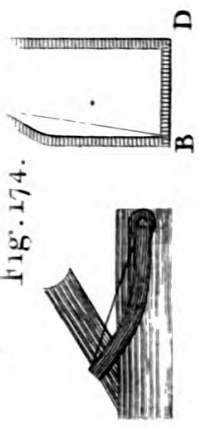


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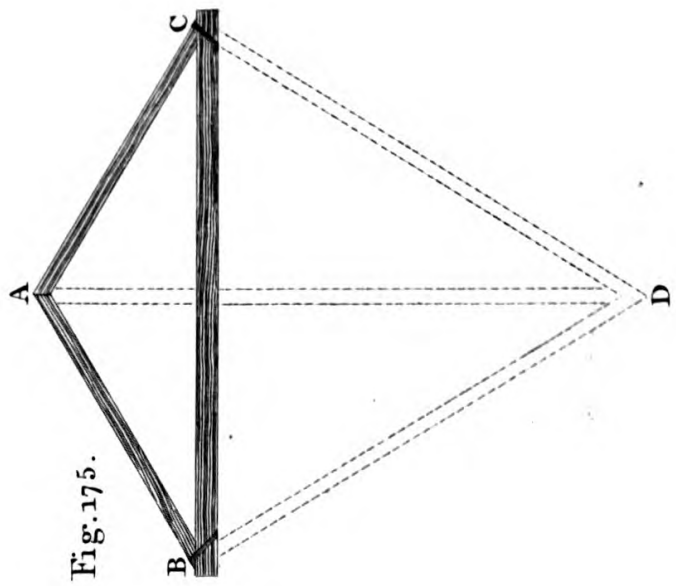


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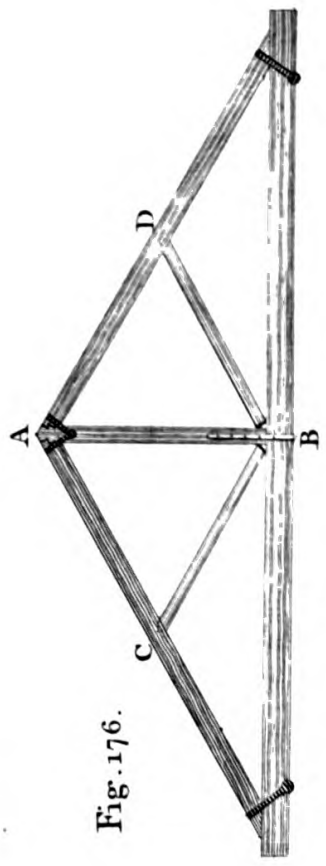
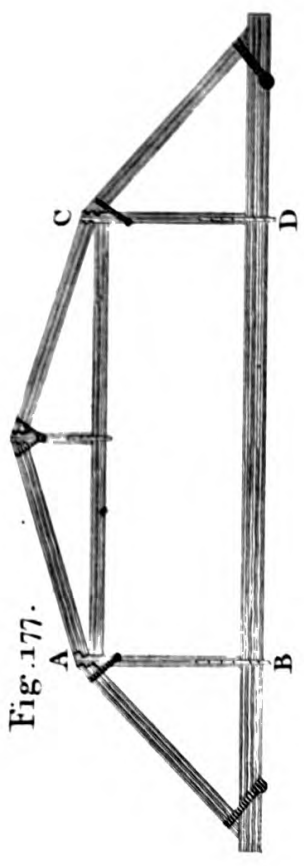


Fig. 177.



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Fig. 178.

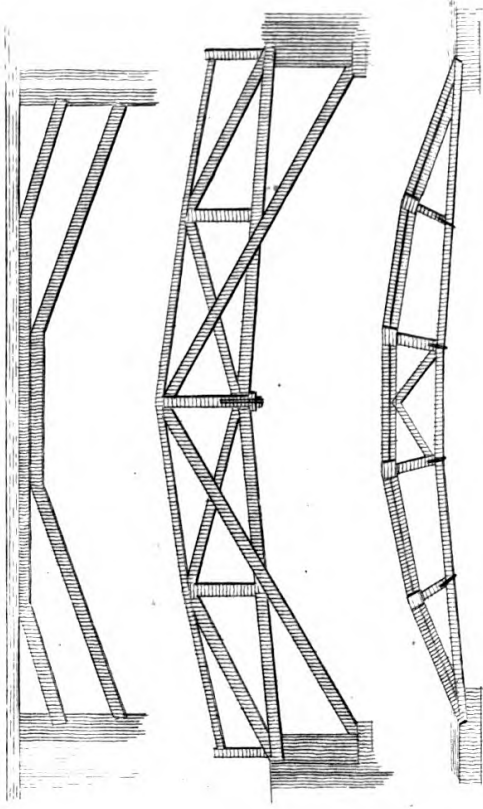


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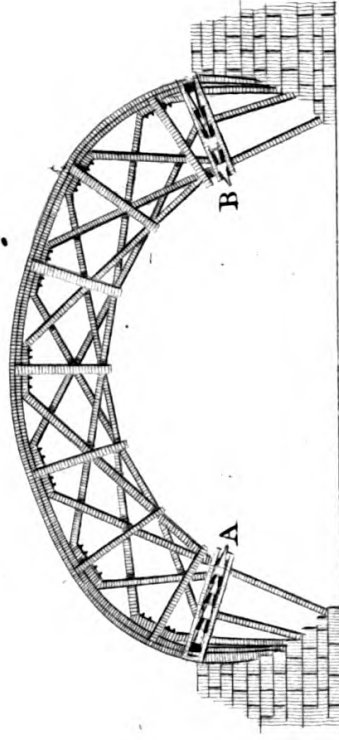


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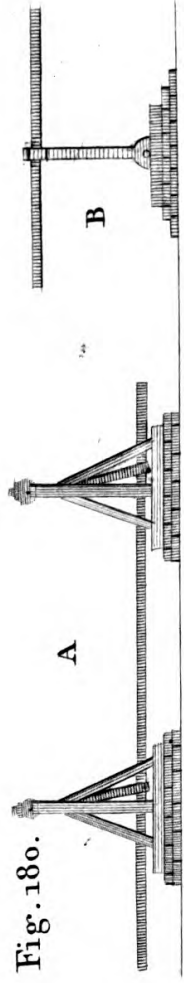


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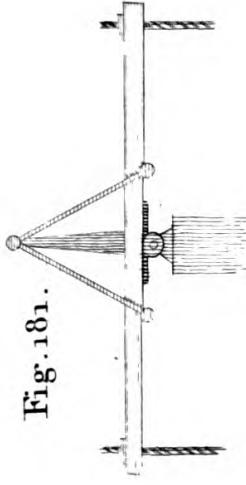


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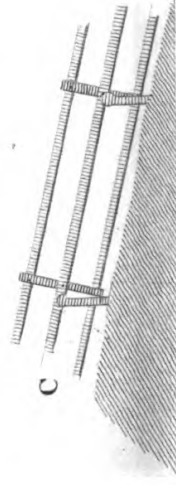


Fig. 182.



Fig. 185.



Fig. 184.



Fig. 183.



Fig. 184.



Fig. 185.

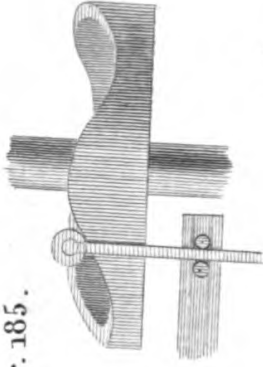


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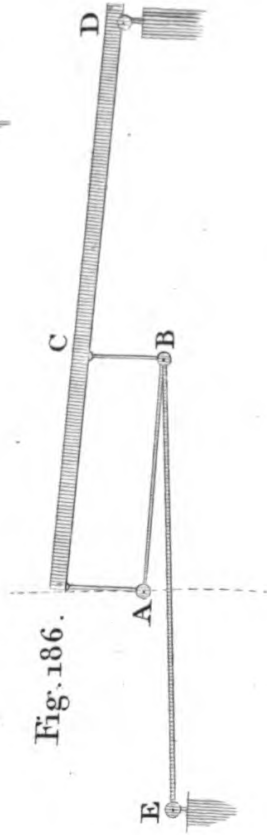


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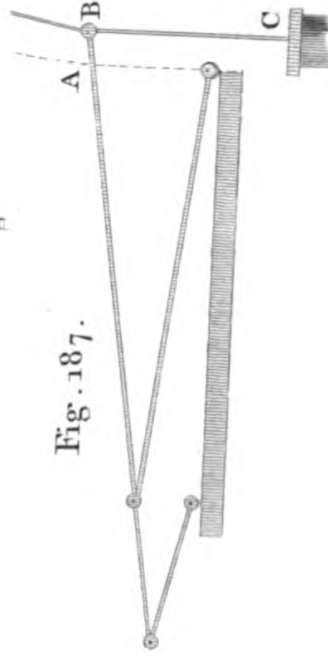
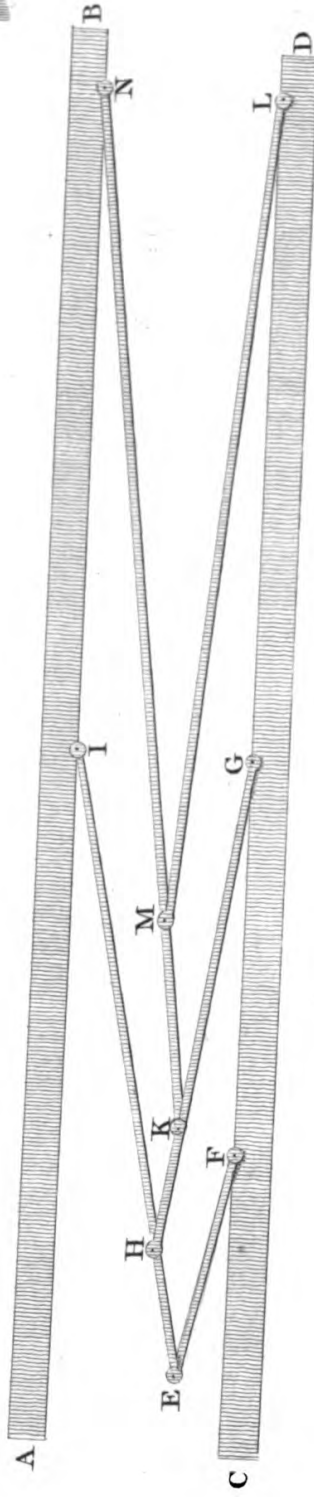
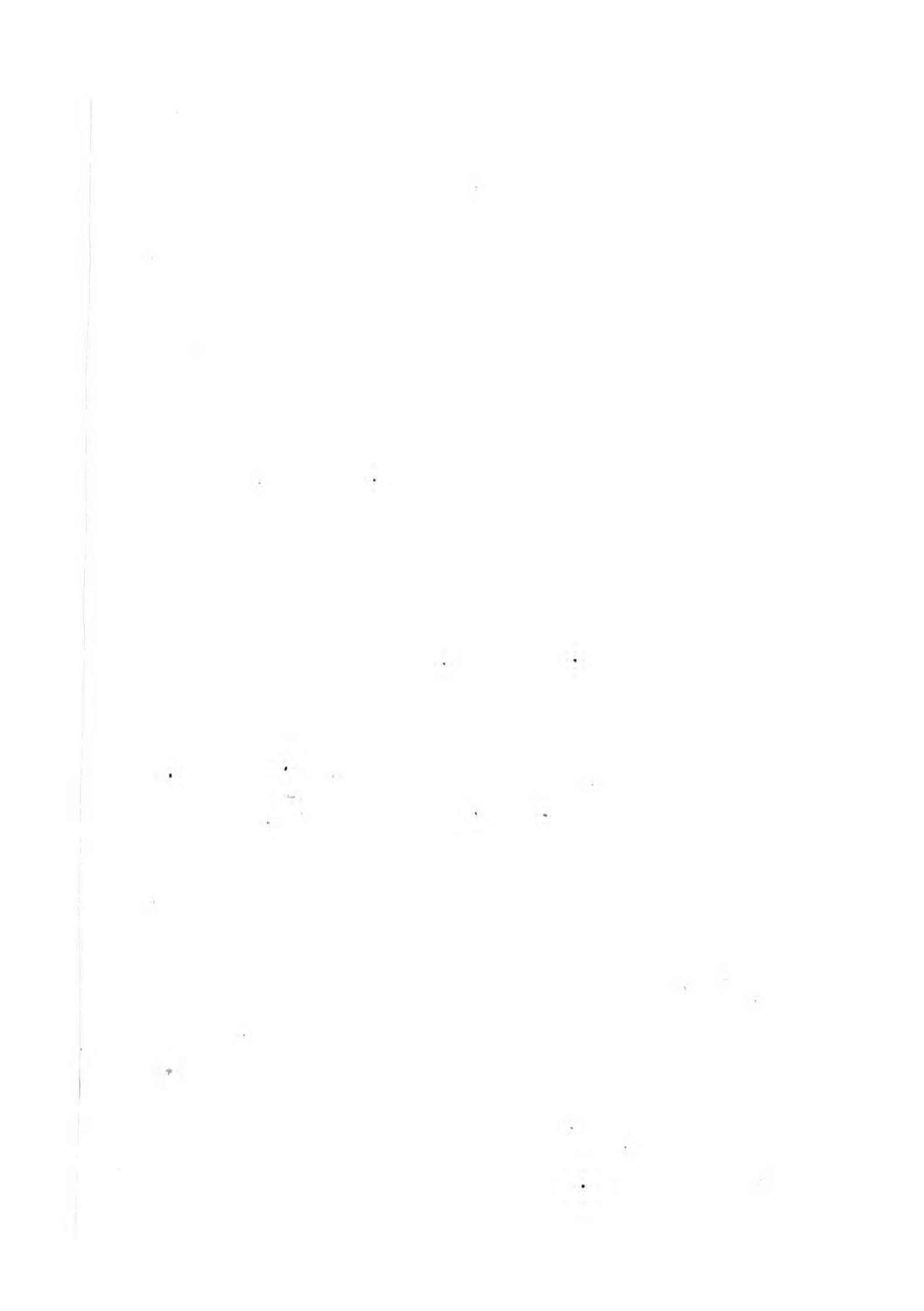


Fig. 188.



Handwritten text, likely bleed-through from the reverse side of the page. The text is extremely faint and illegible due to the quality of the scan and the nature of the bleed-through.



Handwritten text, possibly bleed-through from the reverse side of the page. The text is extremely faint and difficult to decipher, but appears to be a single line of writing.

PLATE XII.

Fig. 156.

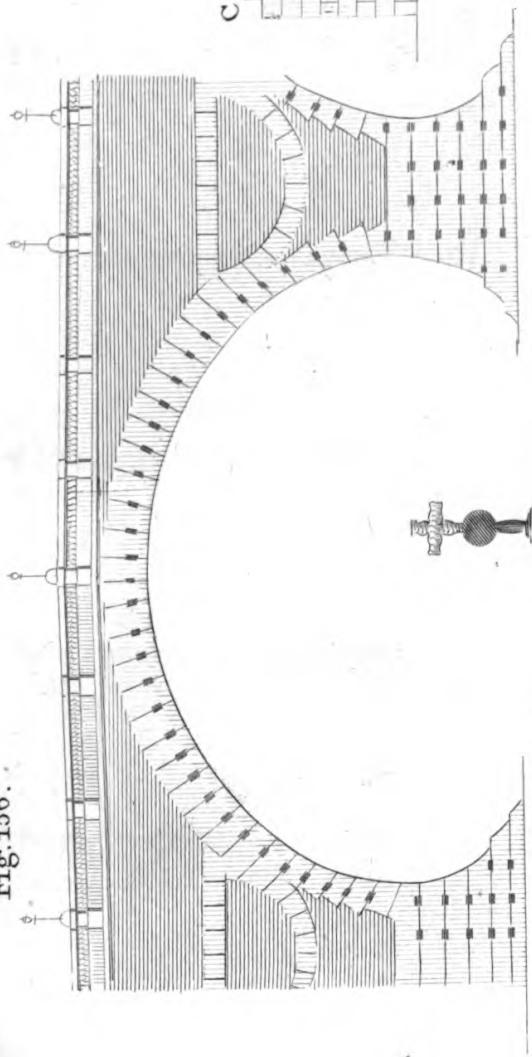


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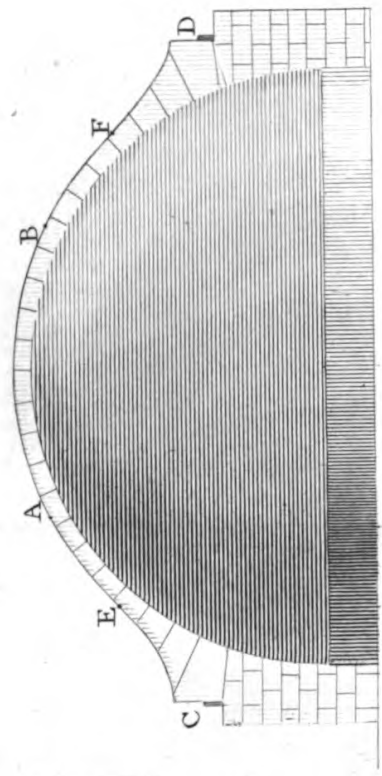


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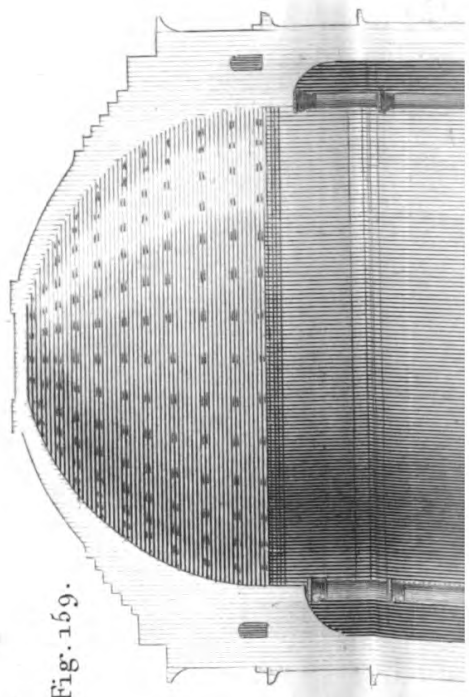
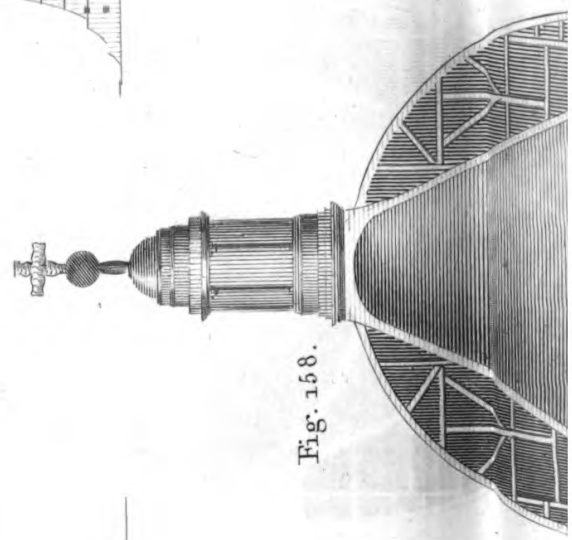


Fig. 158.



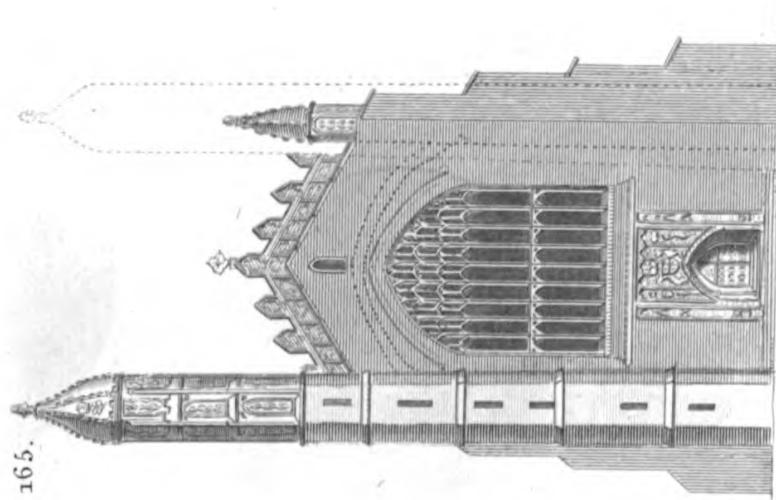
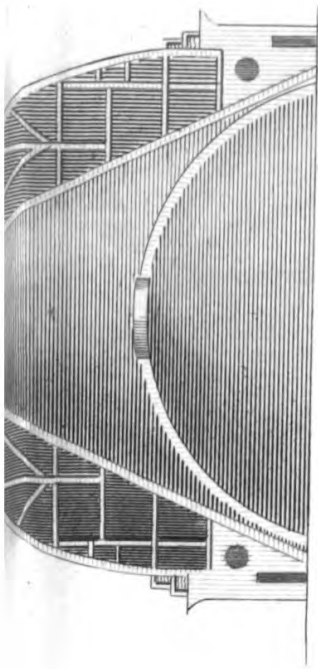
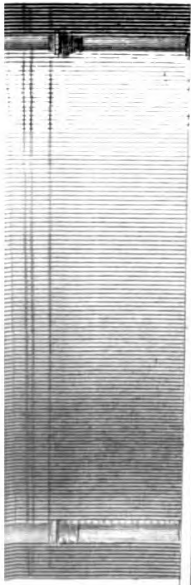


Fig. 165.

Fig. 160.



Fig. 161.



Fig. 162.



Fig. 163.



Fig. 164.



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PLATE XIII

Fig. 166.

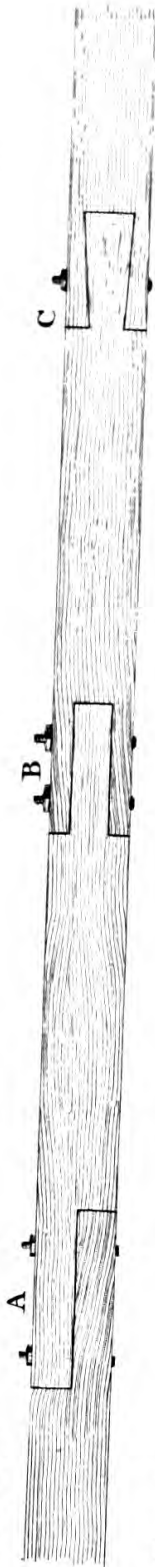


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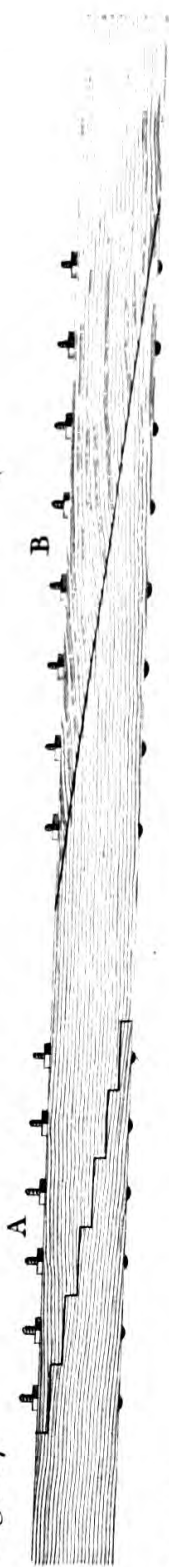


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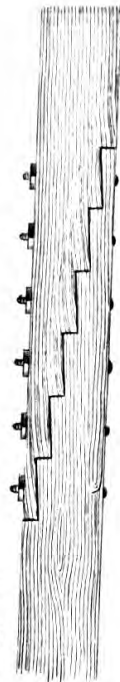


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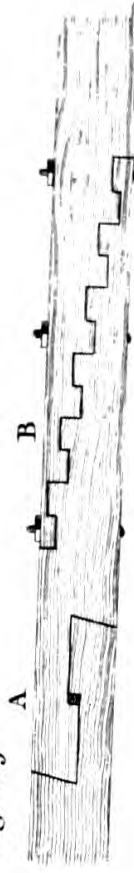


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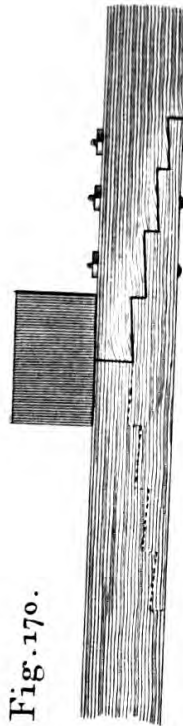


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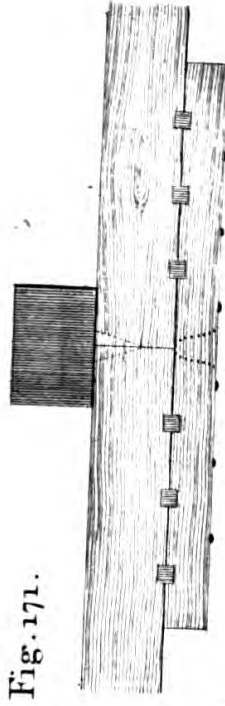
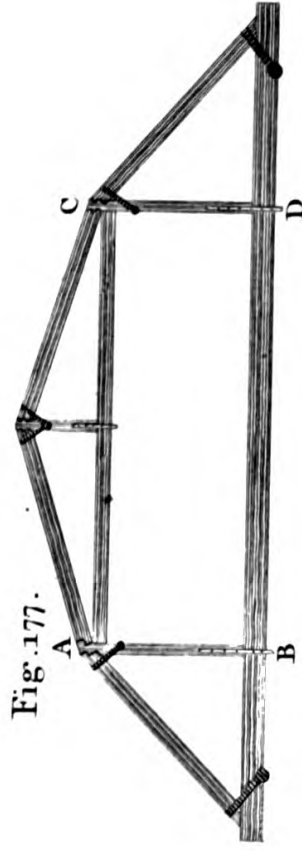
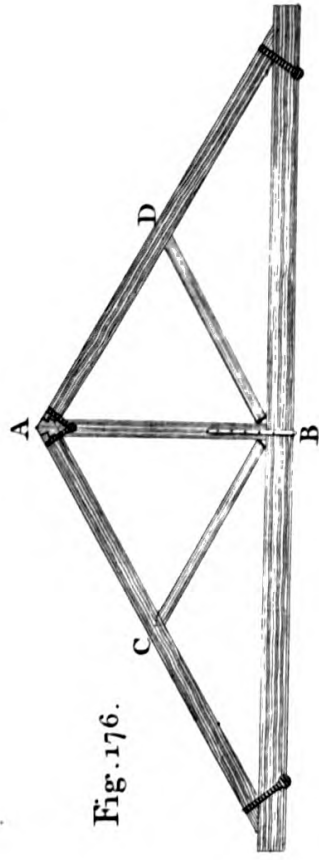
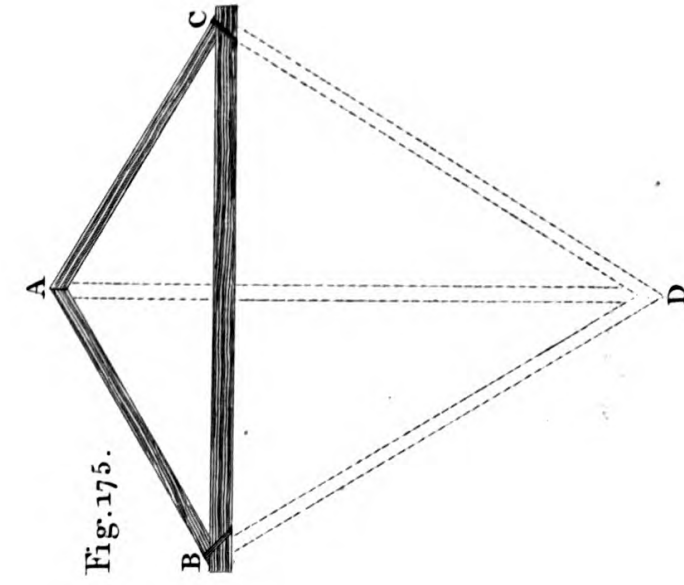
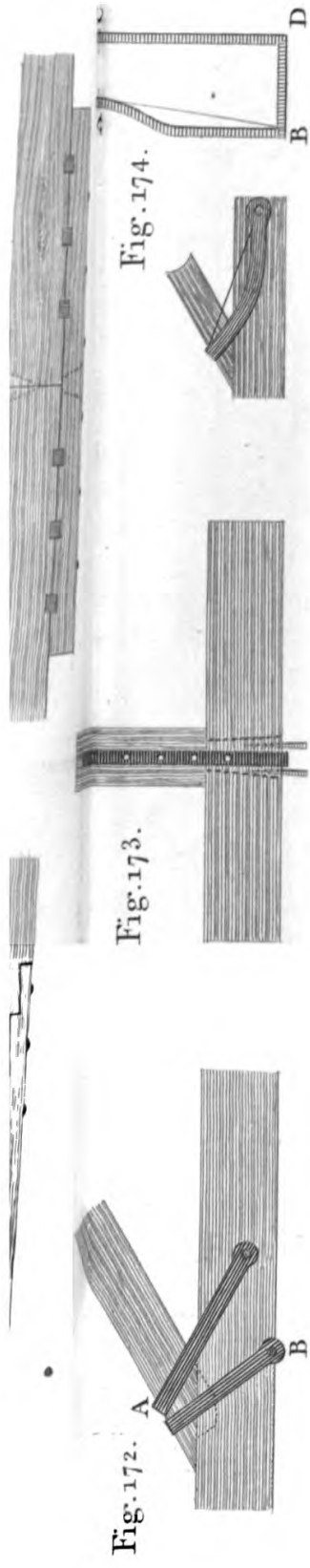


Fig. 172.





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Fig. 178.

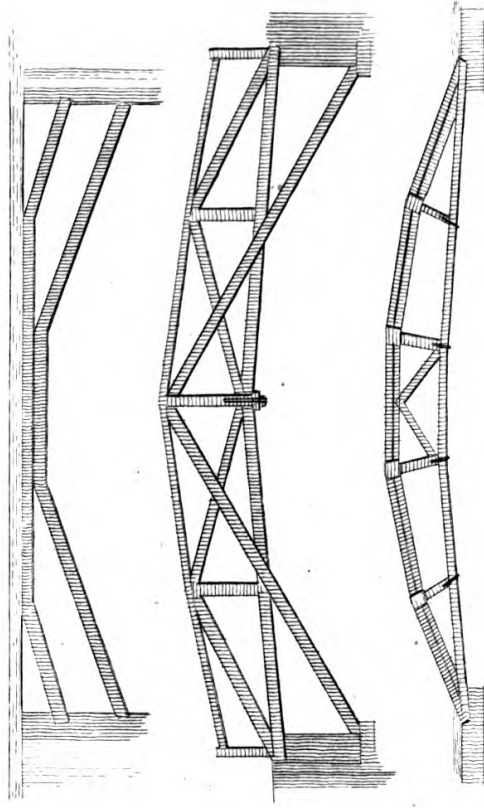


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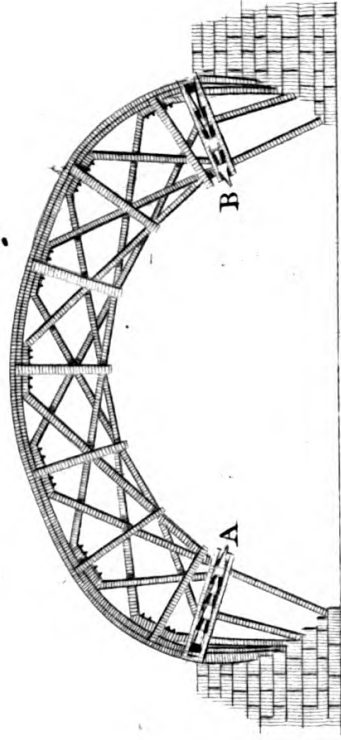


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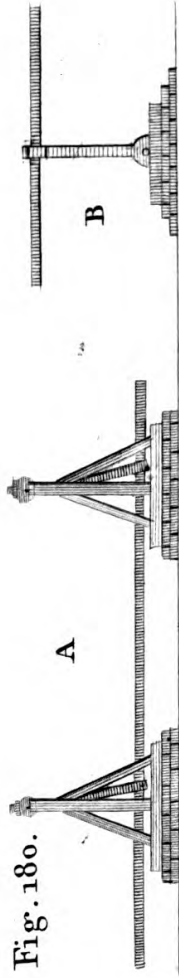
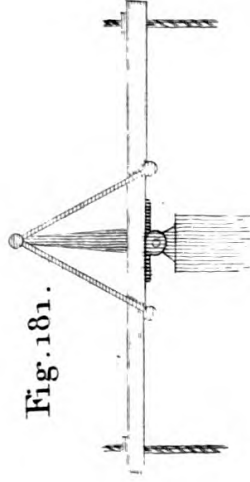
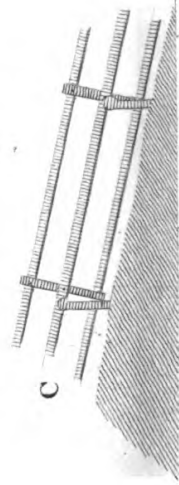


Fig. 181.



C



D



Fig. 182.



Fig. 183.



Fig. 184.



Fig. 185.



Fig. 183.



Fig. 184.



Fig. 185.

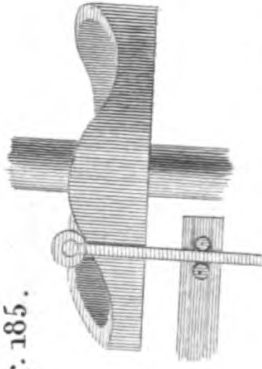


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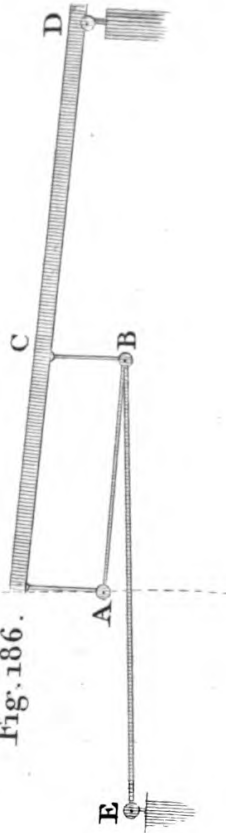


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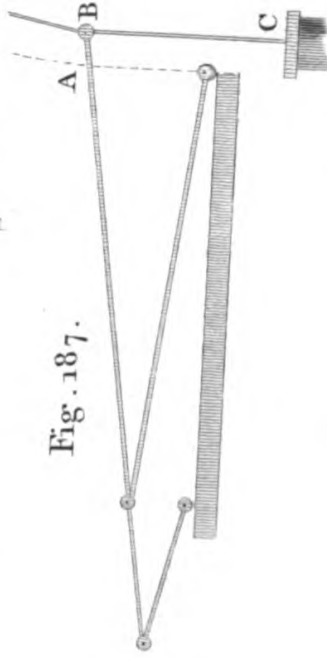
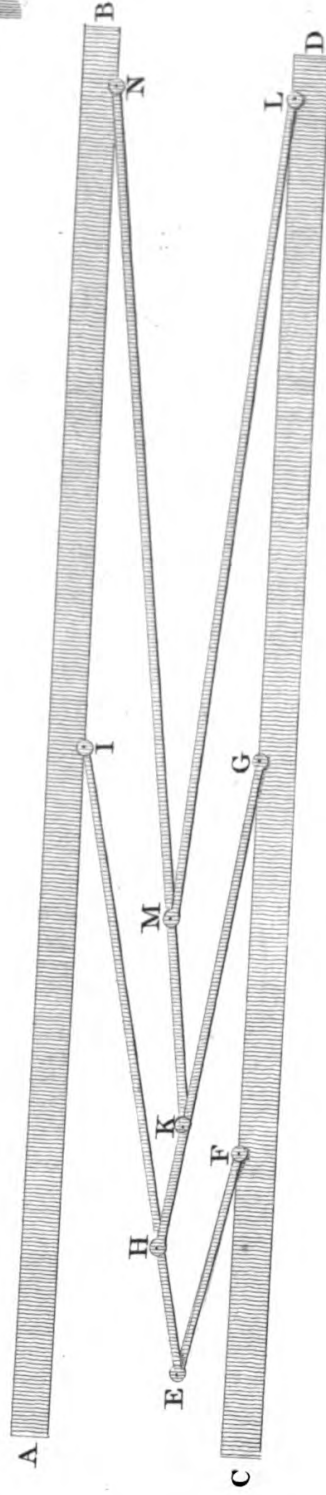
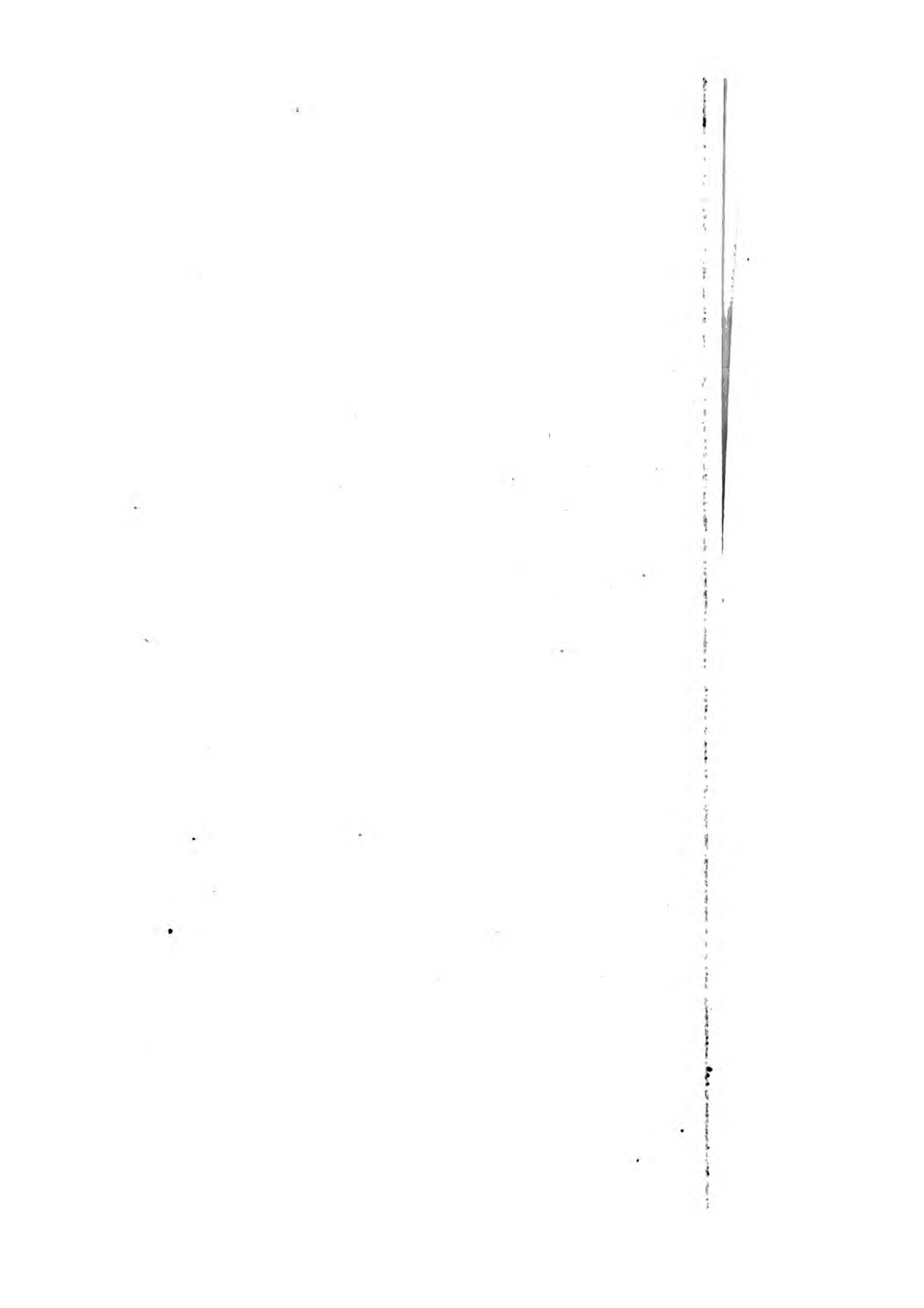


Fig. 188.





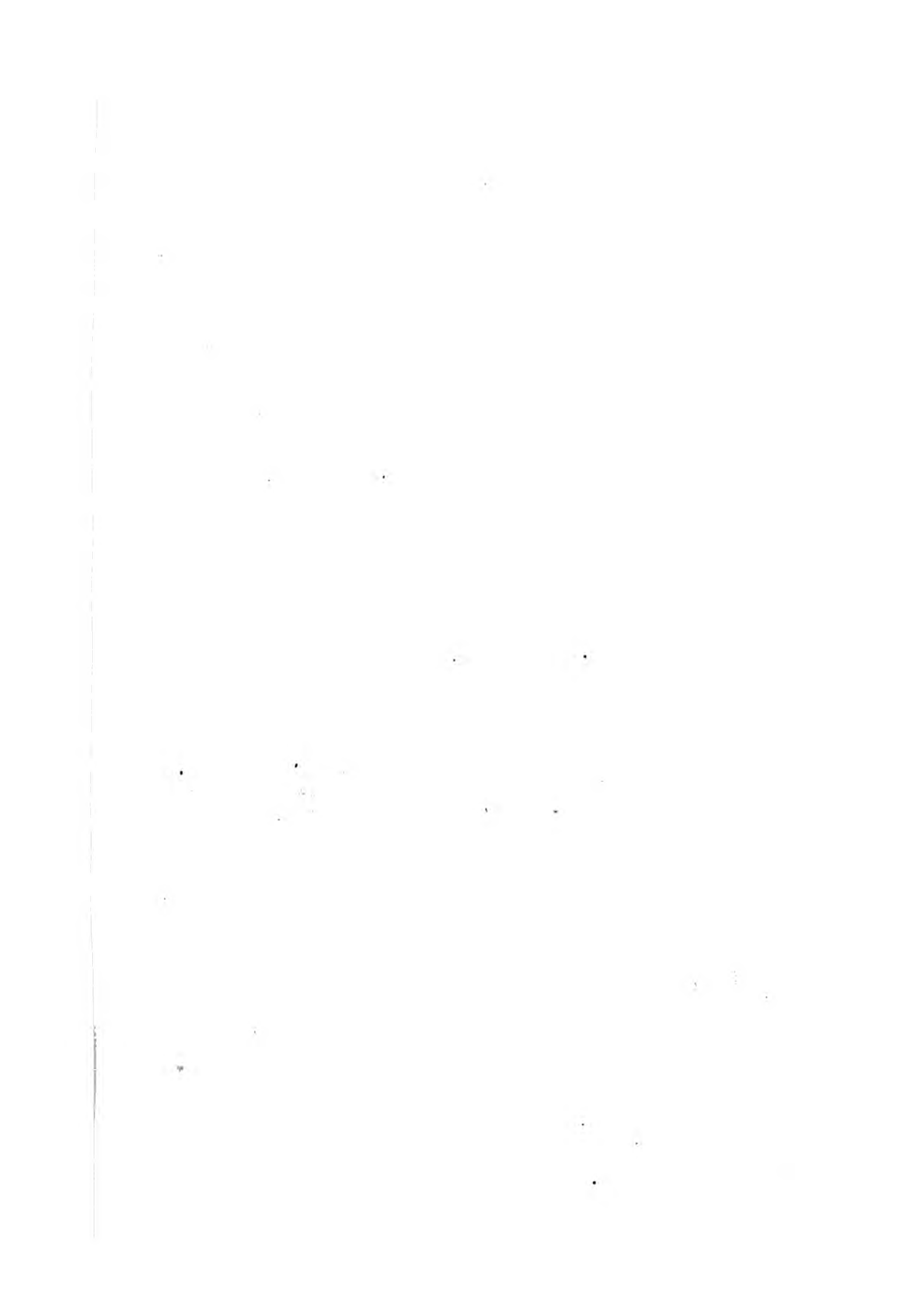


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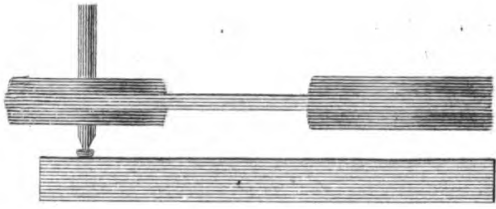


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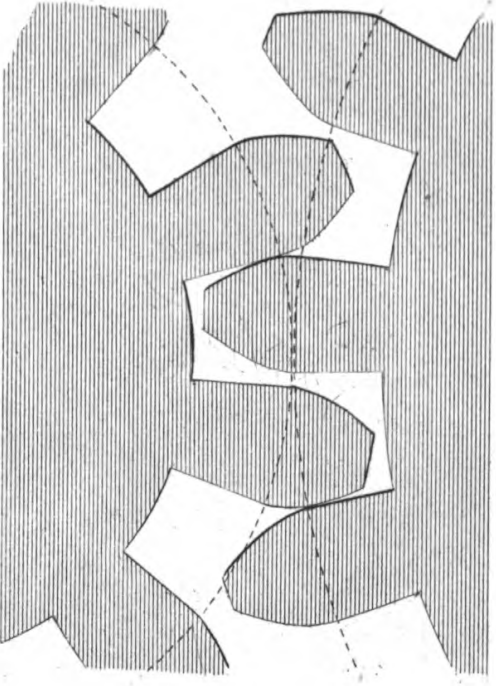


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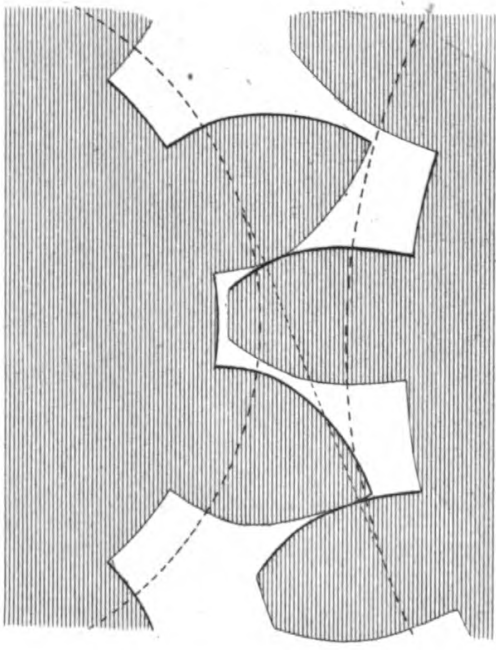


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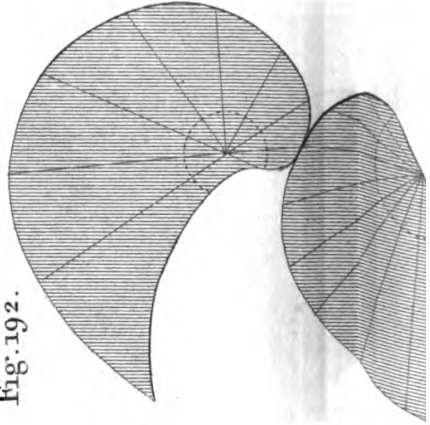


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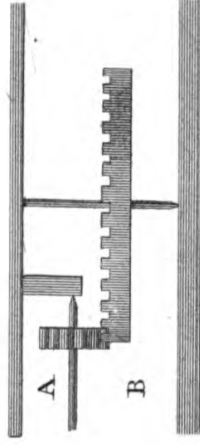


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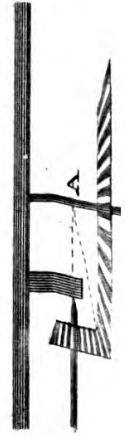


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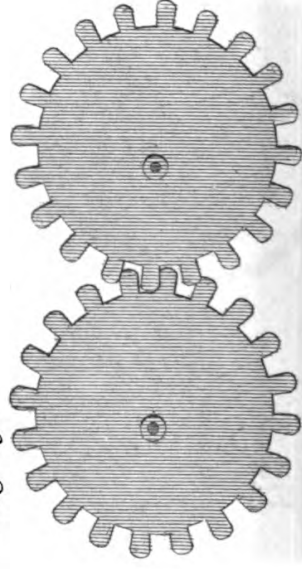


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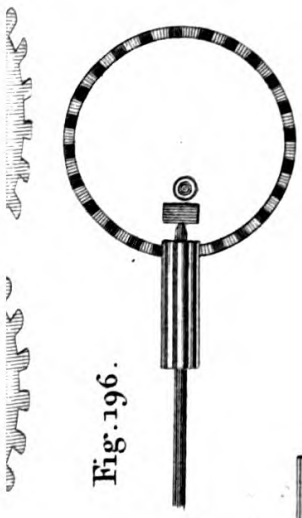
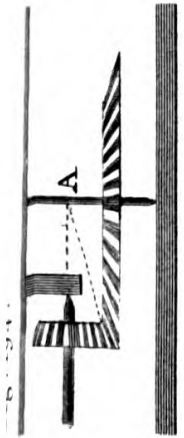
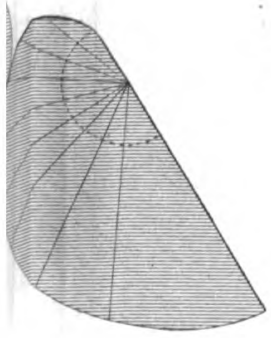


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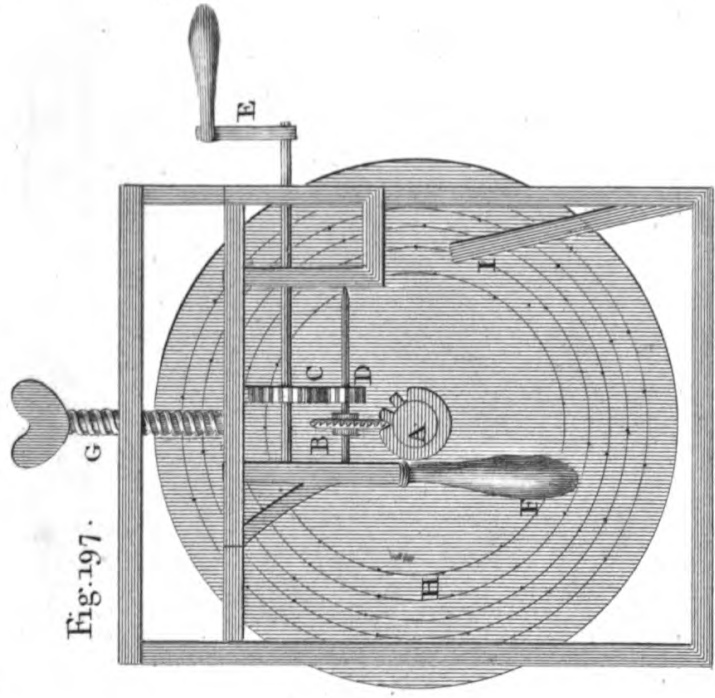


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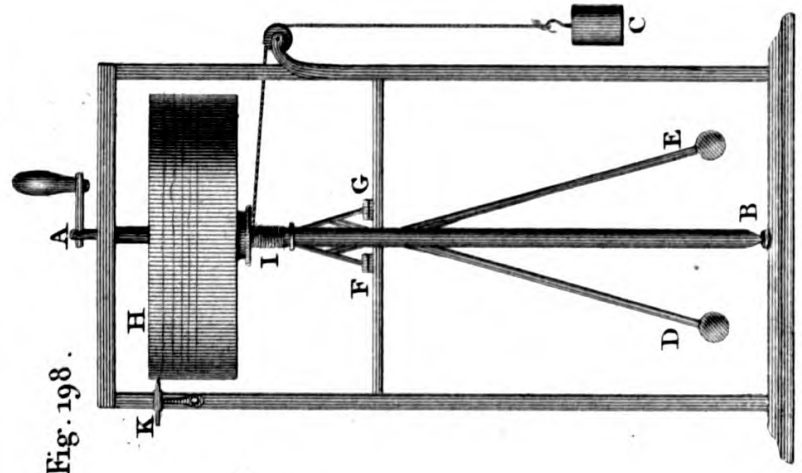


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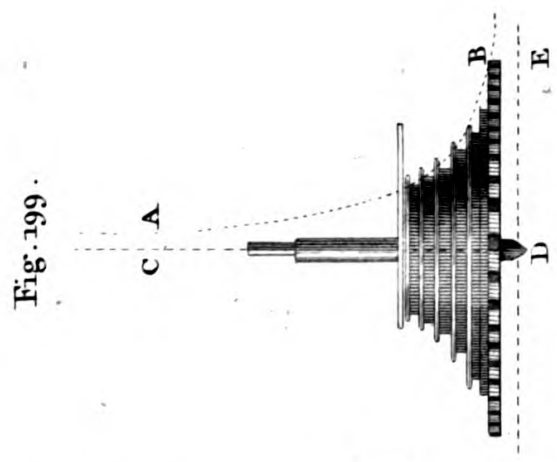


Fig. 199.

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Joseph Skelton sculps

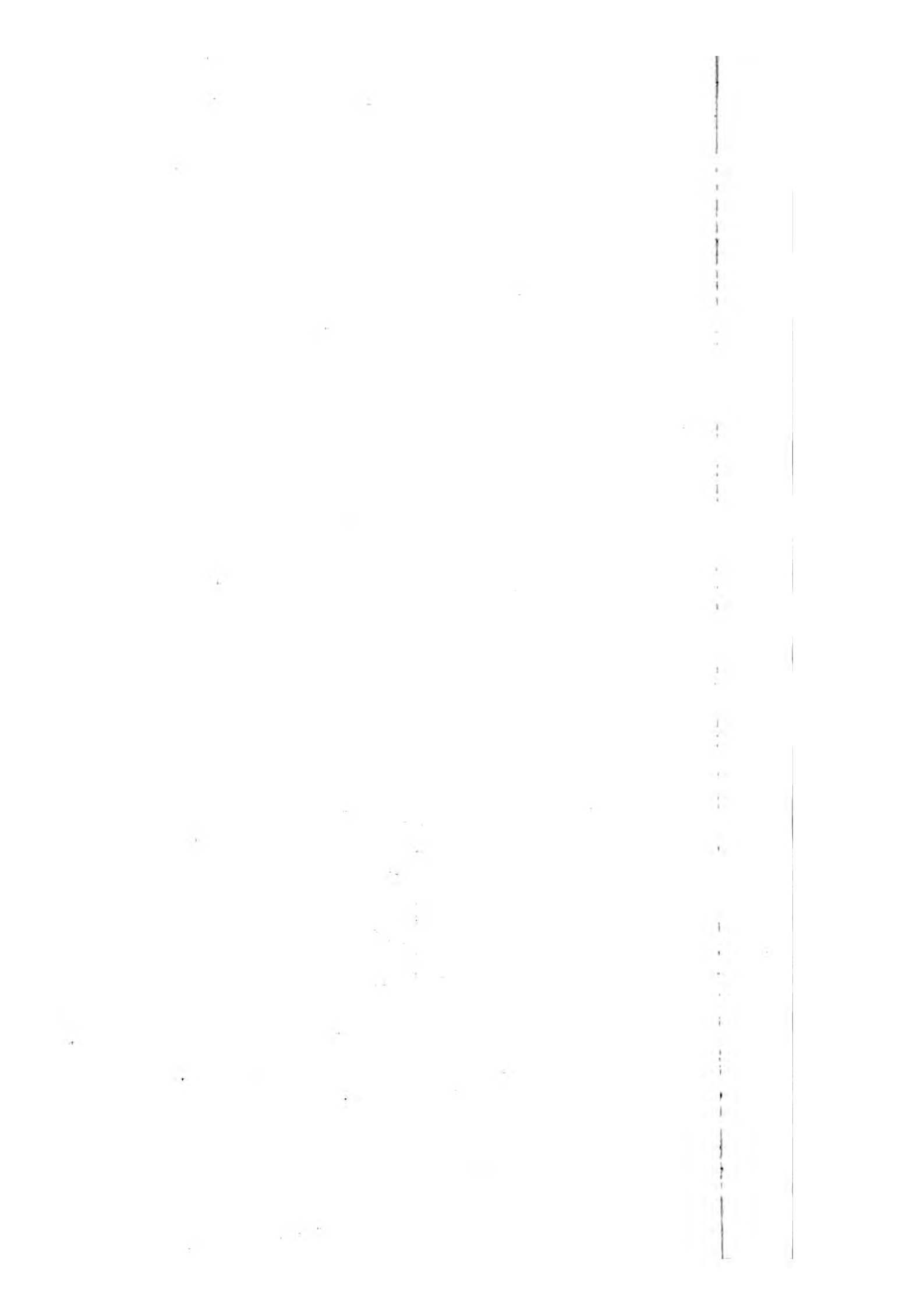




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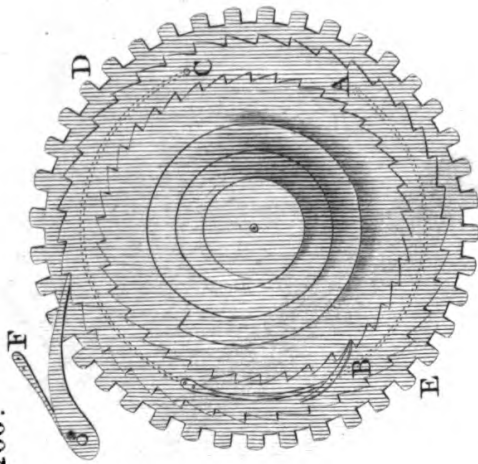


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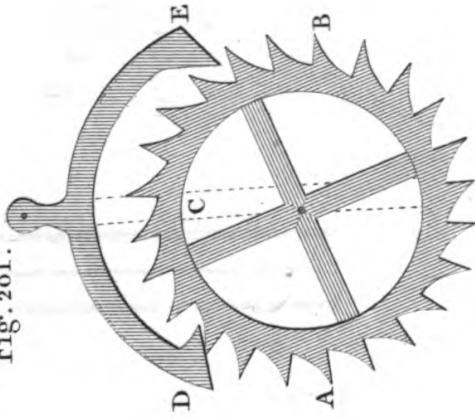


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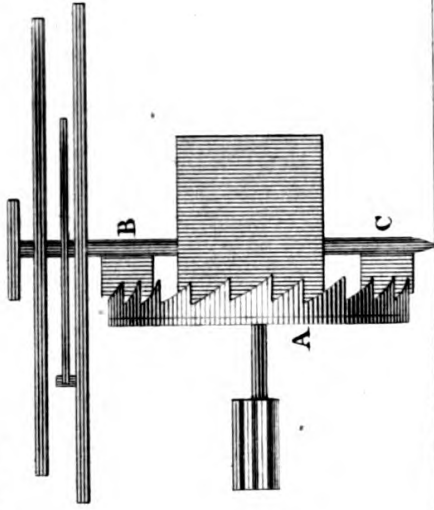


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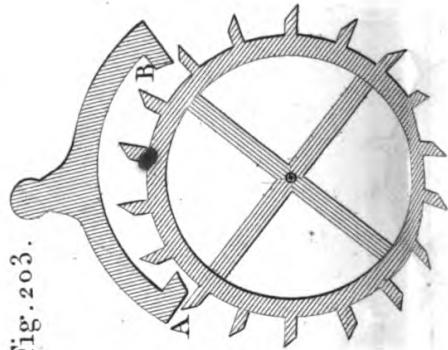


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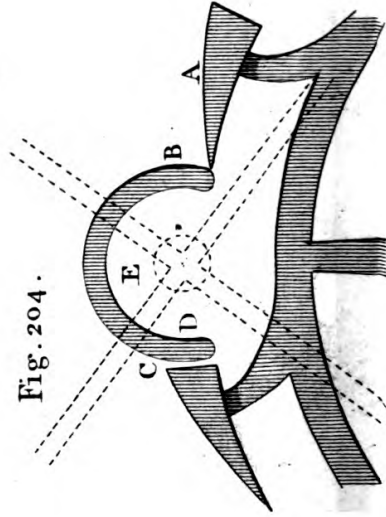
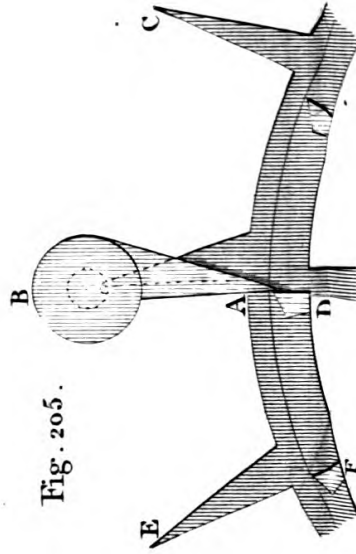


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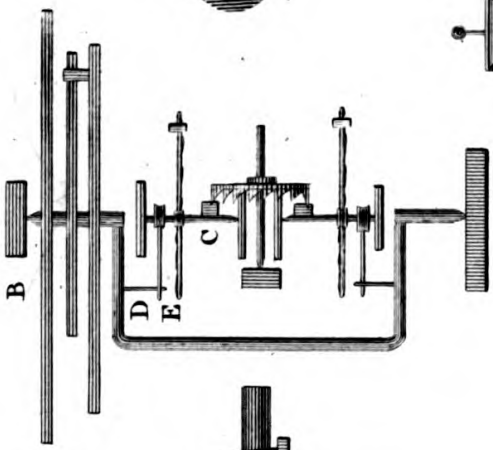
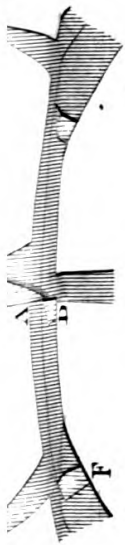


Fig. 206. A

Fig. 207.

Fig. 208.

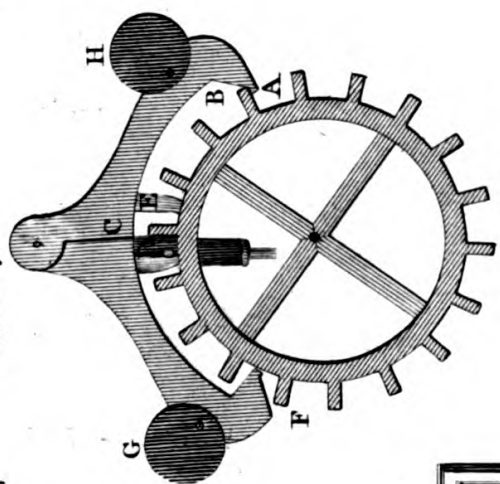


Fig. 209.

Fig. 210.

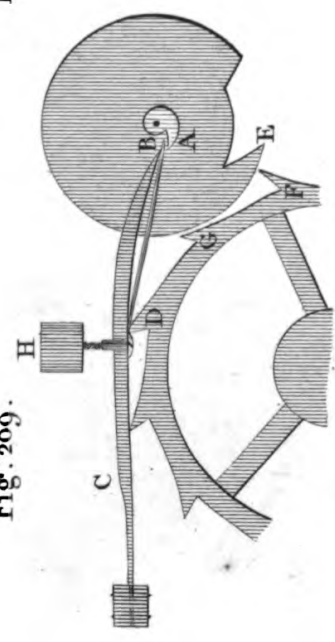


Fig. 211.

Fig. 212.

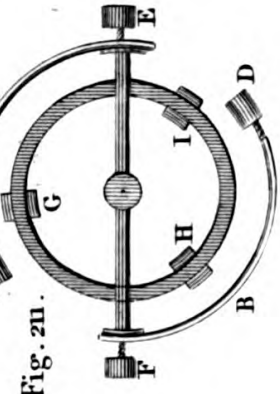
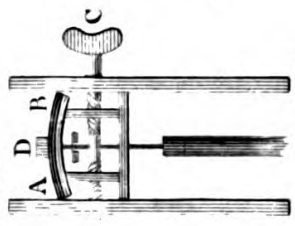


Fig. 212.

Fig. 213.

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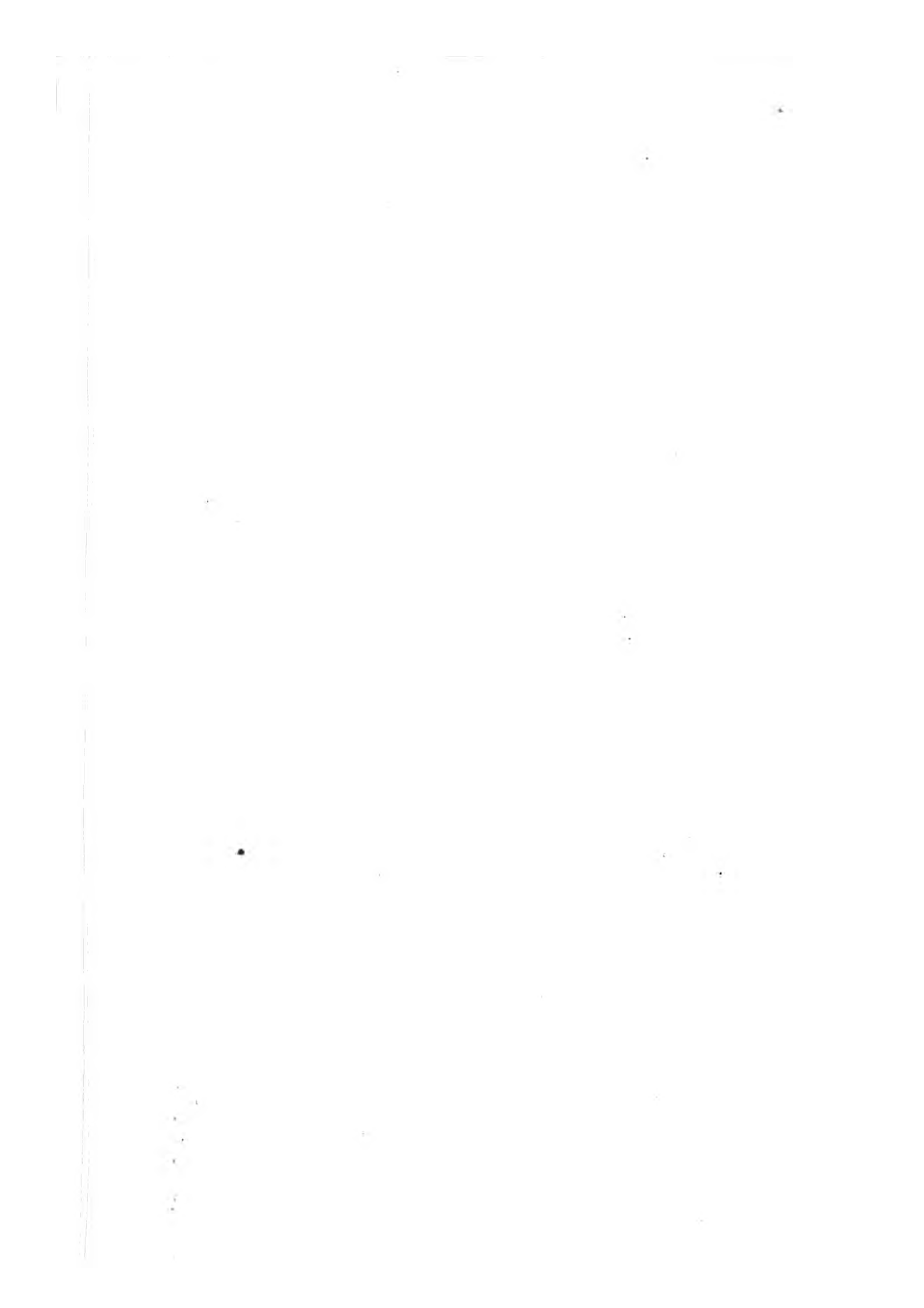


PLATE XVII.

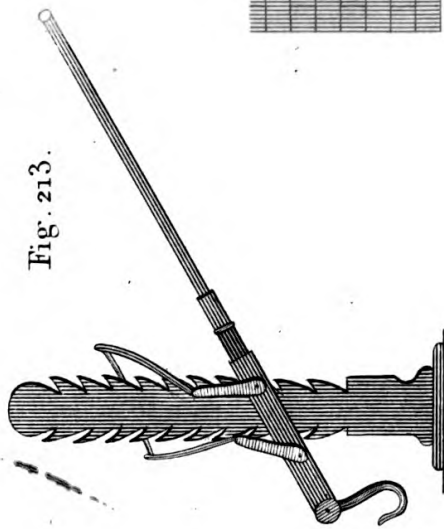


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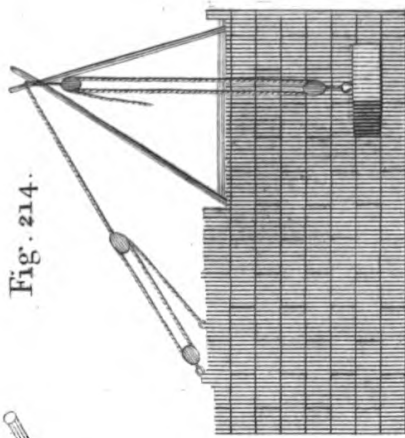


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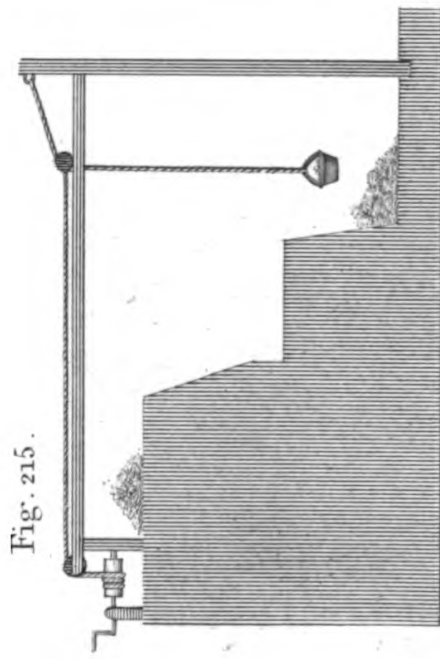


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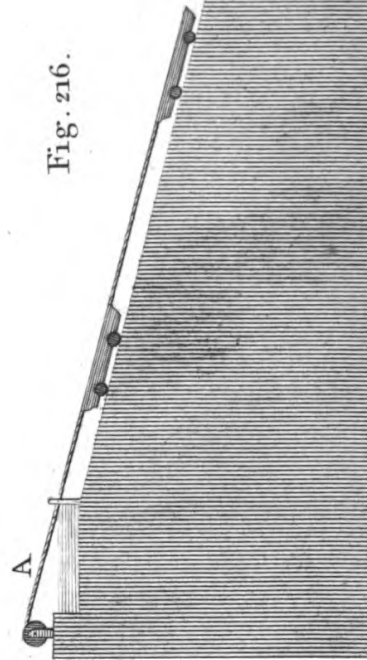


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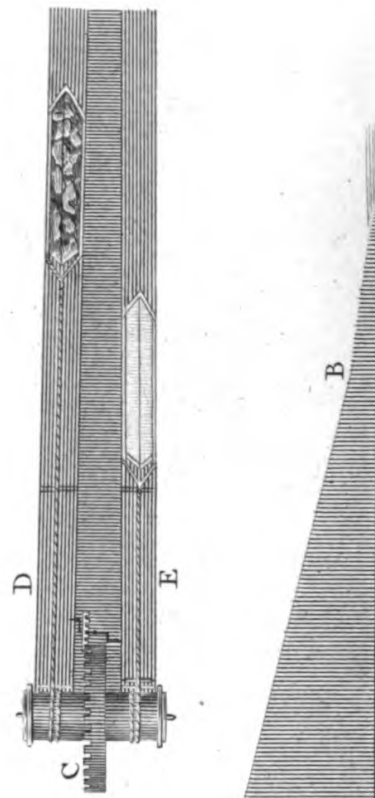
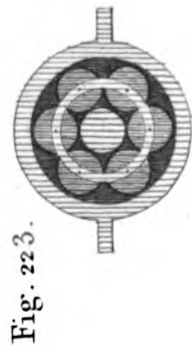
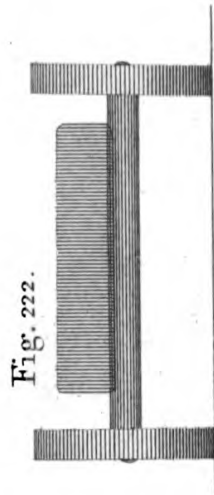
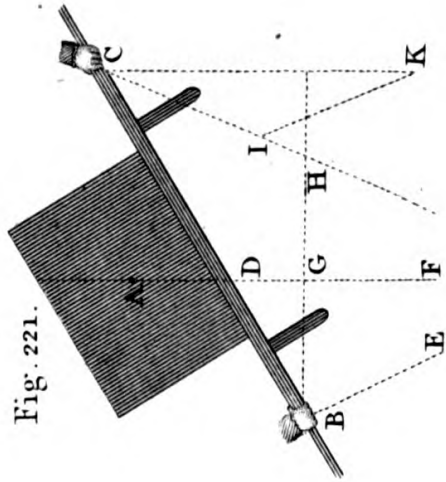
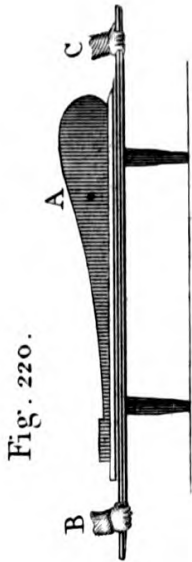
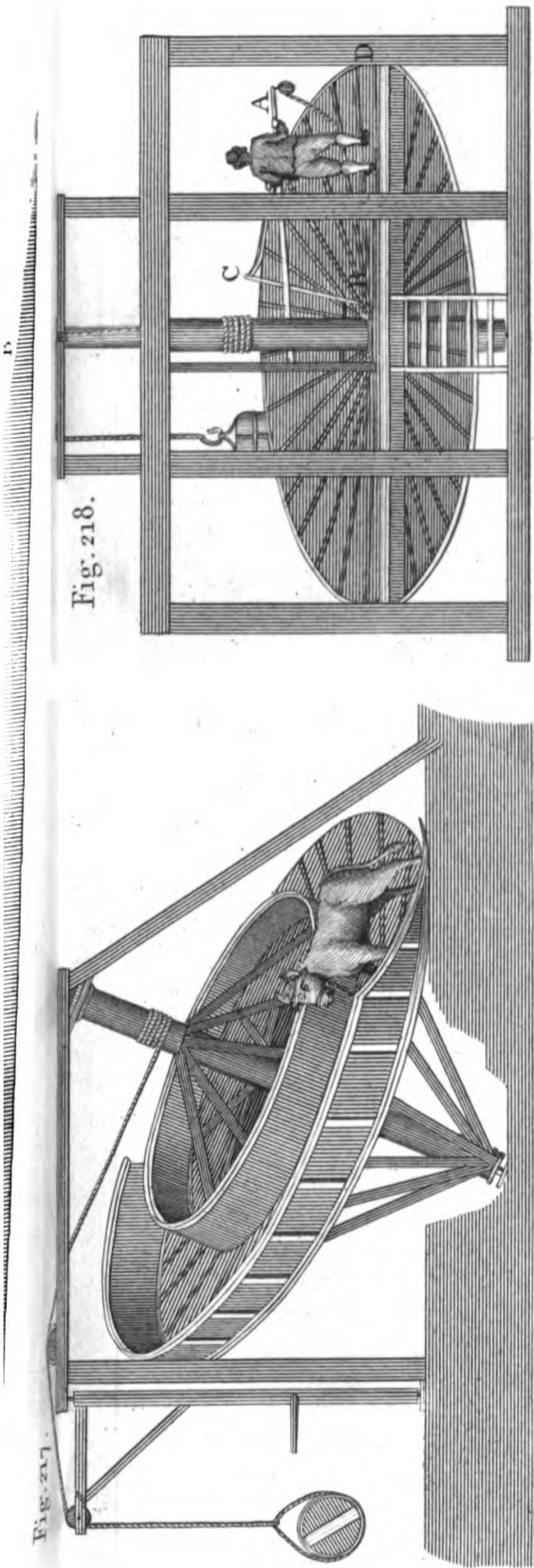


Fig. 217.



Fig. 218.



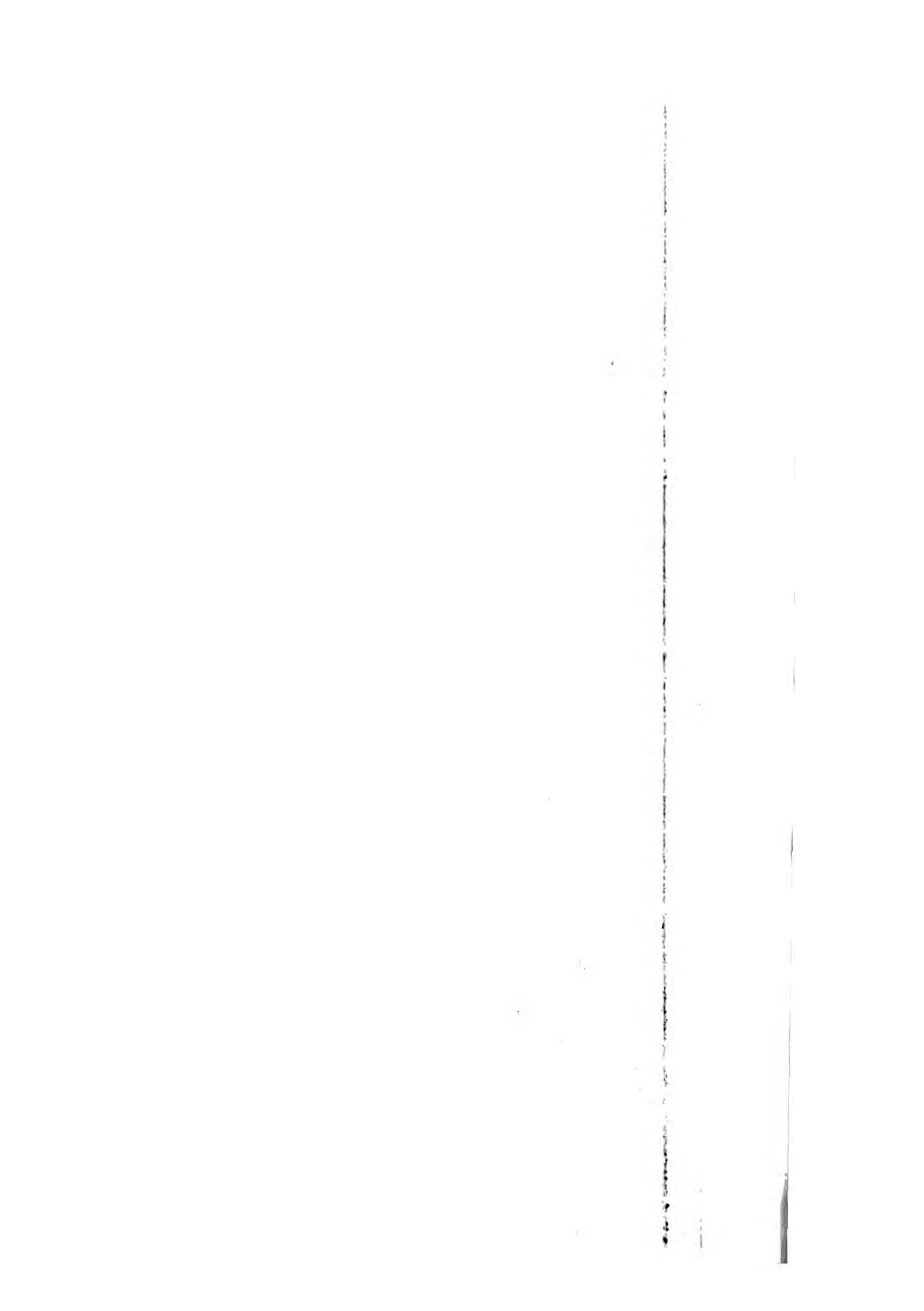


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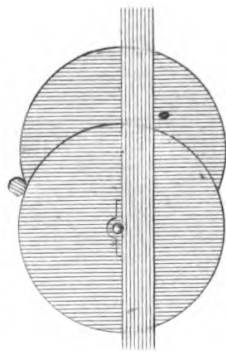


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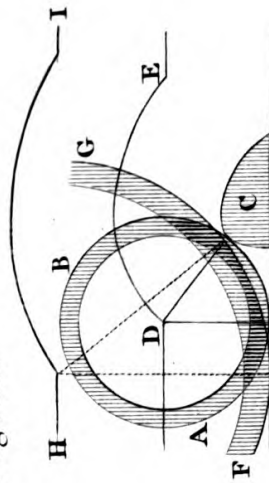


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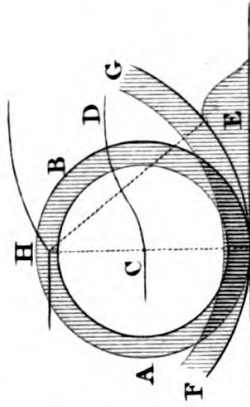


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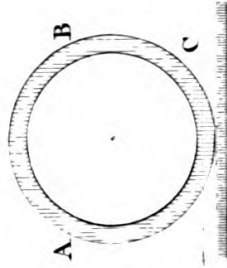


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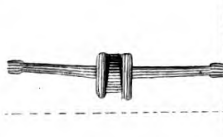


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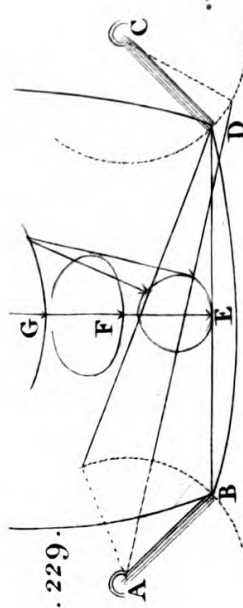


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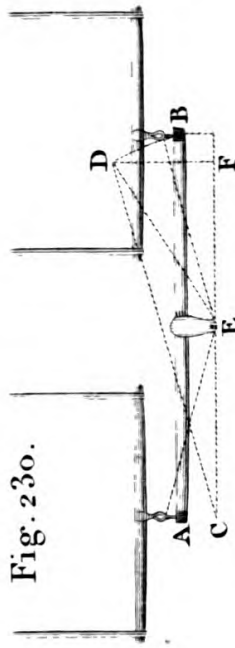


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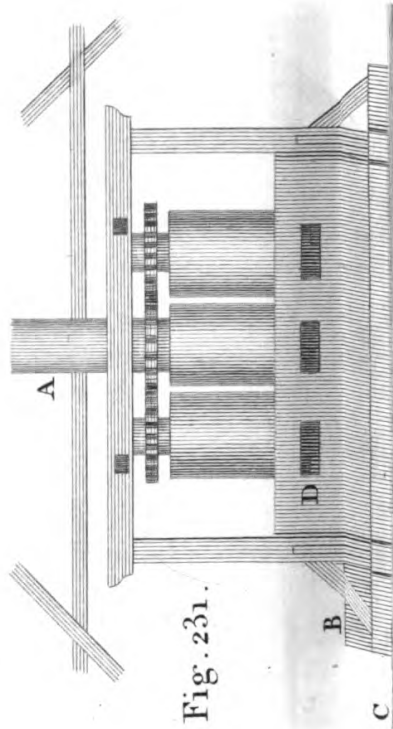


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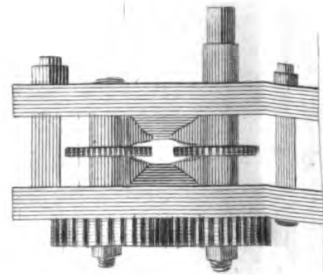


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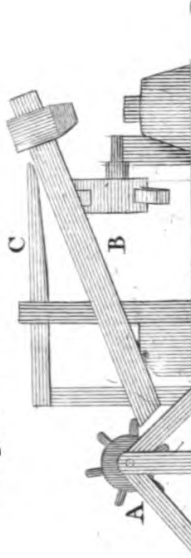
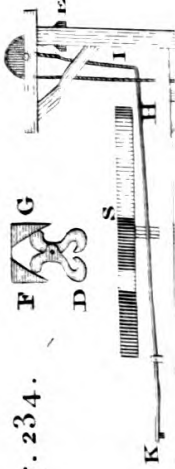


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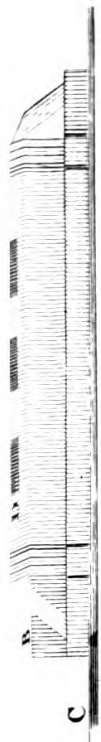


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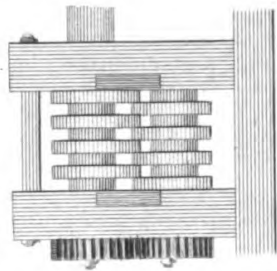


Fig. 236.



Fig. 237.

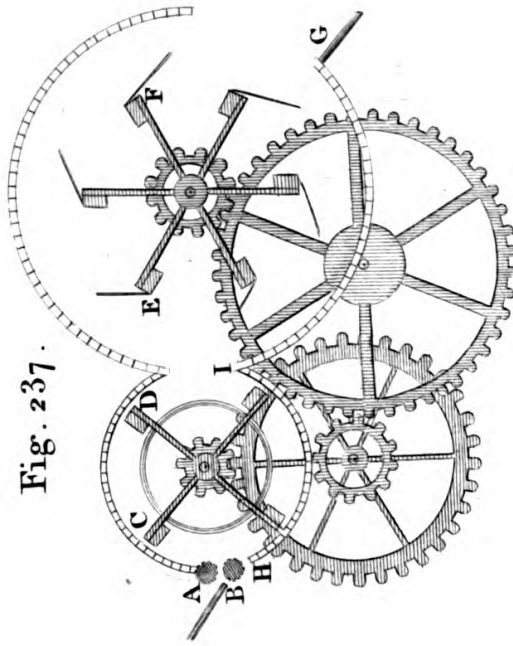
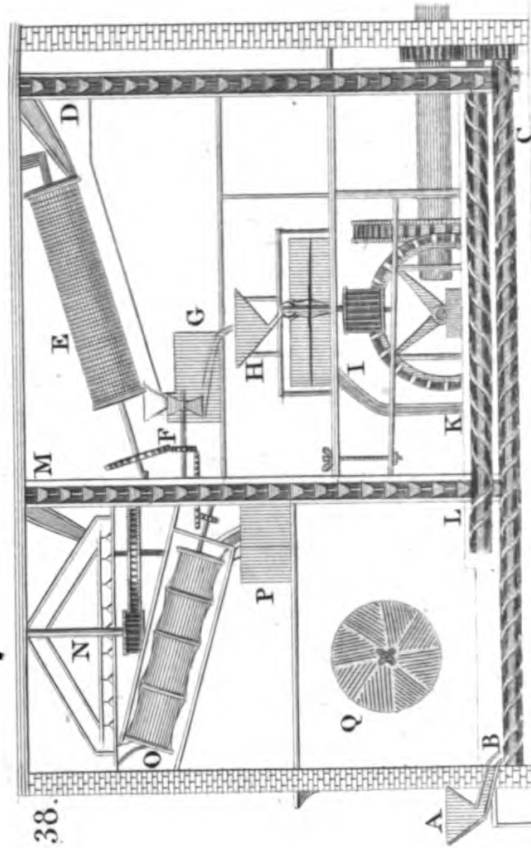
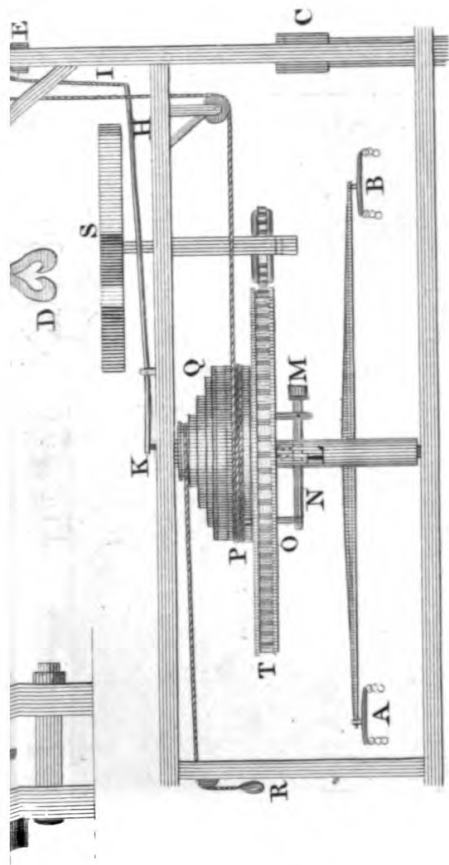


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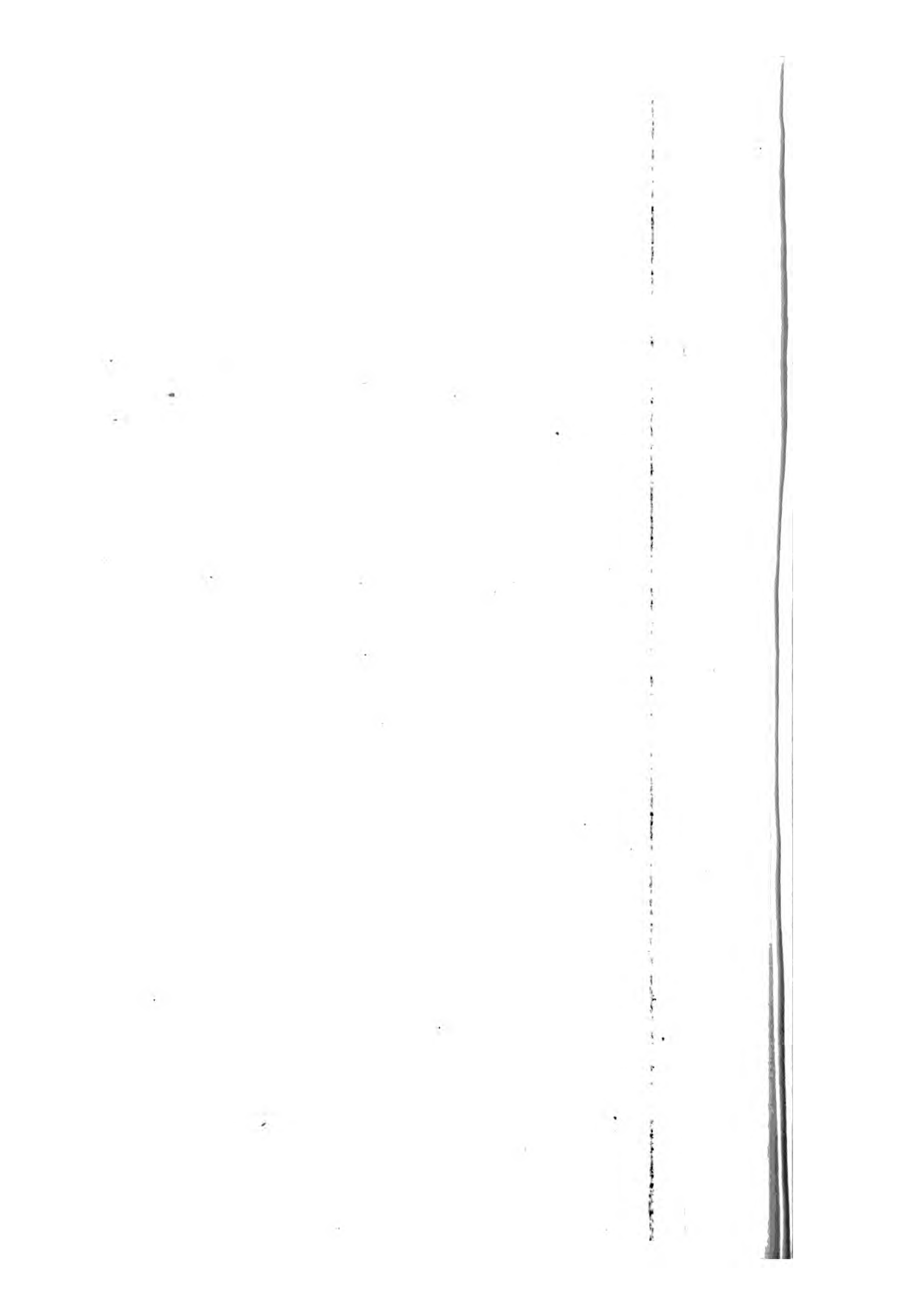


PLATE XIX.

Fig. 239.

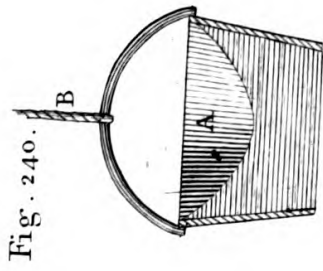
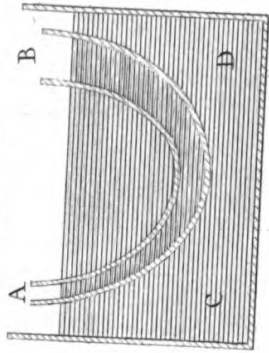


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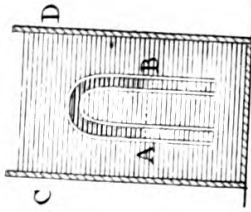


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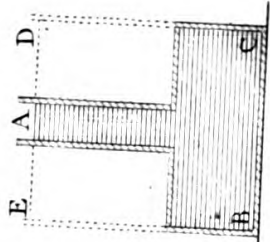


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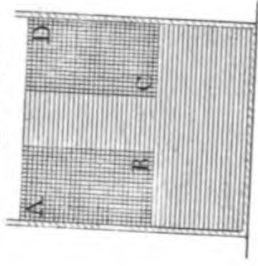


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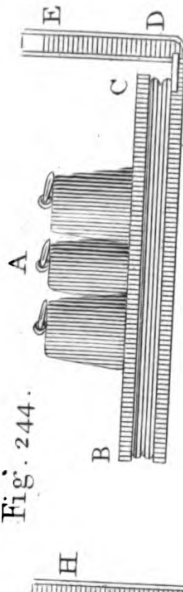


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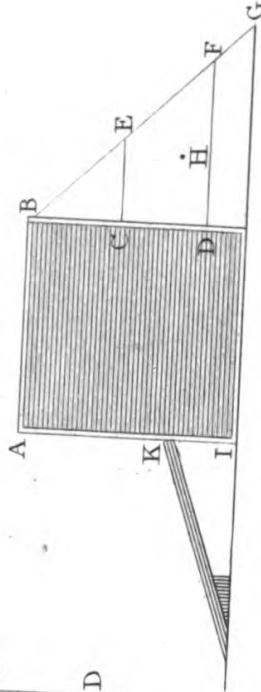


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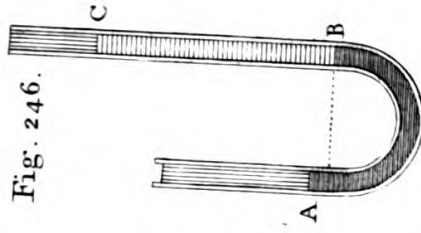


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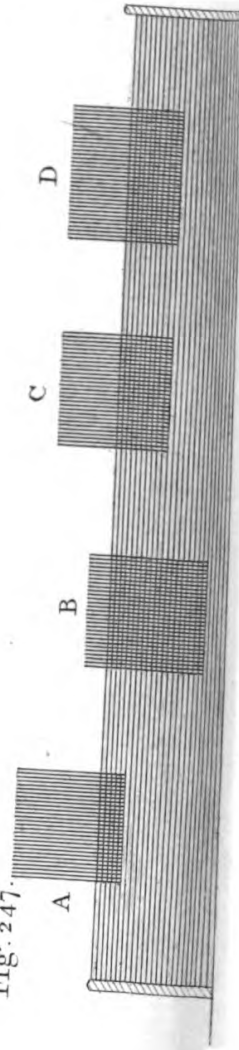


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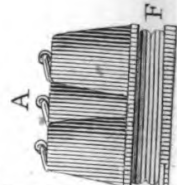


Fig. 251.





Fig. 248.

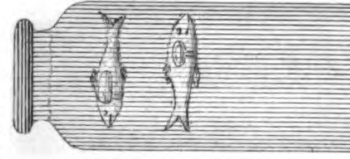


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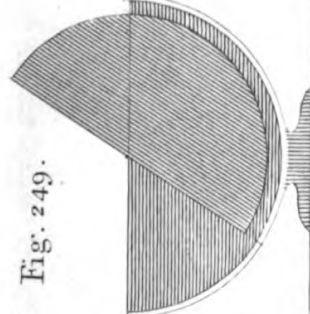


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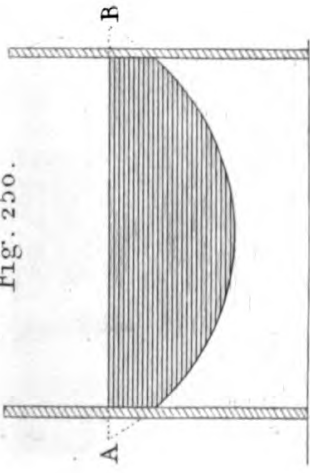


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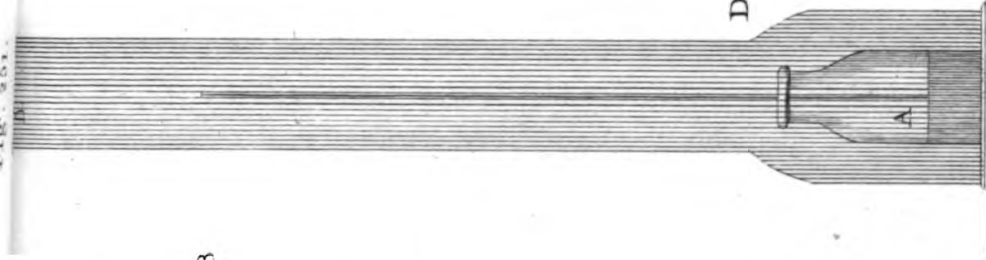


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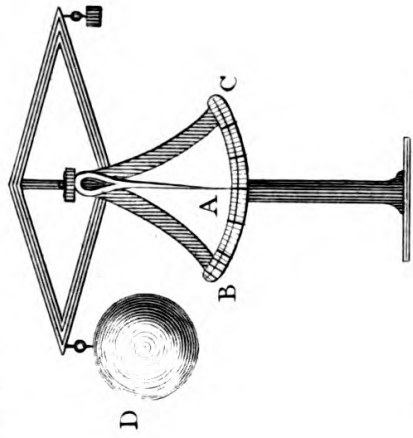


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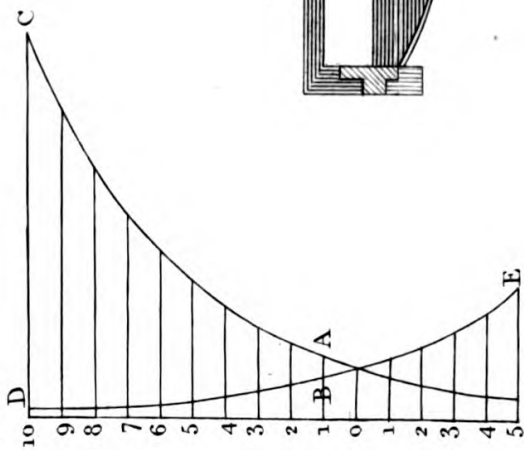
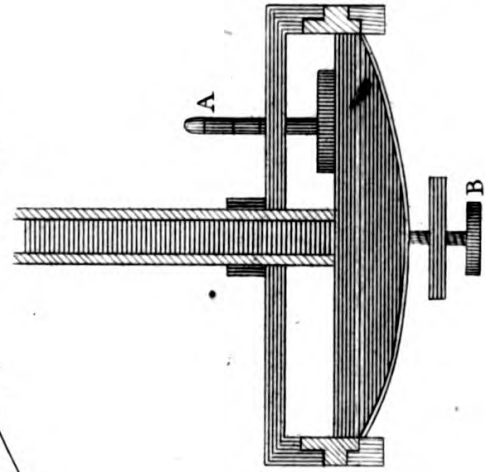
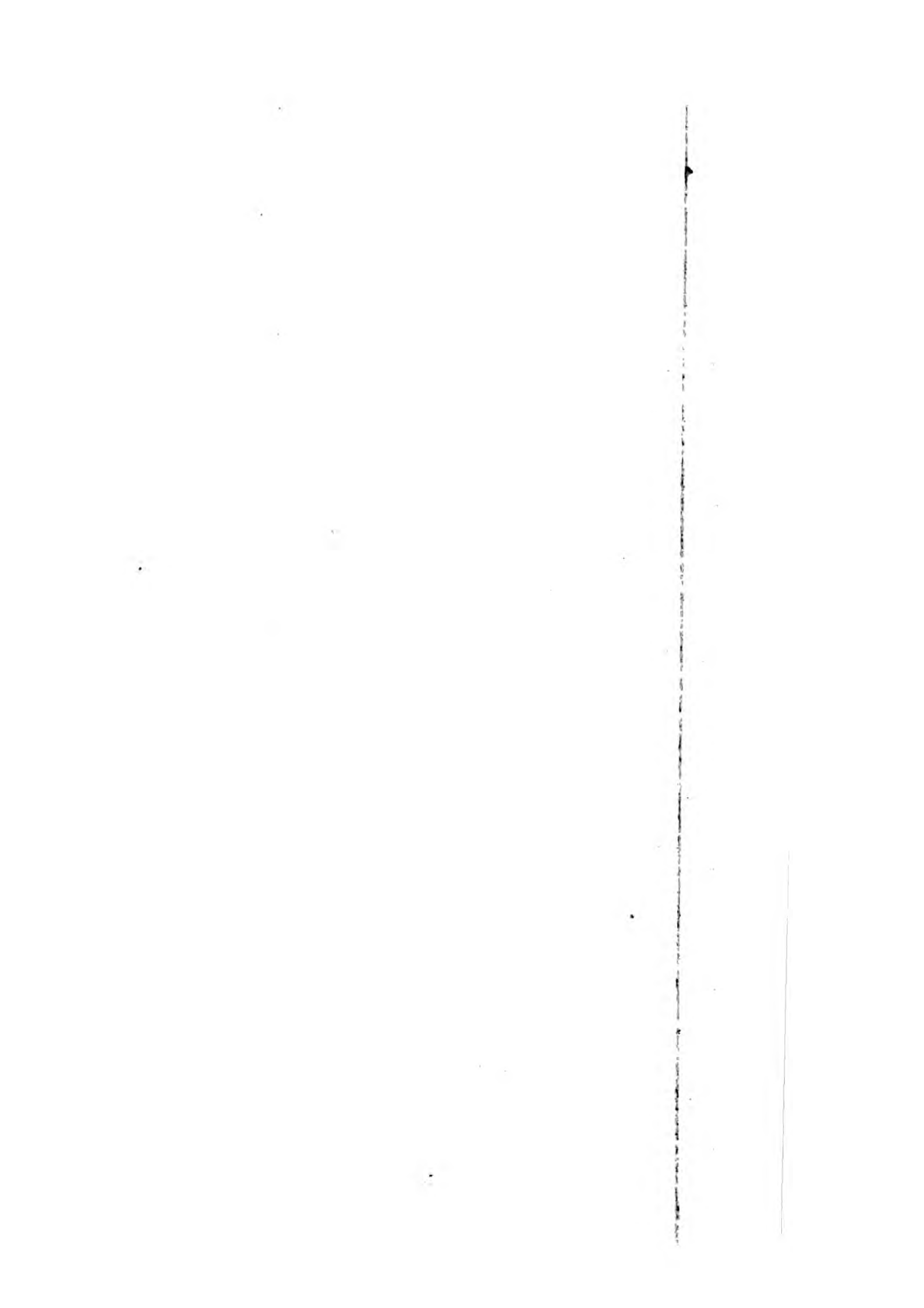


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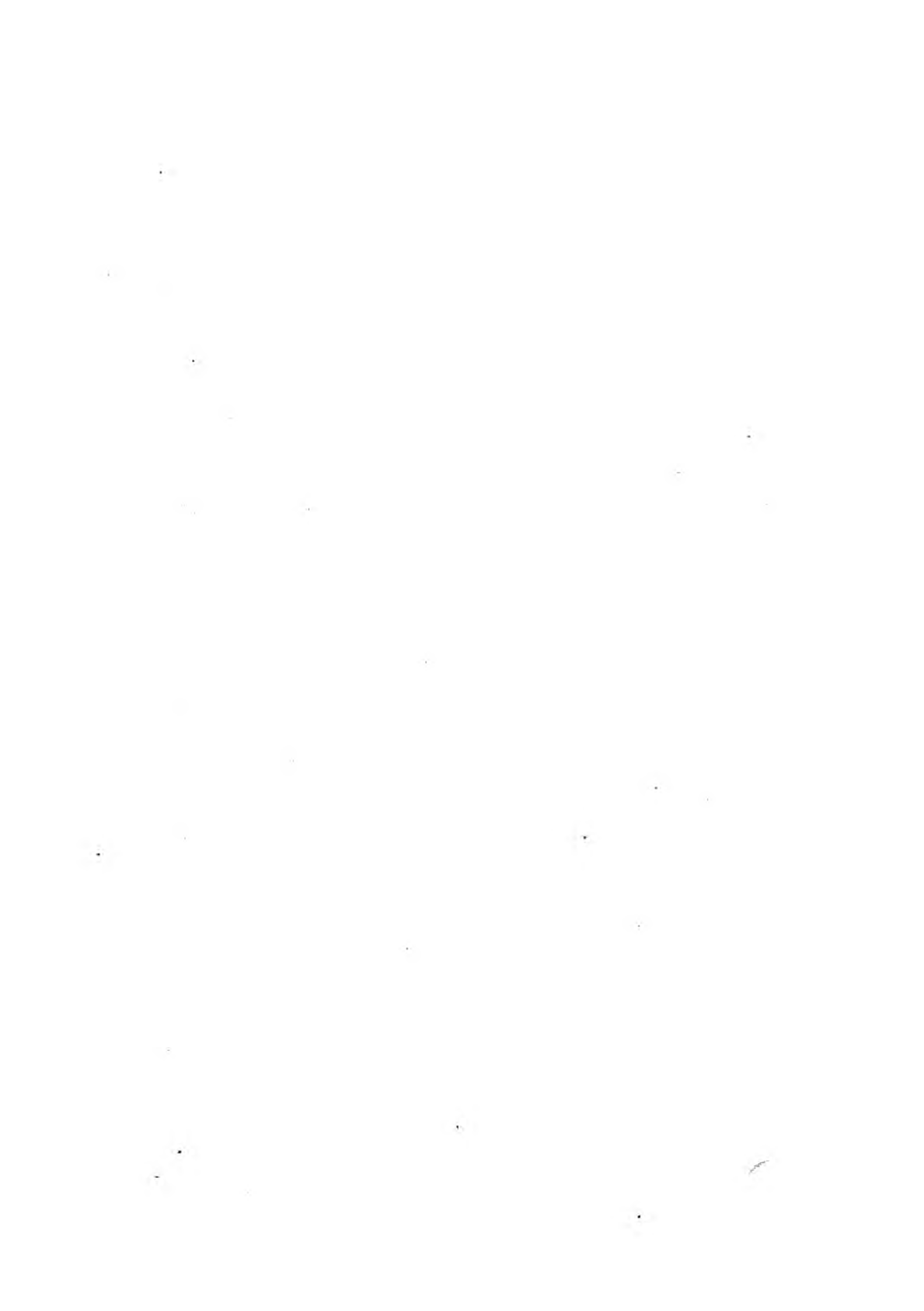


PLATE XX.

Fig. 255.

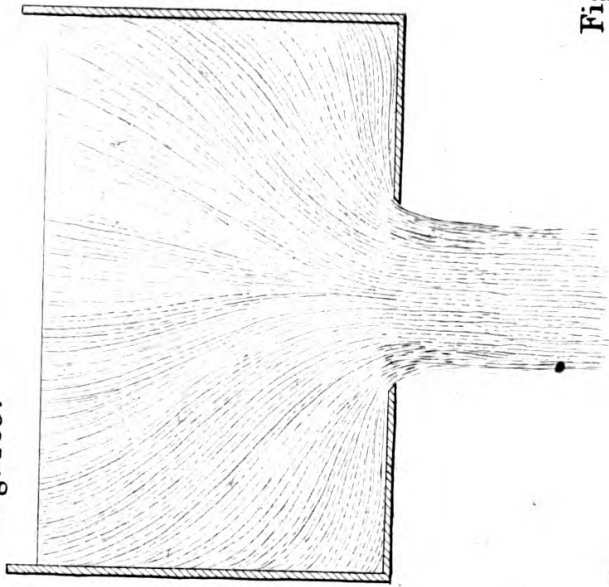


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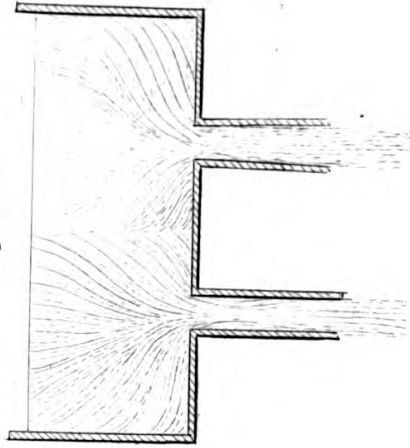


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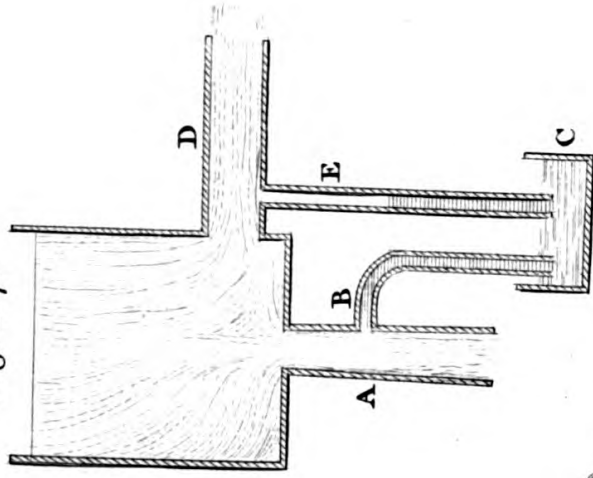


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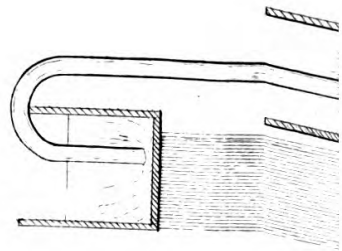


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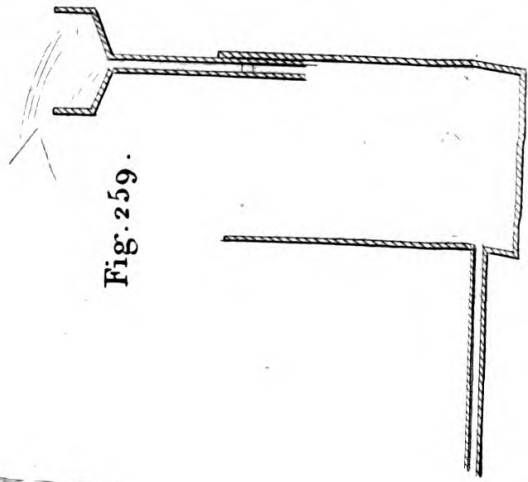


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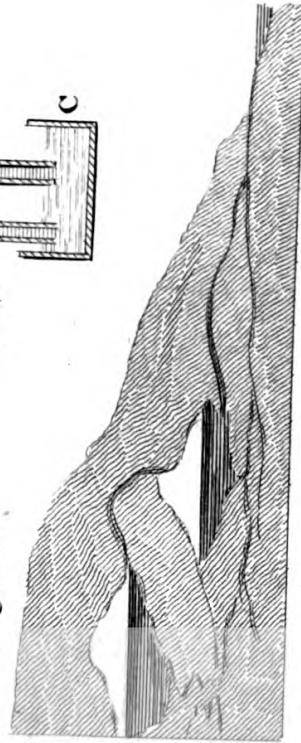


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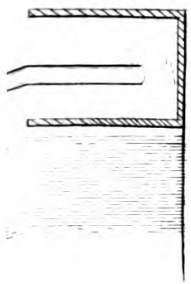


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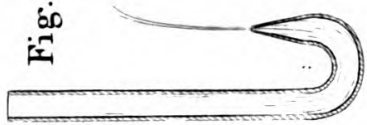


Fig. 262.



Fig. 263.



Fig. 264.

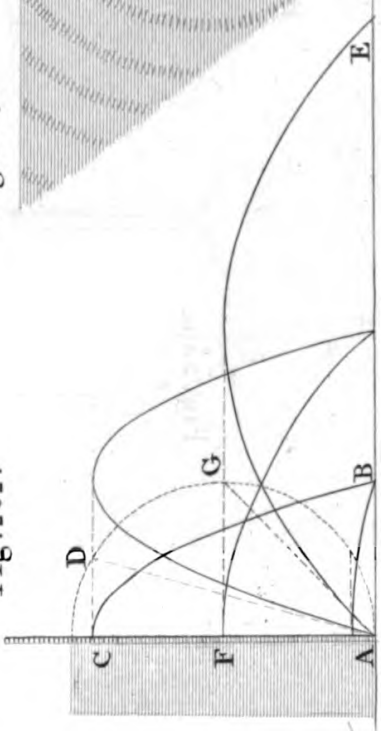


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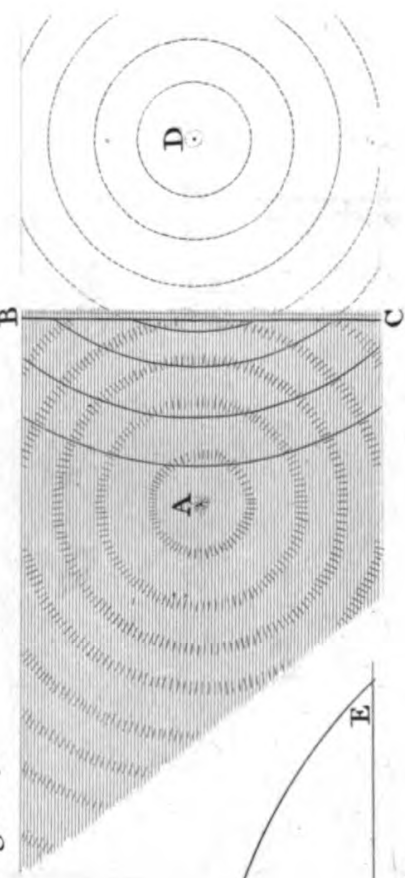


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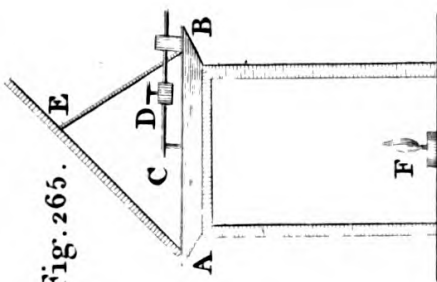


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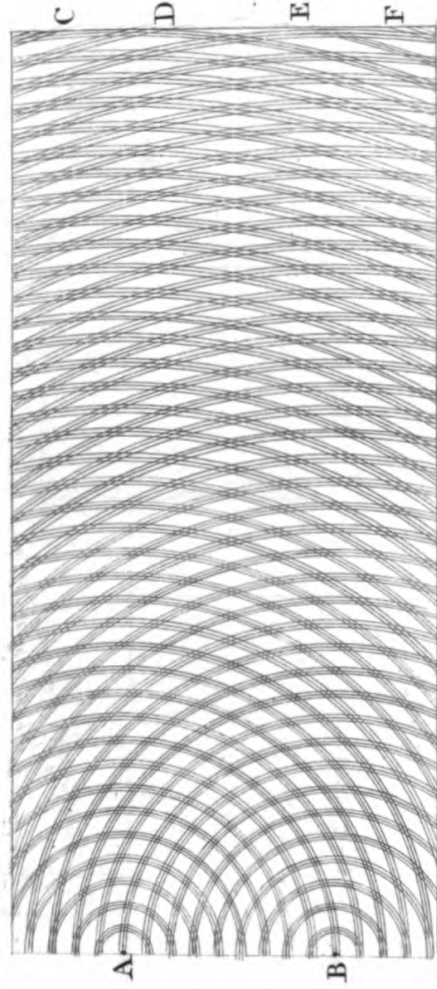


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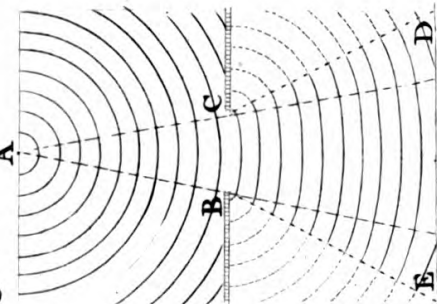
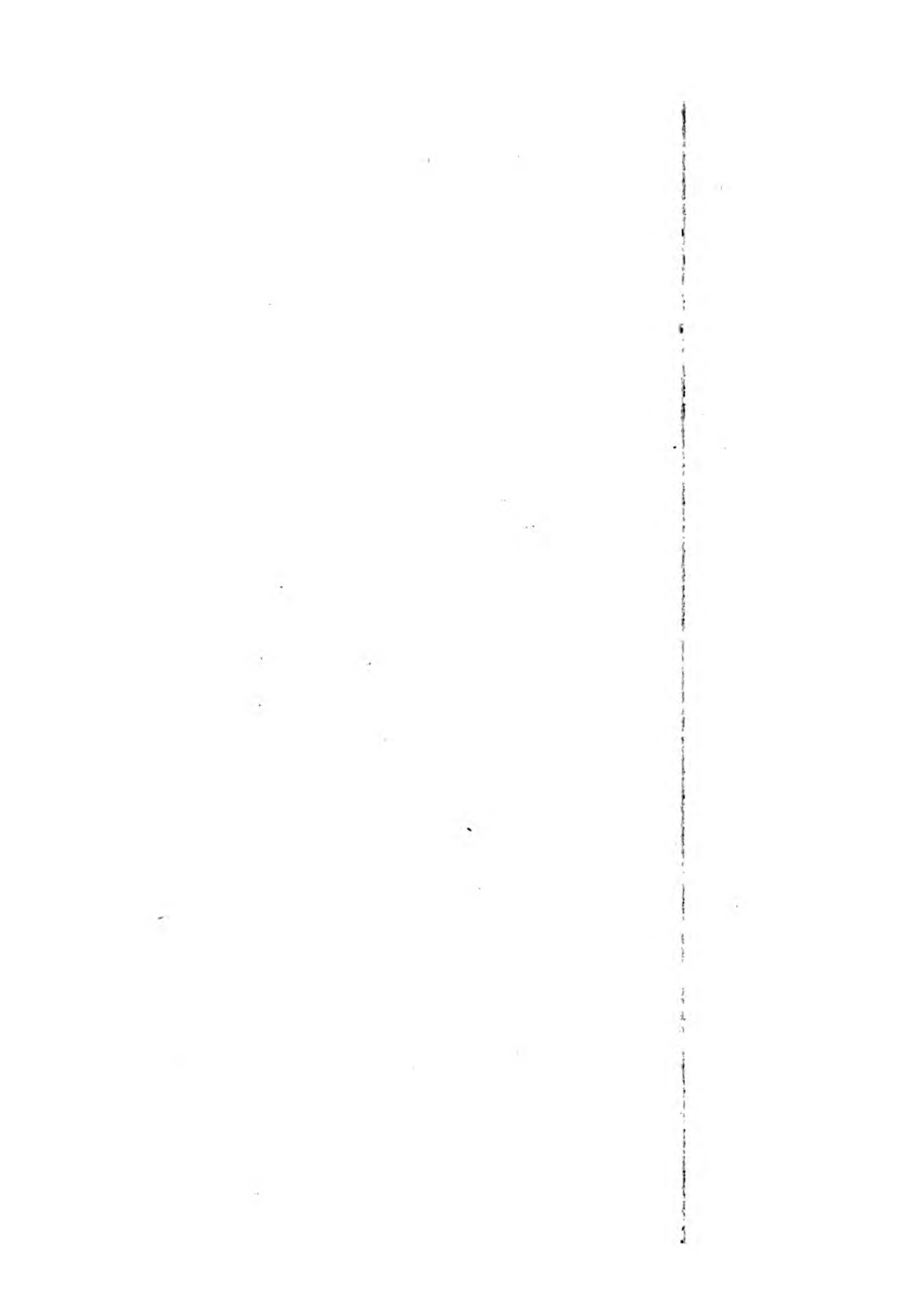


Fig. 269.



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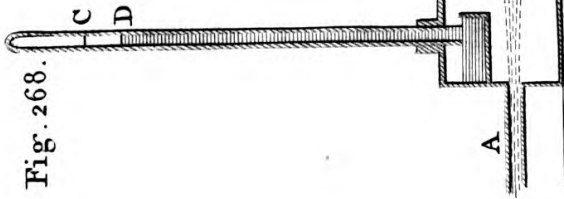


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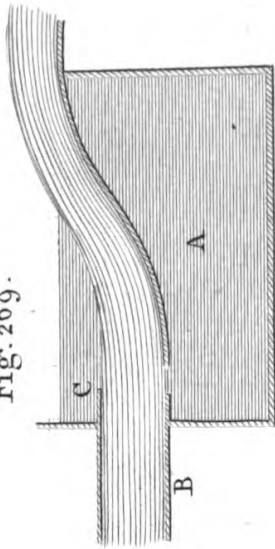


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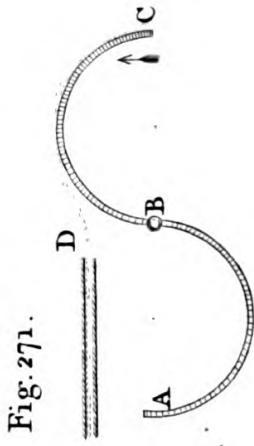


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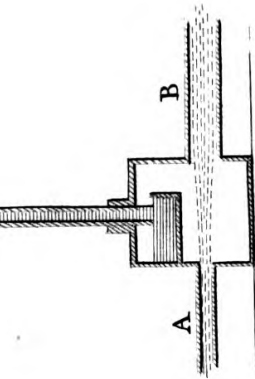


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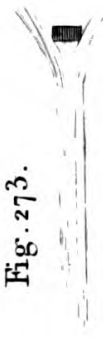


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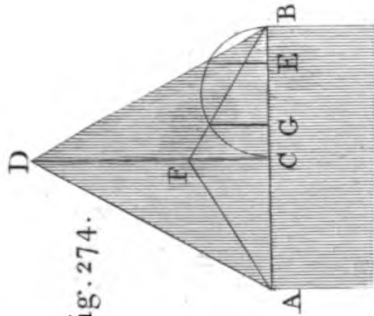


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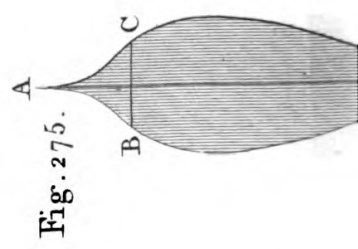


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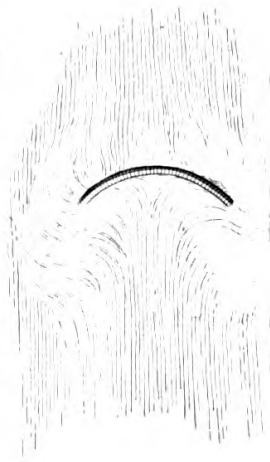


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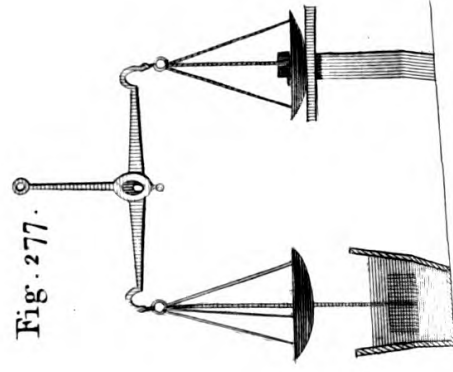


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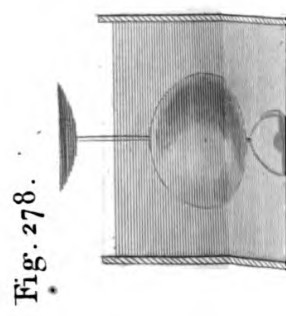


Fig. 278.



Fig. 279.



Fig. 281.



Fig. 282.



Fig. 280.

Fig. 283.

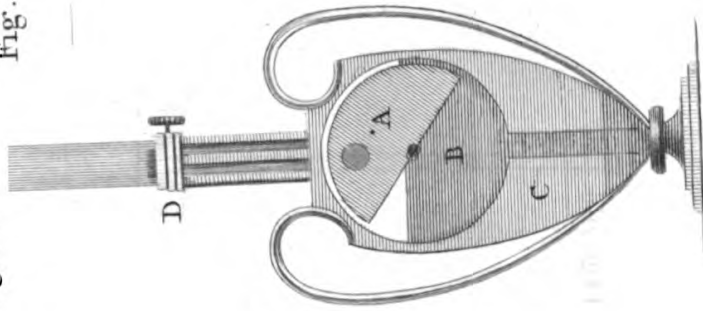


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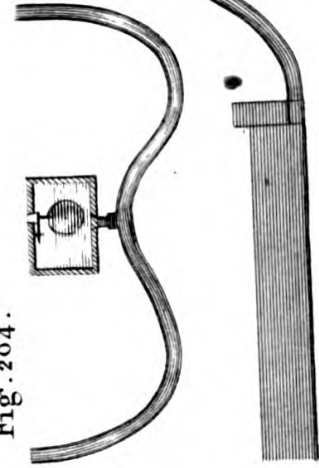


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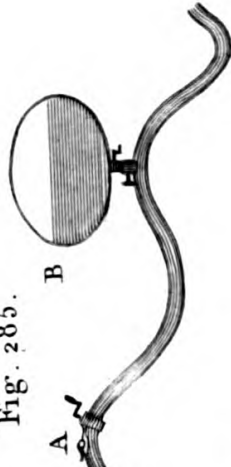


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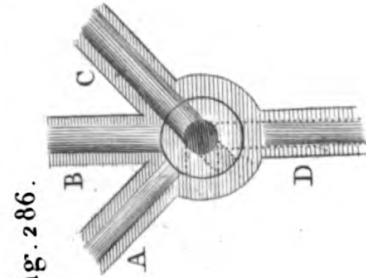


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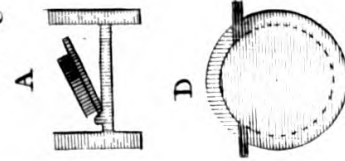


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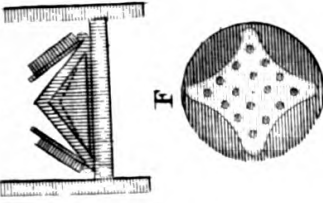
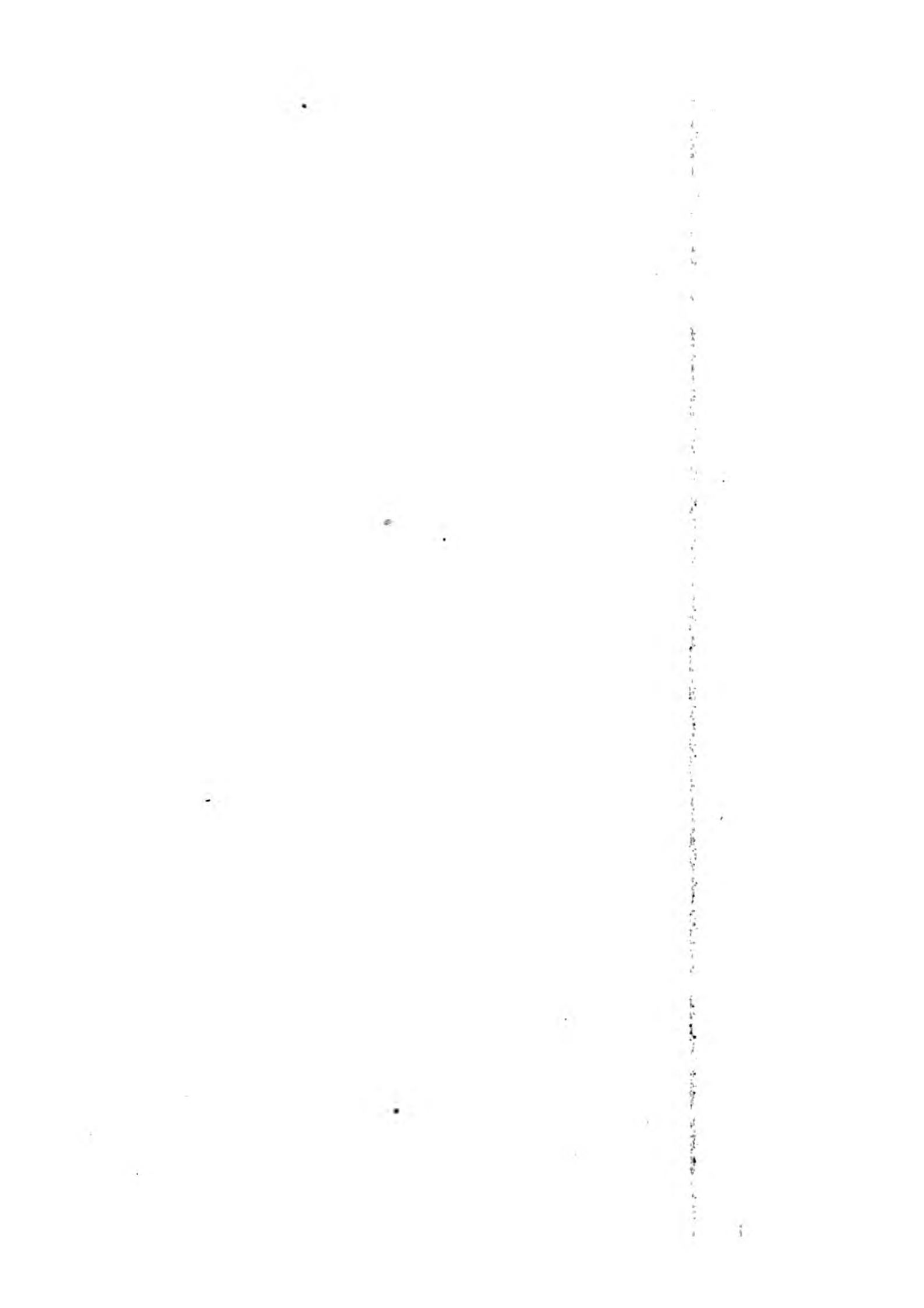


Fig. 289.



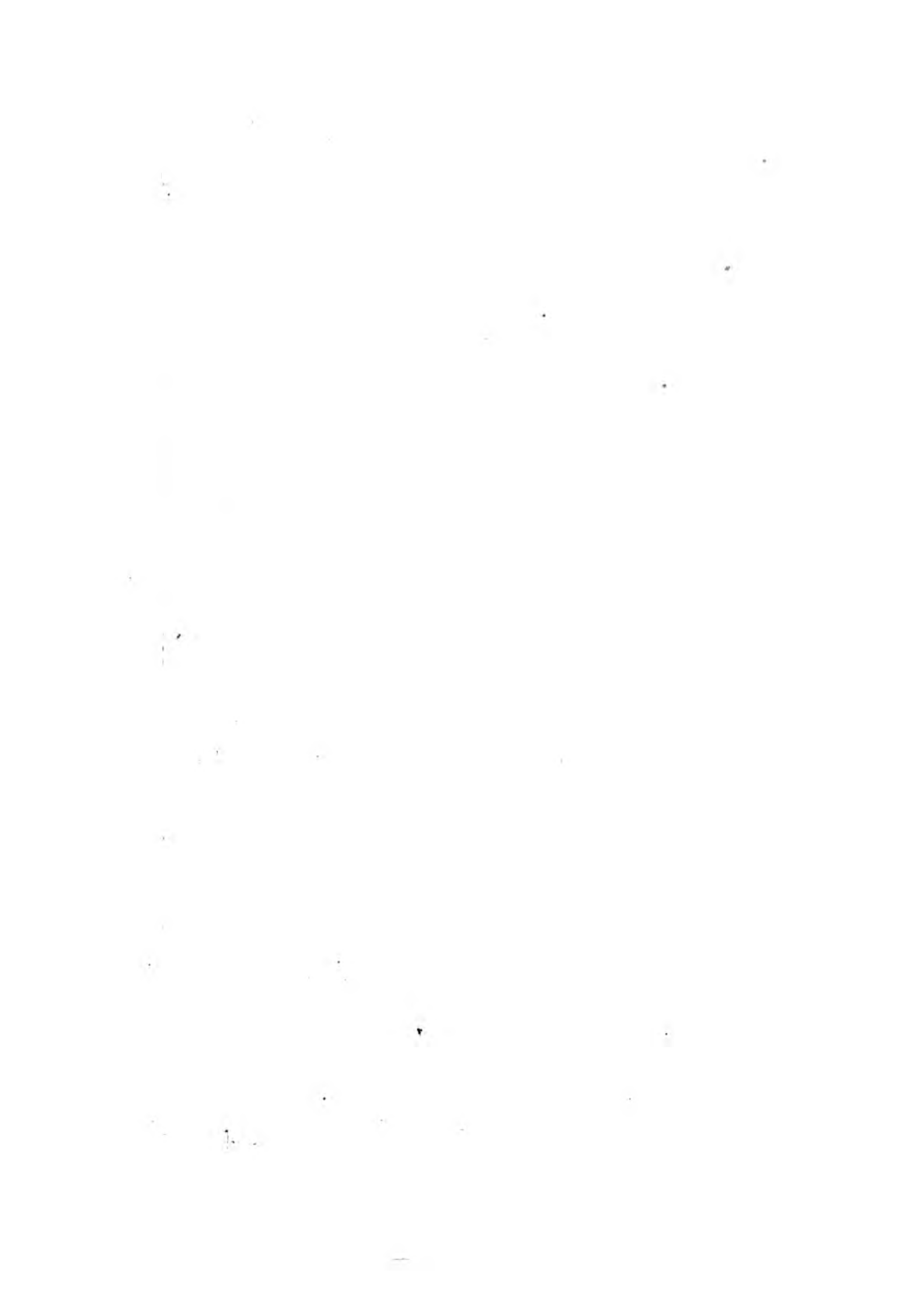


PLATE XXII.

Fig. 288.

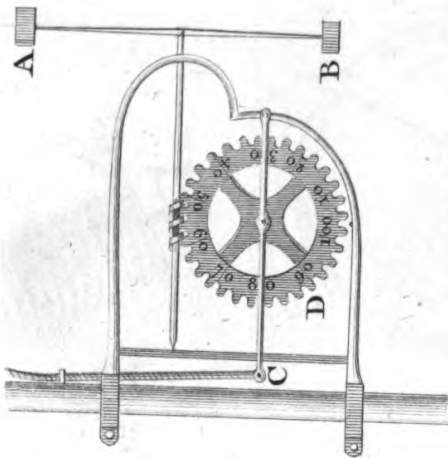


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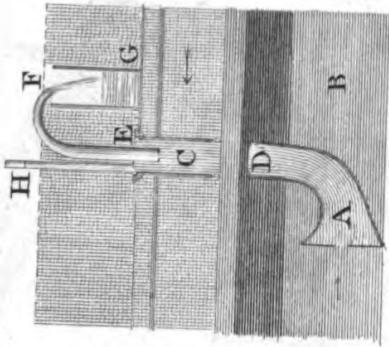


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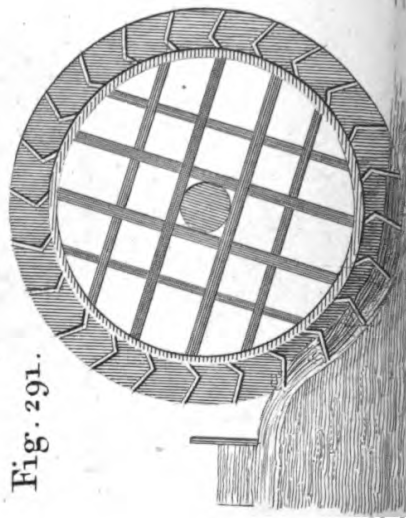


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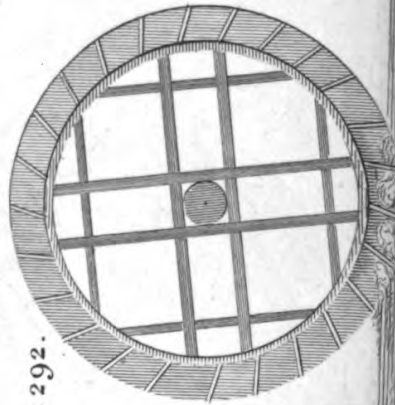


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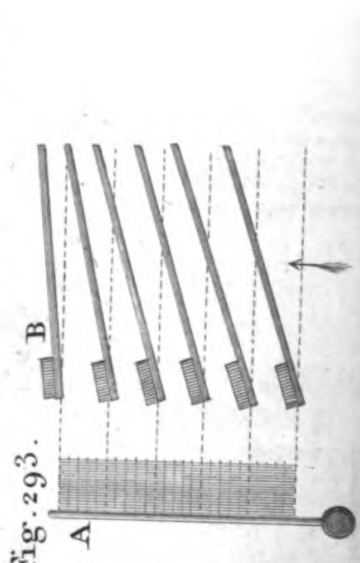


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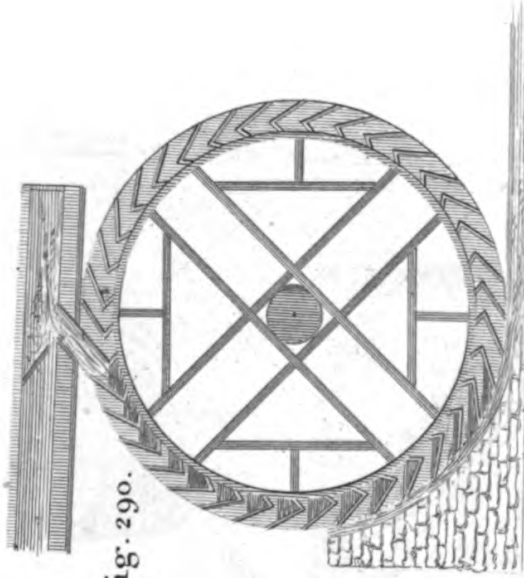


Fig. 205.

Fig. 206.

Fig. 299.



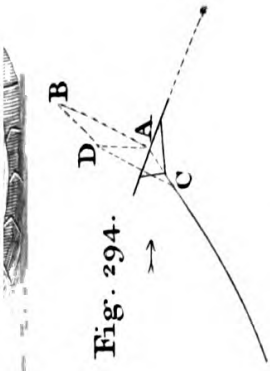


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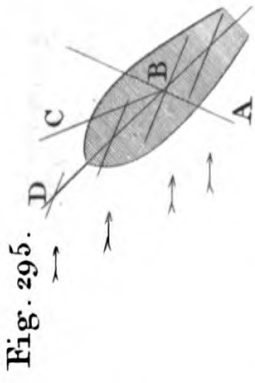


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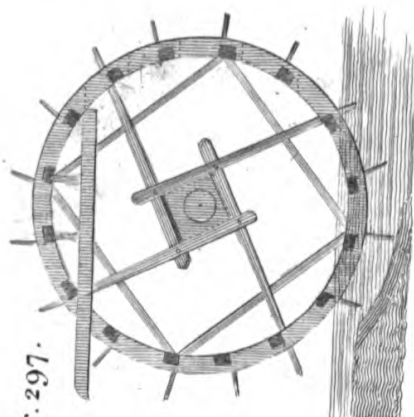


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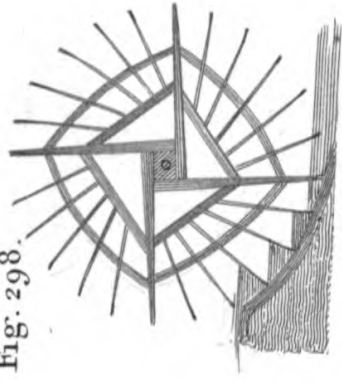


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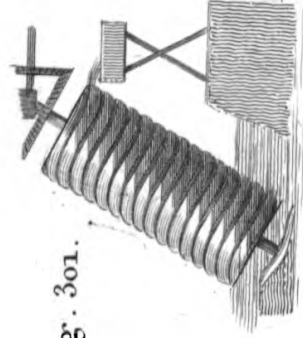


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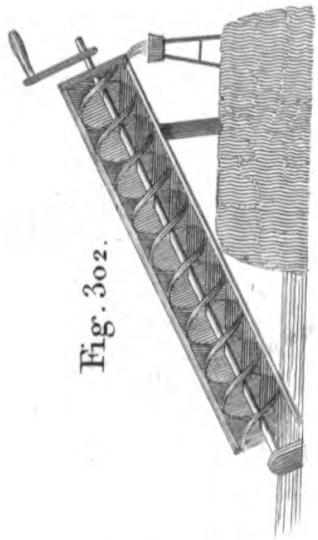


Fig. 302.



Fig. 300.

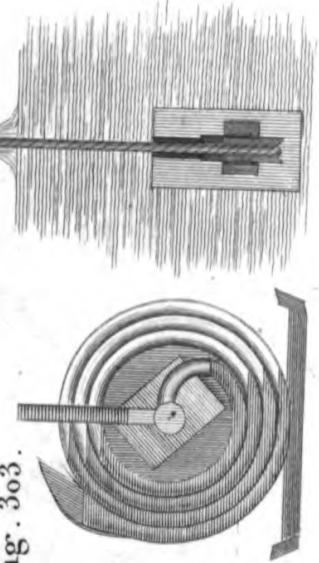


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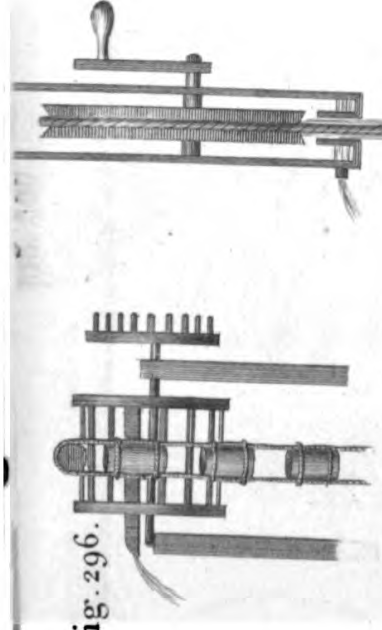


Fig. 296.

1880-1881

Fig. 304.

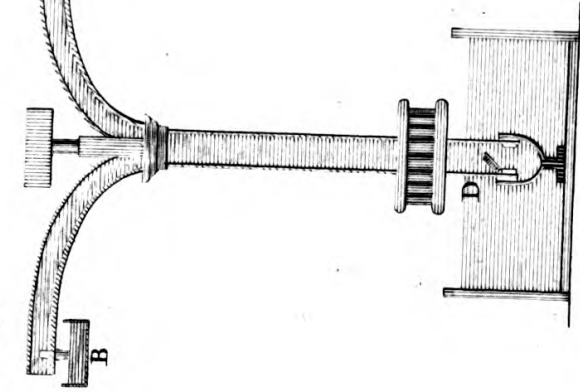


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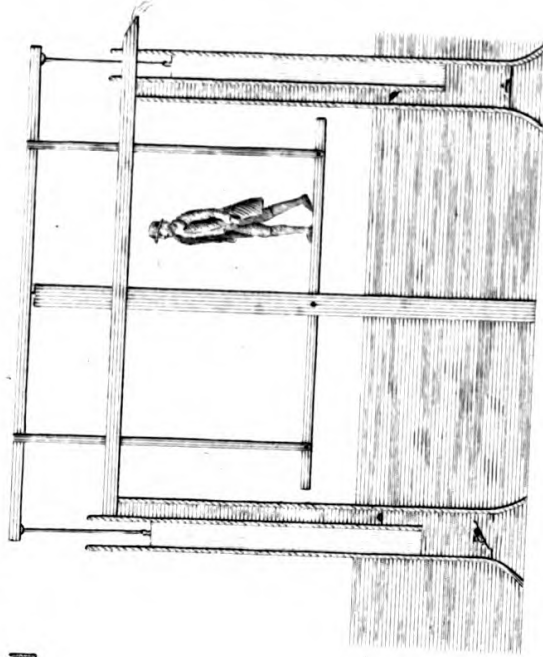


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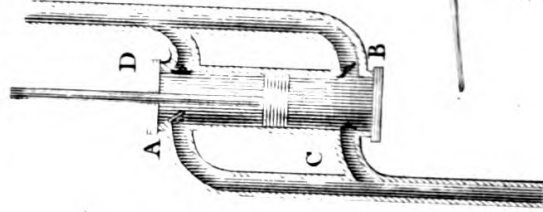


Fig. 307.



Fig. 308.

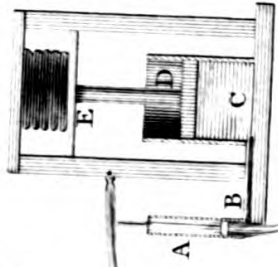


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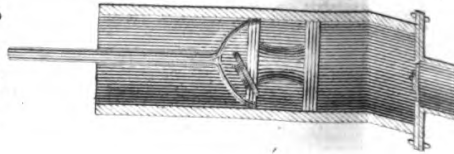


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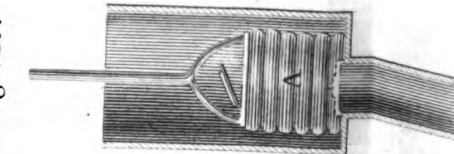


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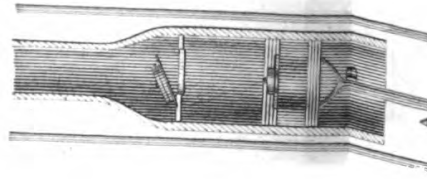


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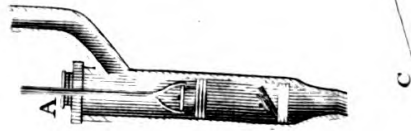


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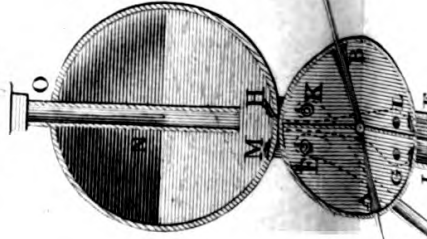
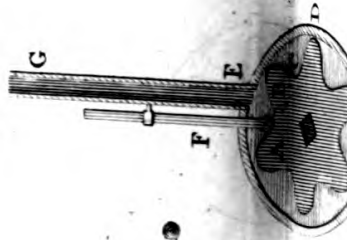


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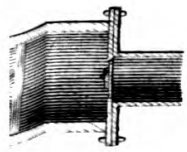


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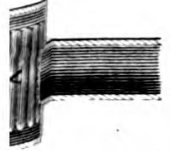


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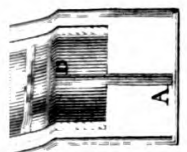


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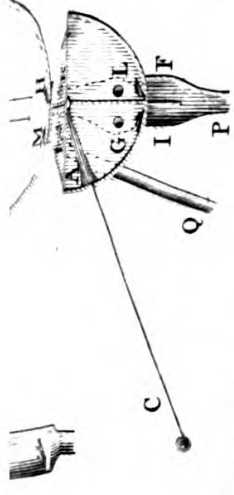


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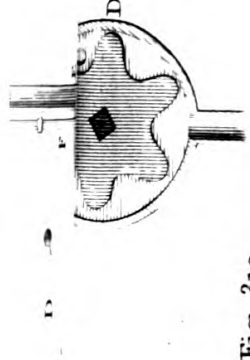


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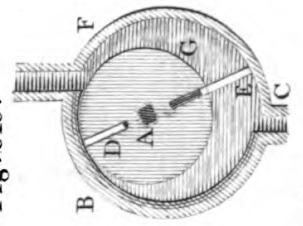


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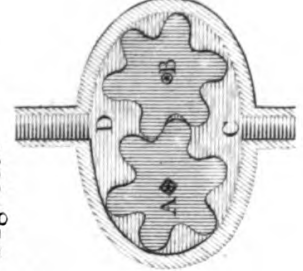


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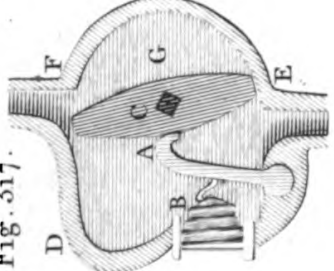


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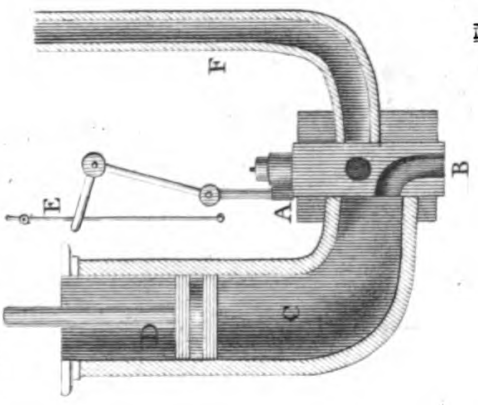


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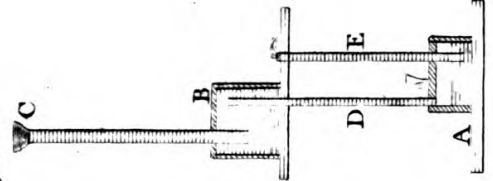


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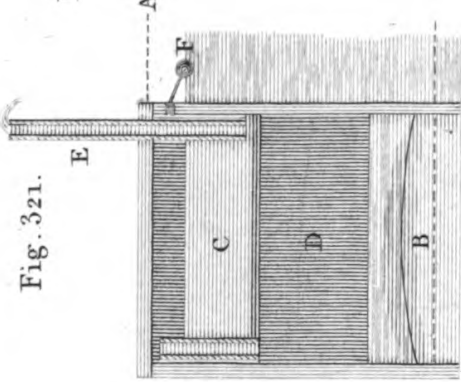


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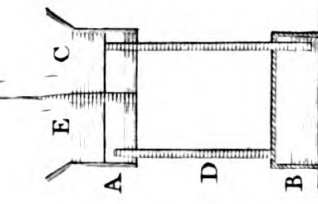


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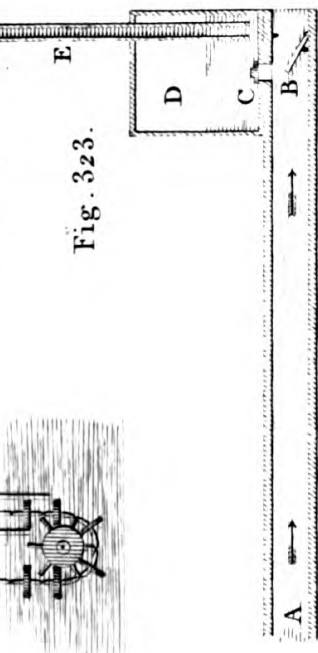


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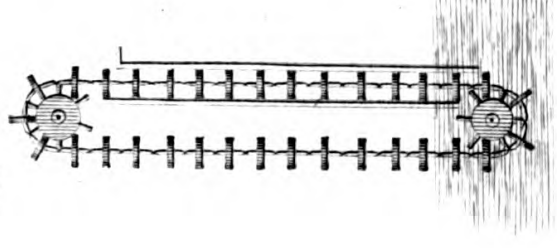
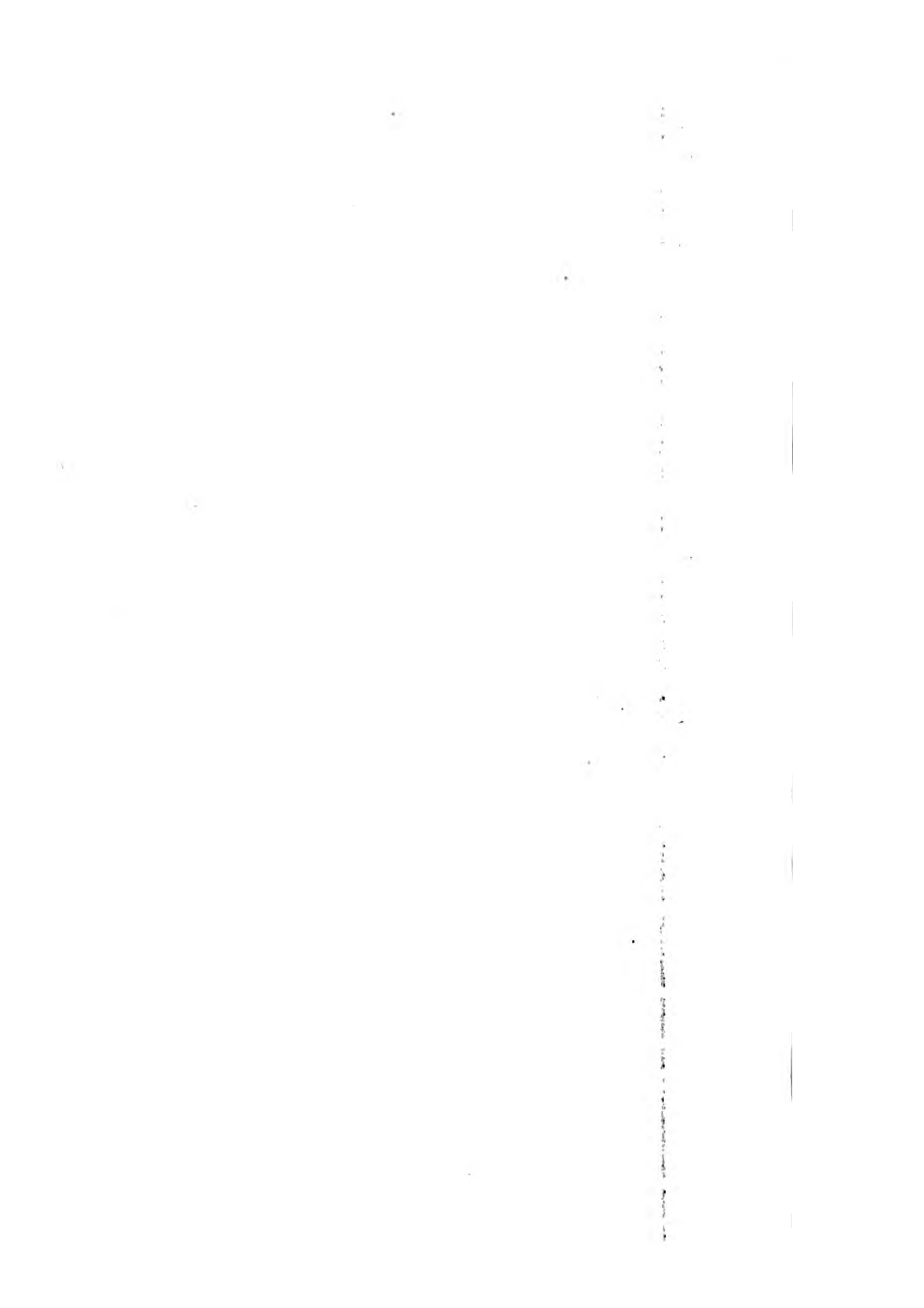


Fig. 328.



Fig. 329.



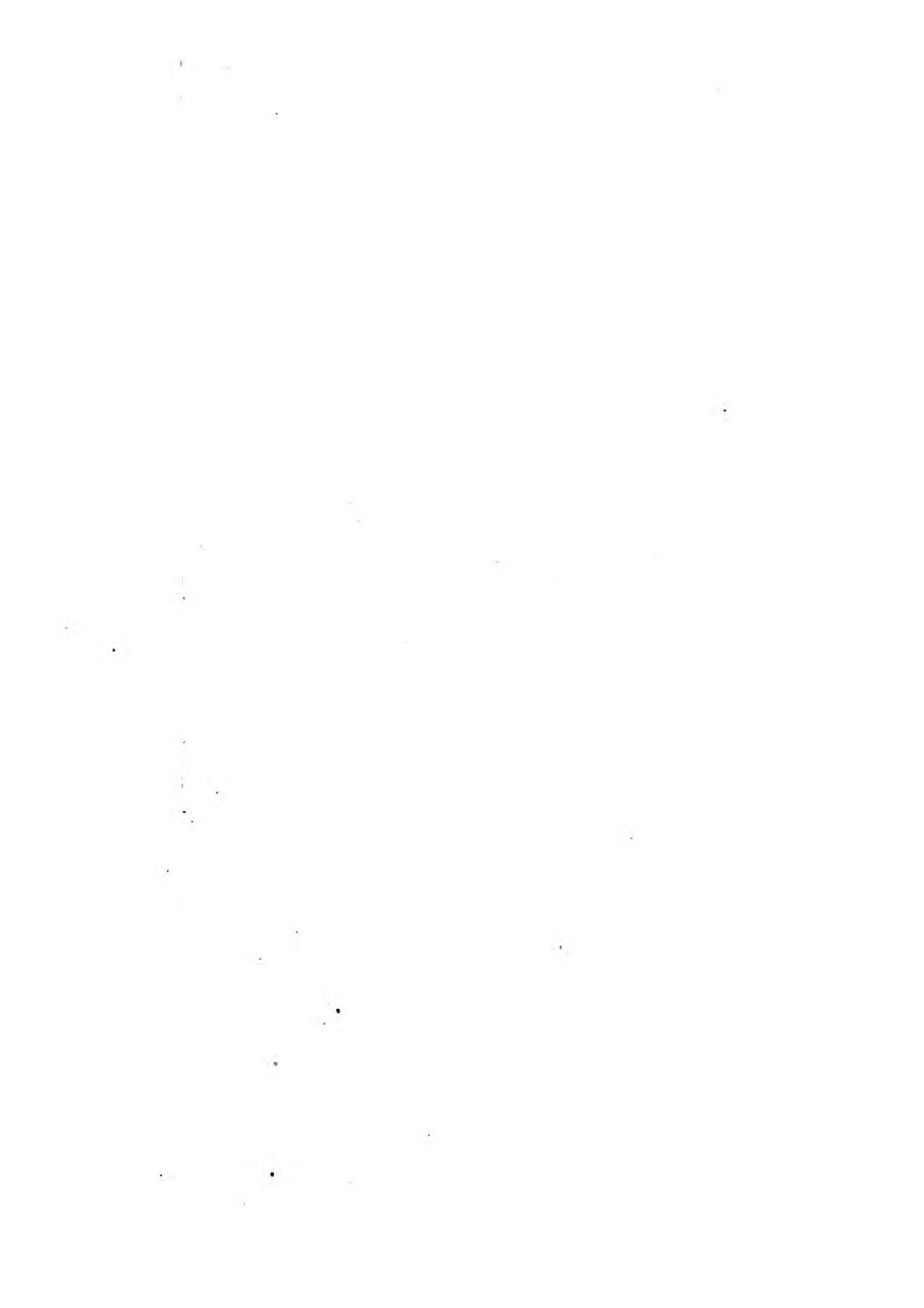


PLATE XXIV.

Fig. 324.

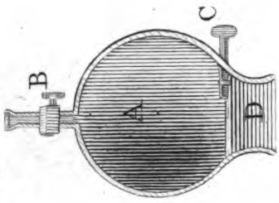


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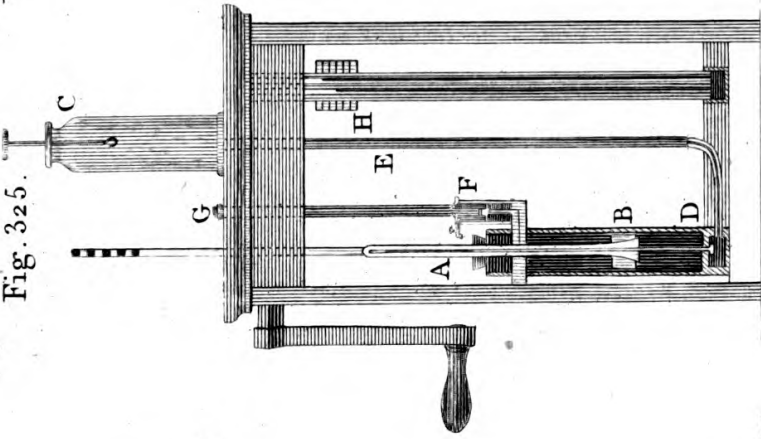


Fig. 327.



Fig. 329.

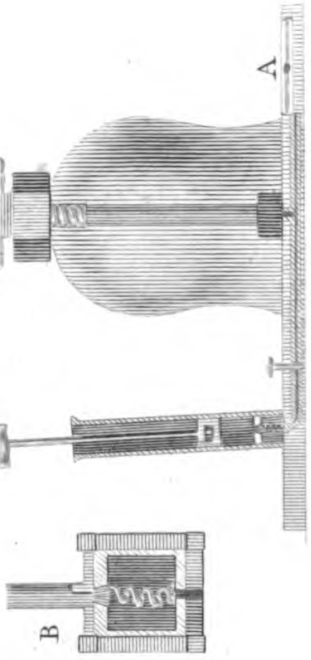


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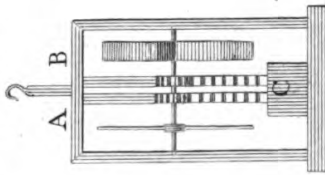


Fig. 328.



Fig. 333.

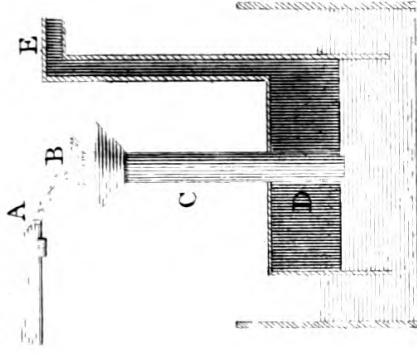


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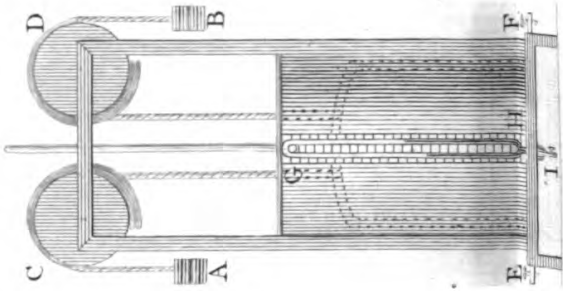


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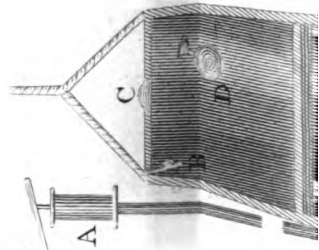


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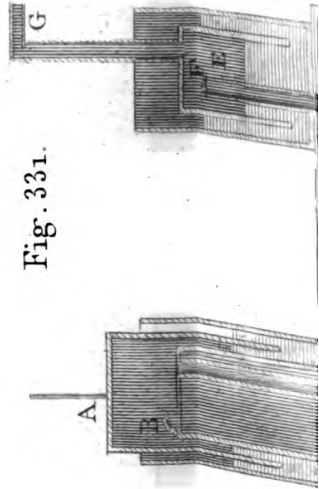
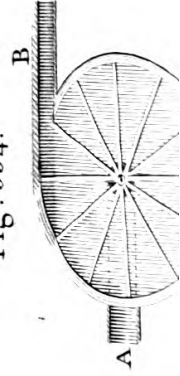


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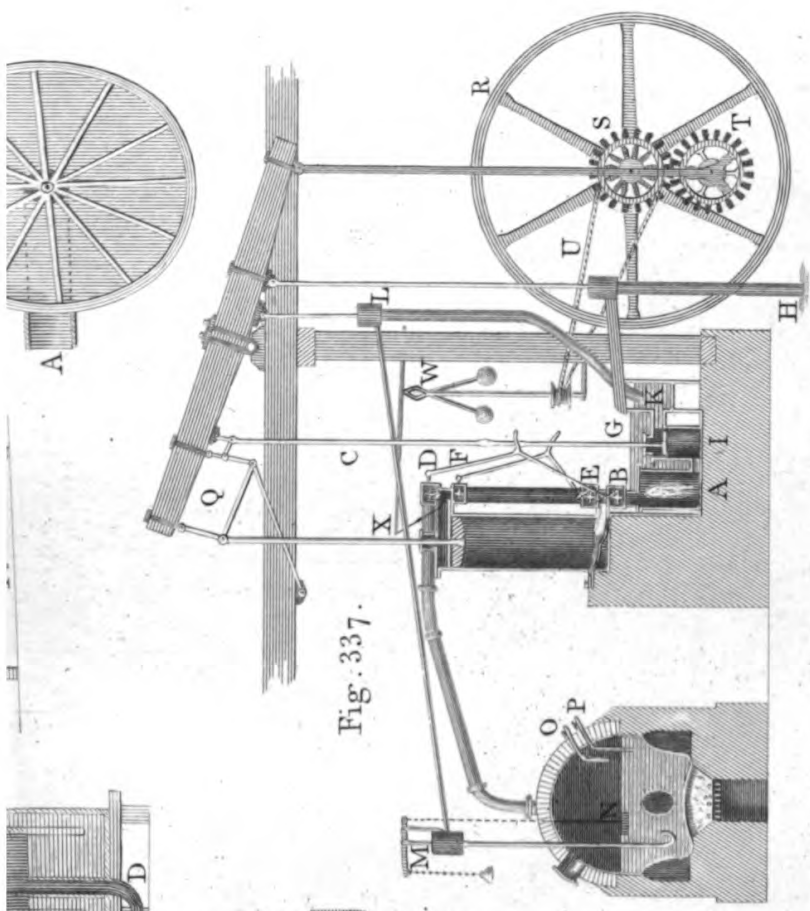


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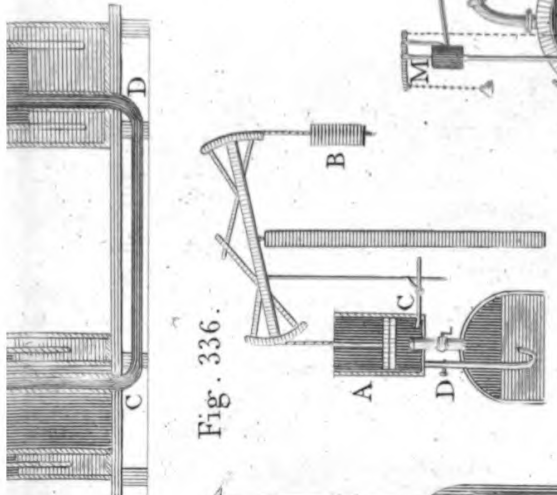


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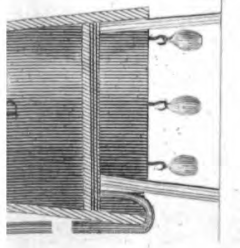


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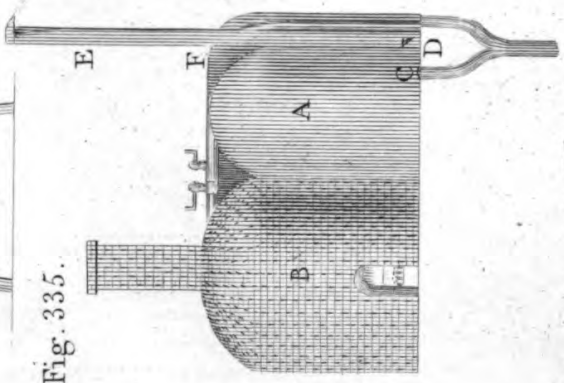


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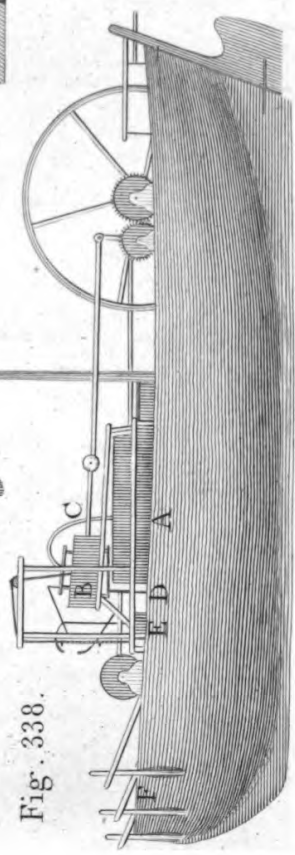


Fig. 339.

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PLATE XXV.

Fig. 340.

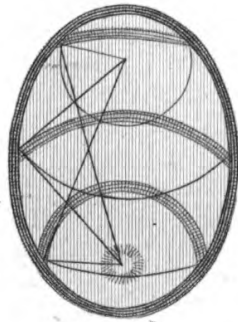


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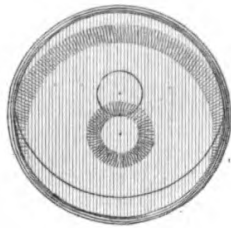


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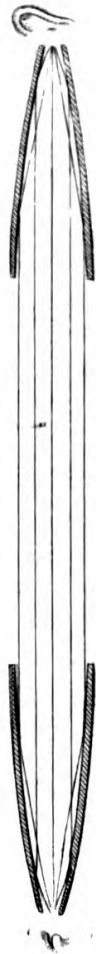


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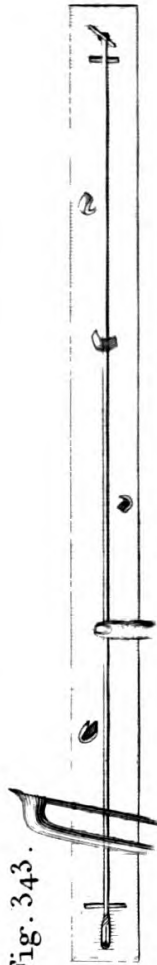


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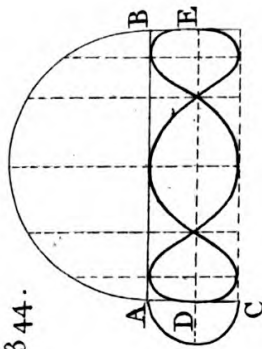


Fig. 345.



Fig. 346.

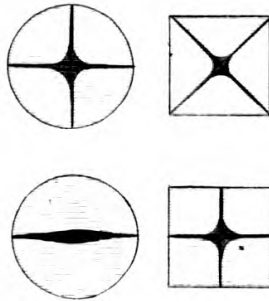


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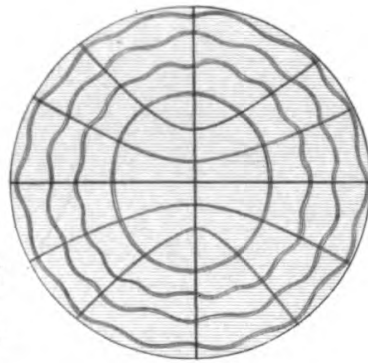


Fig. 348.



Fig. 349.

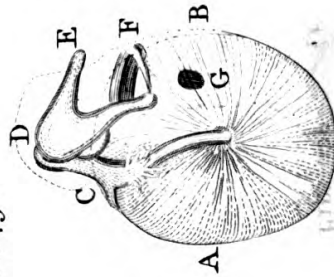


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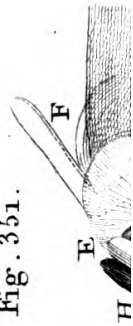


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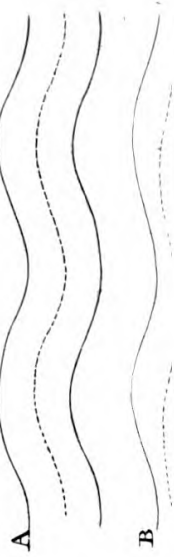


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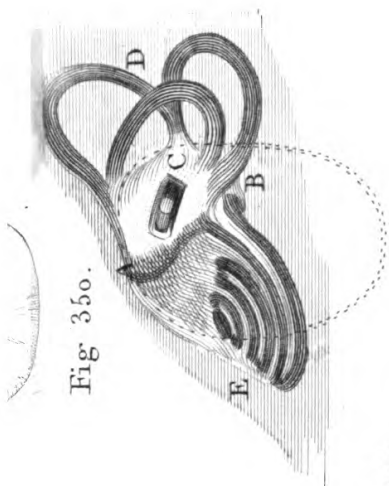


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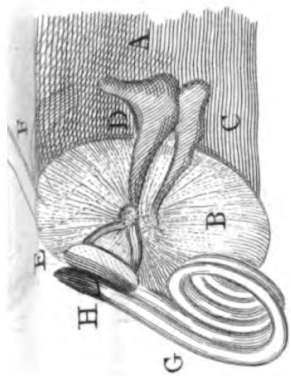


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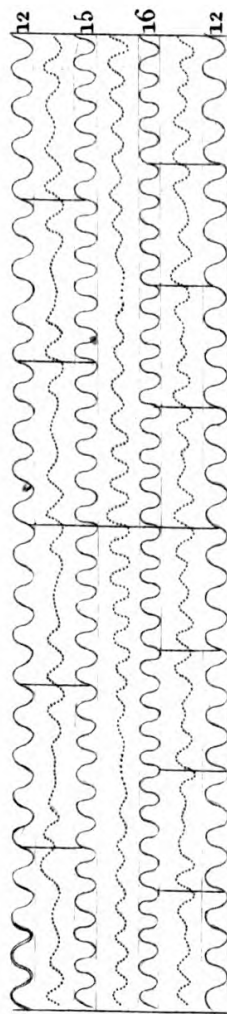


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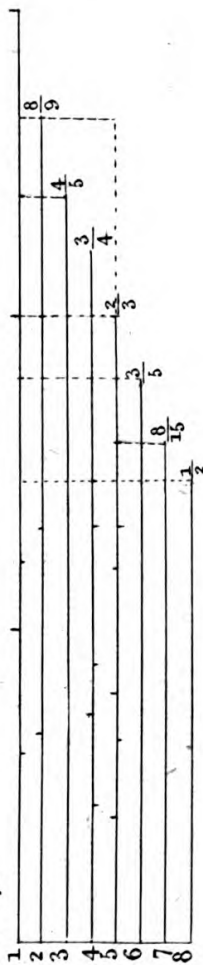


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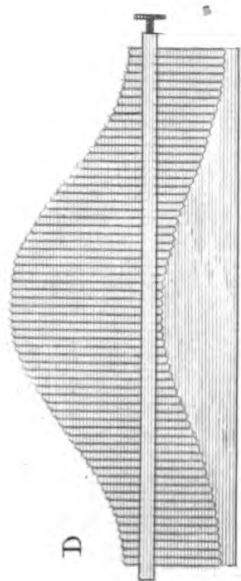
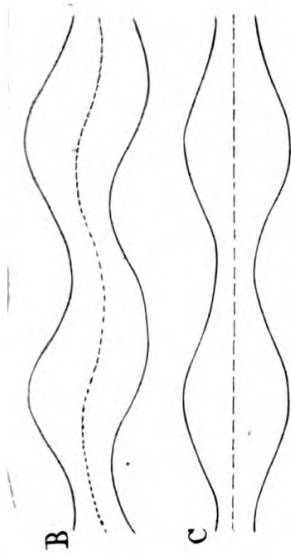
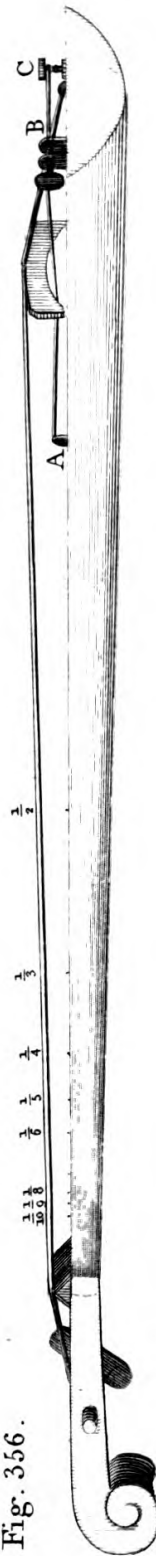
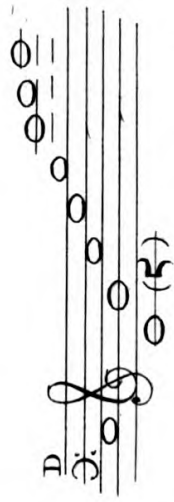
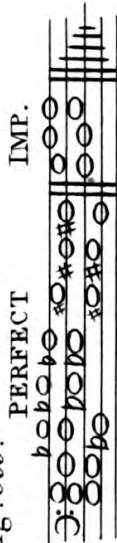


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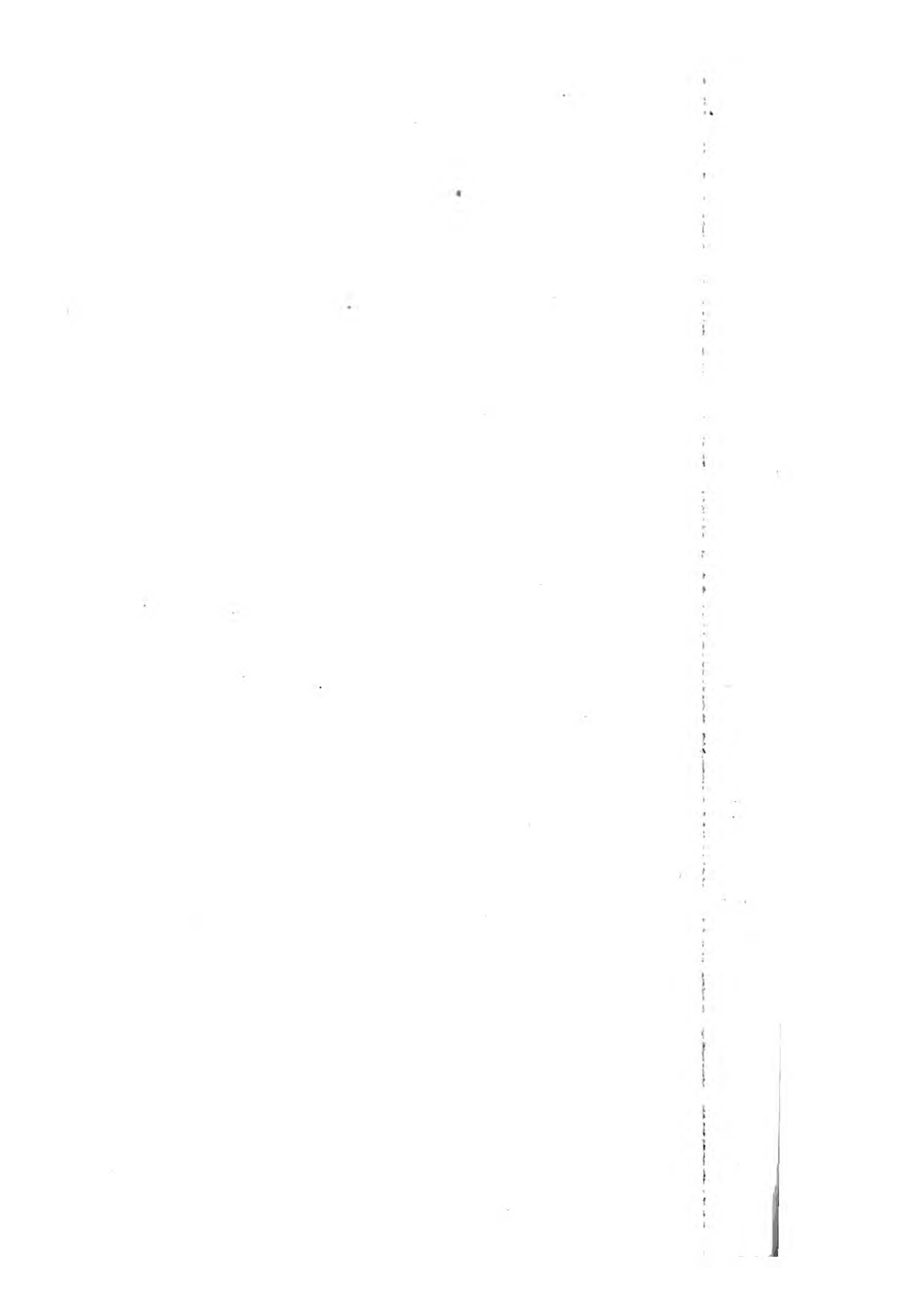




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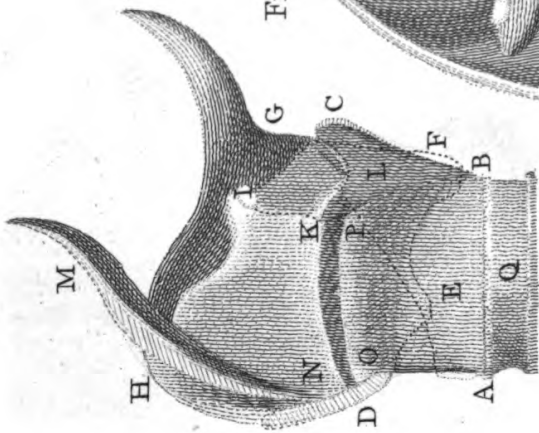


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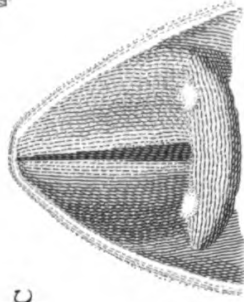


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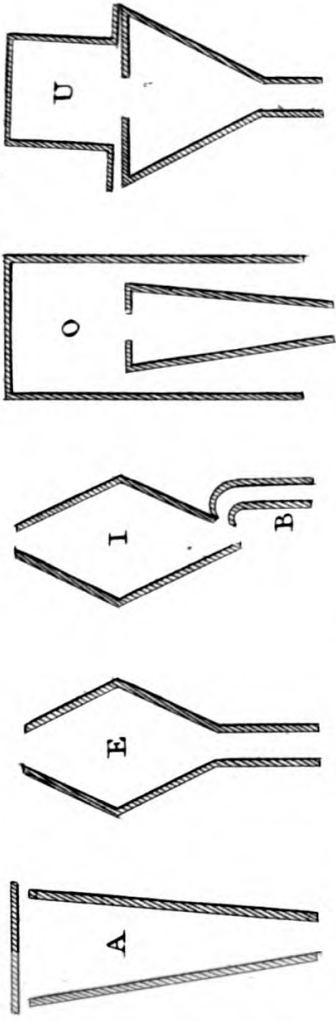


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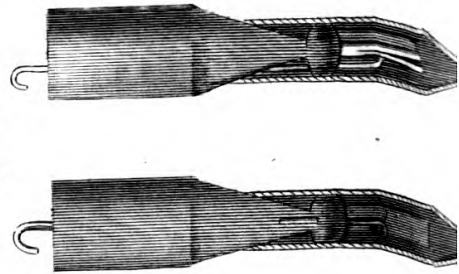


Fig. 361.



Fig. 362.



Fig. 363.

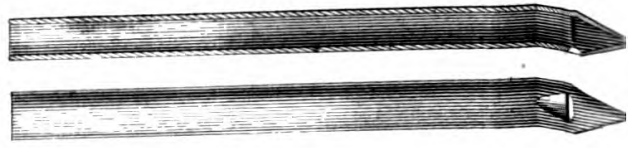


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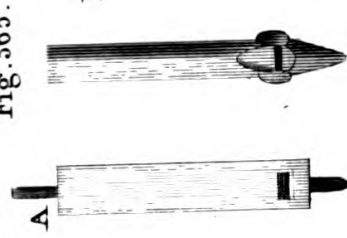


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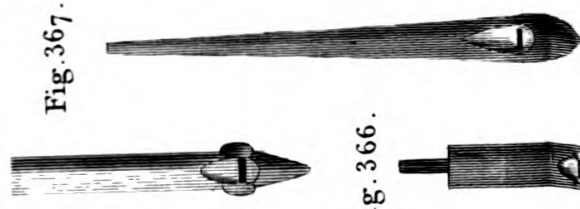


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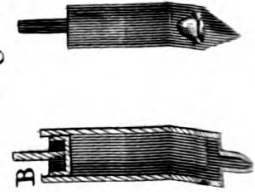
Fig. 367.



Fig. 368.



Fig. 366.



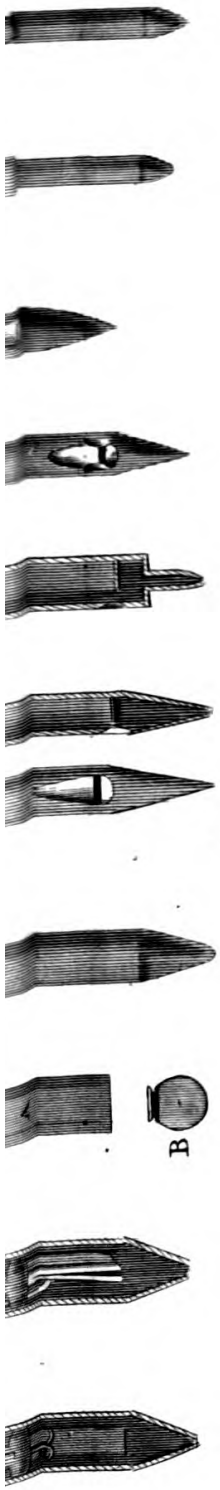


Fig. 369.

Fig. 370.

Fig. 371.

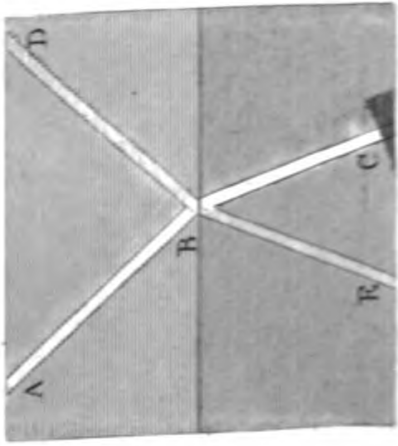
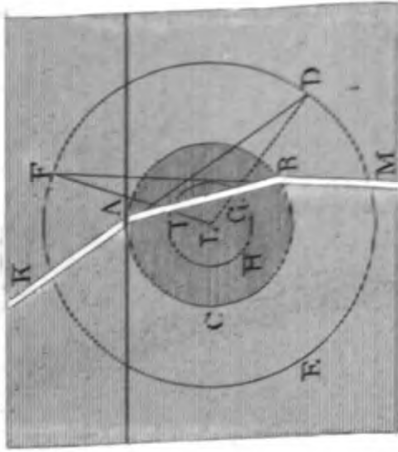
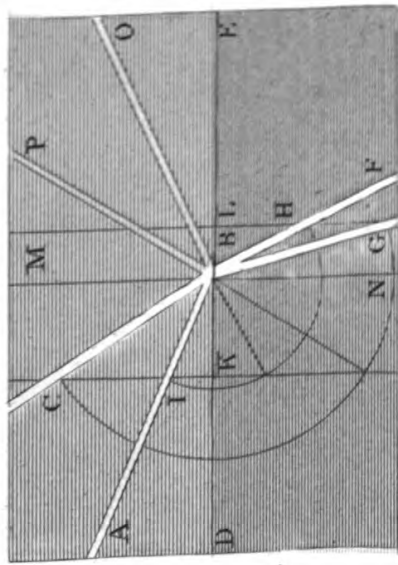
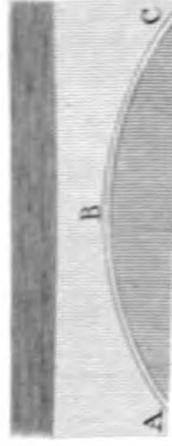
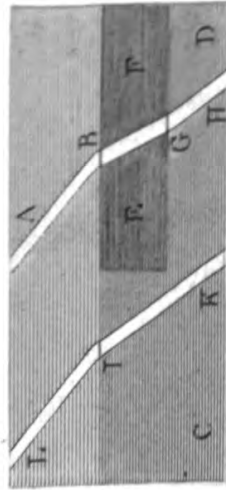
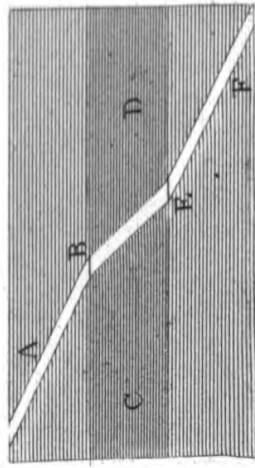


Fig. 372.

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PLATE XXVII.

Fig. 375.



Fig. 378.

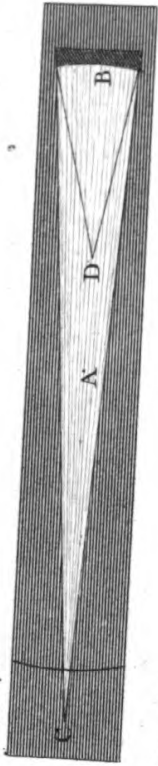


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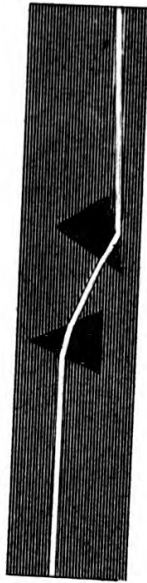


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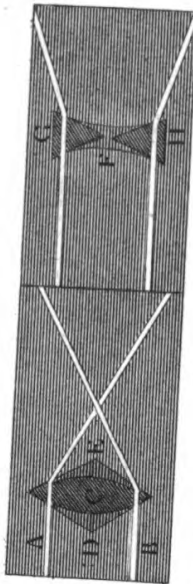


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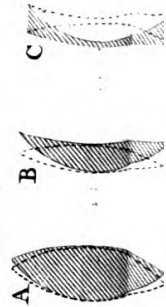


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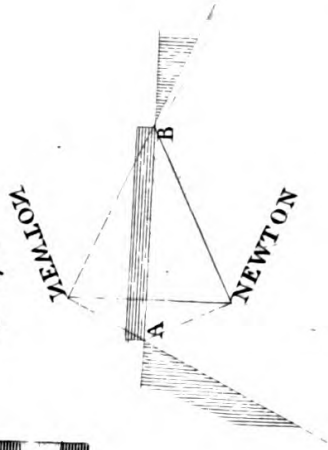


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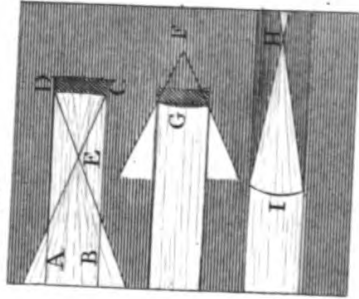


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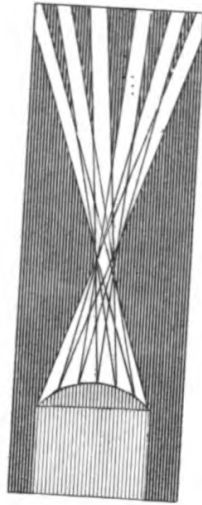


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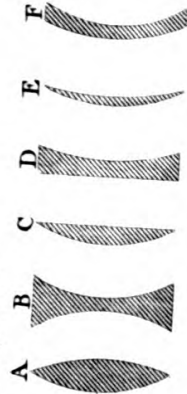


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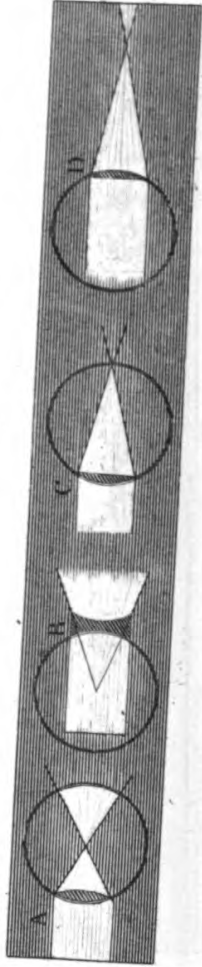


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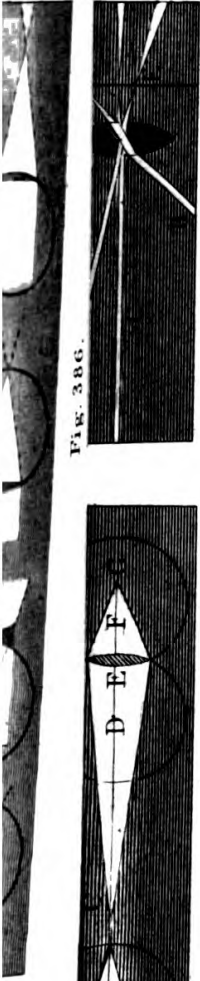


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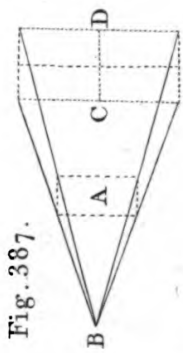


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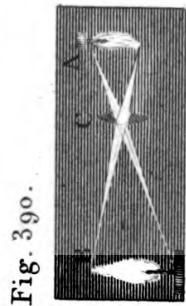


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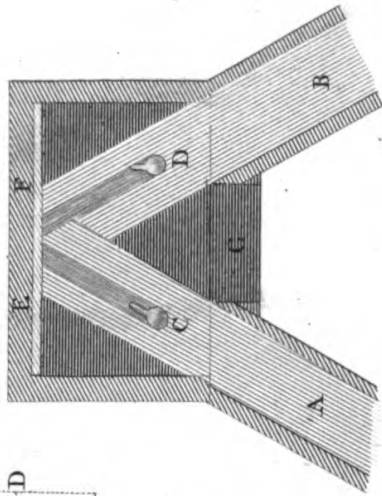


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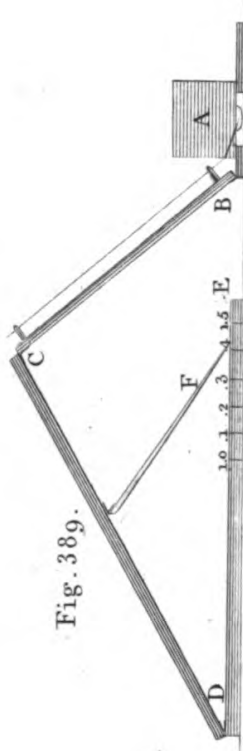


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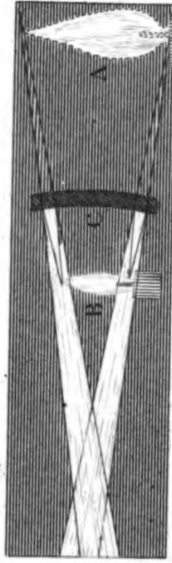


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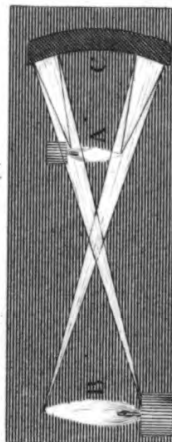


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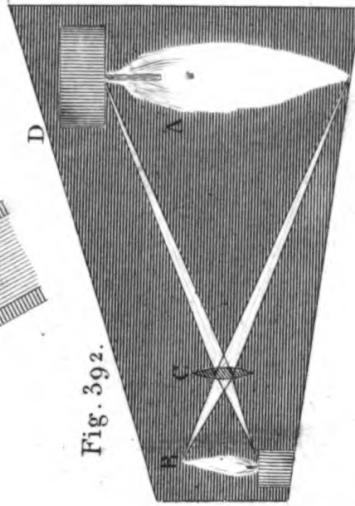


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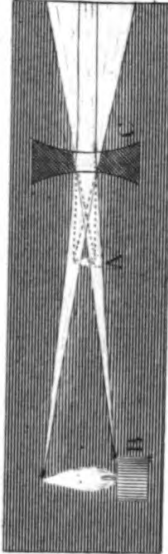


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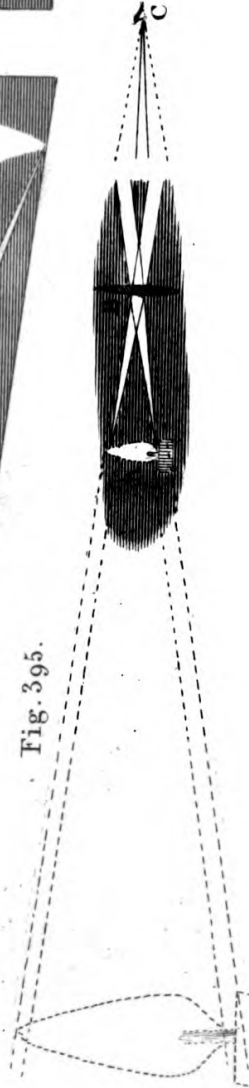
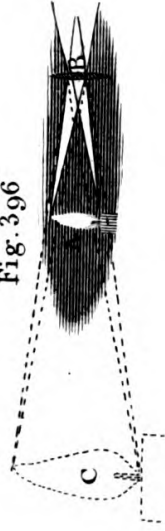


Fig. 396.



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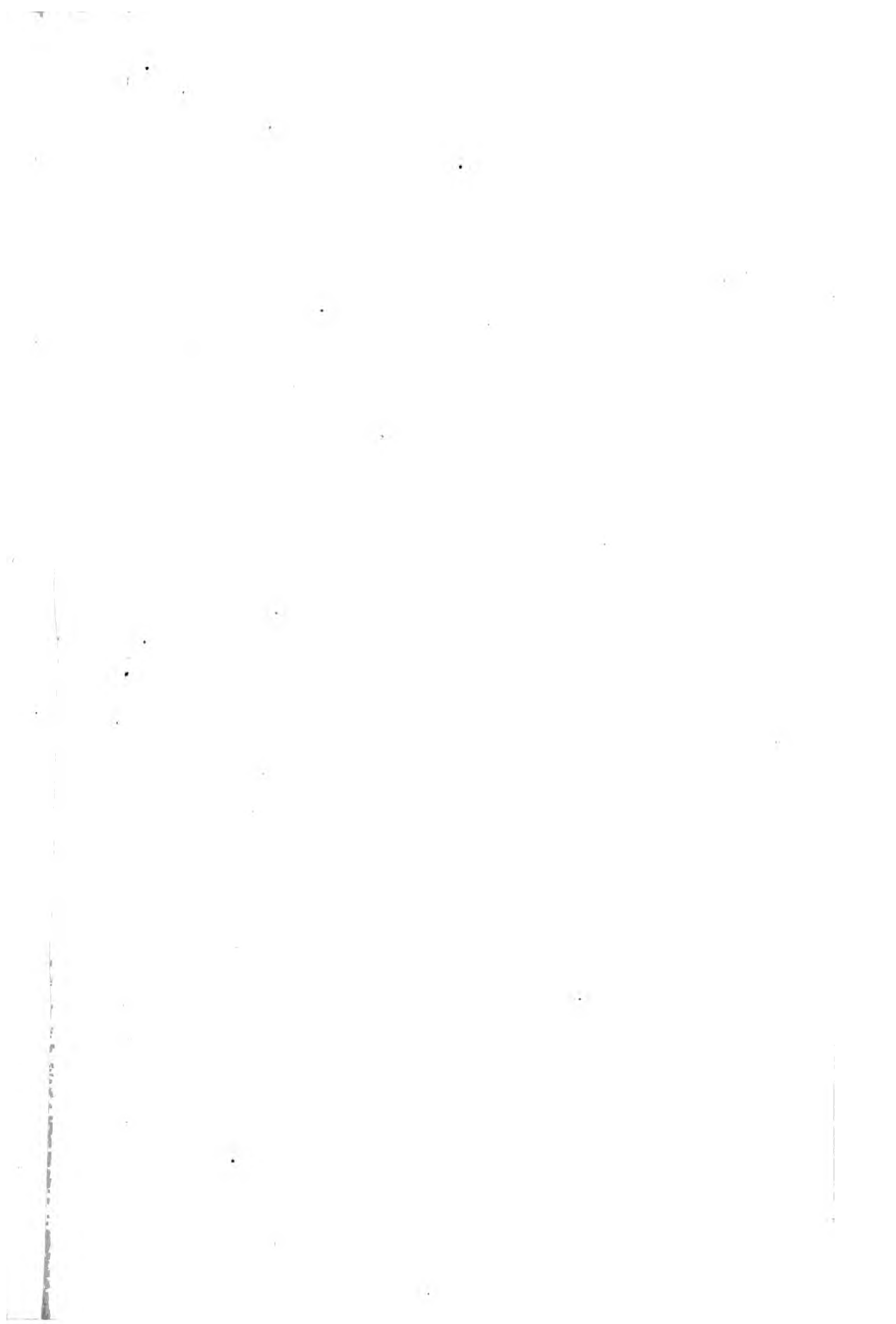


PLATE XXVIII.

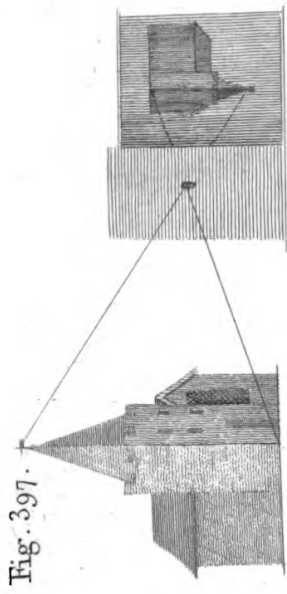


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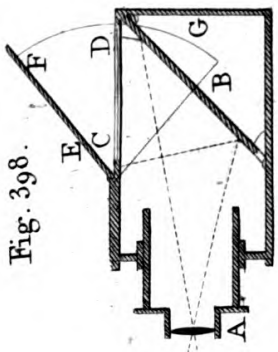


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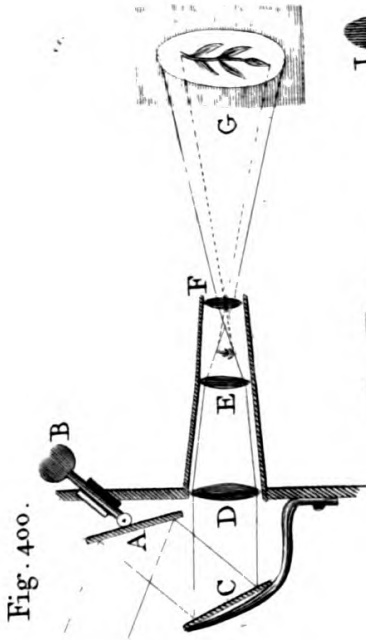


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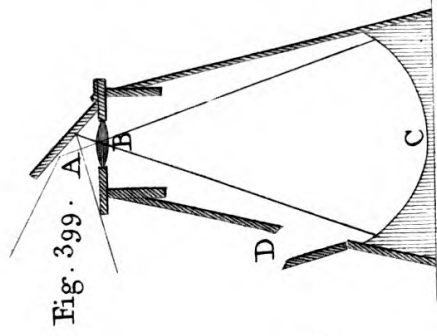


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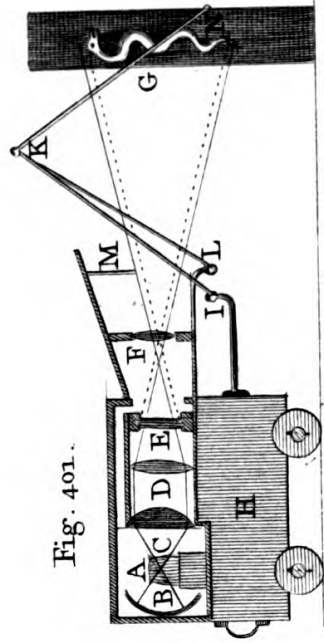


Fig. 401.



Fig. 402.

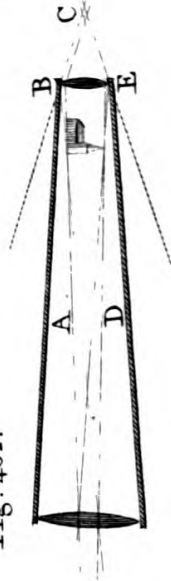


Fig. 403.



Fig. 404.

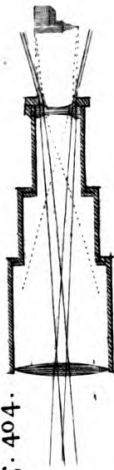


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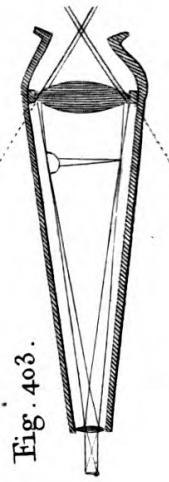


Fig. 406.

Fig. 407.



Fig. 408.

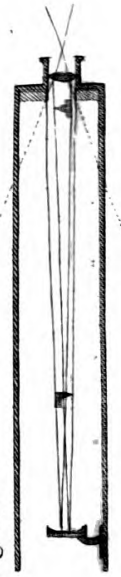


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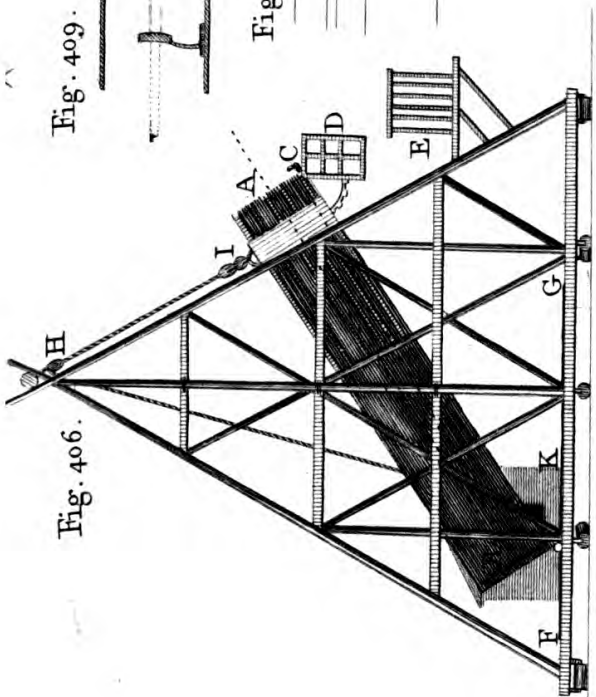


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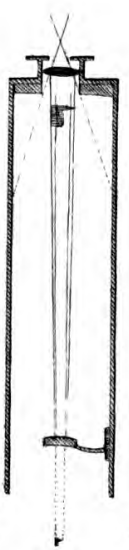


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Fig. 411.

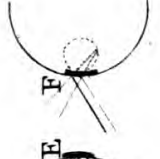
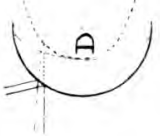
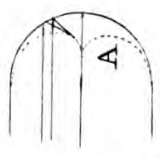


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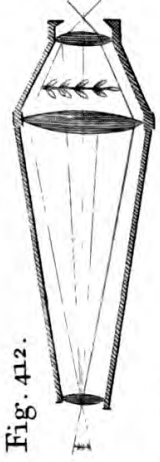


Fig. 412.



Fig. 414.

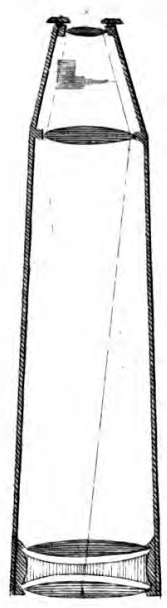


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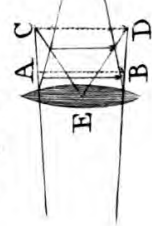
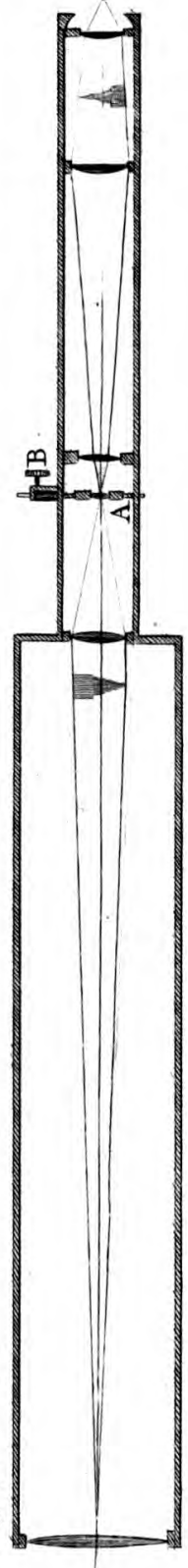
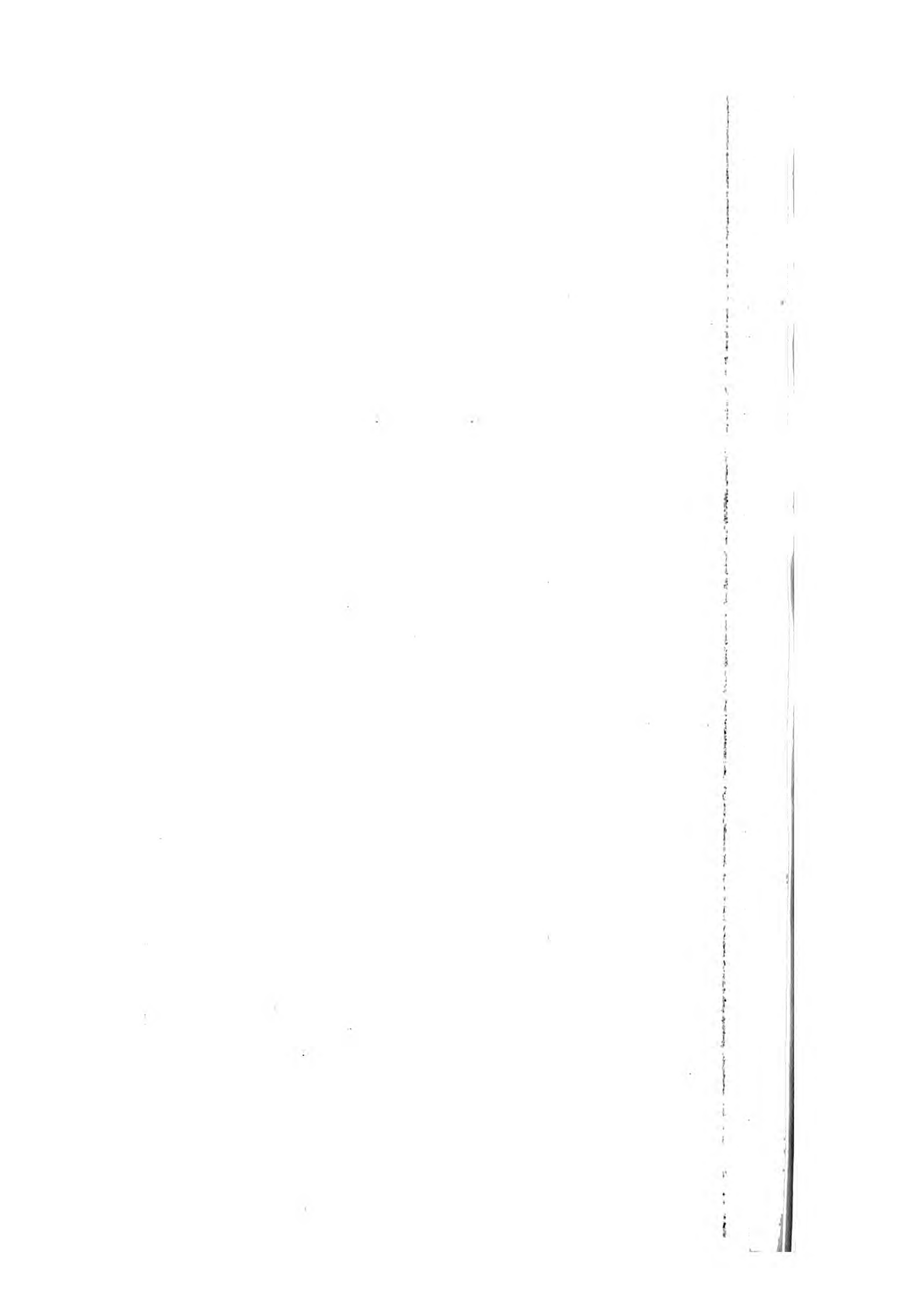


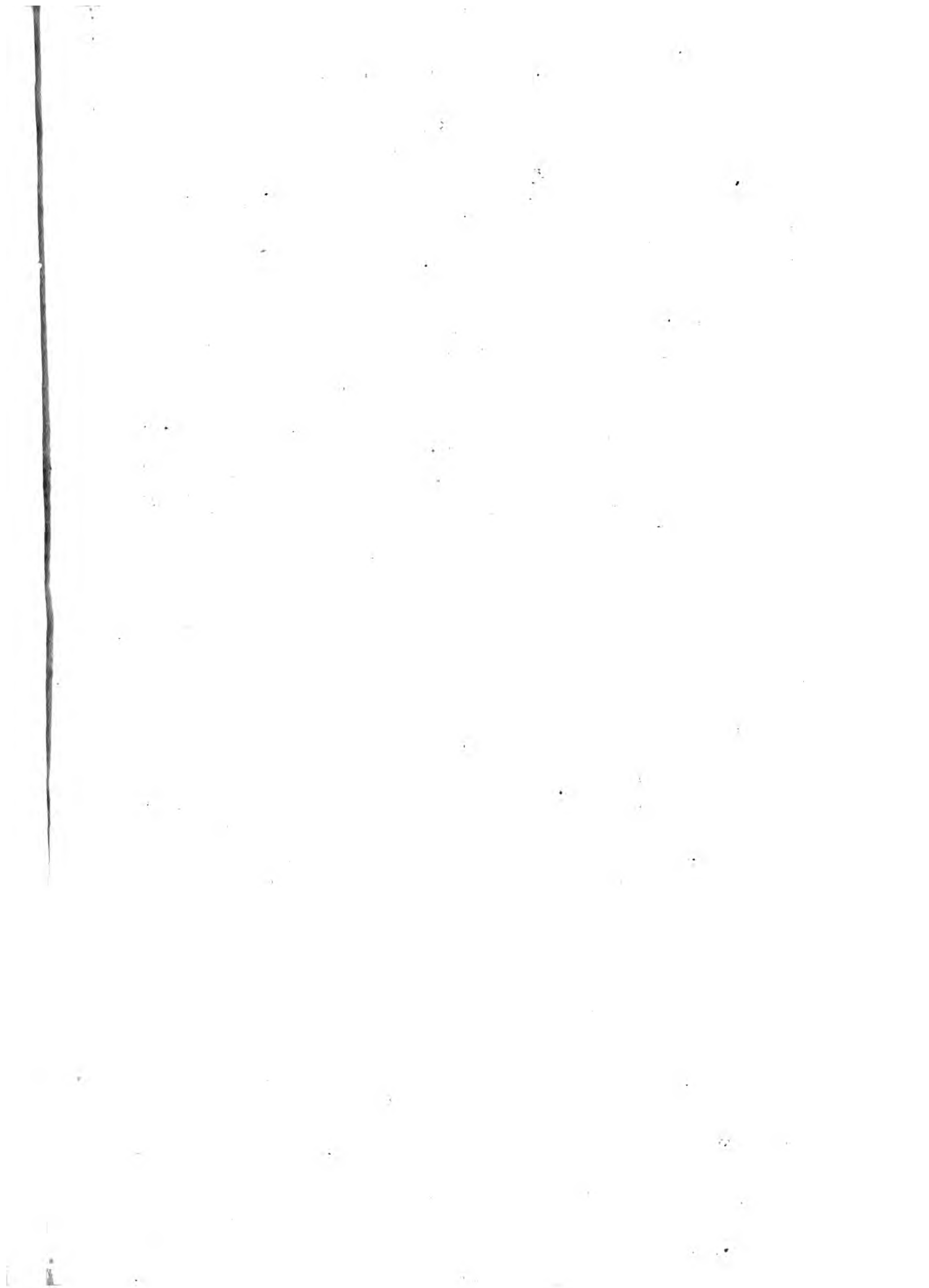
Fig. 417.



Fig. 416.







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PLATE XXV.

Fig. 340.

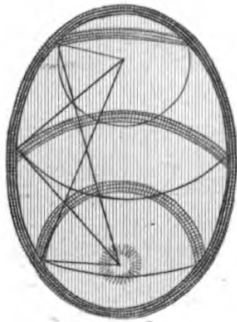


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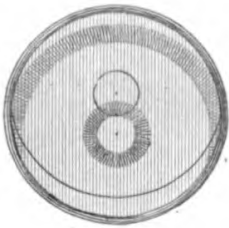


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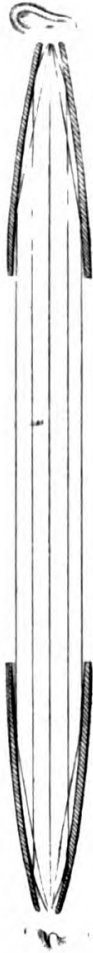


Fig. 343.



Fig. 344.

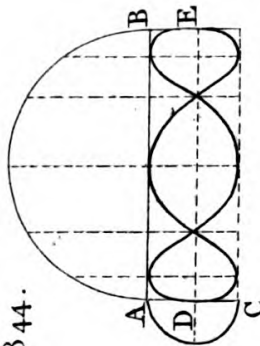


Fig. 345.



Fig. 347.

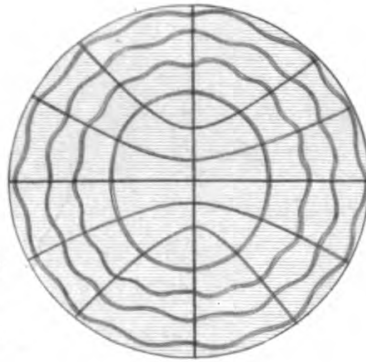


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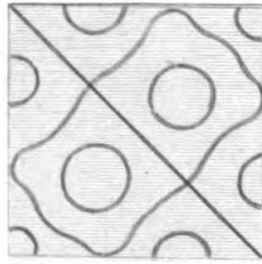


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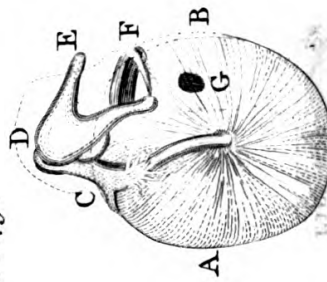


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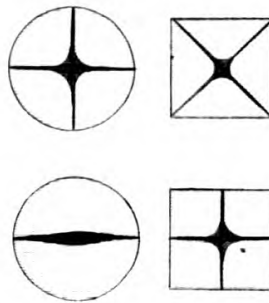


Fig. 352.



Fig. 351.



Fig. 350.



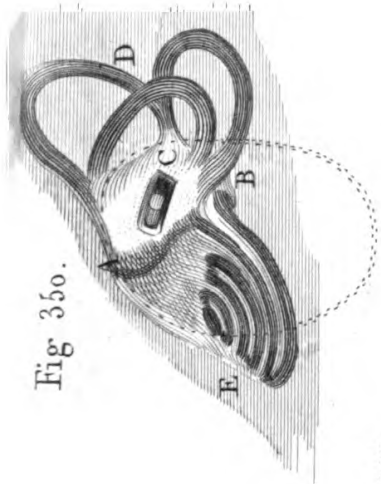


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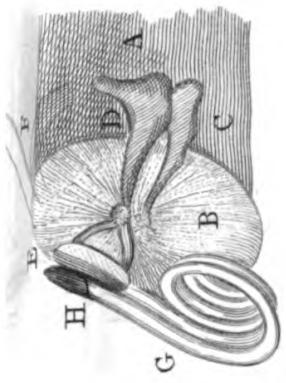


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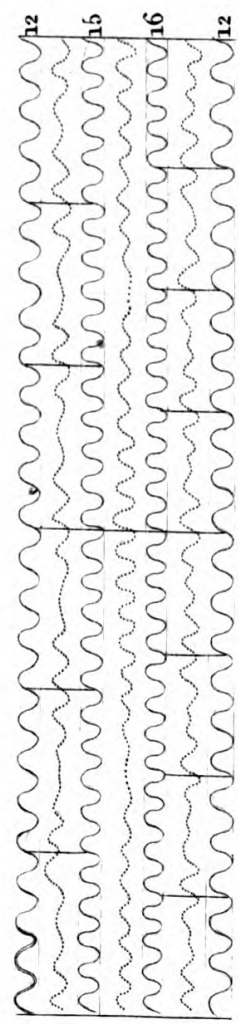


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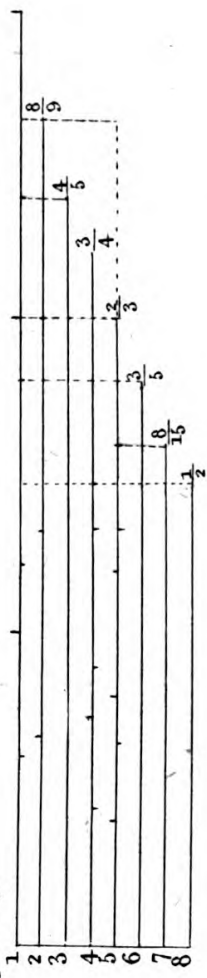


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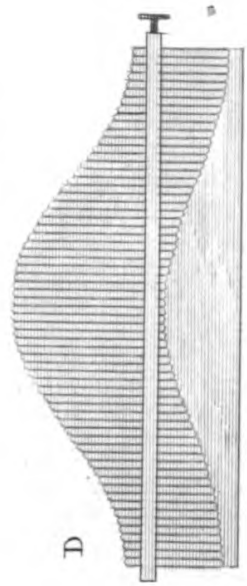
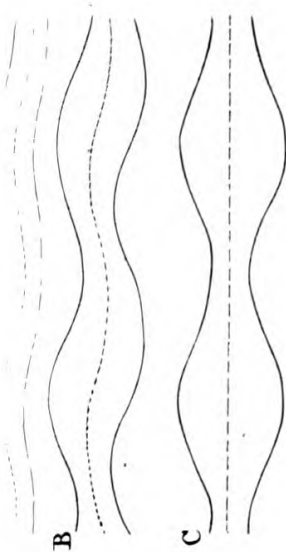
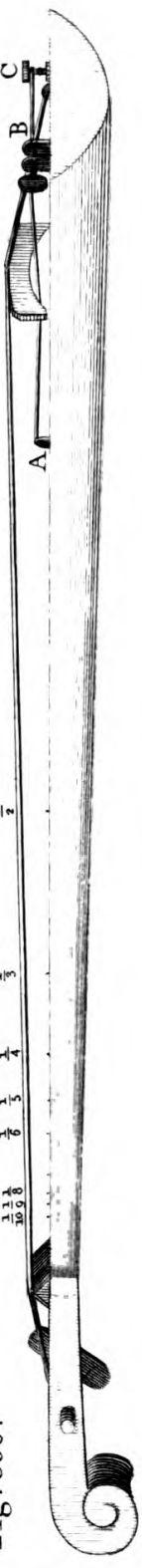
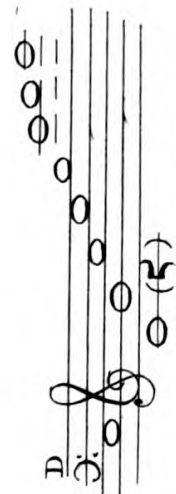
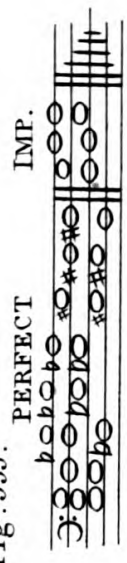


Fig. 355.



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PLATE XXVI.

Fig. 357.

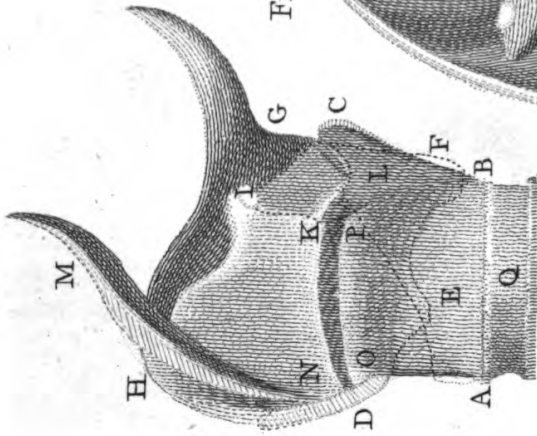


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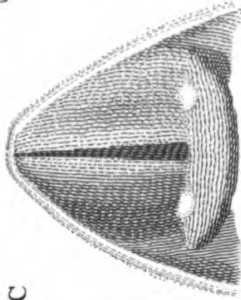


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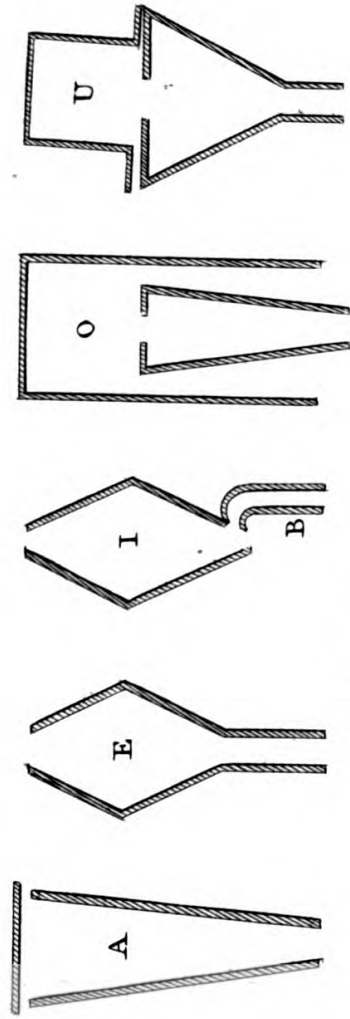


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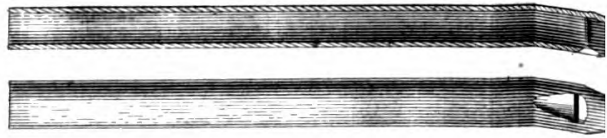


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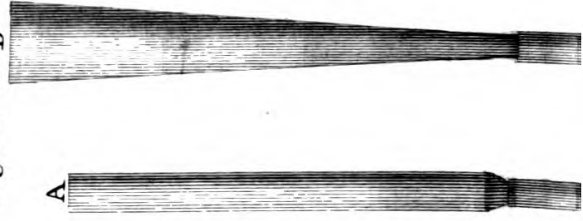


Fig. 367.



Fig. 366.

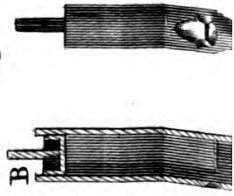


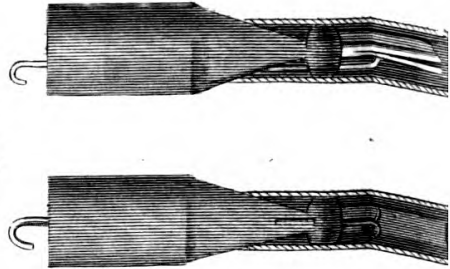
Fig. 361.



Fig. 362.



Fig. 360.



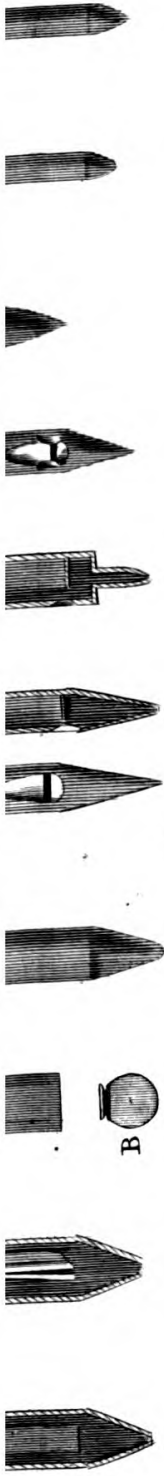


Fig. 369.

Fig. 370.

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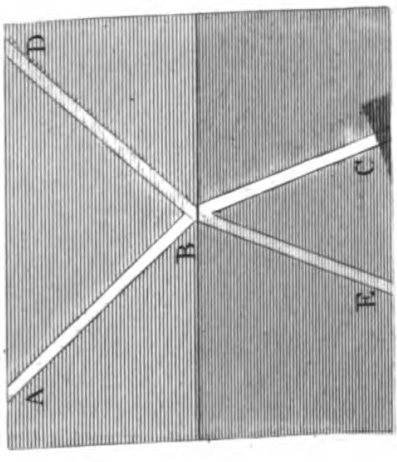
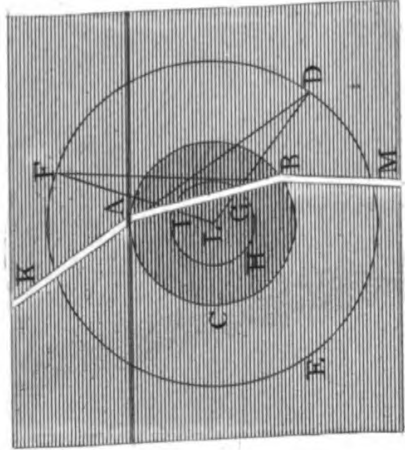
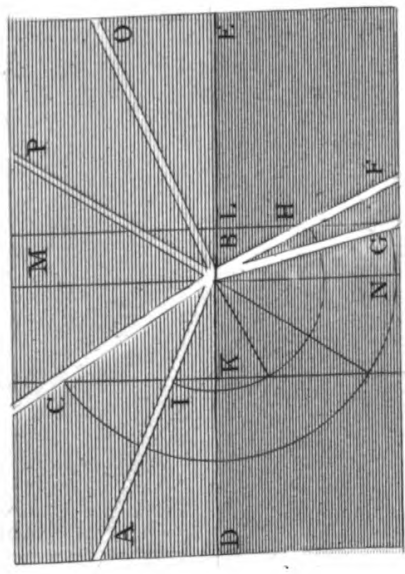
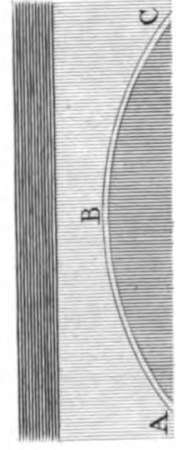
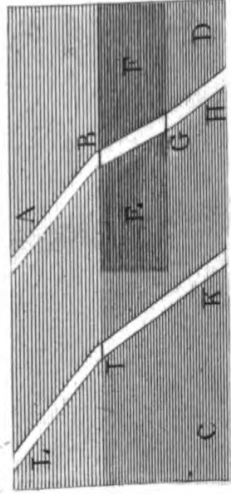
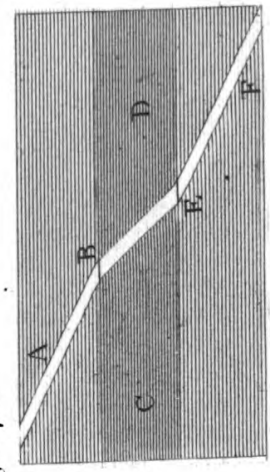


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PLATE XXVII.

Fig. 375.

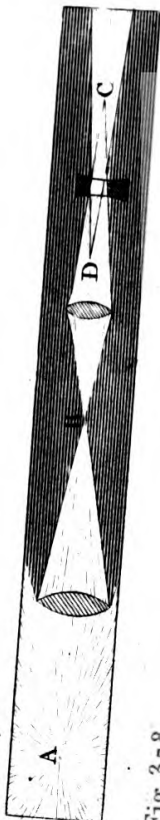


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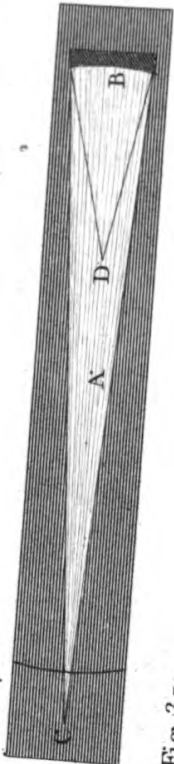


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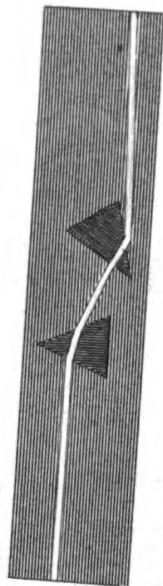


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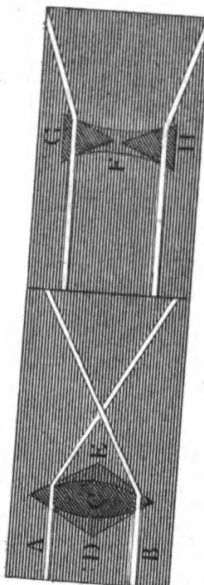


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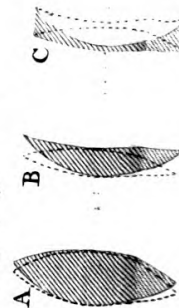


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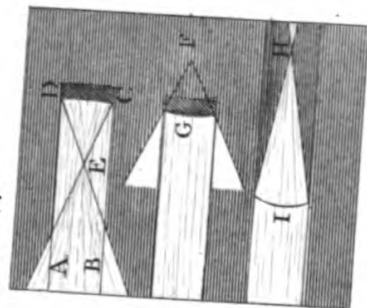


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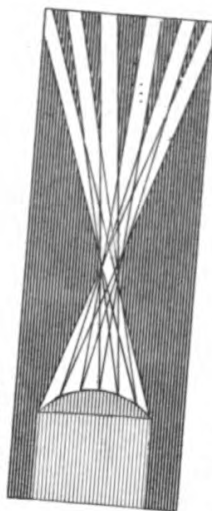


Fig. 381.



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Fig. 385.

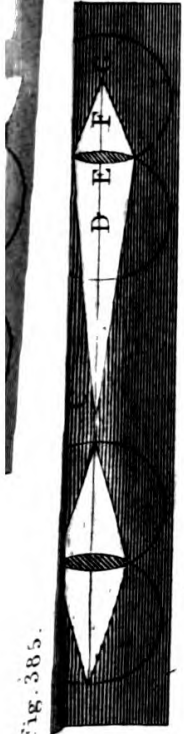


Fig. 386.



Fig. 387.

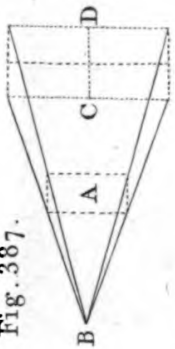


Fig. 388.

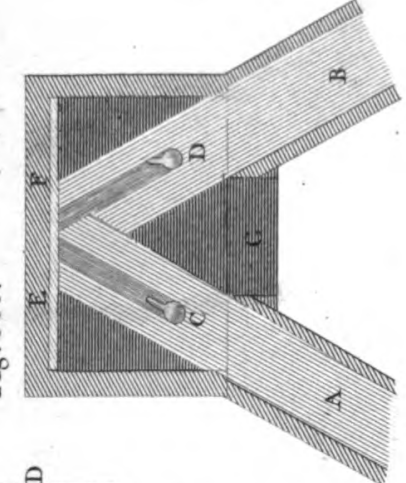


Fig. 389.

Fig. 390.

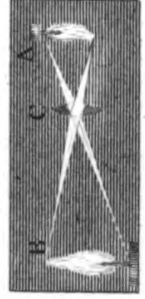


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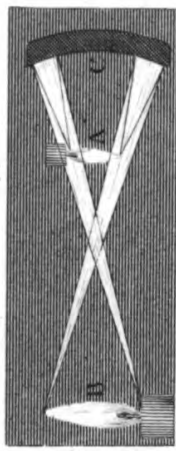


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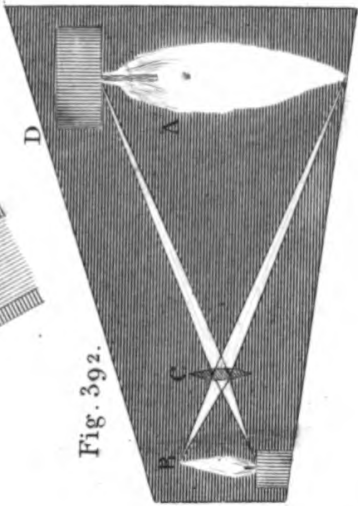


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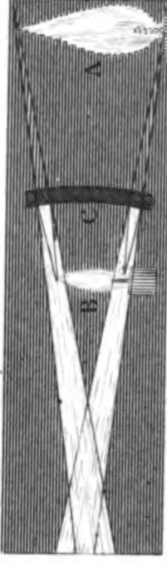


Fig. 394.

Fig. 395.

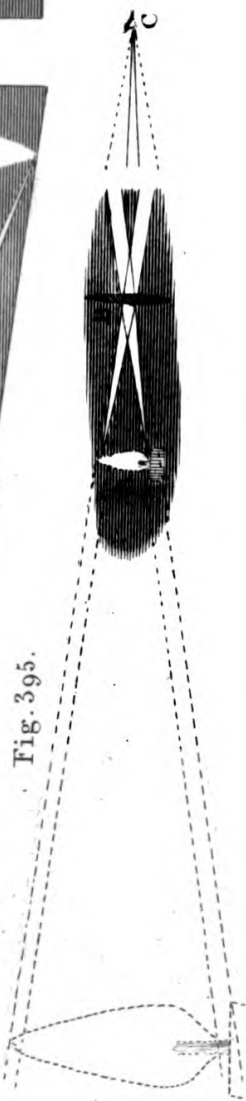


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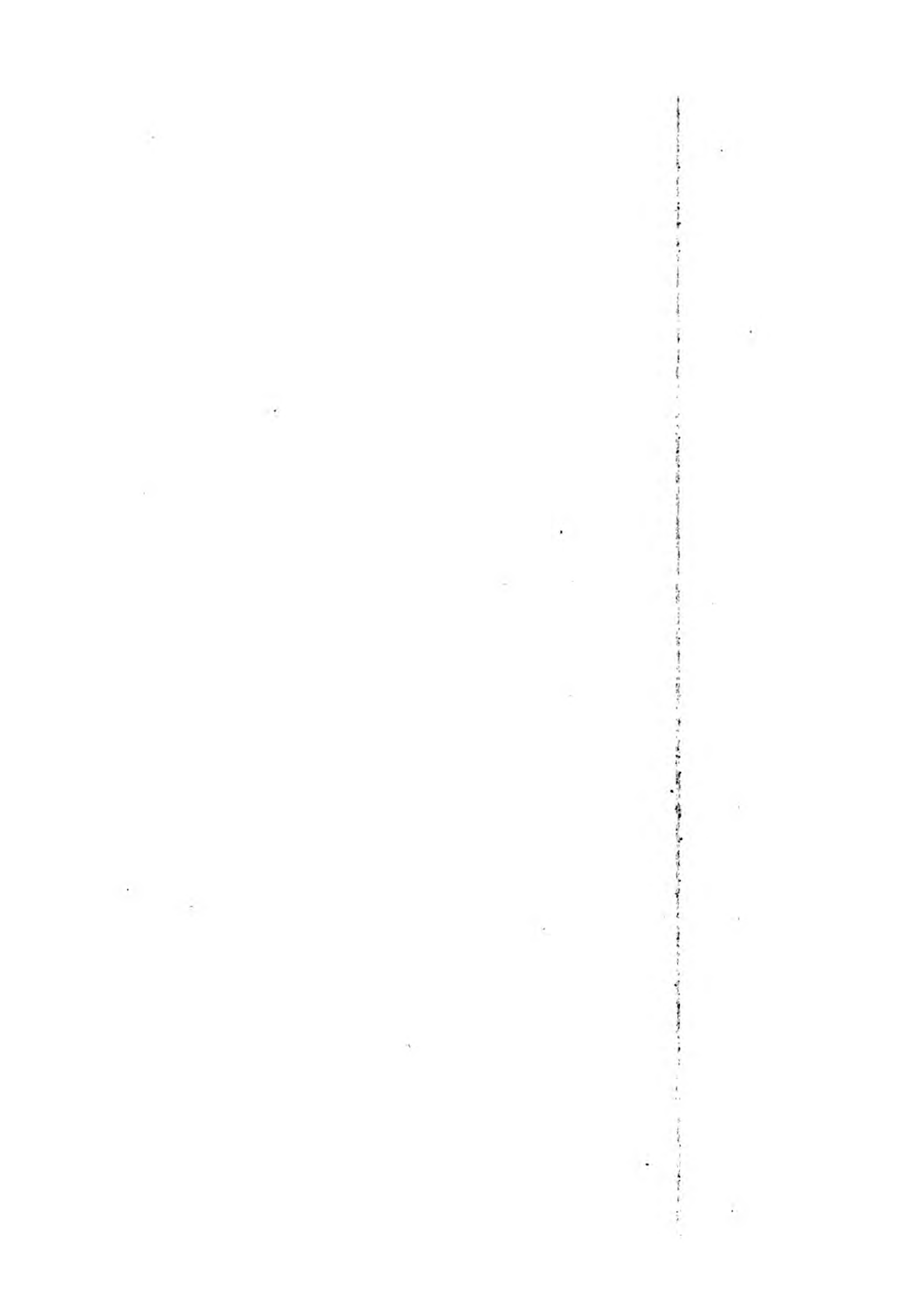


PLATE XXVIII.

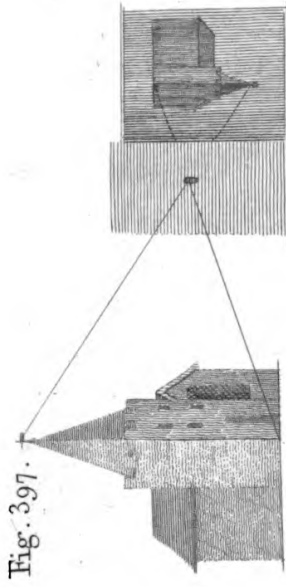


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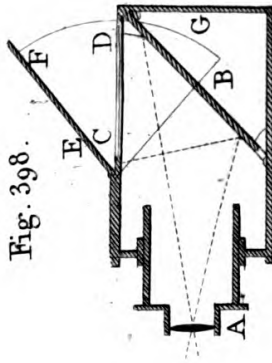


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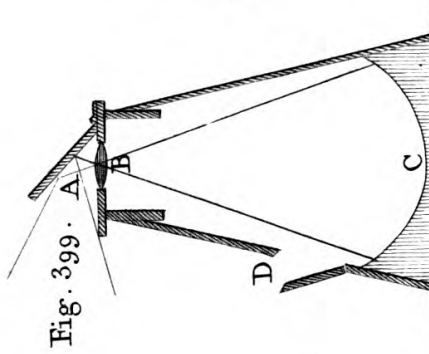


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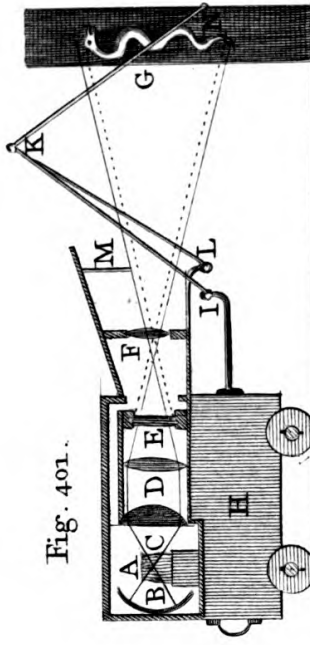


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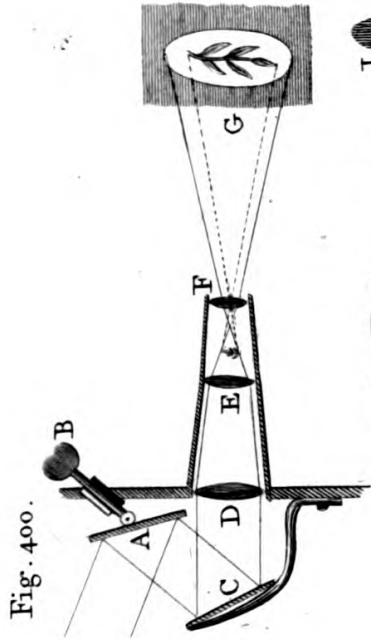


Fig. 400.



Fig. 402.

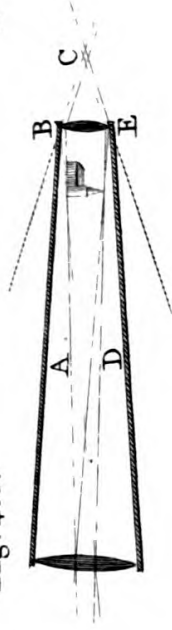


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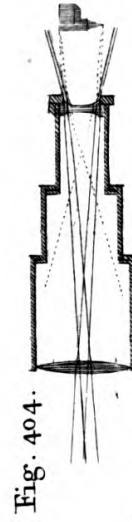


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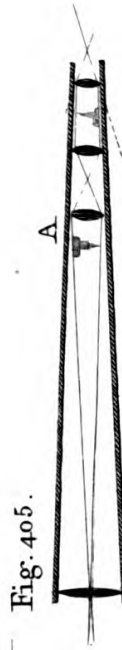


Fig. 405.



Fig. 406.

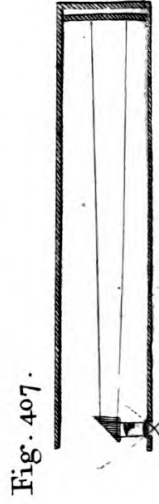


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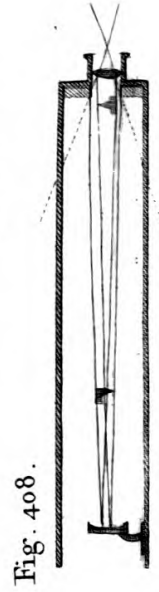


Fig. 408.



Fig. 409.

Fig. 410.

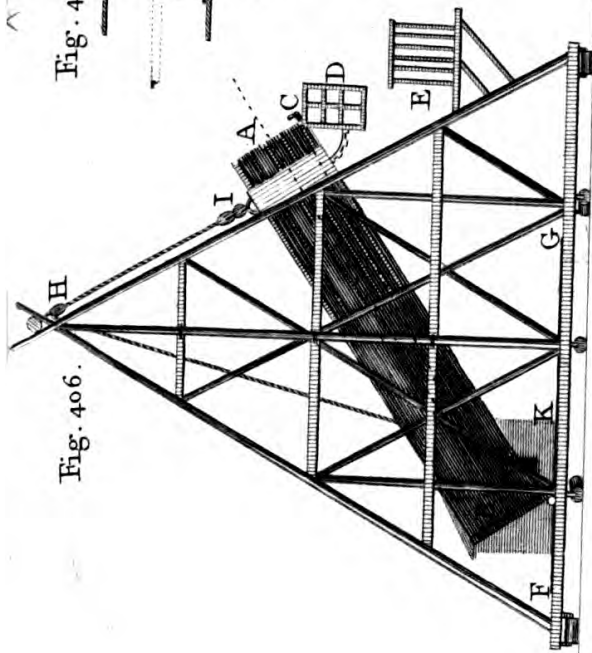


Fig. 406.

Fig. 409.

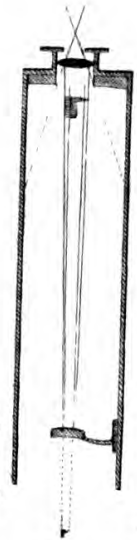


Fig. 410.



Fig. 411.

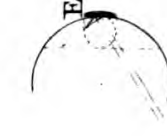
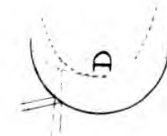
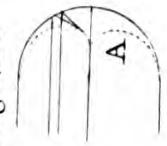


Fig. 413.



Fig. 412.

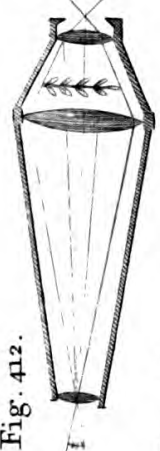


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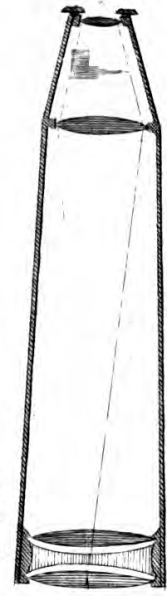


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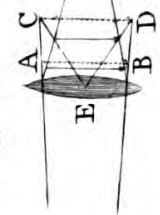


Fig. 417.



Fig. 416.

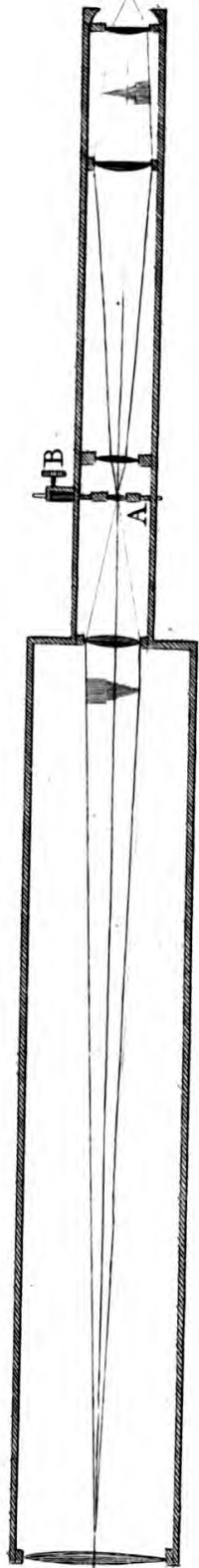






PLATE XXIX.

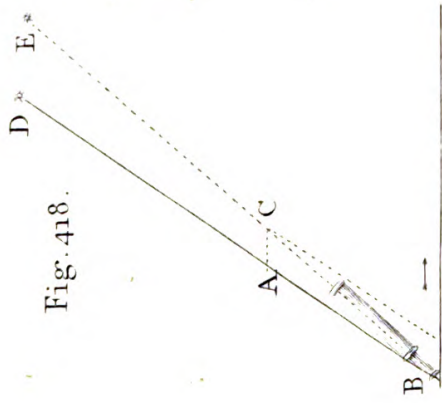


Fig. 418.



Fig. 419.



Fig. 420.



Fig. 421.

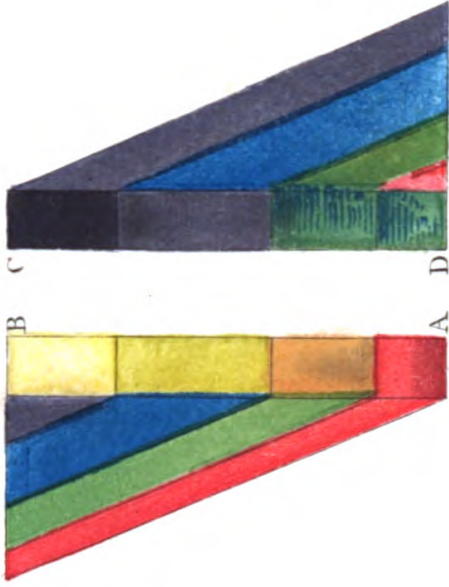


Fig. 422.

Fig. 423.



Fig. 424.

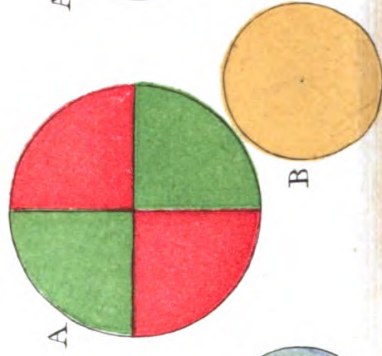


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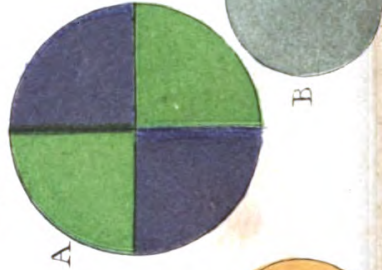


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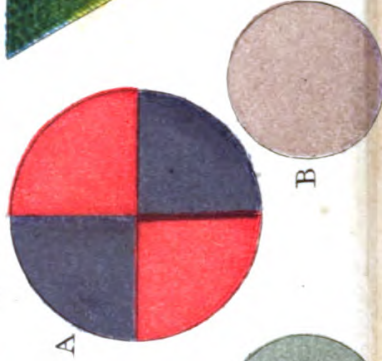


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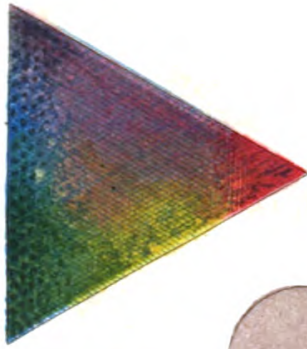


Fig. 428.



Fig. 429.



Fig. 430.

Fig. 429.

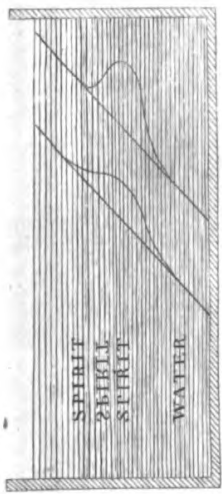


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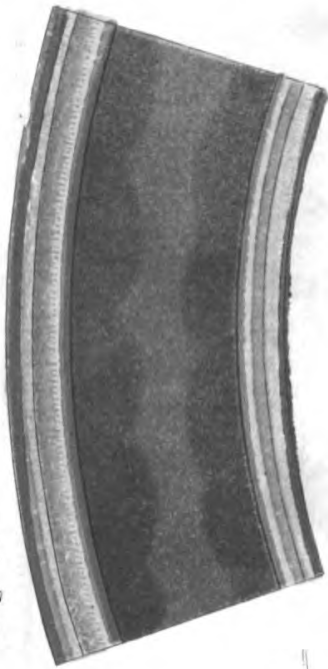


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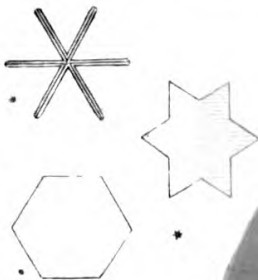


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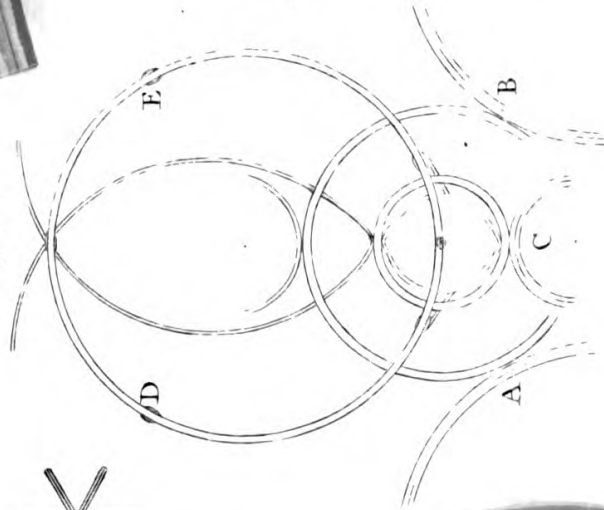


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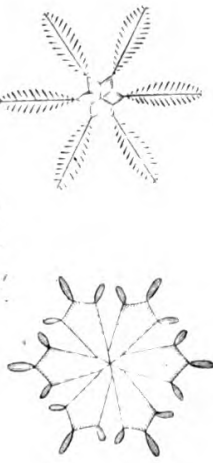


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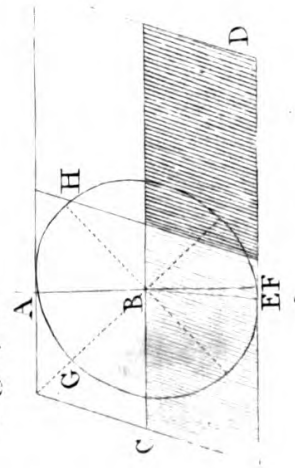
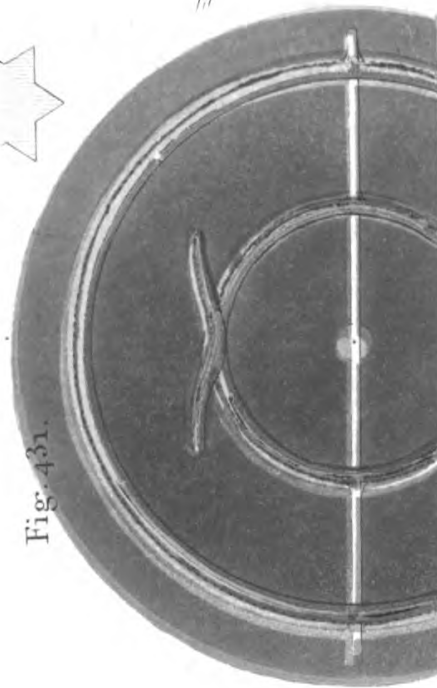


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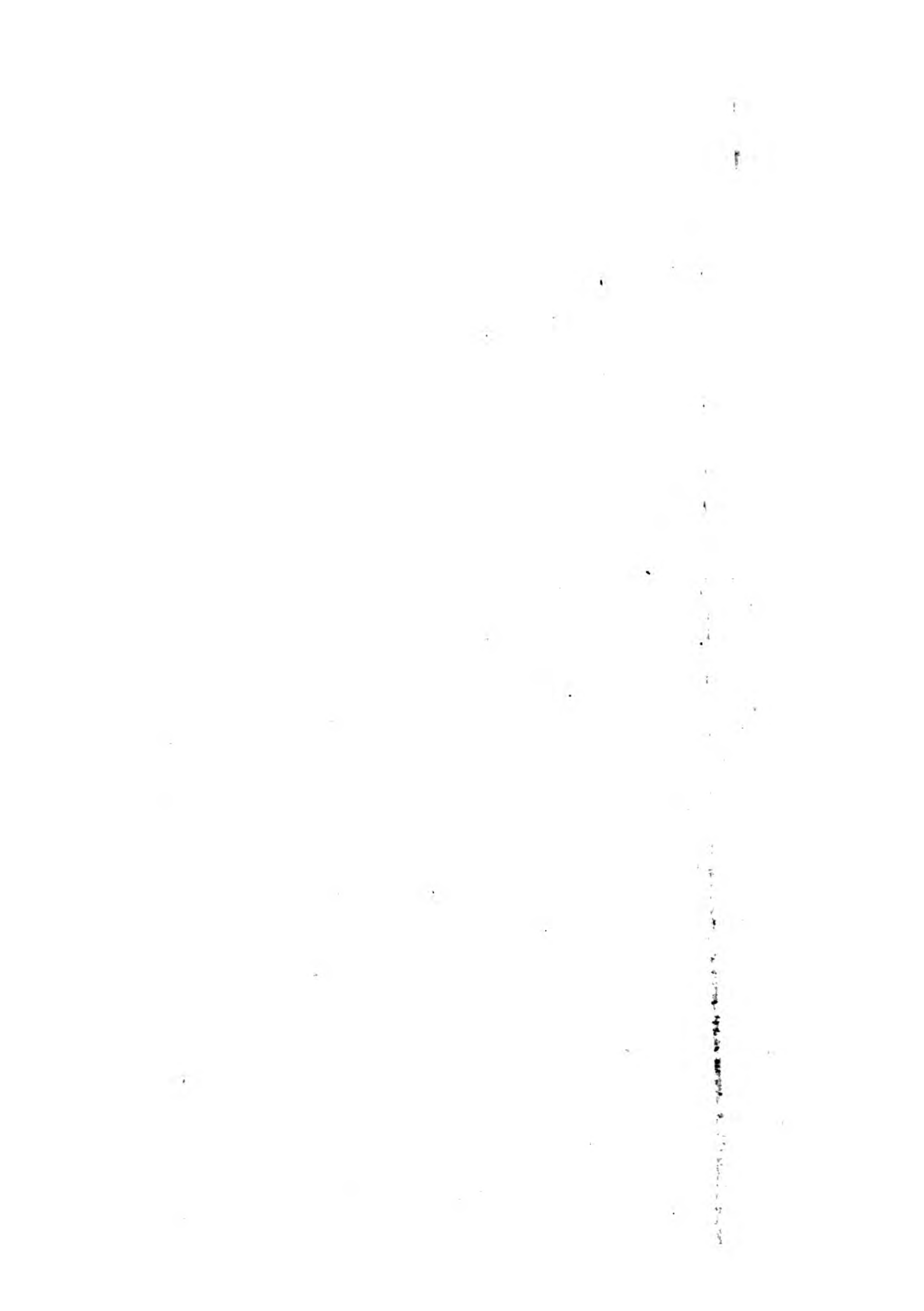


PLATE XXX

Fig. 436.

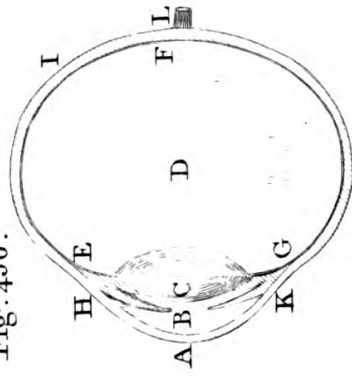


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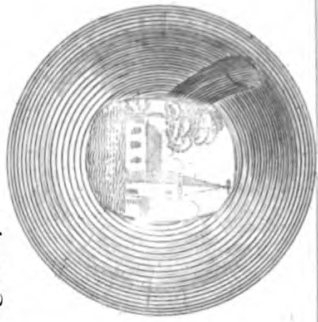


Fig. 438.

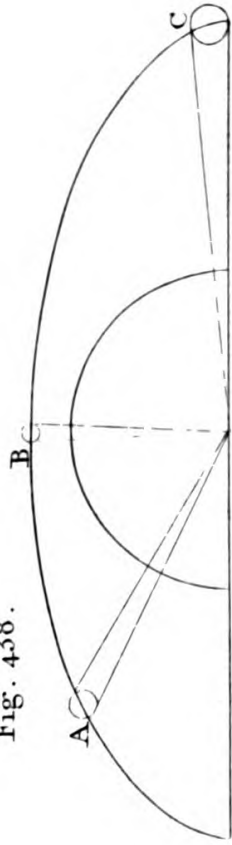


Fig. 439.



Fig. 440.



Fig. 441.



Fig. 442.

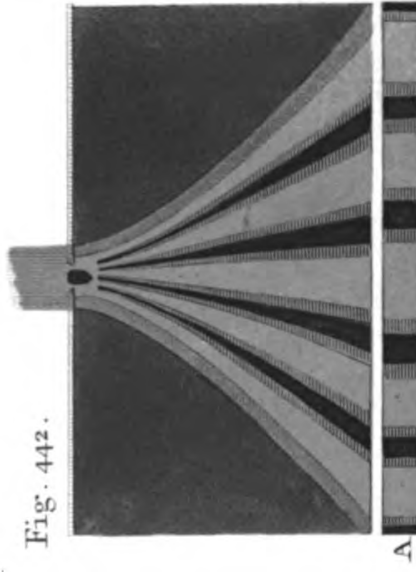


Fig. 443.



Fig. 444.



Fig. 445.



Fig. 446.





Fig. 446.



Fig. 447.

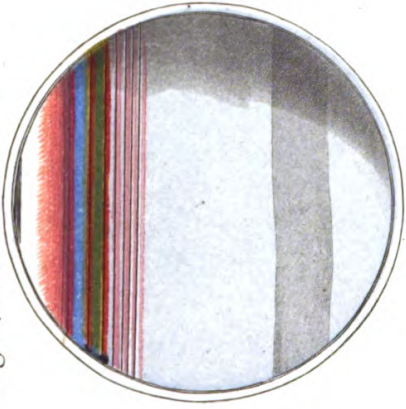


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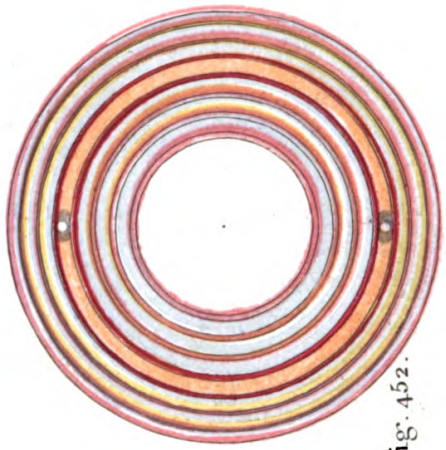


Fig. 452.



Fig. 449.

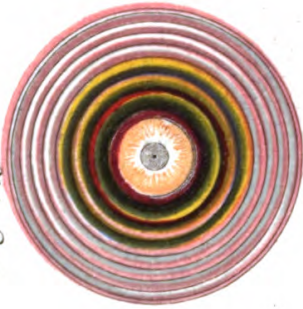


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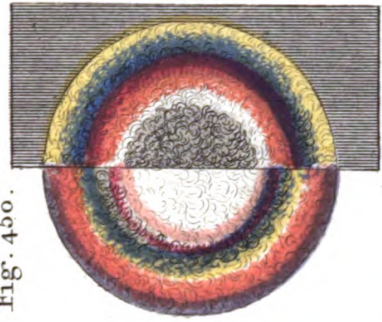
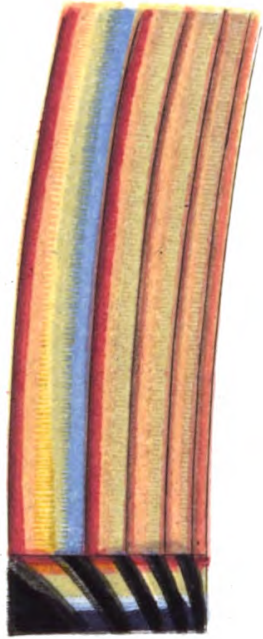


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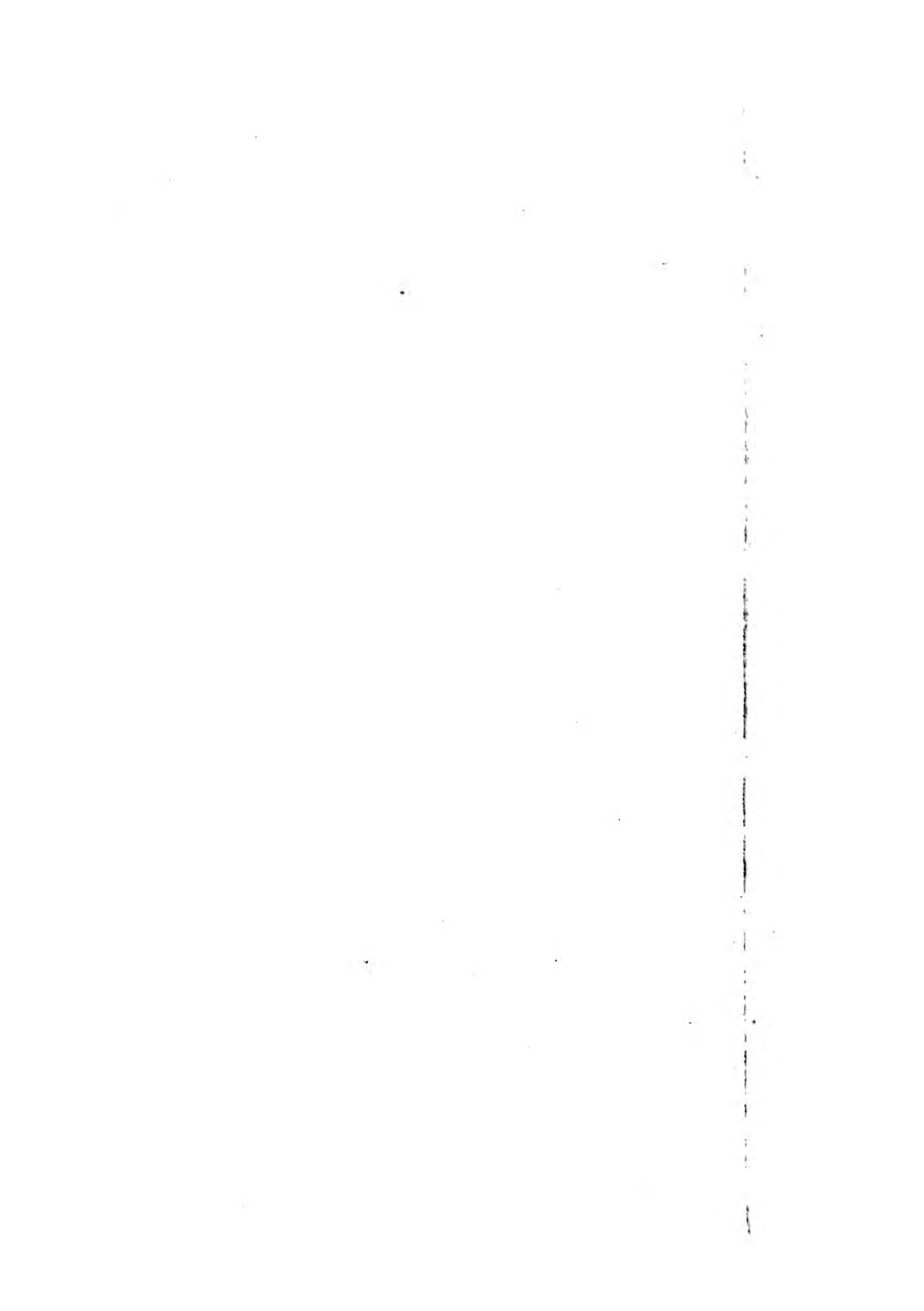


PLATE XXXI.

Fig. 453.



Fig. 454.

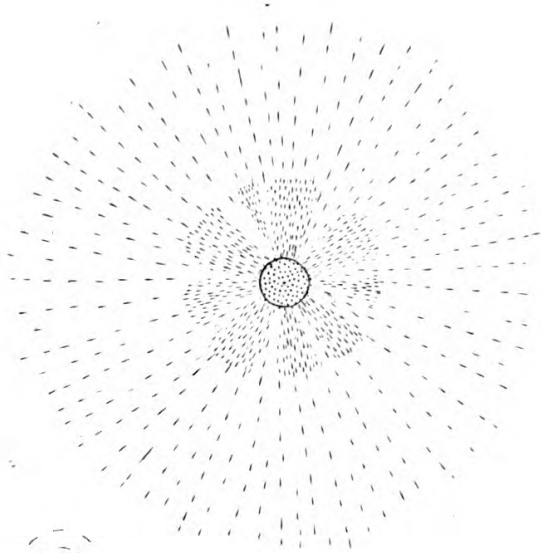


Fig. 455.



Fig. 456.

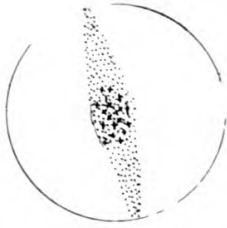


Fig. 457.

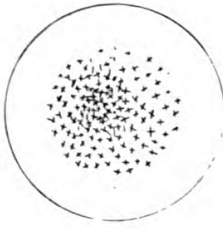


Fig. 458.



Fig. 459.

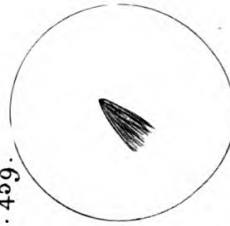


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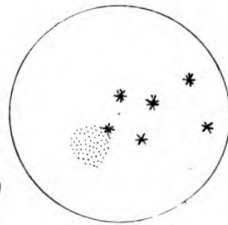


Fig. 461.



Fig. 462.

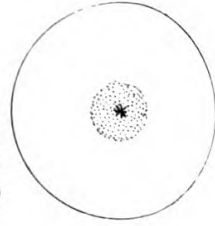


Fig. 463.

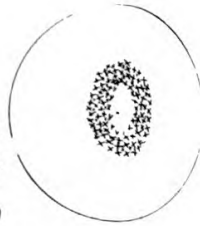


Fig. 465.



Fig. 464.



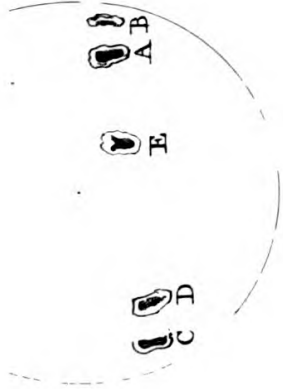
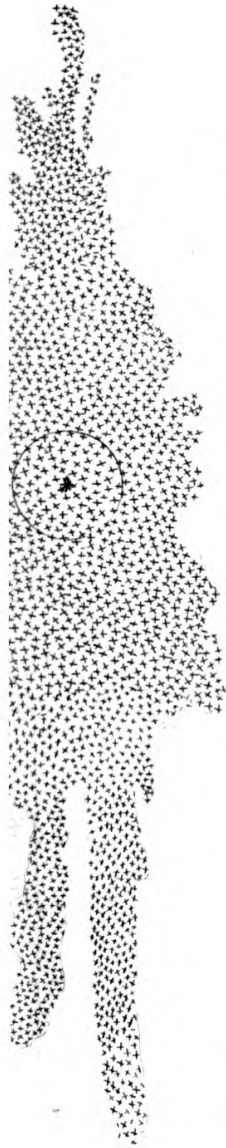


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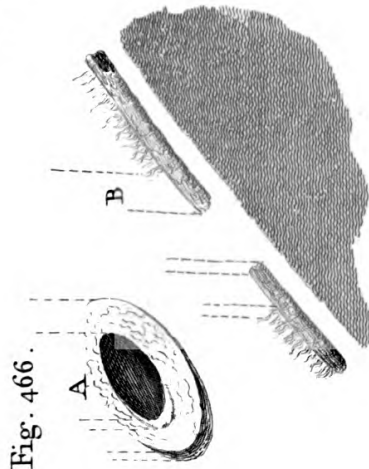
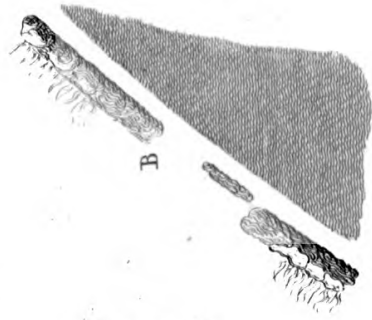


Fig. 467.



*
Aldebaran

*
Pleiades

Fig. 470.

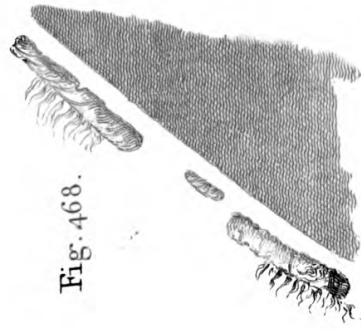
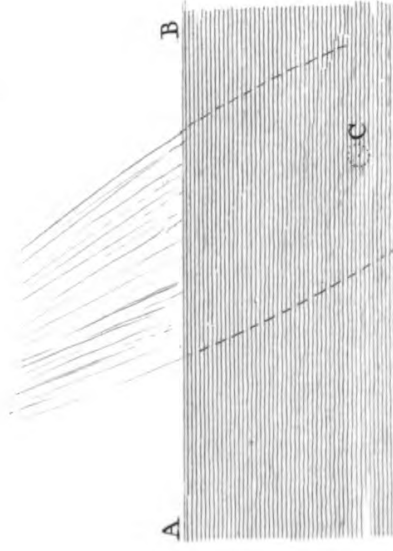
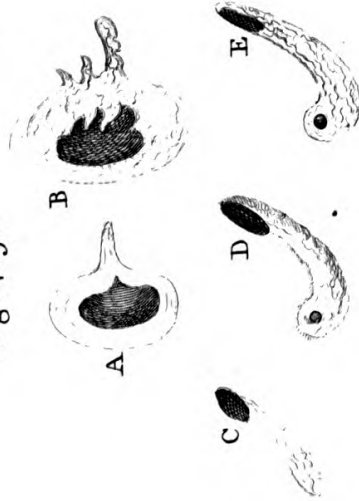
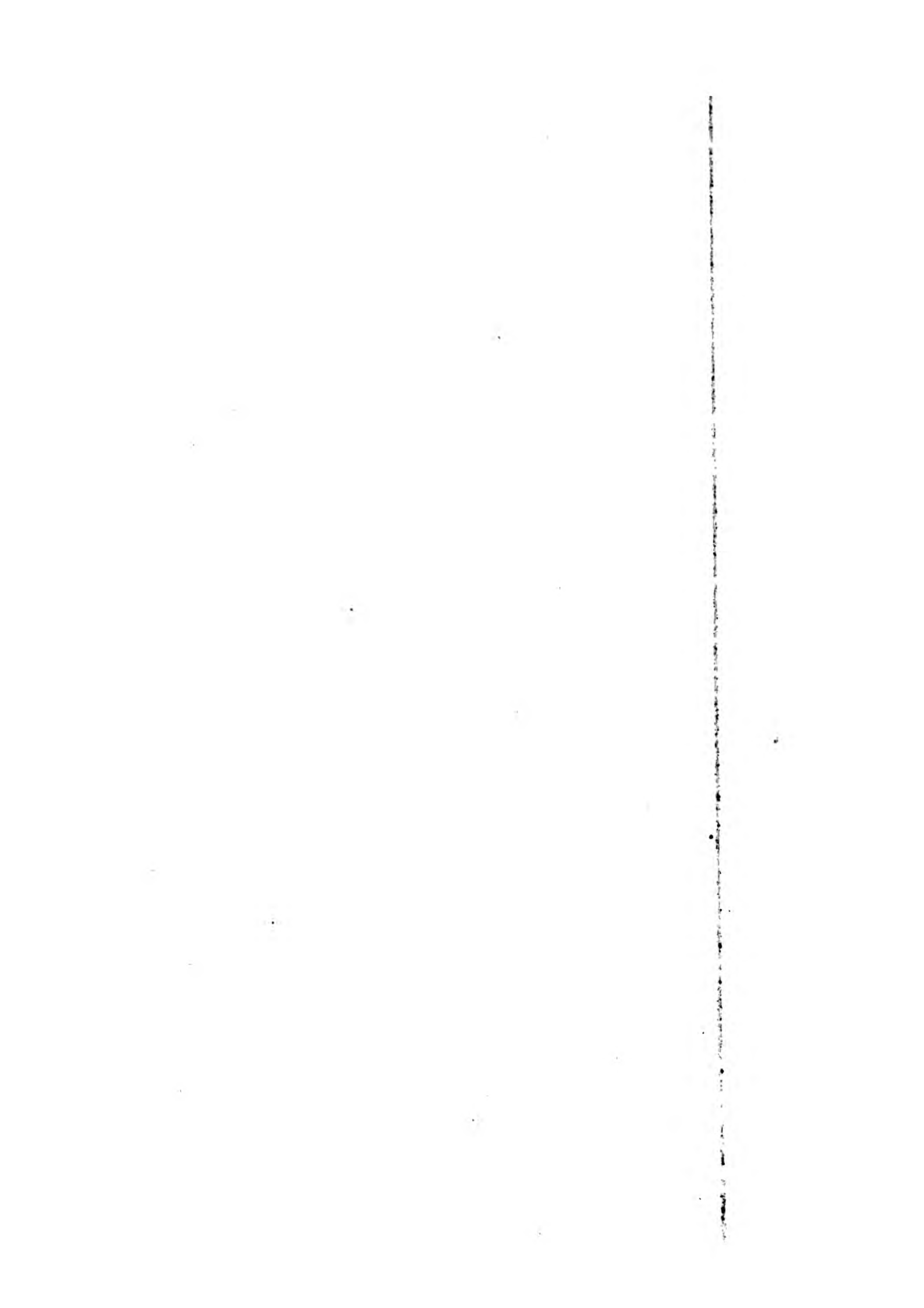


Fig. 468.

Fig. 469.





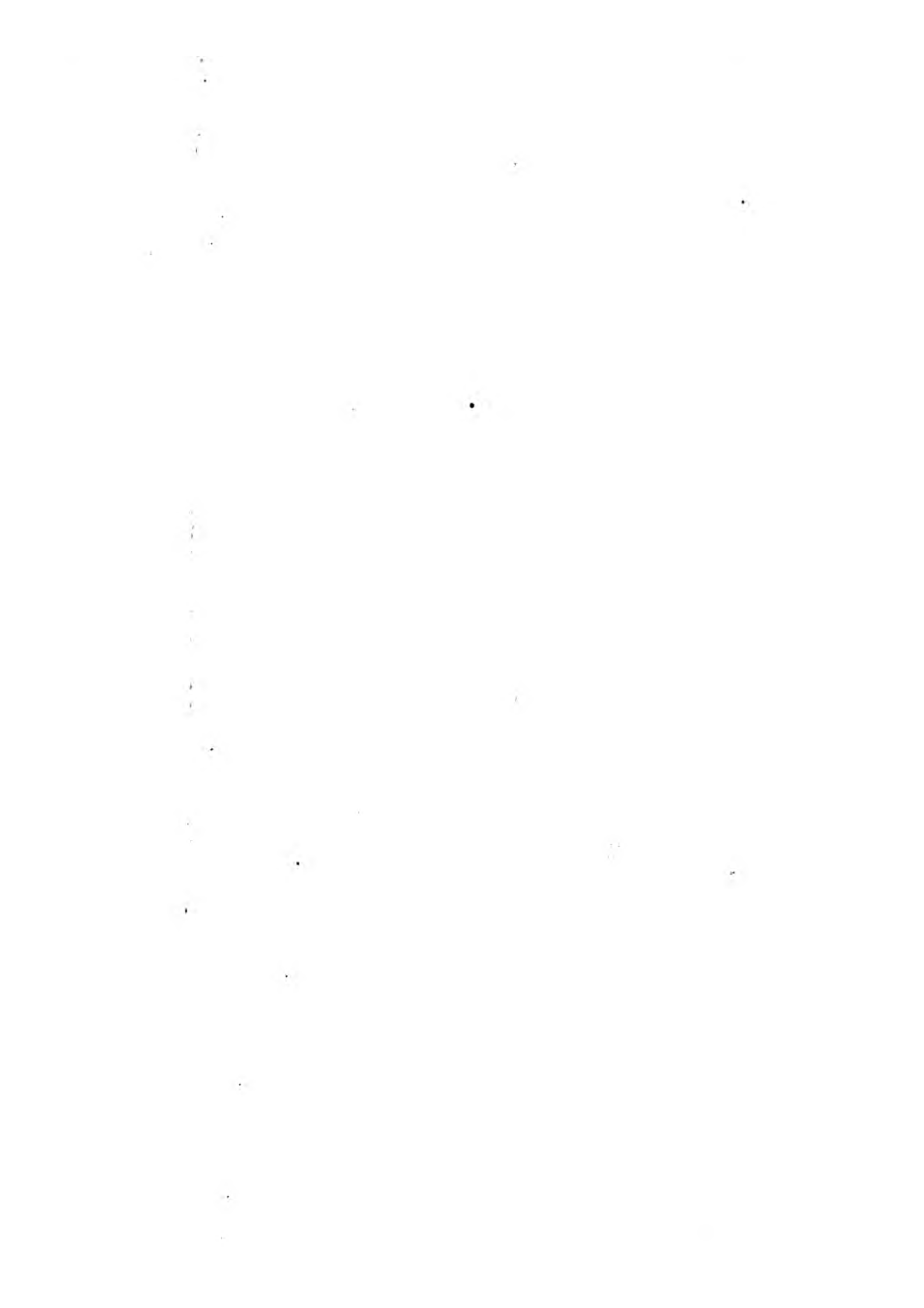


PLATE XXXII.

Fig. 471.

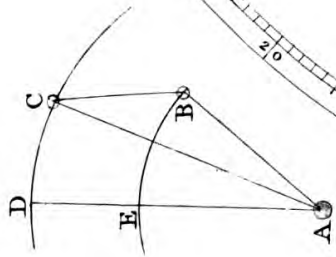
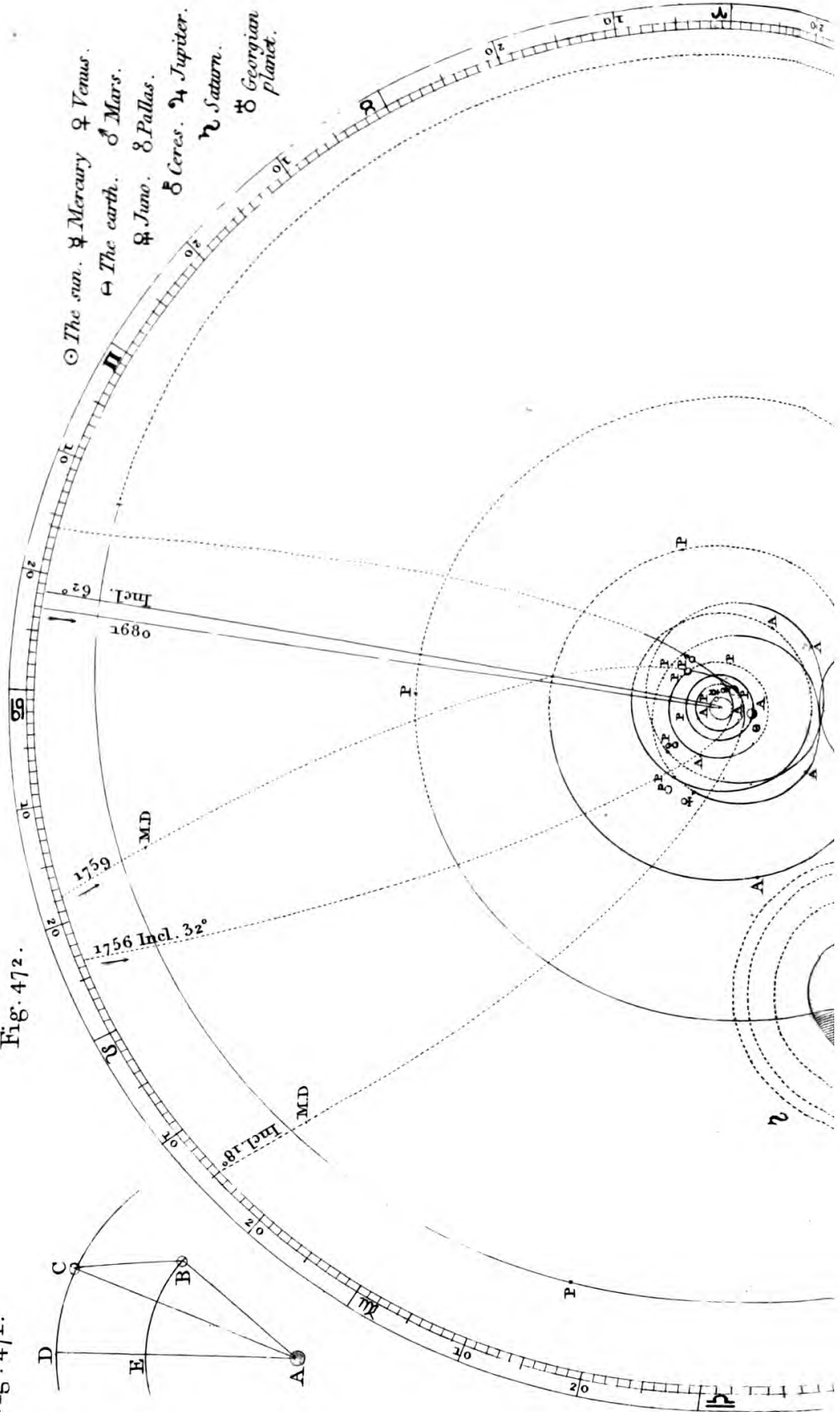


Fig. 472.



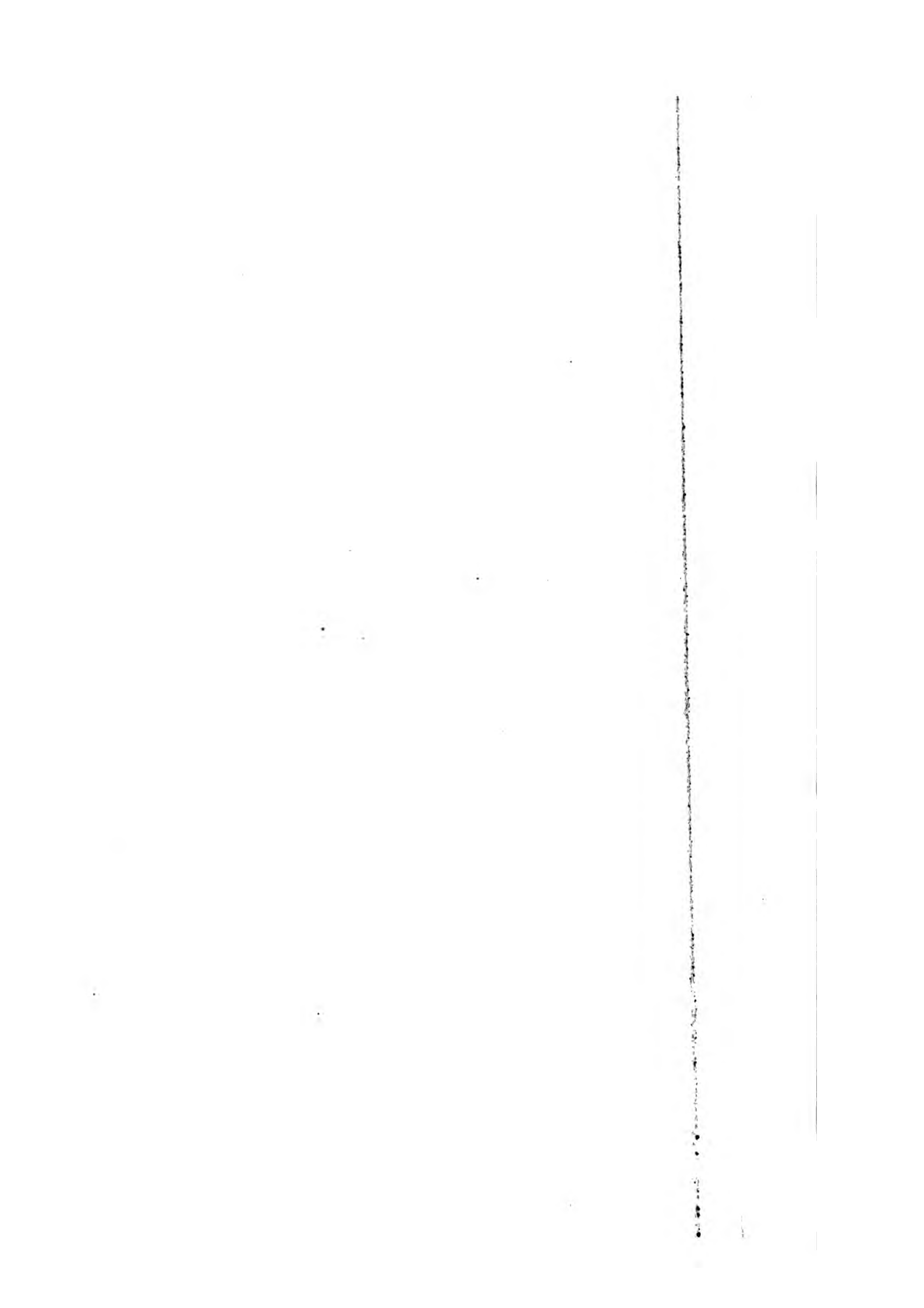


PLATE XXXIII.

Fig. 476.



Fig. 477.

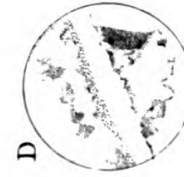
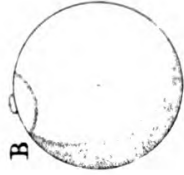
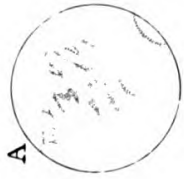


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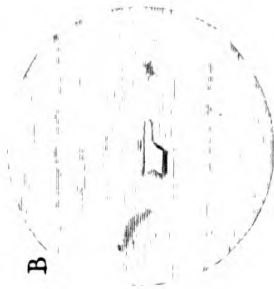
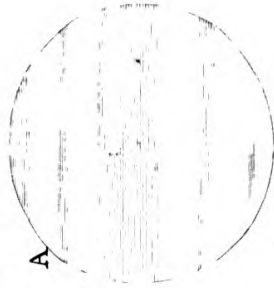


Fig. 479.

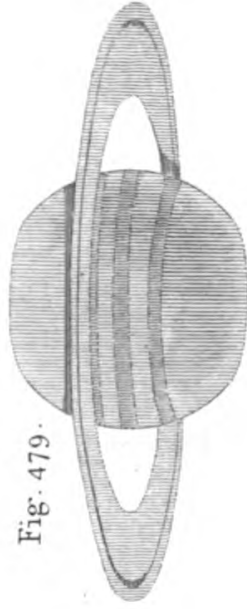
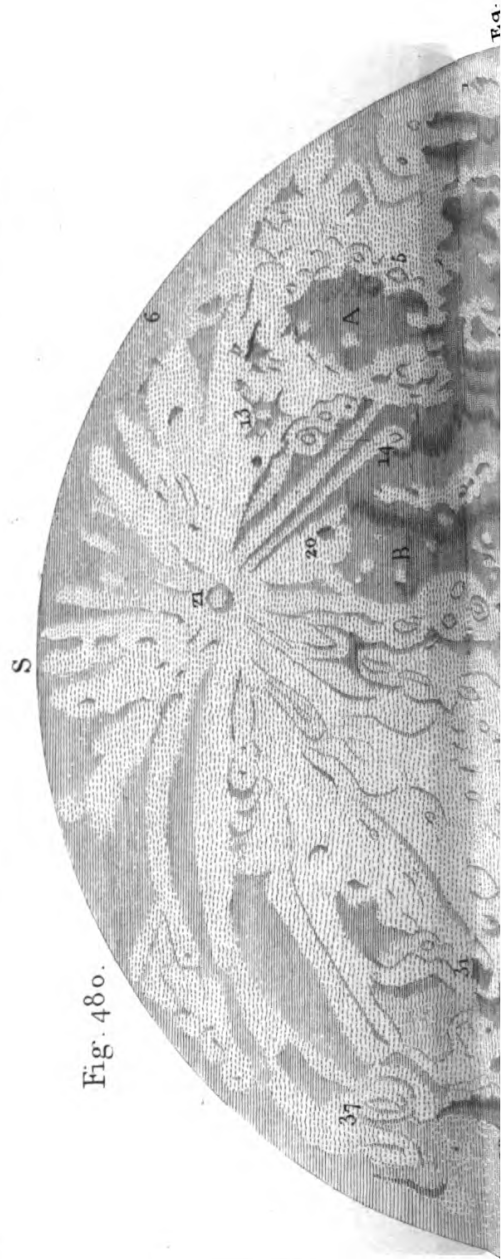


Fig. 480.



70V

P.A.

46



Fig. 482.

Fig. 483.

Fig. 484.

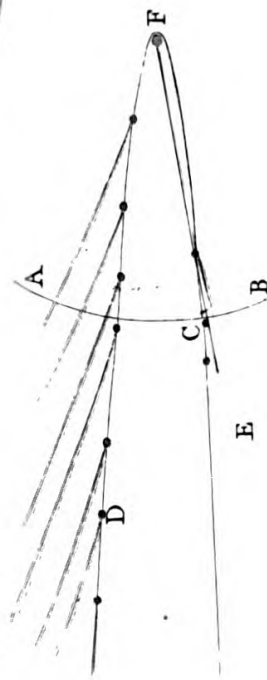


Fig. 485.



1. The first part of the document is a list of names and addresses of the members of the committee.

PLATE XXXIV.

Fig. 486.

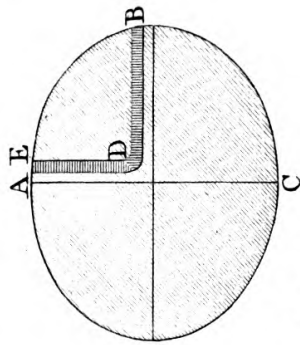


Fig. 488.

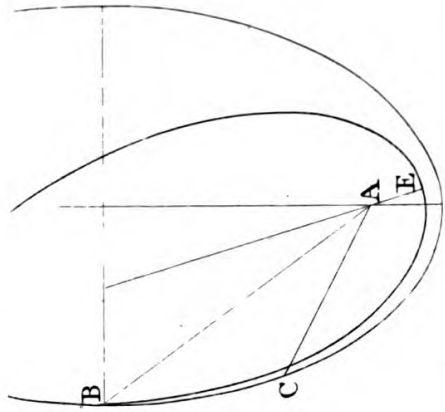


Fig. 489.

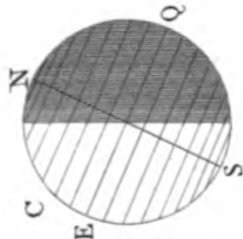
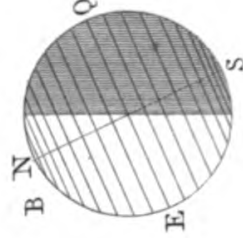
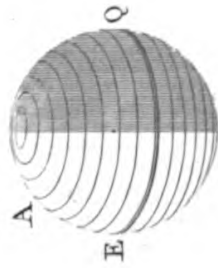


Fig. 487.

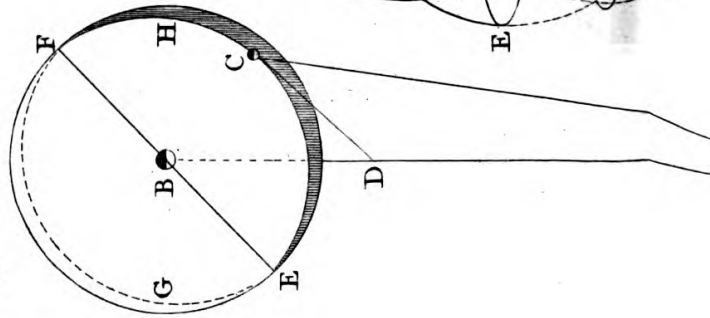


Fig. 491.



Fig. 492.

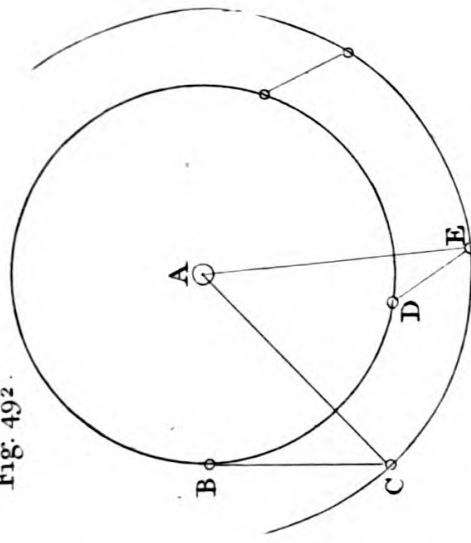


Fig. 490.

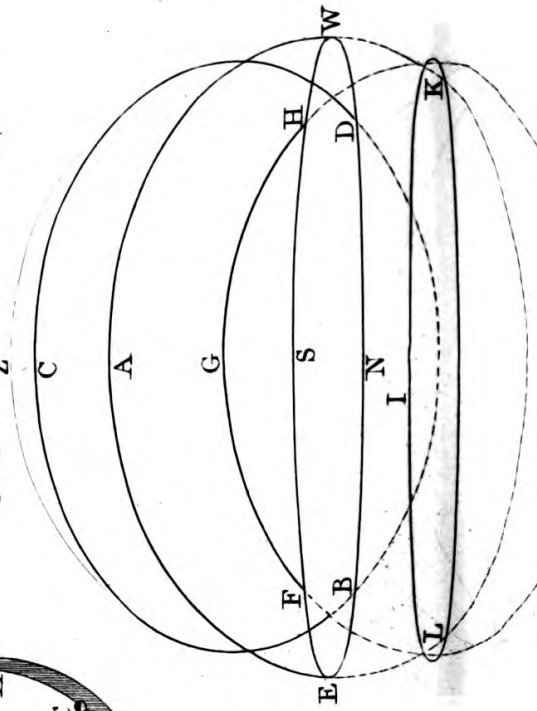
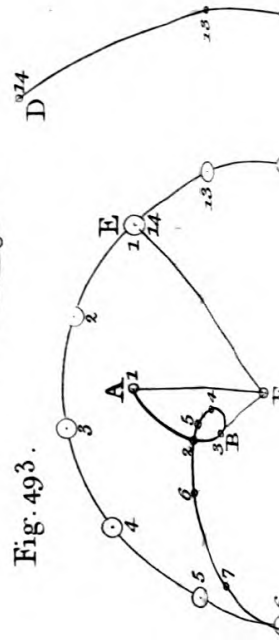


Fig. 493.



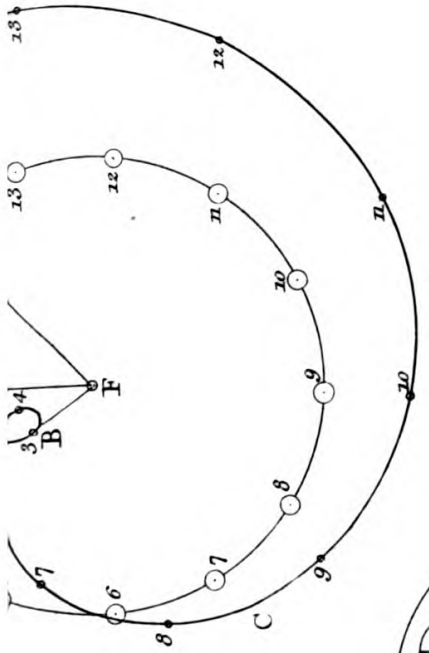


Fig. 494.

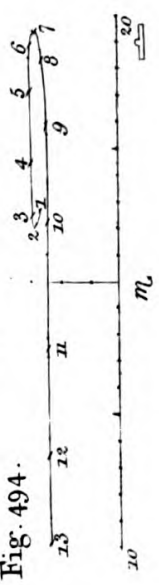


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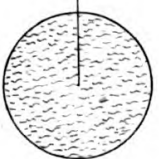


Fig. 496.

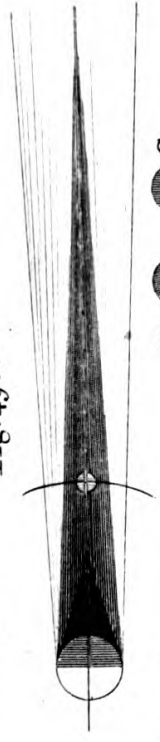


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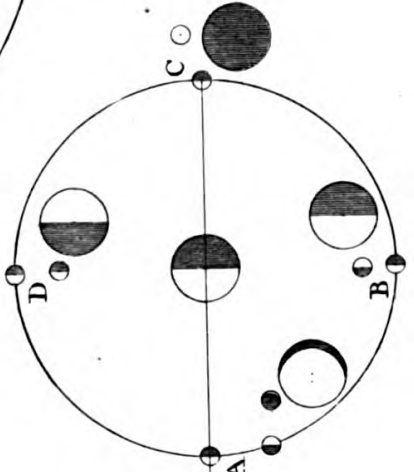


Fig. 498.



Fig. 499.

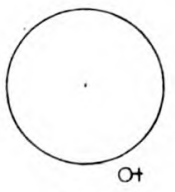


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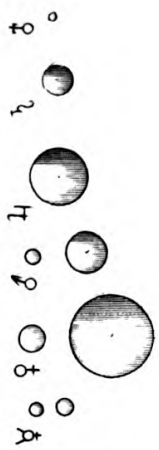


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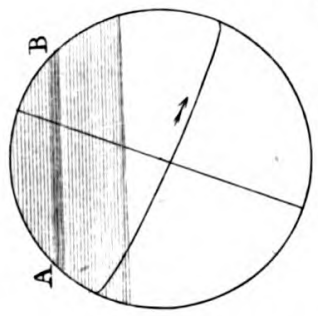


Fig. 502.



Fig. 503.

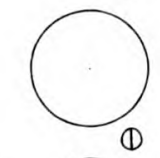


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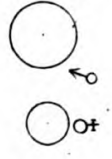


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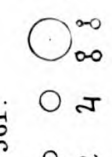


Fig. 506.



Fig. 507.



Fig. 508.



Fig. 509.

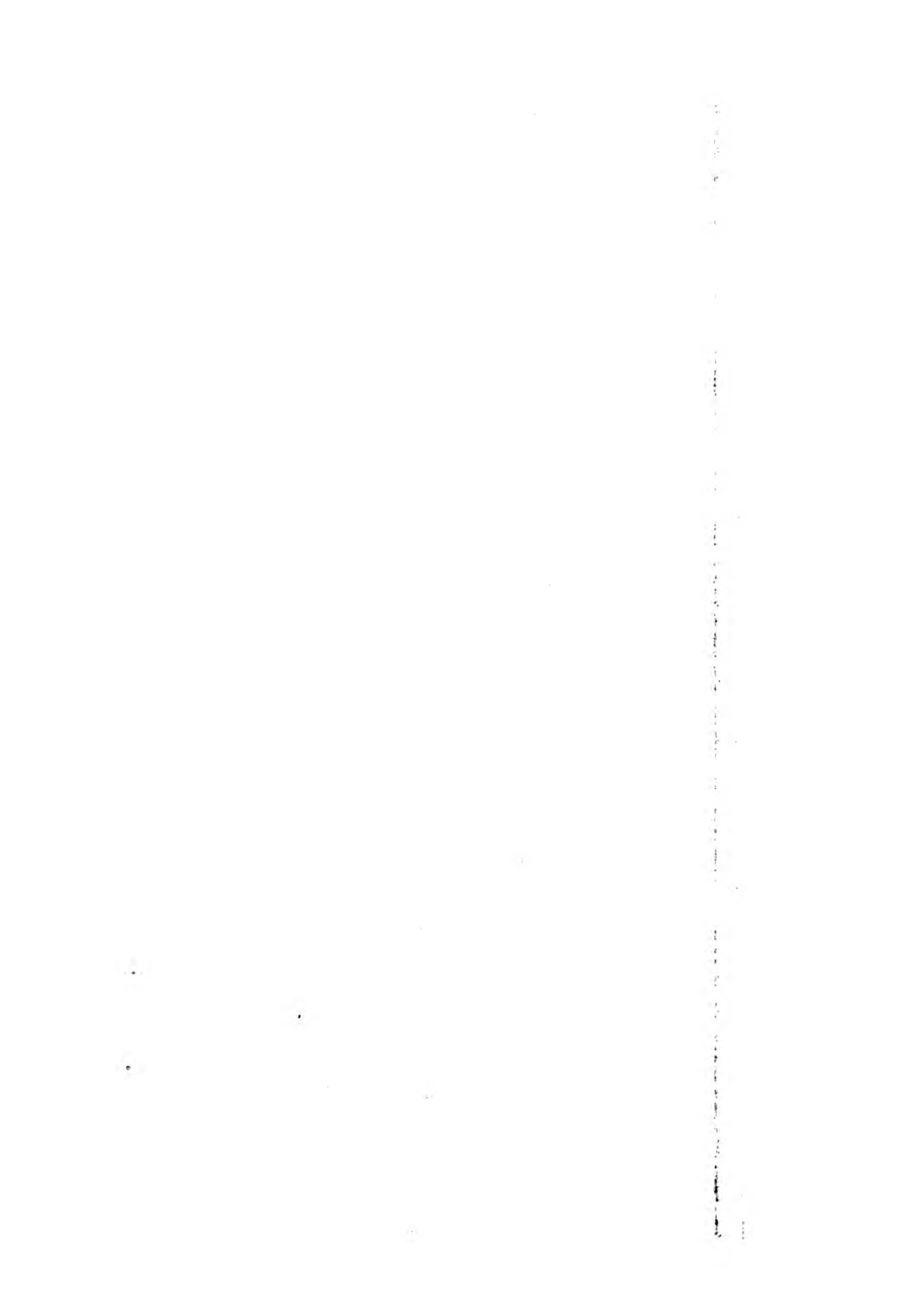




PLATE XXXV.

Fig. 502.

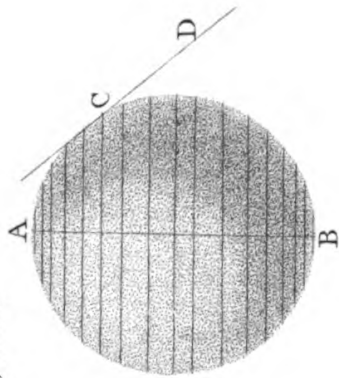


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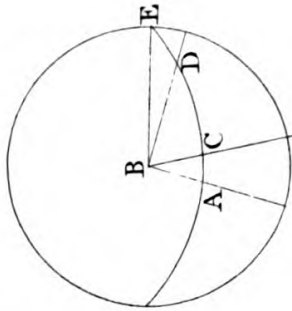


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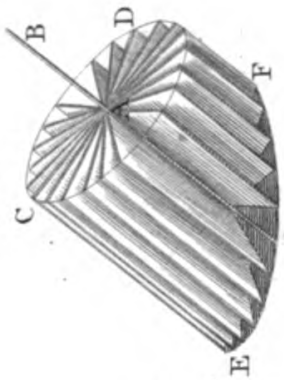


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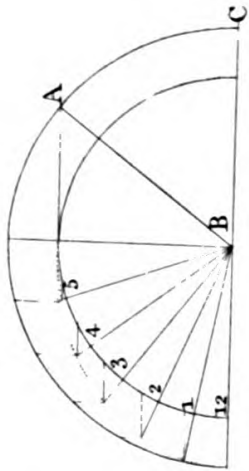


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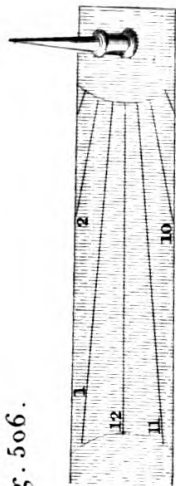


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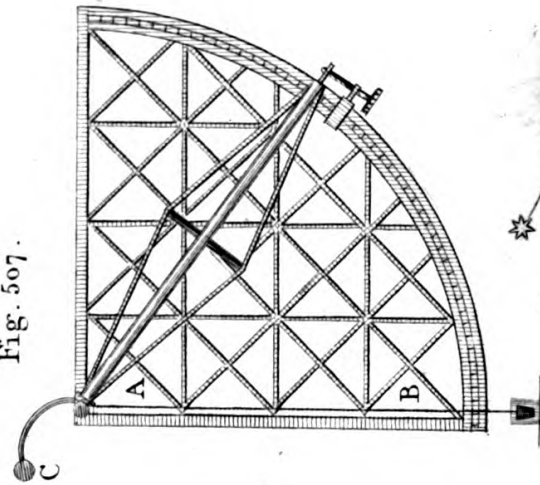


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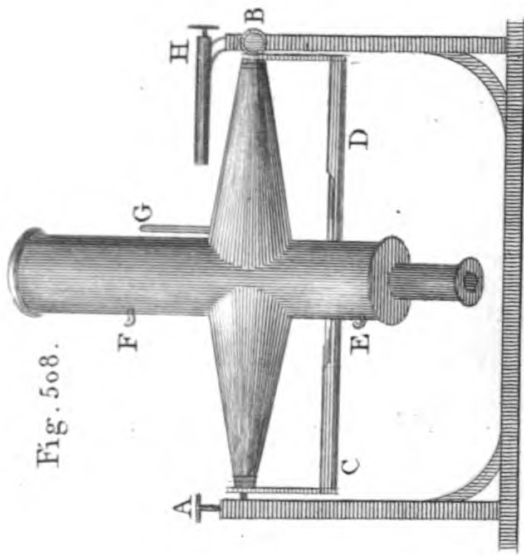


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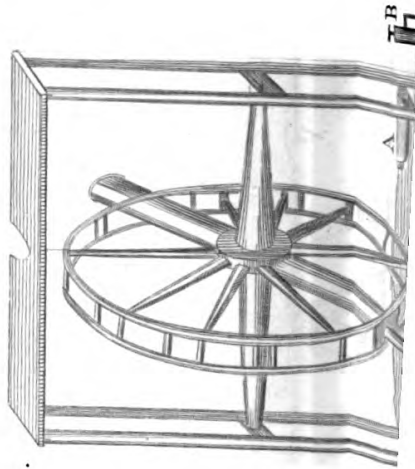


Fig. 511.



Fig. 512.



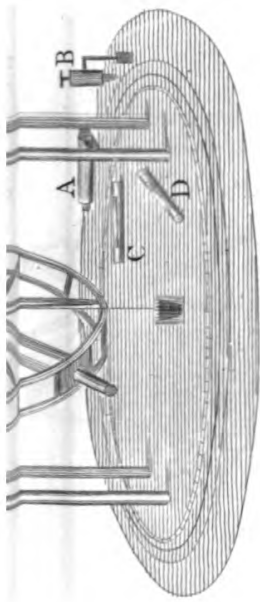


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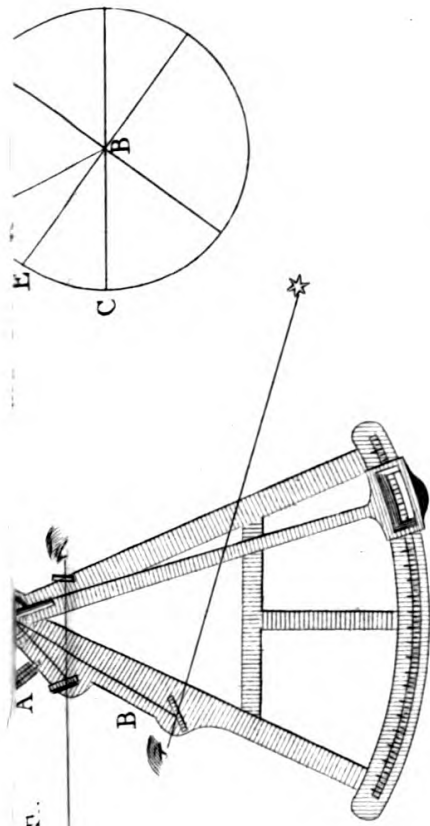


Fig. 513.



Fig. 514.

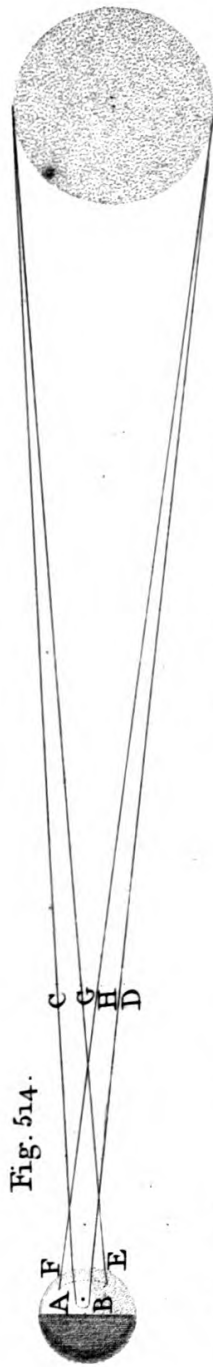


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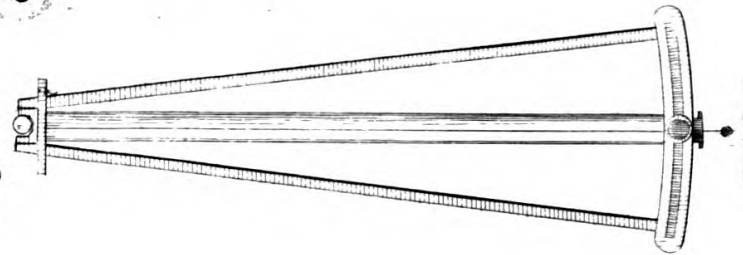


Fig. 515.

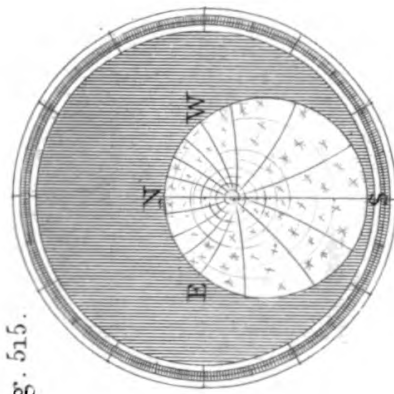
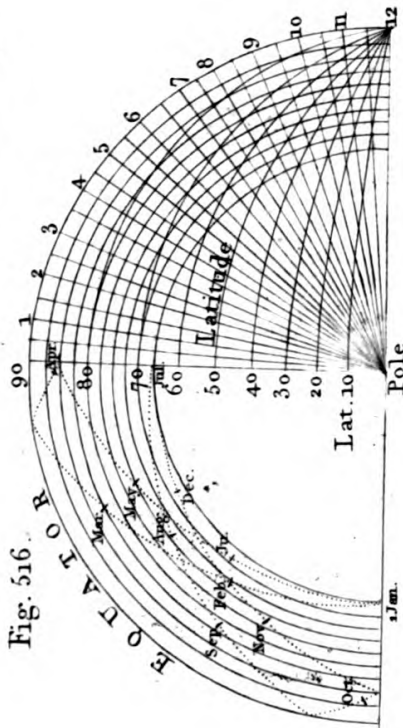
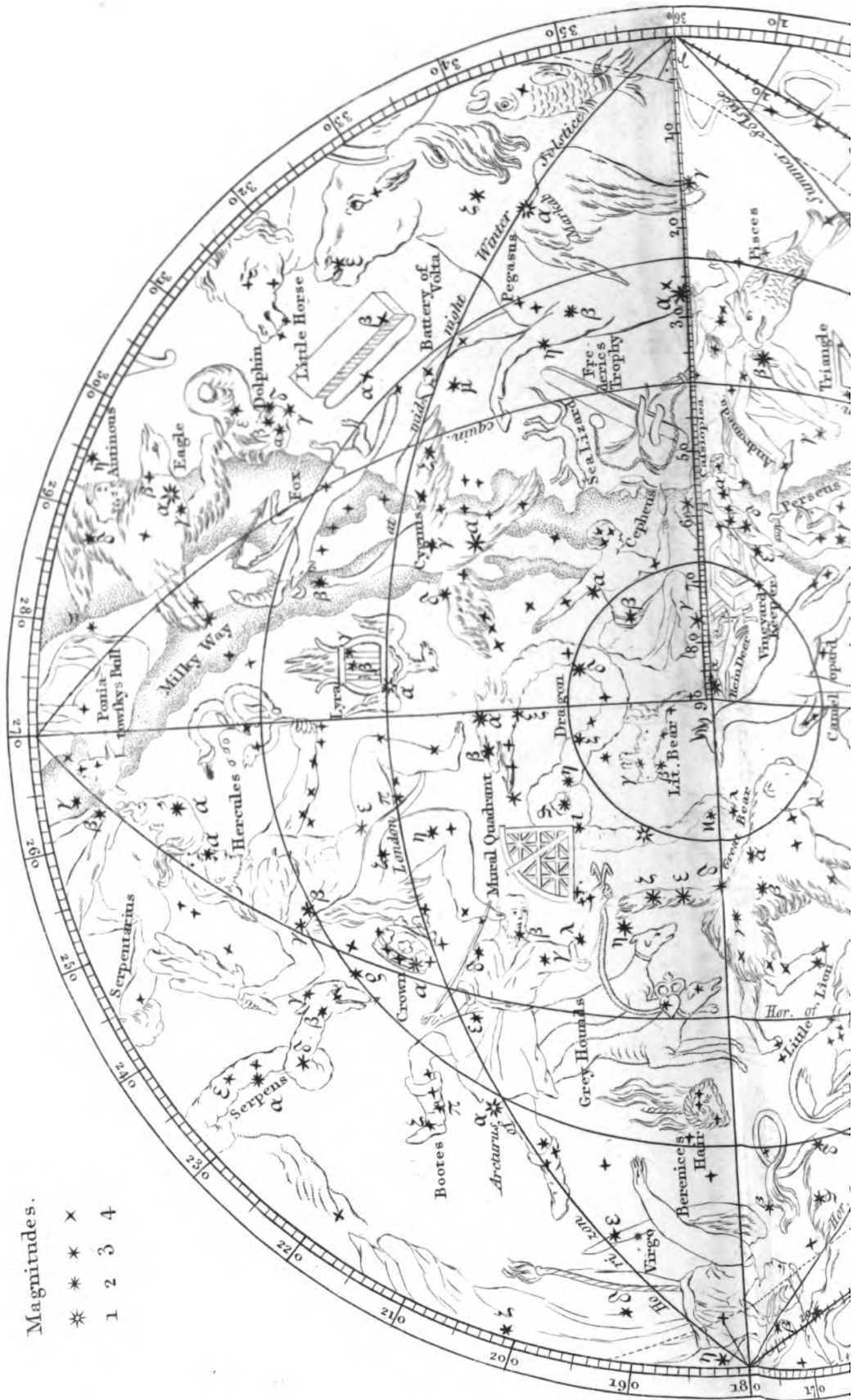


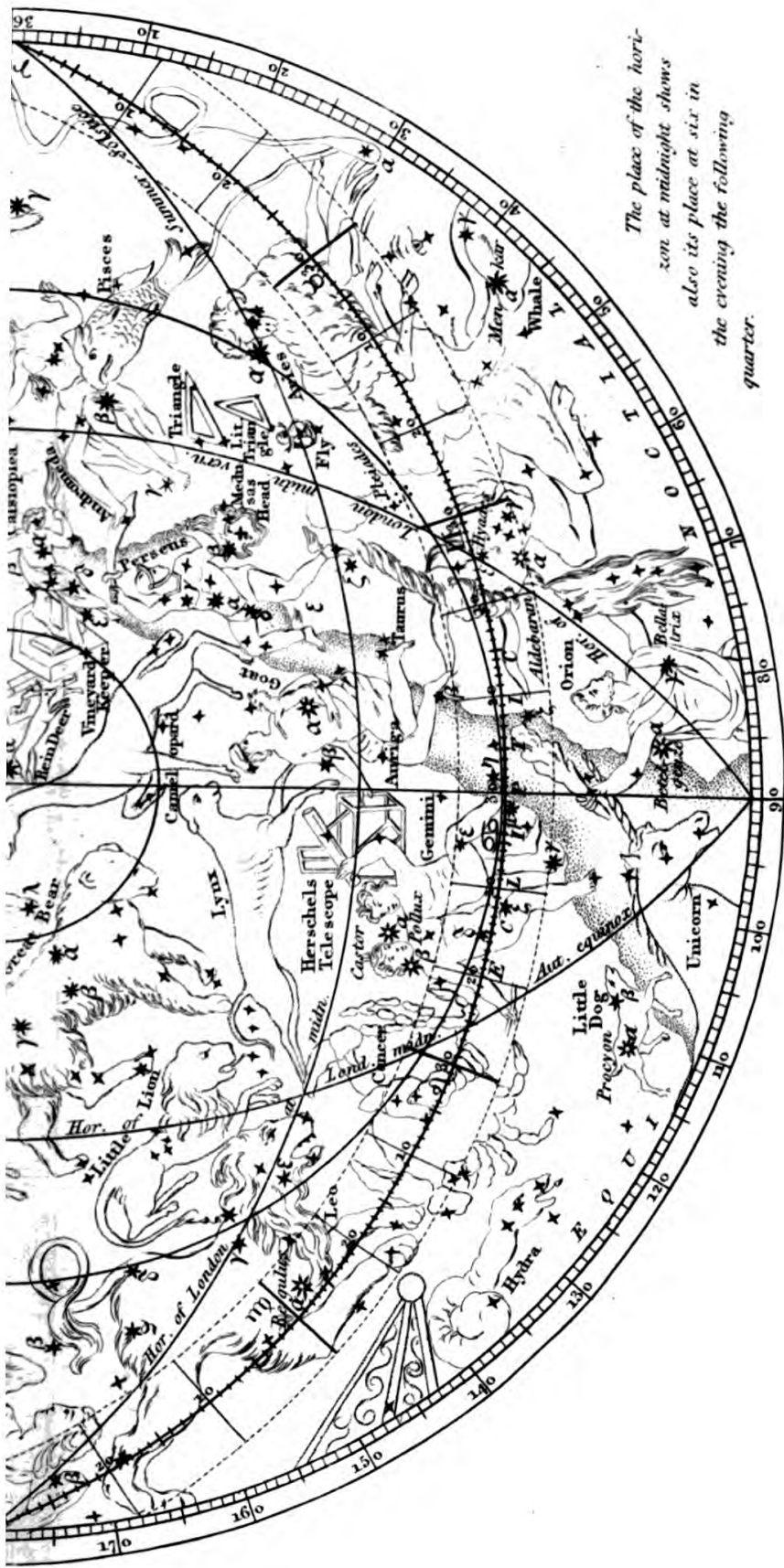
Fig. 516.



Handwritten text, possibly bleed-through from the reverse side of the page.

PLATE XXXVI. Fig. 517.





The place of the horizon at midnight shows also its place at six in the evening the following quarter.

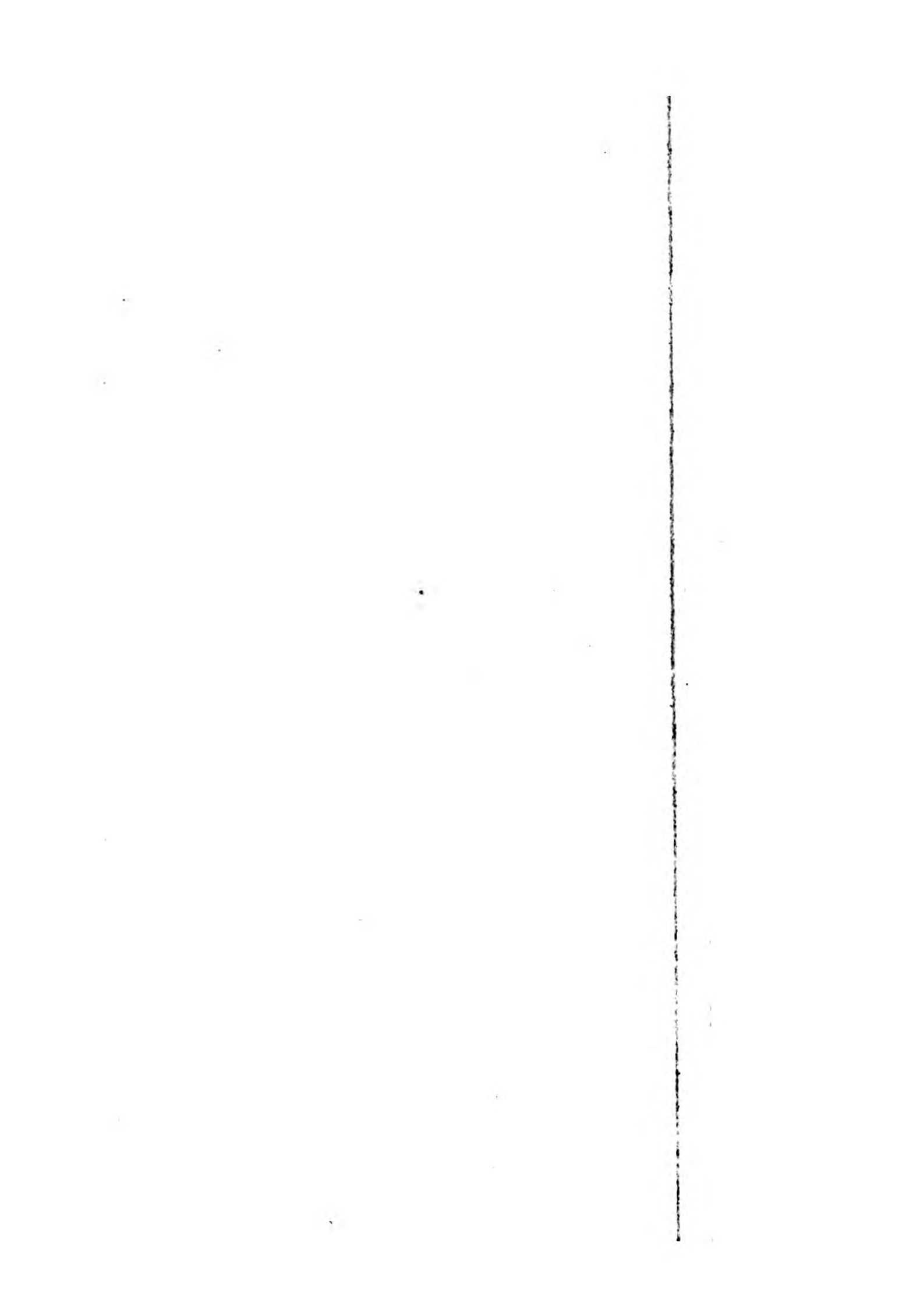
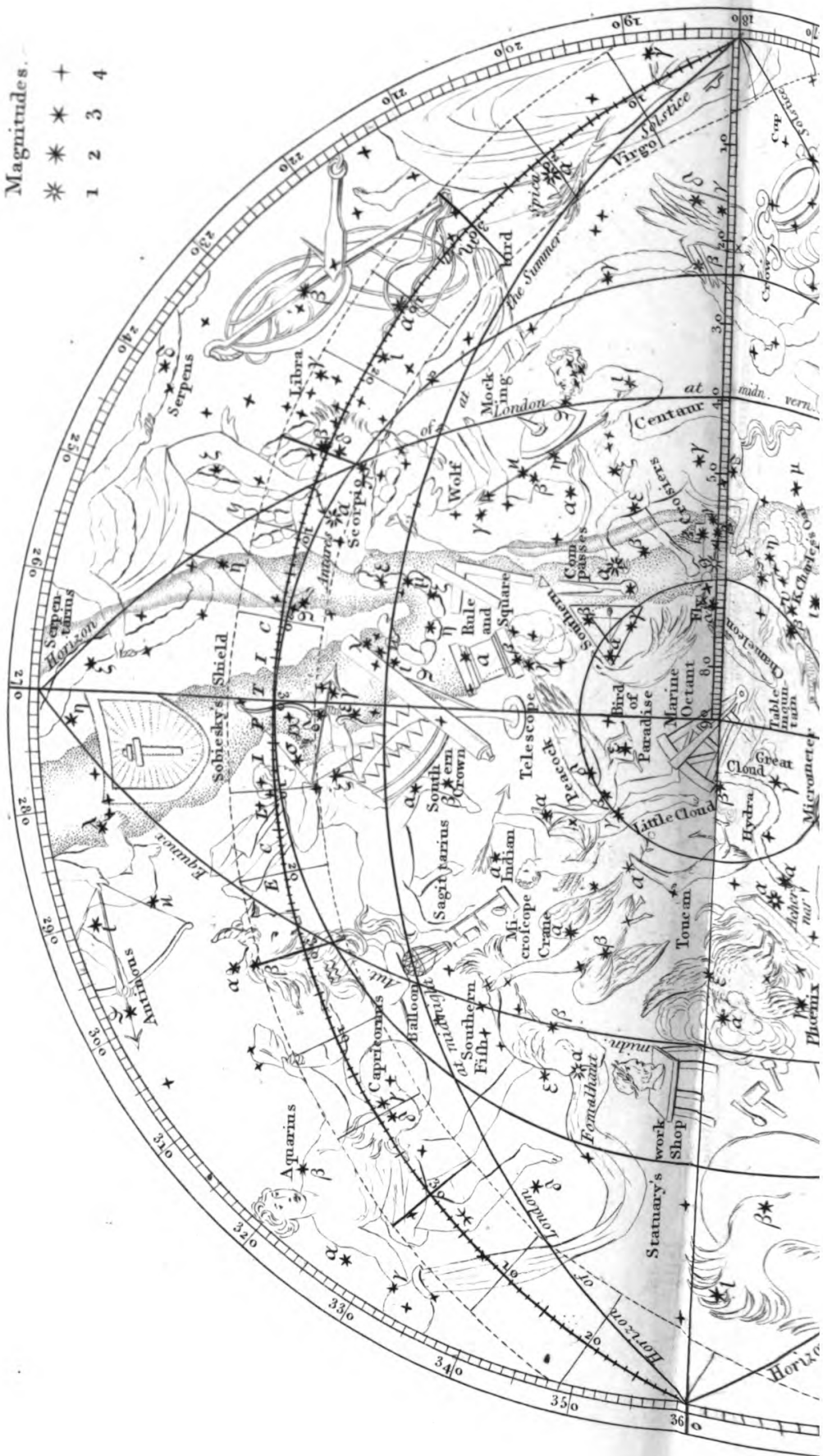
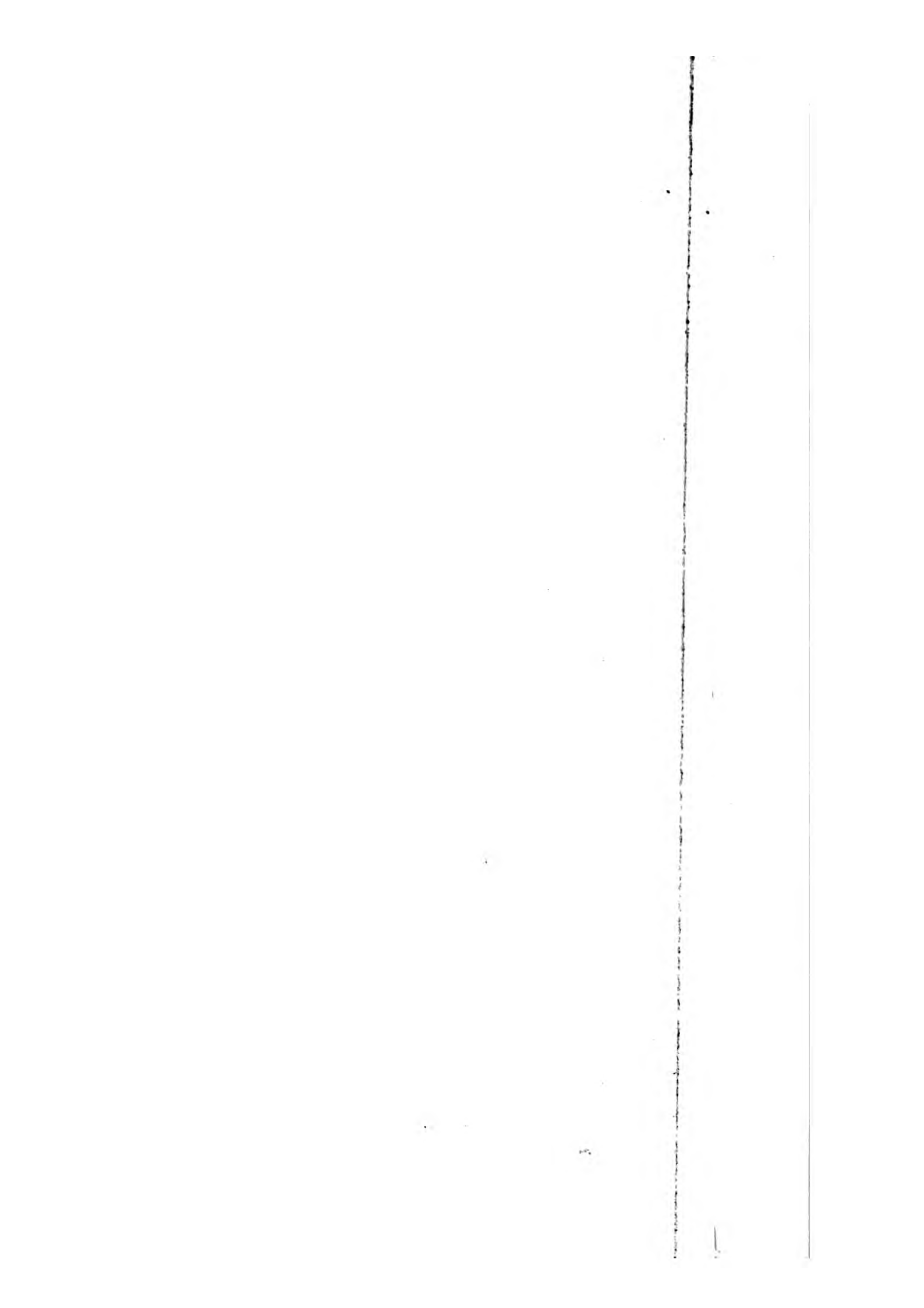


PLATE XXVII. Fig. 518.

Magnitudes.
 * * * * +
 * * 2 3 4





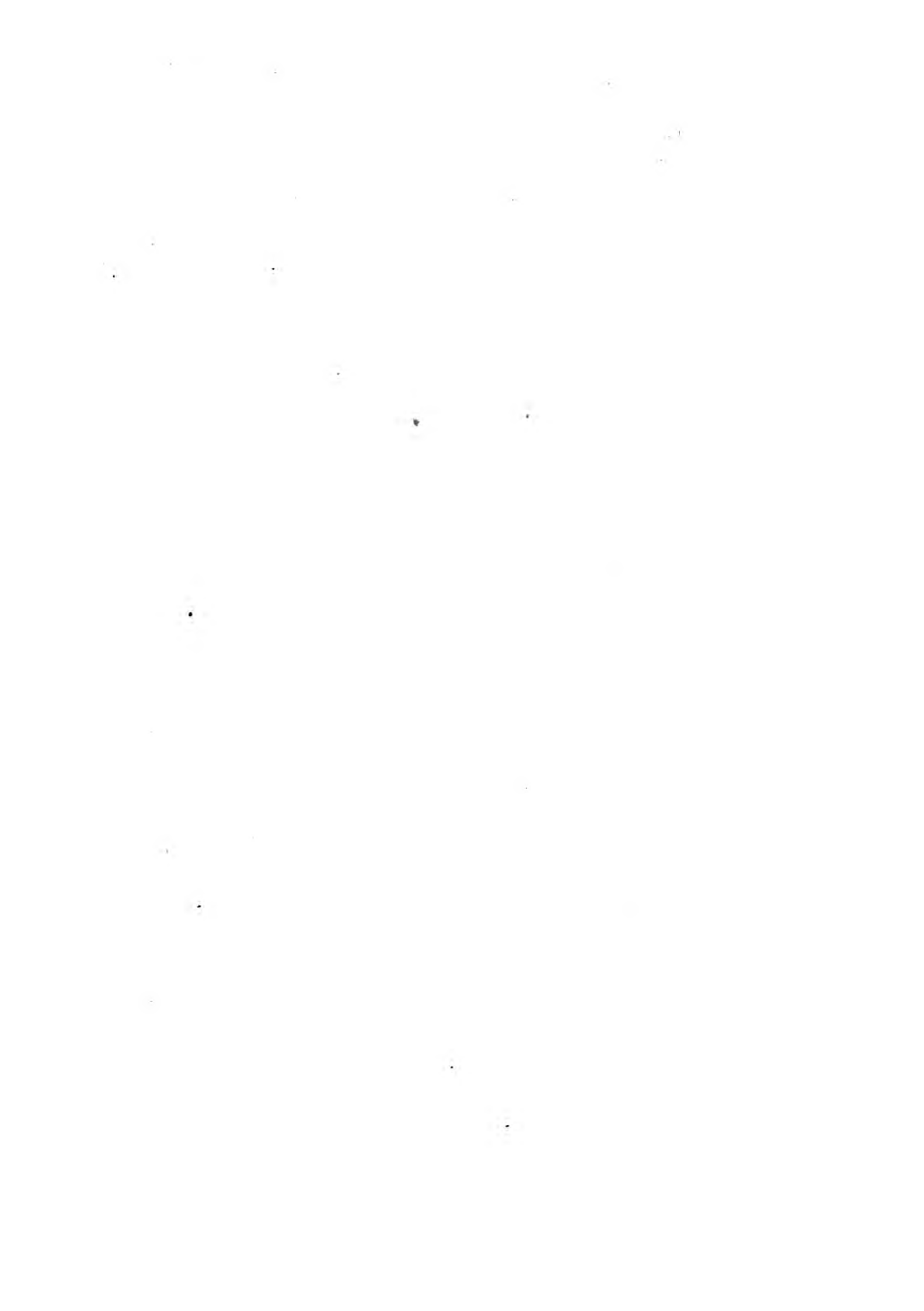


Fig. 519.

IV Miles

20,000 Feet

Chimborazo
Aristina
(3000 Toises)

18 Cotopaxi

17

16 III
Pichincha
Mont Blanc

15

14 Ophir

Pic d'Argentiere

13 4000

12 Corne du Midi
Pic d'Ossano

11 Pike of Teneriffe
Etna

10 II
Buet
St. Gothard
Monte Tevo
(Chaco, 7000)

Fig. 520.

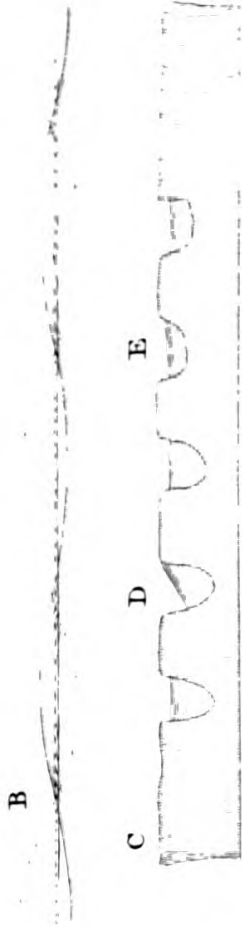
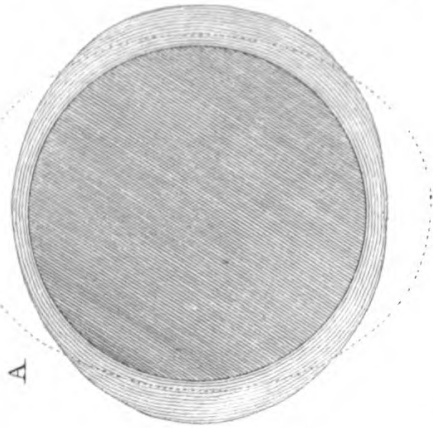


Fig. 521.

Fig. 522.

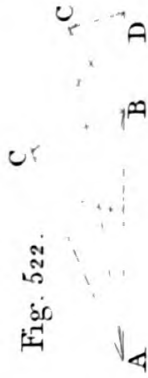


Fig. 523.

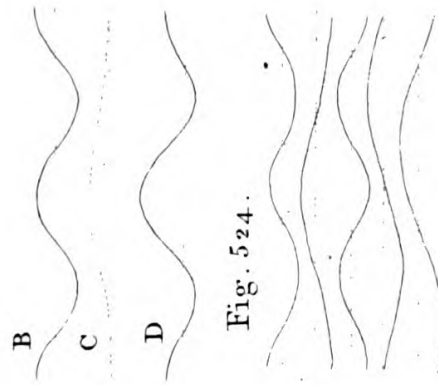
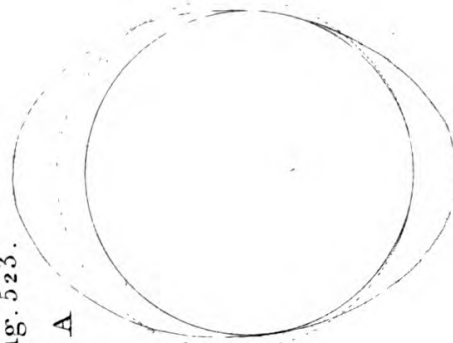


Fig. 524.

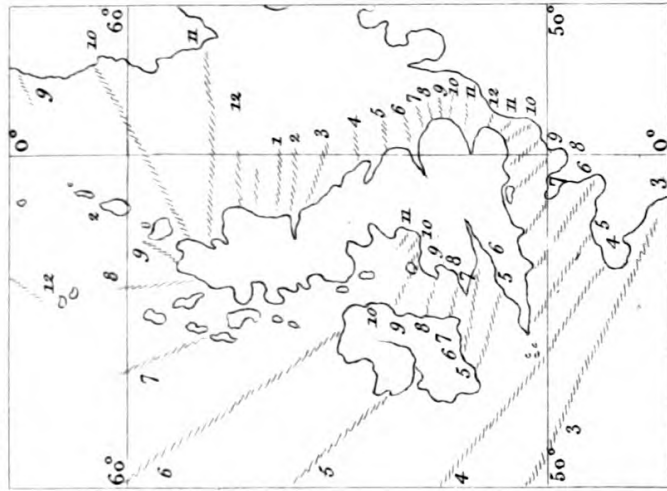
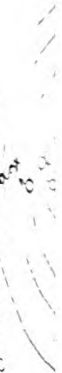
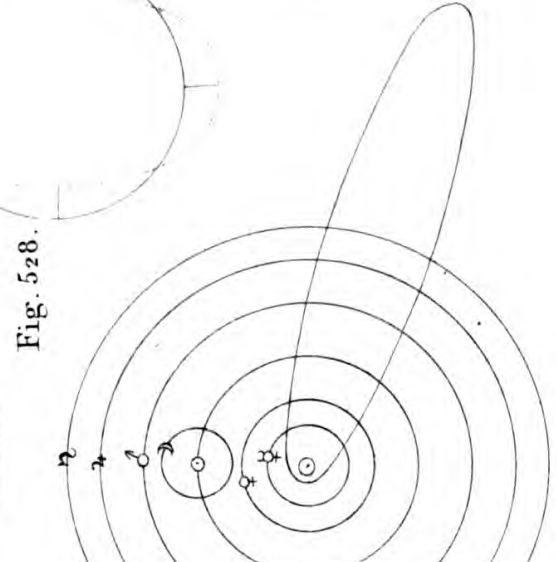
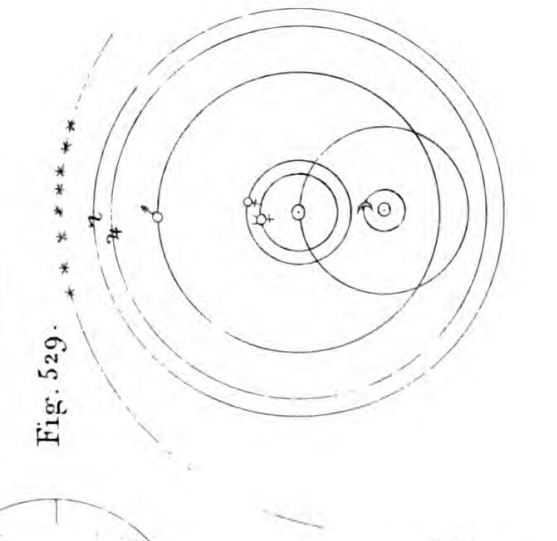
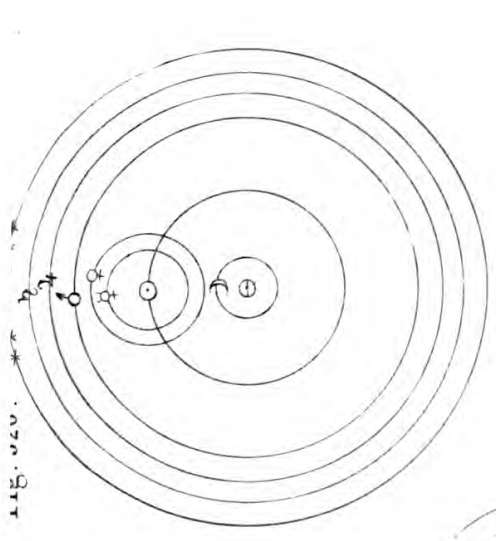


Fig. 525.

Fig. 526.



- 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
- 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
 - Monte Tiso
 - Quito
 - Pic du Midi
 - Mont Genis
 - Canigou
 - Genivar Abyss.
 - Monte Tebino
 - Pic de los Reyes
 - Mont d'or
 - Mont Genis, post house
 - Mole
 - Mont Jura
 - I Pic de Dome
 - Pic Ruivo Mad
 - Hecla
 - Ben Nevis
 - Piton
 - Wharfedale
 - Ingleborough
 - Visurys
 - Snowdon
 - Schallion
 - Fatic moat
 - Chamussy in
 - Skiddaw
 - Ben Lomond
 - Saddleback
 - Aosta
 - Lake of Geneva
 - Arthur's seat
 - Chanakbury ring duss
 - S^r Peter's from the ground
 - Sea
 - Caspian Sea



Joseph Stokem sculp

London: Taylor & Walton, Upper-Gower Street, 1845

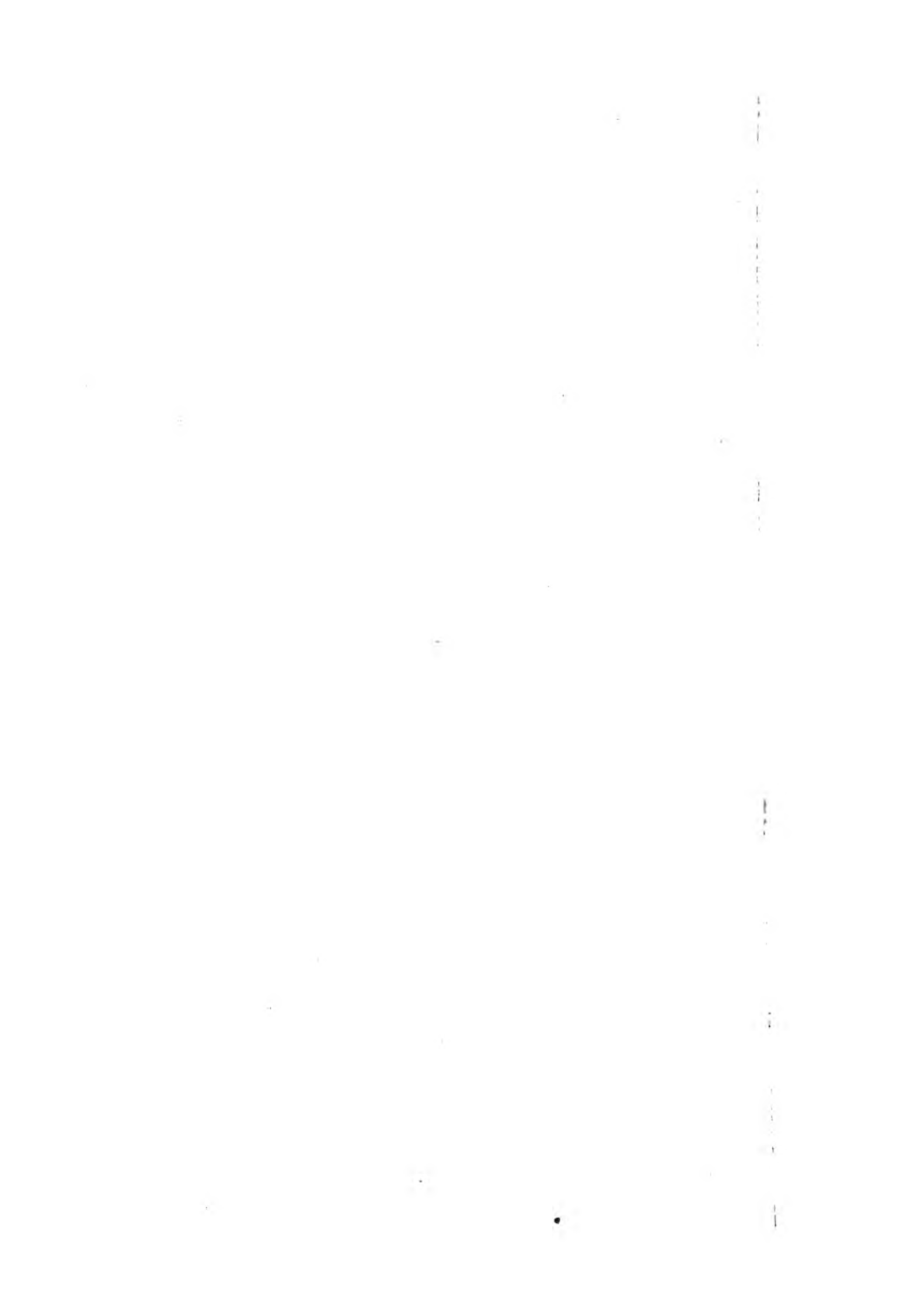


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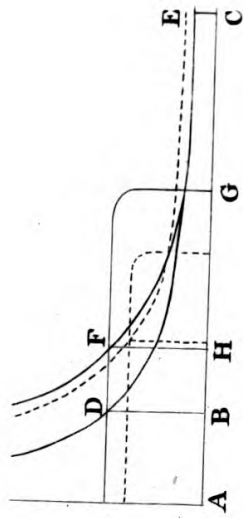


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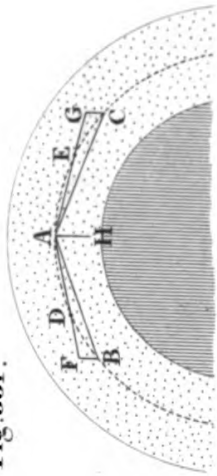


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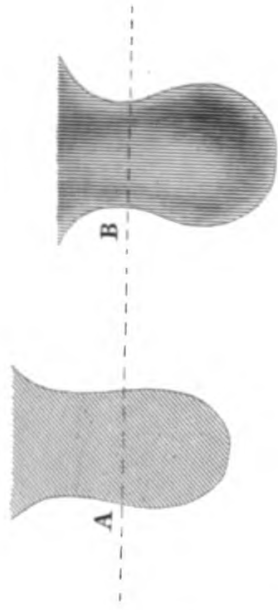


Fig. 533.

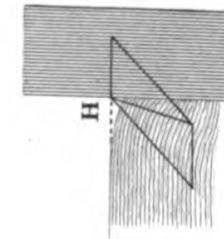
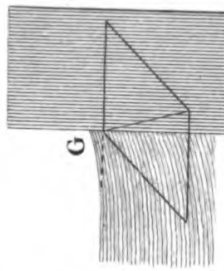
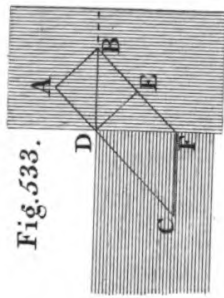


Fig. 534.

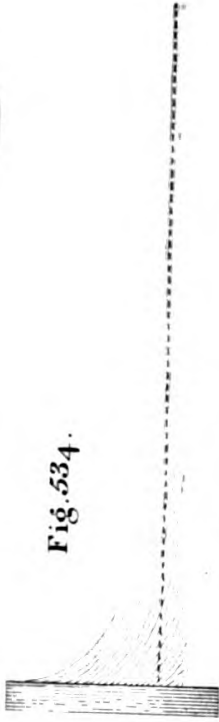


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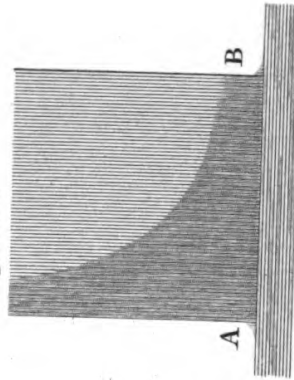


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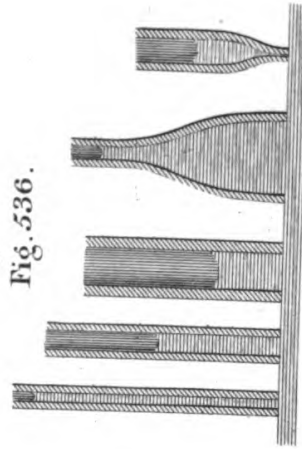


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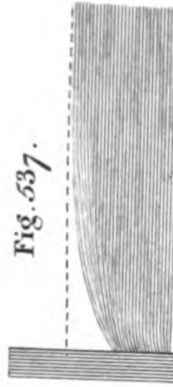


Fig. 538.



Fig. 539.

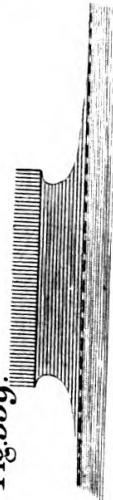


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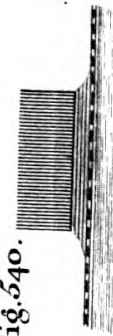
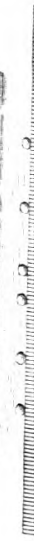


Fig. 541.



Fig. 542.



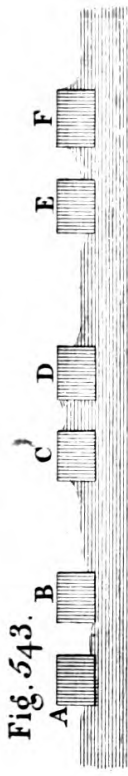


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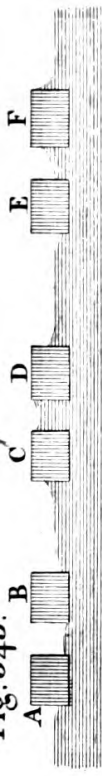


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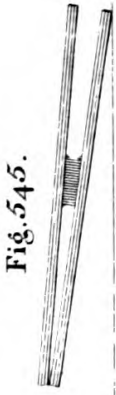


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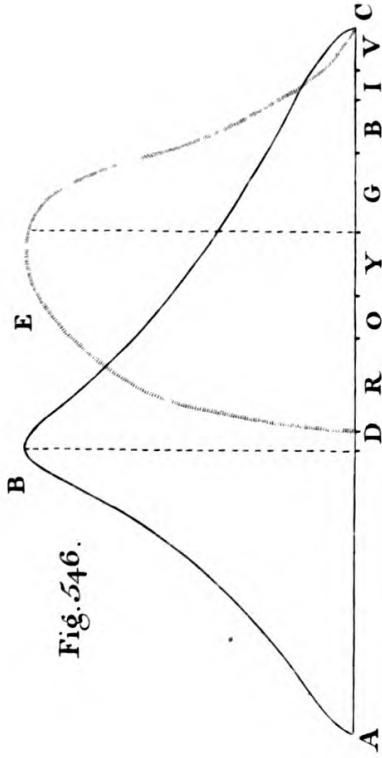


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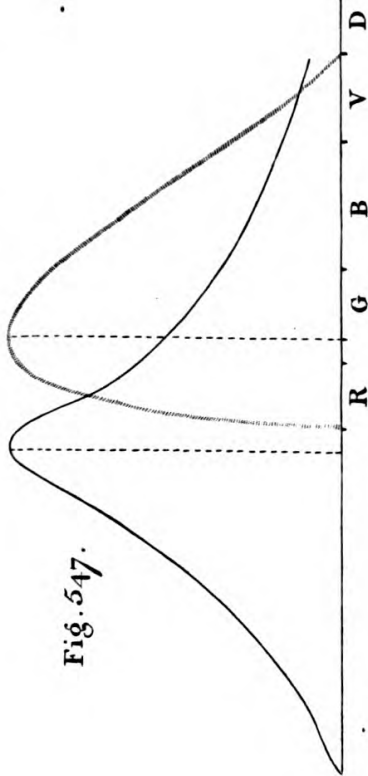


Fig. 547.



Fig. 548.



Fig. 549.



Fig. 550.

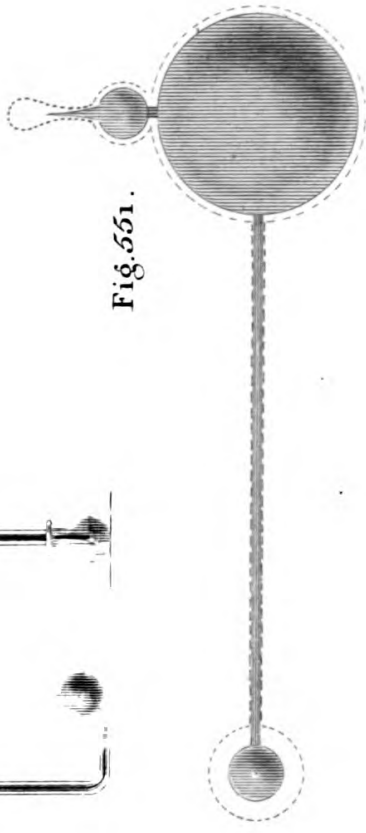


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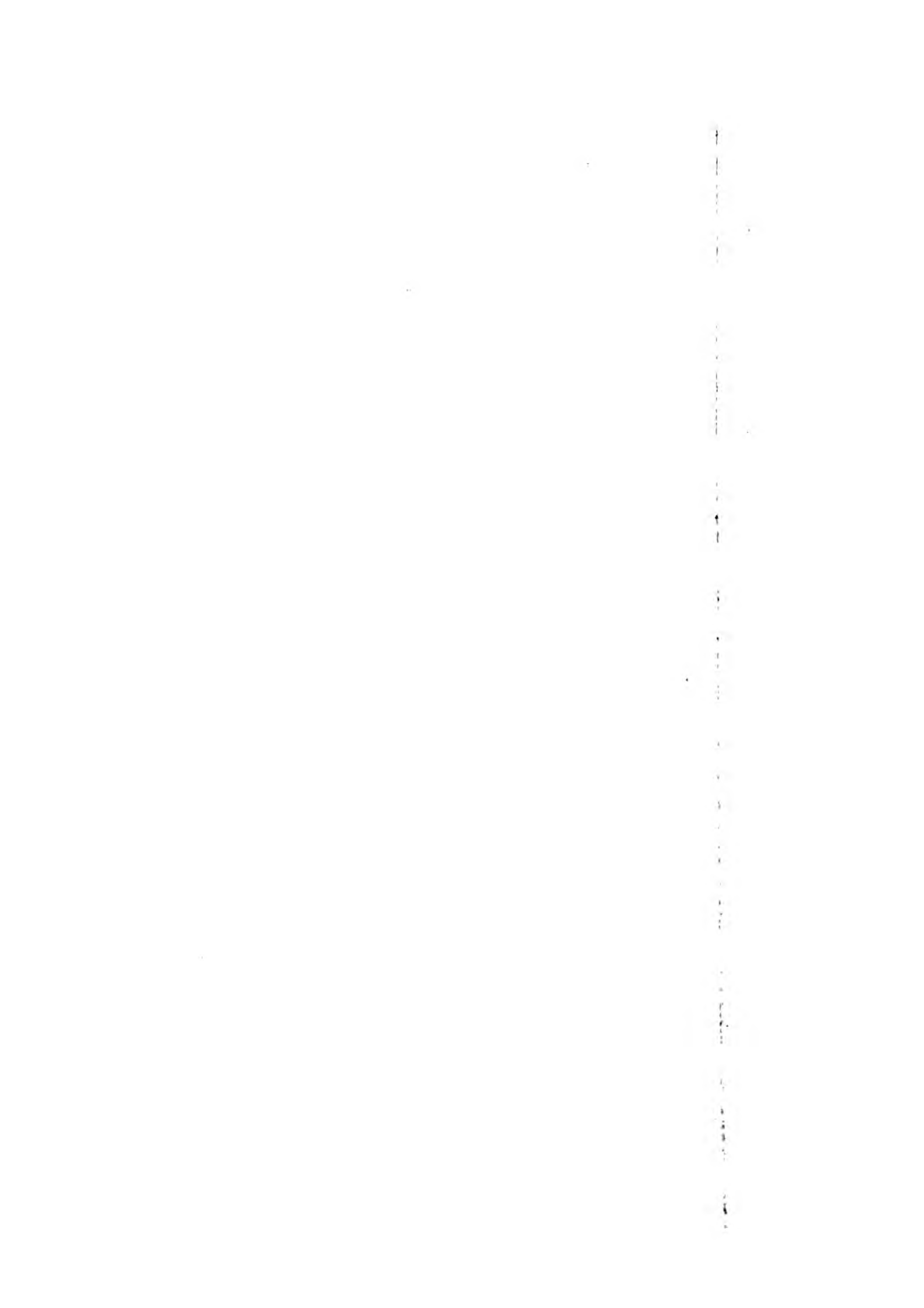


PLATE XL.

Fig. 552.

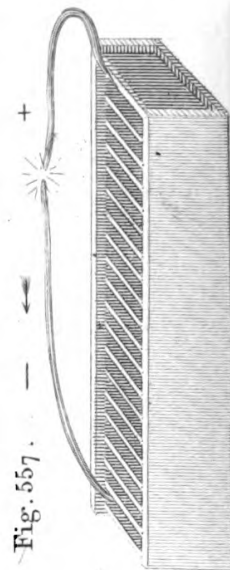
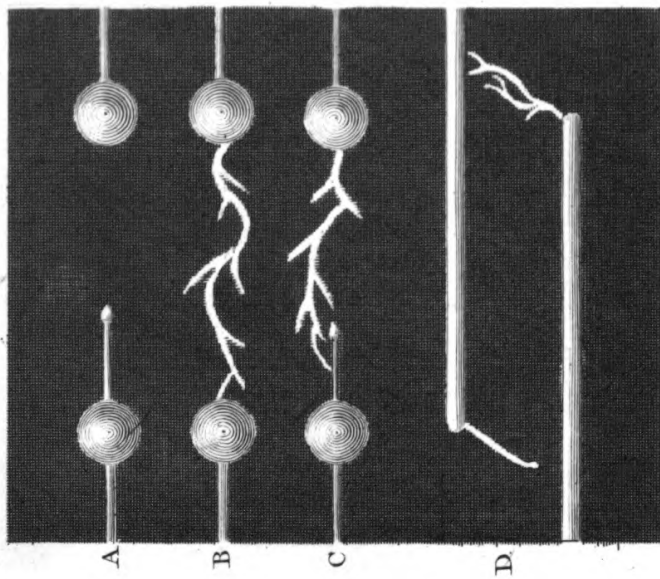


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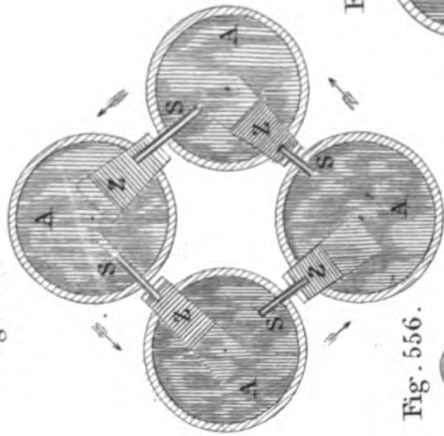


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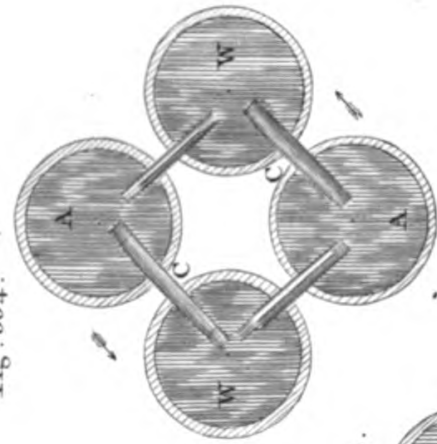


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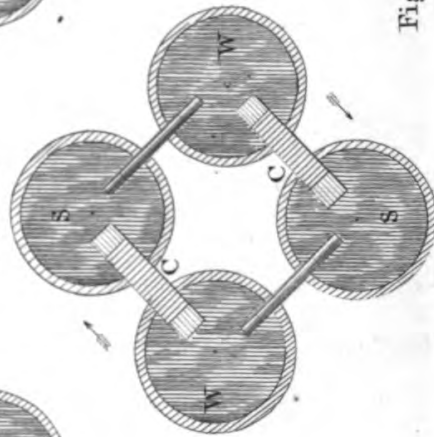


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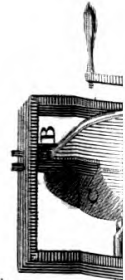
Fig. 560.



Fig. 561.



Fig. 569.



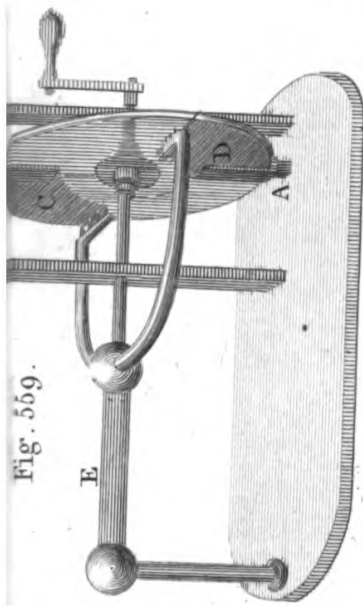


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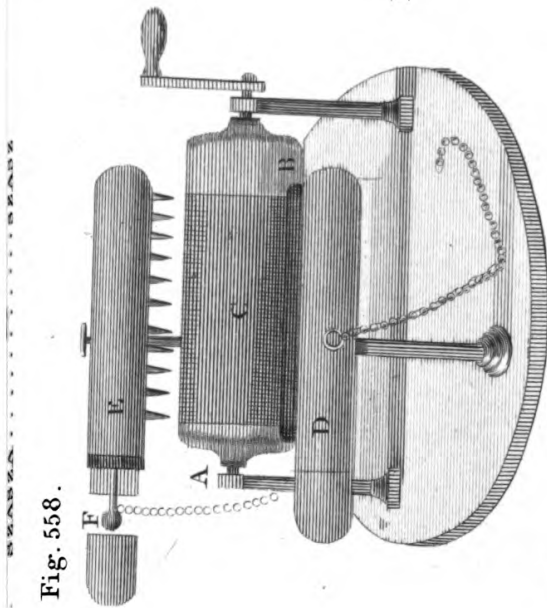


Fig. 558.

Fig. 561.

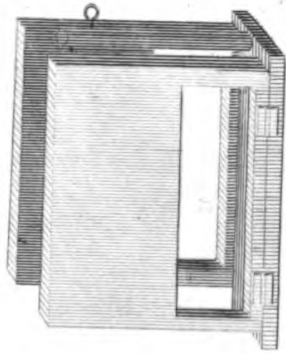


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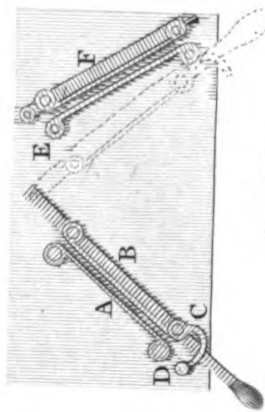


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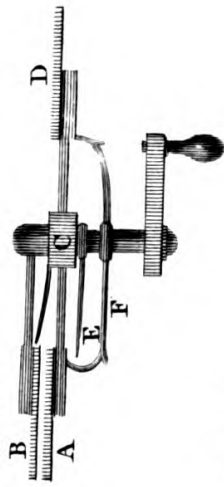


Fig. 564. D

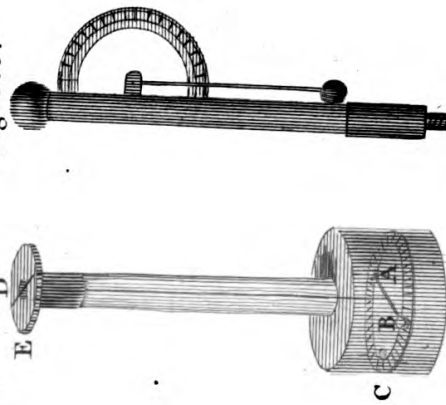


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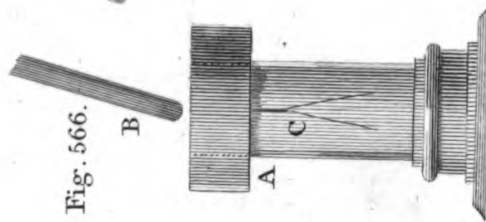


Fig. 567.

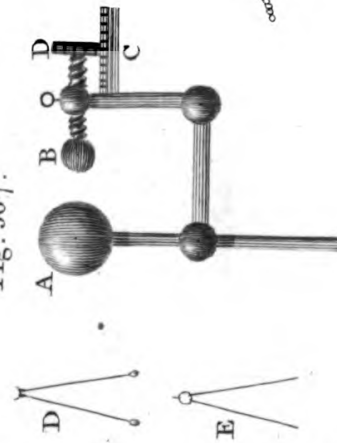
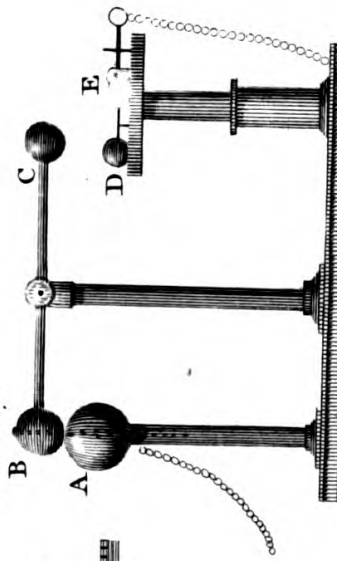


Fig. 568.



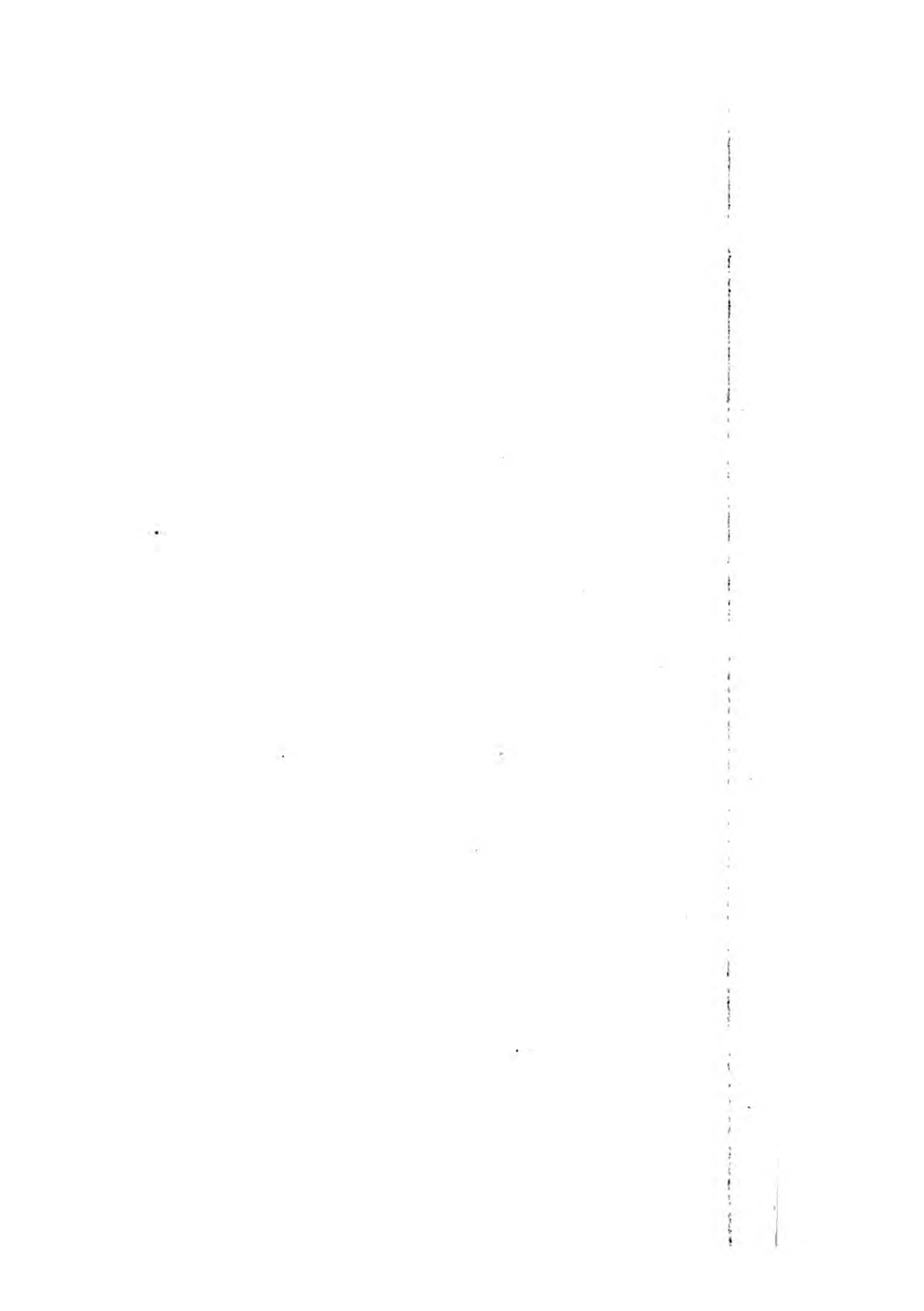


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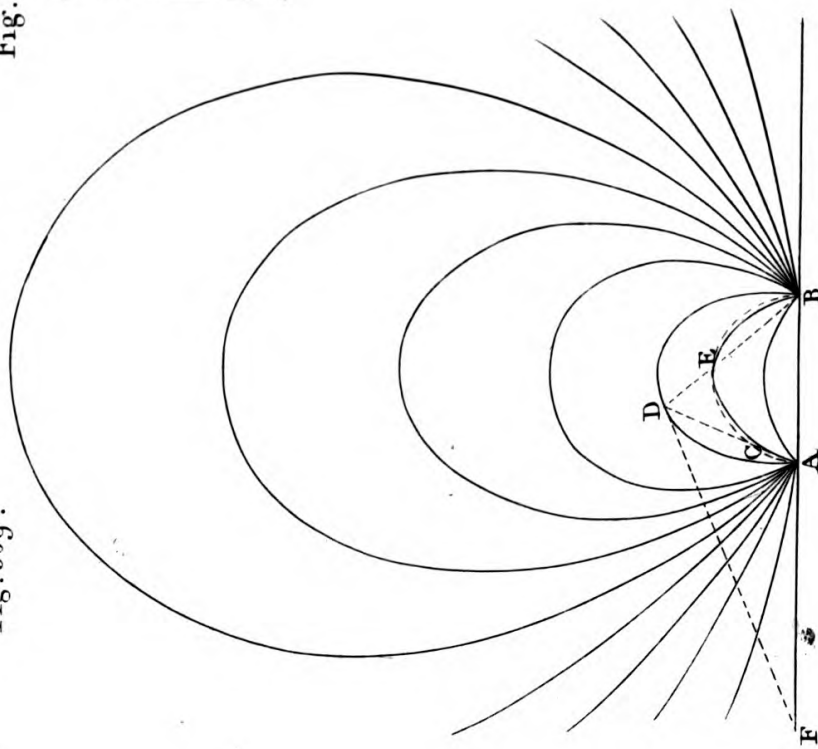


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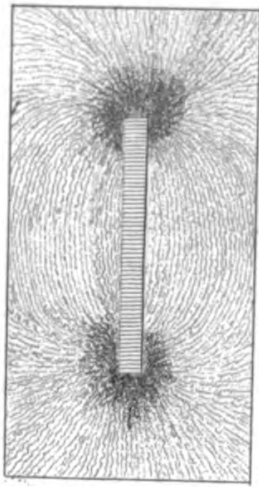


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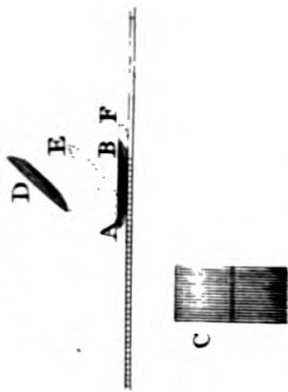


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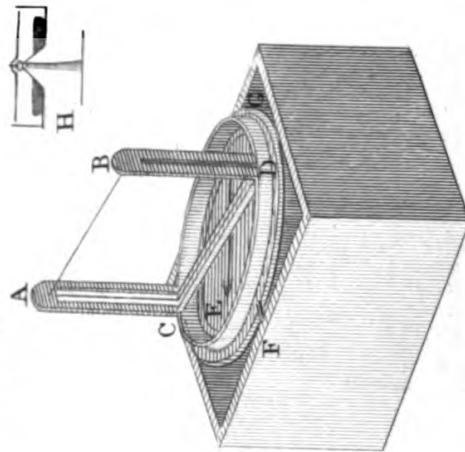


Fig. 573.

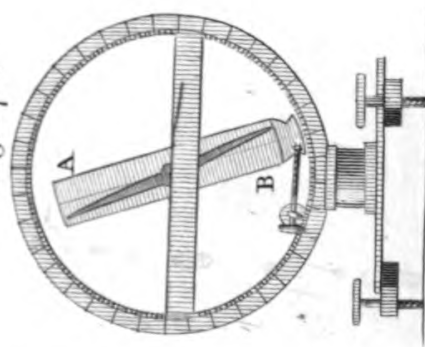


Fig. 574.

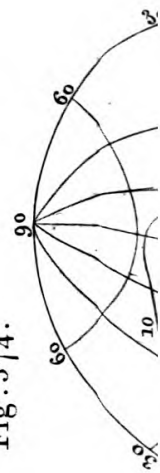


Fig. 575.

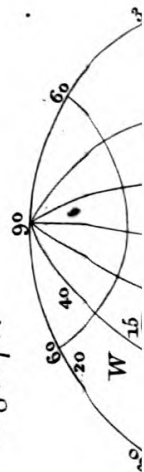
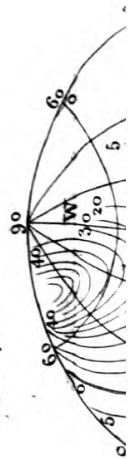


Fig. 576.



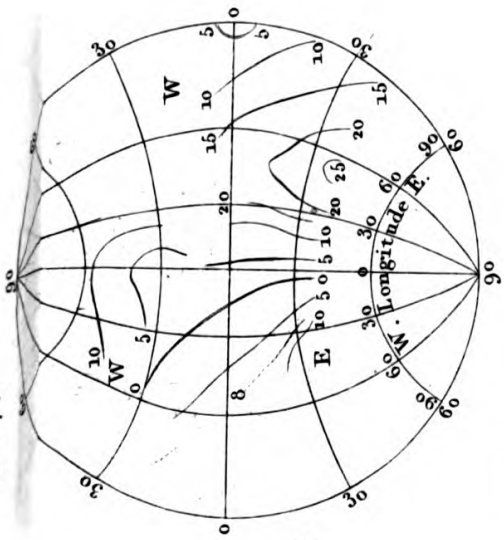


Fig. 575.

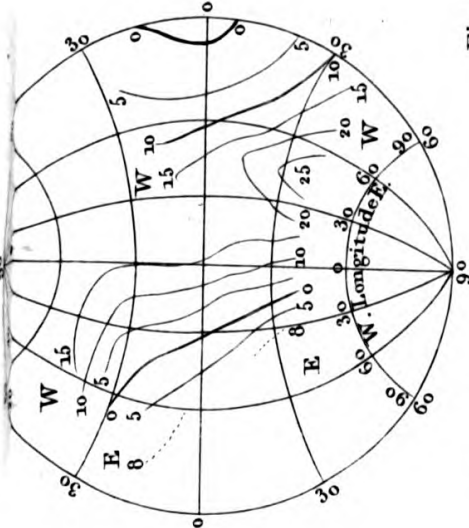


Fig. 576.

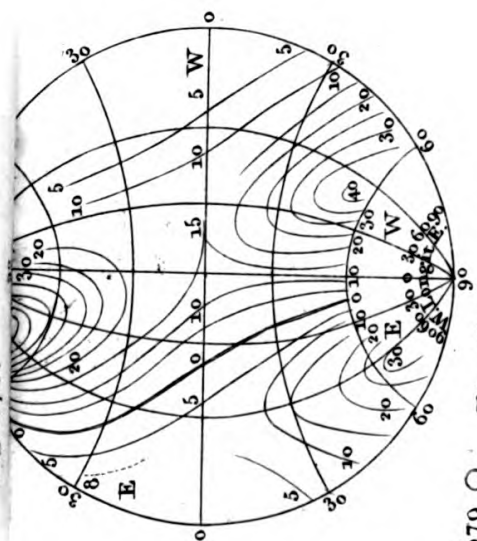


Fig. 577.

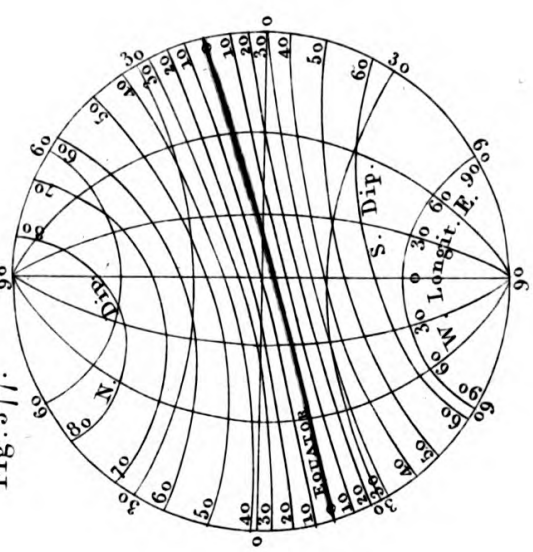


Fig. 578.

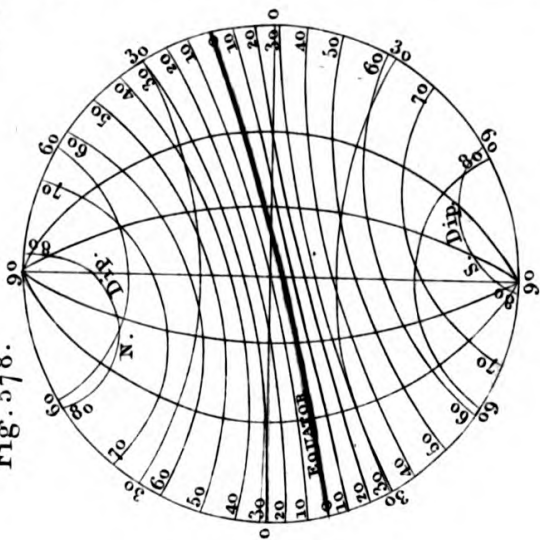


Fig. 579.

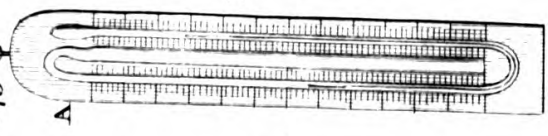


Fig. 580.

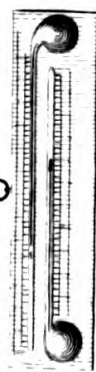
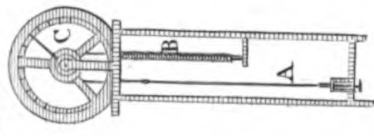
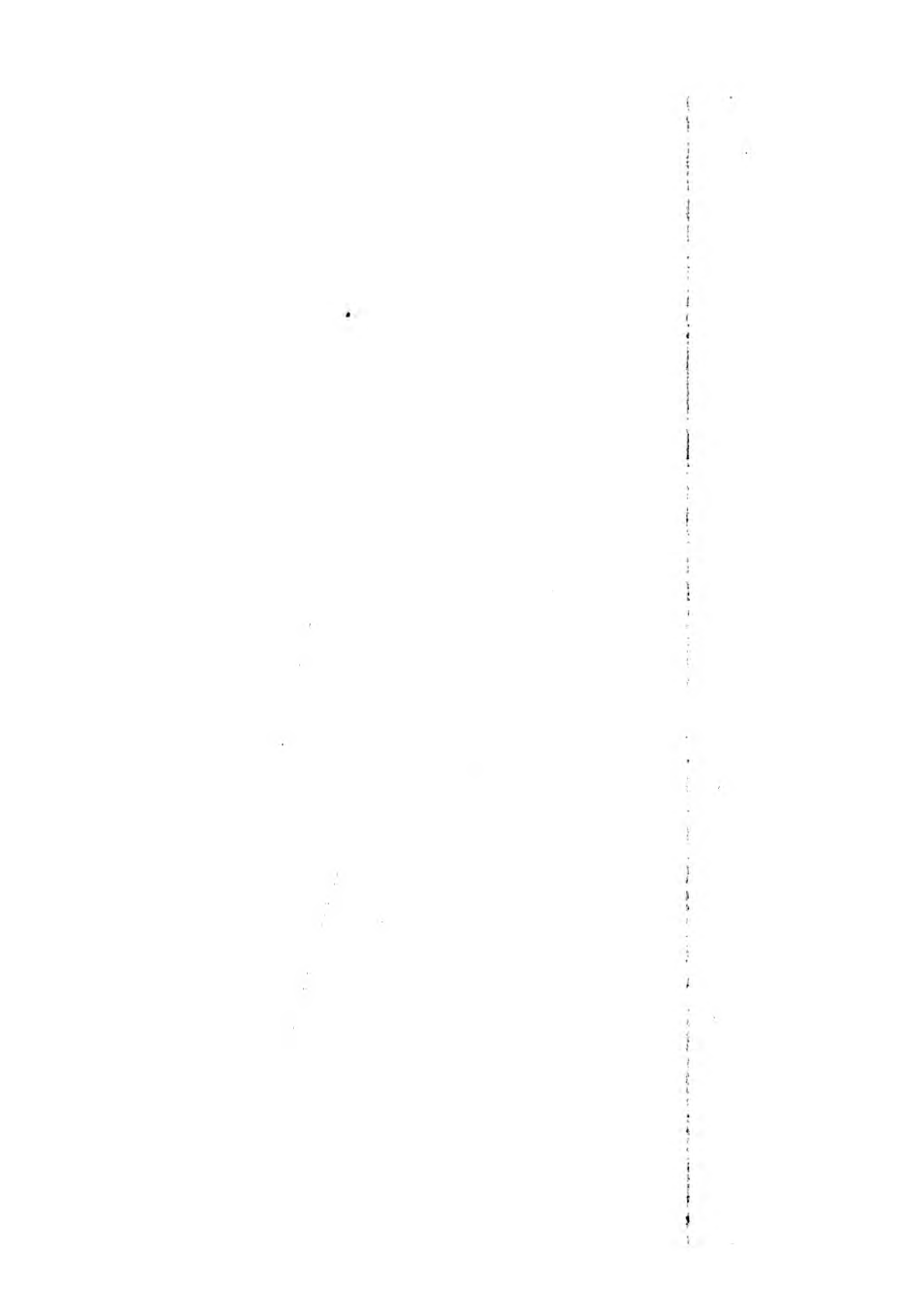


Fig. 581.





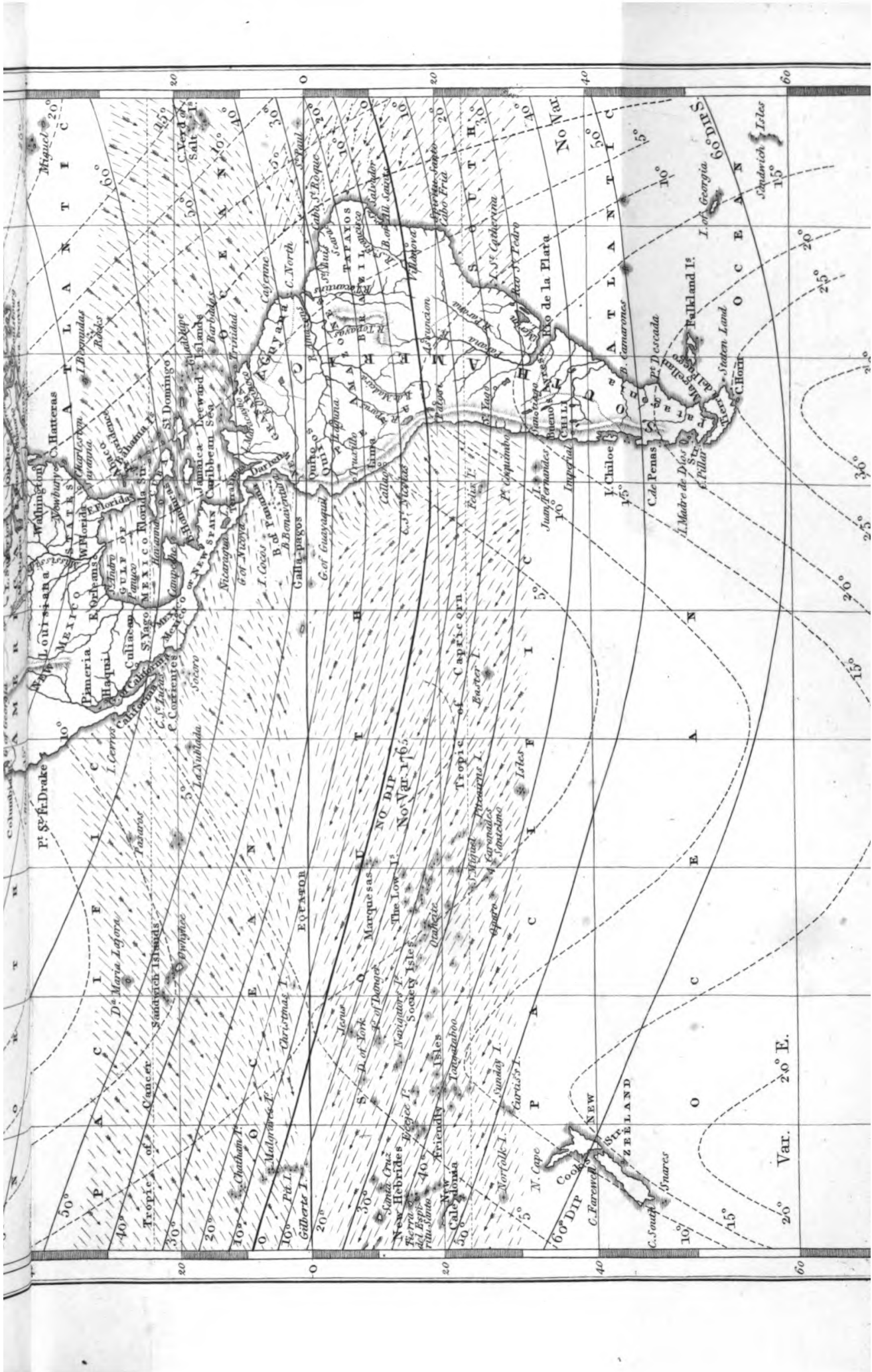


PLATE XLII. Fig. 382.

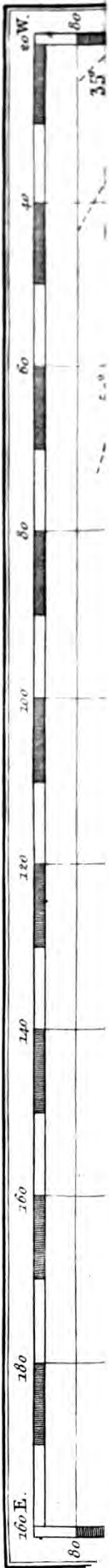


PLATE XLIII. Fig. 582.







