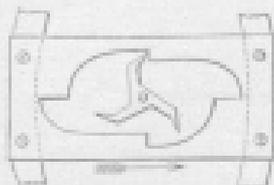


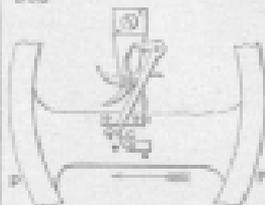
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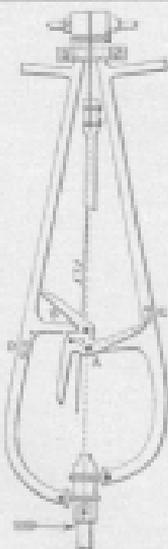
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306. Three-legged pendulum escapement. The pallets are formed in an opening in a plate attached to the pendulum, and the three teeth of the escape-wheel operate on the upper and lower pallets alternately. One tooth is shown in operation on the upper pallet.

307. A modification of the above with long stopping teeth, D and E. A and B are the pallets.

308. A detached pendulum escapement, leaving the pendulum, P, free or detached from the escape-wheel, except at the time of receiving the impulse and unlocking the wheel. There is but one pallet, I, which receives impulse only during the vibrations of the pendulum to the left. The lever, Q, locks the escape-wheel until just before the time for giving the impulse, when it is unlocked by the click, C, attached to the pendulum. As the pendulum returns to the right, the click, which oscillates on a pivot, will be pushed aside by the lever.

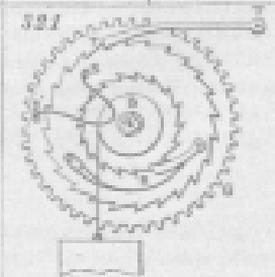
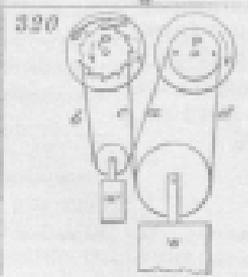
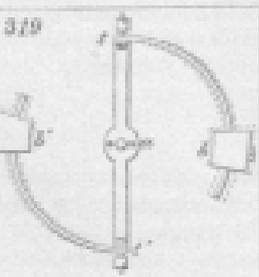
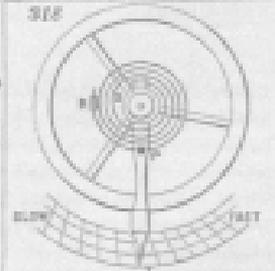
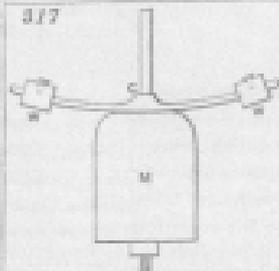
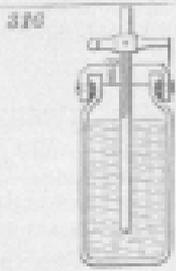
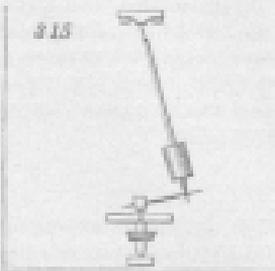
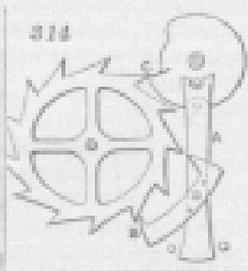
309. Mudge's gravity escapement. The pallets, A, B, instead of being on one arbor, are on two, as shown at C. The pendulum plays between the fork-pins, P, Q, and so

raises one of the weighted pallets out of the wheel at each vibration. When the pendulum returns the pallet falls with it, and the weight of the pallet gives the impulse.

310. Three-legged gravity escapement. The lifting of the pallets, A and B, is done by the three pins near the center of the escape-wheel, the pallets vibrating from two centers near the point of suspension of the pendulum. The escape-wheel is locked by means of stops, D and E, on the pallets.

311. Double three-legged gravity escapement. Two lockingwheels, A, B, C, and α , β , γ , are here used with one set of lifting pins between them. The two wheels are set wide enough apart to allow the pallets to lie between them. The teeth of the first-mentioned locking-wheel are stopped by a stop-tooth, D, on one pallet, and those of the other one by a stop-tooth, E, on the other pallet.

312. Bloxam's gravity escapement. The pallets are lifted alternately by the small wheel, and the stopping is done by the action of the stops, A and B, on the larger wheel. E and F are the fork-pins which embrace the pendulum.



313. Chronometer escapement, the form now commonly constructed. As the balance rotates in the direction of the arrow, the tooth, V, on the verge, presses the passing-spring against the lever, pressing aside the lever and removing the detent from the tooth of the escape-wheel. As balance returns, tooth, V, presses aside and passes spring without moving lever, which then rests against the stop, E. P is the only pallet upon which impulse is given.

314. Lever chronometer escapement. In this the pallets, A, B, and lever, look like those of the lever escapement 296; but these pallets only lock the escape-wheel, having no impulse. Impulse is given by teeth of escape-wheel directly to a pallet, C, attached to balance.

315. Conical pendulum, hung by a thin piece of round wire. Lower end connected with and driven in a circle by an arm attached to a vertical rotating spindle. The pendulum-rod describes a cone in its revolution.

316. Mercurial compensation pendulum. A glass jar of mercury is used for the bob or weight. As the pendulum-rod is expanded lengthwise by increased temperature, the expansion of mercury in jar carries it to a greater height therein, and so raises its center of gravity relatively to the rod sufficiently to compensate for downward expansion of the rod. As rod is contracted by a reduction of temperature, contraction of mercury lowers it relatively to rod. In this way the center of oscillation is always kept in the same place, and the effective length of pendulum always the same.

317. Compound bar compensation pendulum. C is a compound bar of brass and iron or steel, brazed together with brass downward. As brass expands more than iron, the bar will bend upward as it gets warmer, and carry the weights, W, W, up with it, raising the center of the aggregate weight, M, W, to raise the center of oscillation as much as elongation of the pendulum rod would let it down.

318. Watch regulator. The balance-spring is attached at its outer end to a fixed stud, R, and at its inner end to staff of balance. A neutral point is formed in the spring at P by inserting it between two curb-pins in the lever, which is fitted to turn on a fixed ring concentric with staff of balance, and the spring only vibrates between this neutral point and staff of balance. By moving lever to the

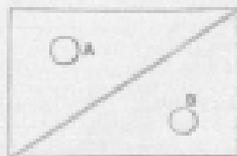
right, the curb-pins are made to reduce the length of acting part of spring, and the vibrations of balance are made faster; and by moving it to the left an opposite effect is produced.

319. Compensation balance. z, a, z' , is the main bar of balance, with timing screws for regulation at the ends. z and z' are two compound bars, of which the outside is brass and the inside steel, carrying weights, b, b' . As heat increases, these bars are bent inward by the greater expansion of the brass, and the weights are thus drawn inward, diminishing the inertia of the balance. As the heat diminishes, an opposite effect is produced. This balance compensates both for its own expansion and contraction, and that of the balance-spring.

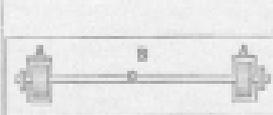
320. Endless chain, maintaining power on going barrel, to keep a clock going while winding, during which operation the action of the weight or main-spring is taken off the barrel. The wheel to the right is the "going-wheel," and that to the left the "striking-wheel." P is a pulley fixed to the great wheel of the going part, and roughened, to prevent a rope or chain hung over it from slipping. A similar pulley rides on another arbor, A , which may be the arbor of the great wheel of the striking part, and attached by a ratchet and click to that wheel, or to clock-frame, if there is no striking part. The weights are hung, as may be seen, the small one being only large enough to keep the rope or chain on the pulleys. If the part, b , of the rope or chain is pulled down, the ratchet-pulley runs under the click, and the great weight is pulled up by c , without taking its pressure off the going-wheel at all.

321. Harrison's "going-barrel." Larger ratchet-wheel, to which the click, R, is attached, is connected with the great wheel, G, by a spring, S, S'. While the clock is going, the weight acts upon the great wheel, G, through the spring; but as soon as the weight is taken off by winding, the click, T, whose pivot is set in the frame, prevents the larger ratchet from falling back, and so the spring, S, S', still drives the great wheel during the time the clock takes to wind, as it need only just keep the escapement going, the pendulum taking care of itself for that short time. Good watches have a substantially similar apparatus.

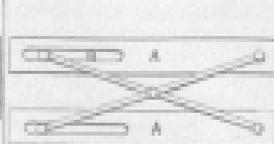
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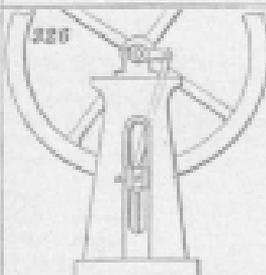
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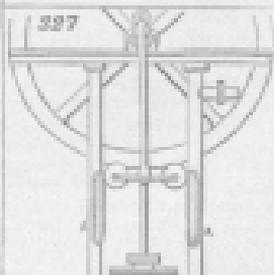
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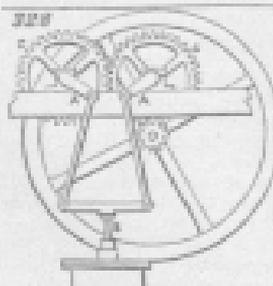
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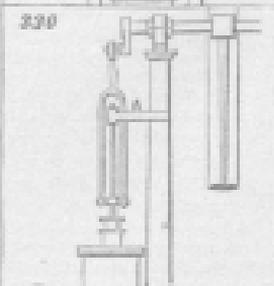
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322. A very convenient construction of parallel ruler for drawing, made by cutting a quadrangle through the diagonal, forming two right-angled triangles, A and B. It is used by sliding the hypotenuse of one triangle upon that of the other.

323. Parallel ruler consisting of a simple straight ruler, B, with an attached axle, C, and pair of wheels, A, A. The wheels, which protrude but slightly through the under side of the ruler, have their edges nicked to take hold of the paper and keep the ruler always parallel with any lines drawn upon it.

324. Compound parallel ruler, composed of two simple rulers, A, A, connected by two crossed arms pivoted together at the middle of their length, each pivoted at one end to one of the rulers, and connected with the other one by a slot and sliding-pin, as shown at B. In this the ends as well as the edges are kept parallel. The principle of construction of the several rulers represented is taken advantage of in the formation of some parts of machinery.

325. Parallel ruler composed of two simple rulers, A, B, connected by two pivoted swinging arms, C, C.

326. A simple means of guiding or obtaining a parallel motion of the piston-rod of an engine. The slide, A, moves in and

is guided by the vertical slot in the frame, which is planed to a true surface.

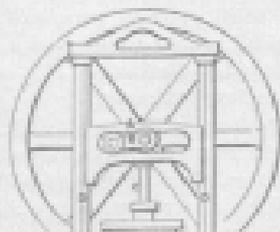
327. Differs from 326 in having rollers substituted for the slides on the cross-head, said rollers working against straight guide-bars, A, A, attached to the frame. This is used for small engines in France.

328. A parallel motion invented by Dr. Cartwright in the year 1787. The toothed wheels, C, C, have equal diameters and numbers of teeth; and the cranks, A, A, have equal radii, and are set in opposite directions, and consequently give an equal obliquity to the connecting-rods during the revolution of the wheels. The cross-head on the piston-rod being attached to the two connecting-rods, the piston-rod is caused to move in a right line.

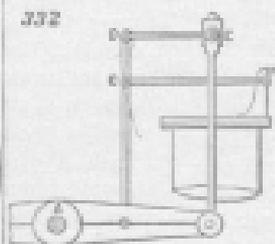
329. A piston-rod guide. The piston-rod, A, is connected with a wrist attached to a cog-wheel, B, which turns on a crank-pin, carried by a plate, C, which is fast on the shaft. The wheel, B, revolves around a stationary internally toothed gear, D, of double the diameter of B, and so motion is given to the crank-pin, and the piston-rod is kept upright.

330. The piston-rod is prolonged and works in a guide, A, which is in line with the center of the cylinder. The lower part of the connecting-rod is forked to permit the upper part of the piston-rod to pass between.

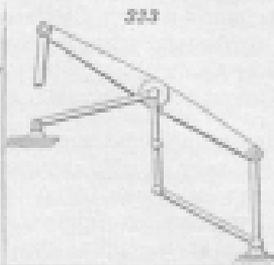
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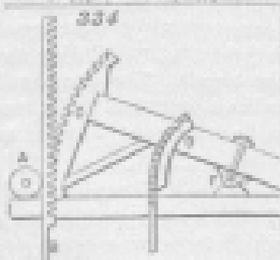
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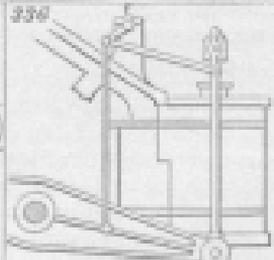
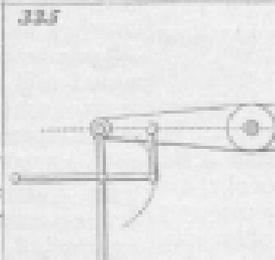
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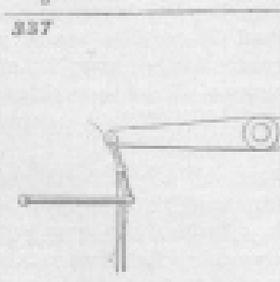
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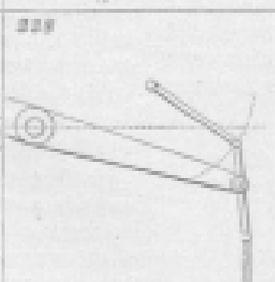
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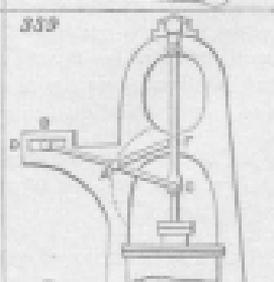
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331. An engine with crank motion like that represented in 93 and 279 of this table, the crank-wrist journal working in a slotted cross-head, A. This cross-head works between the pillar guides, D, D, of the engine framing.

332. A parallel motion used for the piston-rod of side lever marine engines. F, C, is the radius bar, and E the cross-head to which the parallel bar, E, D, is attached.

333. A parallel motion used only in particular cases.

334. Shows a parallel motion used in some of the old single-acting beam engines. The piston-rod is formed with a straight rack gearing with a toothed segment on the beam. The back of the rack works against a roller, A.

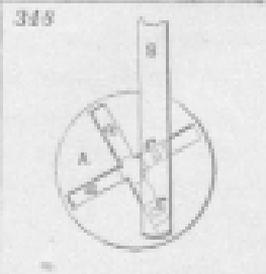
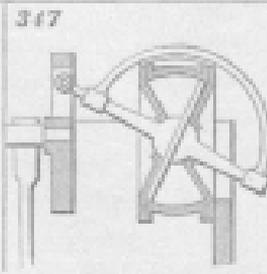
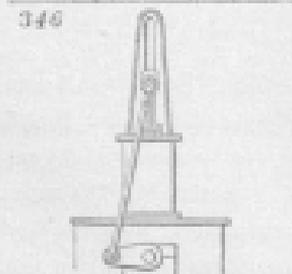
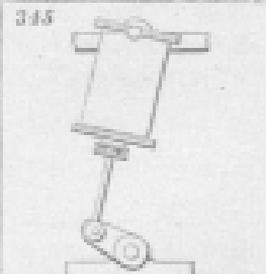
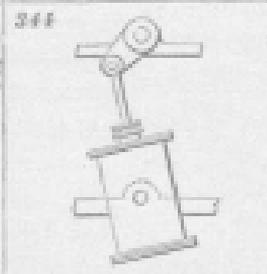
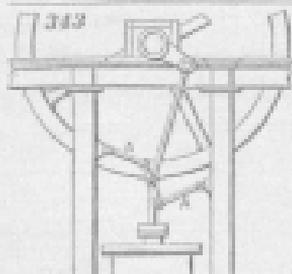
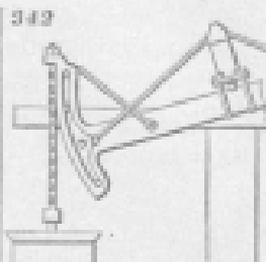
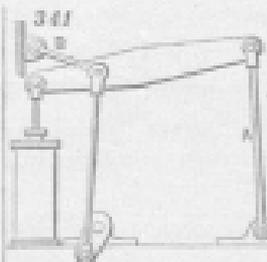
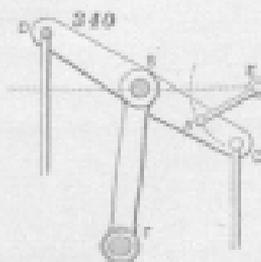
335. A parallel motion commonly used for stationary beam engines.

336. An arrangement of parallel motion for side lever marine engines. The parallel rods connected with the side rods from the beams or side levers are also connected with short radius arms on a rock-shaft working in fixed bearings.

337. Parallel motion in which the radius rod is connected with the lower end of a short vibrating rod, the upper end of which is connected with the beam, and to the center of which the piston-rod is connected.

338. Another modification, in which the radius bar is placed above the beam.

339. Parallel motion for direct action engines. In this, the end of the bar, B, C, is connected with the piston-rod, and the end, B, slides in a fixed slot, D. The radius bar, F, A, is connected at F with a fixed pivot, and at A, midway between the ends of B, C.



340. Another parallel motion. Beam, D, C, with joggling pillar-support, B, F, which vibrates from the center, F. The piston-rod is connected at C. The radius-bar, E, A, produces the parallel motion.

341. "Grasshopper" beam engine. The beam is attached at one end to a rocking-pillar, A, and the shaft arranged as near to the cylinder as the crank will work. B is the radius-bar of the parallel motion.

342. Old-fashioned single-acting beam pumping engine on the atmospheric principle, with chain connection between piston-rod and a segment at end of beam. The cylinder is open at top. Very low pressure steam is admitted below piston, and the weight of pump-rod, etc., at the other end of beam, helps to raise piston. Steam is then condensed by injection, and a vacuum thus produced below piston, which is then forced down by atmospheric pressure thereby drawing up pump-rod.

343. Parallel motion for upright engine. A, A, are radius-rods connected at one end with the framing and at the other with a vibrating piece on top of piston-rod.

344. Oscillating engine. The cylinder has trunnions at the middle of its length working in fixed bearings, and the piston-rod is connected directly with the crank, and no guides are used.

345. Inverted oscillating or pendulum en-

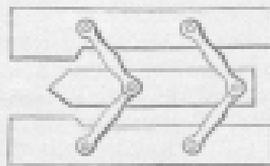
gine. The cylinder has trunnions at its upper end and swings like a pendulum. The crank-shaft is below, and the piston-rod connected directly with crank.

346. Table engine. The cylinder is fixed on a table-like base. The piston-rod has a cross-head working in straight slotted guides fixed on top of cylinder, and is connected by two side connecting-rods with two parallel cranks on shaft under the table.

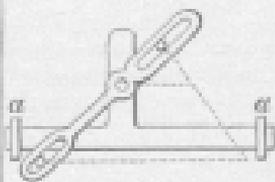
347. Section of disk engine. Disk piston, seen edgewise, has a motion substantially like a coin when it first falls after being spun in the air. The cylinder-heads are cones. The piston-rod is made with a ball to which the disk is attached, said ball working in concentric seats in cylinder-heads, and the left-hand end is attached to the crank-arm or fly-wheel on end of shaft at left. Steam is admitted alternately on either side of piston.

348. Mode of obtaining two reciprocating movements of a rod by one revolution of a shaft, patented in 1836 by B. F. Snyder, has been used for operating the needle of a sewing machine, by J. S. McCurdy, also for driving a gang of saws. The disk, A, on the central rotating shaft has two slots, a, a, crossing each other at a right angle in the center, and the connecting-rod, B, has attached to it two pivoted slides, c, c, one working in each slot.

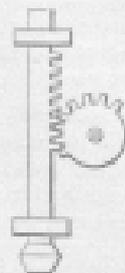
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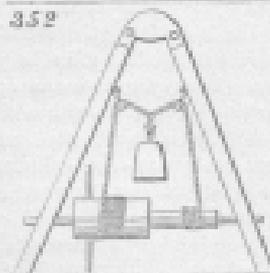
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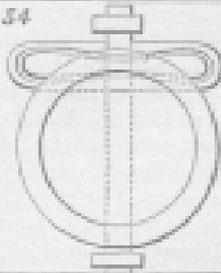
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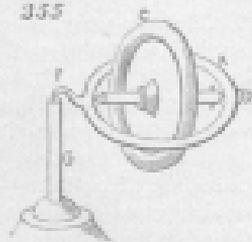
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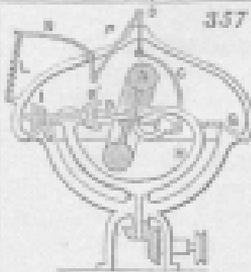
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349. Another form of parallel ruler. The arms are jointed in the middle and connected with an intermediate bar, by which means the ends of the ruler, as well as the sides, are kept parallel.

350. Traverse or to-and-fro motion. The pin in the upper slot being stationary, and the one in the lower slot made to move in the direction of the horizontal dotted line, the lever will by its connection with the bar give to the latter a traversing motion in its guides, *a, a*.

351. Stamp. Vertical percussive falls derived from horizontal rotating shaft. The mutilated toothed pinion acts upon the rack to raise the rod until its teeth leave the rack and allow the rod to fall.

352. Another arrangement of the Chinese windlass illustrated by 129 of this table.

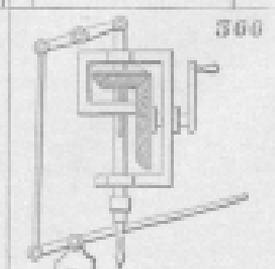
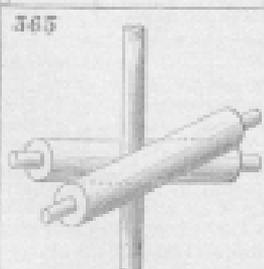
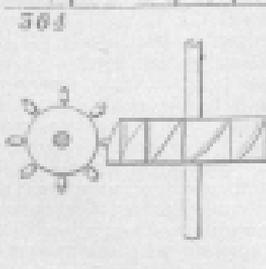
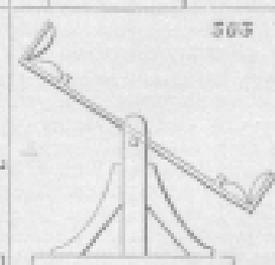
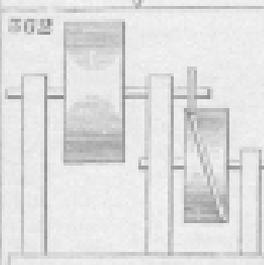
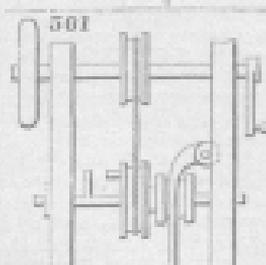
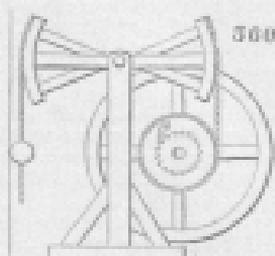
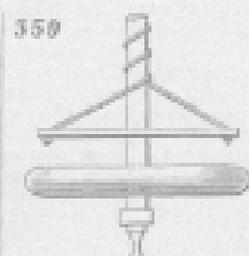
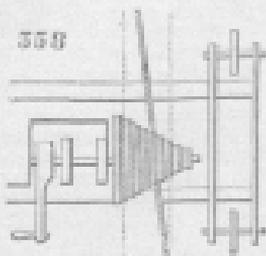
353. A modification of the tilt or trip hammer, illustrated by 72. In this the hammer helve is a lever of the first order. In 74 it is a lever of the third order.

354. A modification of the crank and slotted cross-head, 93. The cross-head contains an endless groove in which the crank-wrist works, and which is formed to produce a uniform velocity of movement of the wrist or reciprocating rod.

355. The gyroscope or rotascope, an instrument illustrating the tendency of rotating bodies to preserve their plane of rotation. The spindle of the metallic disk, *C*, is fitted to turn easily in bearings in the ring, *A*. If the disk is set in rapid rotary motion on its axis, and the pintle, *F*, at one side of the ring, *A*, is placed on the bearing in the top of the pillar, *G*, the disk and ring seem indifferent to gravity, and instead of dropping begin to revolve about the vertical axis.

356. Bohnenberger's machine illustrating the same tendency of rotating bodies. This consists of three rings, *A, A', A''*, placed one within the other and connected by pivots at right angles to each other. The smallest ring, *A''*, contains the bearings for the axis of a heavy ball, *B*. The ball being set in rapid rotation, its axis will continue in the same direction, no matter how the position of the rings may be altered; and the ring, *A''*, which supports it will resist a considerable pressure tending to displace it.

357. What is called the gyroscope governor, for steam engines, etc., patented by Alban Anderson in 1858. *A* is a heavy wheel, the axle, *B, B'*, of which is made in two pieces connected together by a universal joint. The wheel, *A*, is on one piece, *B*, and a pinion, *I*, on the other piece, *B'*. The piece, *B*, is connected at its middle by a hinge joint with the revolving frame, *H*, so that variations in the inclination of the wheel, *A*, will cause the outer end of the piece, *B*, to rise and fall. The frame, *H*, is driven by bevel gearing from the engine, and by that means the pinion, *I*, is carried round the stationary toothed circle, *G*, and the wheel, *A*, is thus made to receive a rapid rotary motion on its axis. When the frame, *H*, and wheel, *A*, are in motion, the tendency of the wheel, *A*, is to assume a vertical position, but this tendency is opposed by a spring, *L*. The greater the velocity of the governor, the stronger is the tendency above mentioned, and the more it overcomes the force of the spring, and *vice versa*. The piece, *B*, is connected with the valve-rod by rods, *C, D*, and the spring, *L*, is connected with the said rod by levers, *N*, and rod, *P*.



358. Traverse of carriage, made variable by fusee according to the variation in diameter where the band acts.

359. Primitive drilling apparatus. Being once set in motion, it is kept going by hand, by alternately pressing down and relieving the transverse bar to which the bands are attached, causing the bands to wind upon the spindle alternately in opposite directions, while the heavy disk or fly-wheel gives a steady momentum to the drill-spindle in its rotary motion.

360. Continuous rotary motion from oscillating. The beam being made to vibrate, the drum to which the cord is attached, working loose on fly-wheel shaft, gives motion to said shaft through the pawl and ratchet-wheel, the pawl being attached to drum and the ratchet-wheel fast on shaft.

361. Another simple form of clutch for pulleys, consisting of a pin on the lower shaft and a pin on side of pulley. The pulley is moved lengthwise of the shaft by means of a lever or other means to bring its pin into or out of contact with the pin on shaft.

362. Alternating traverse of upper shaft and its drum, produced by pin on the end of the shaft working in oblique groove in the lower cylinder.

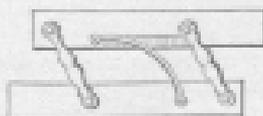
363. See-saw, one of the simplest illustrations of a limited oscillating or alternate circular motion.

364. Intermittent rotary motion from continuous rotary motion about an axis at right angles. Small wheel on left is driver; and the friction rollers on its radial studs work against the faces of oblique grooves or projections across the face of the larger wheel, and impart motion thereto.

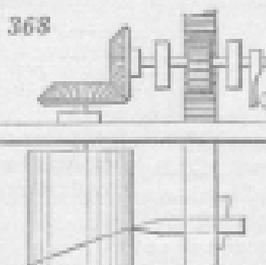
365. Cylindrical rod arranged between two rollers, the axes of which are oblique to each other. The rotation of the rollers produces both a longitudinal and a rotary motion of the rod.

366. Drilling machine. By the large bevel-gear rotary motion is given to vertical drill-shaft, which slides through small bevel-gear but is made to turn with it by a feather and groove, and is depressed by treadle connected with upper lever.

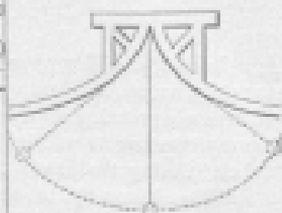
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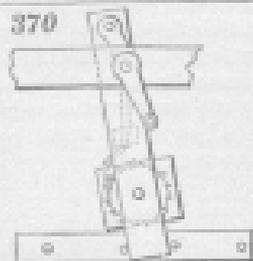
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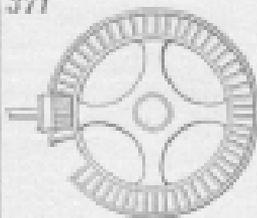
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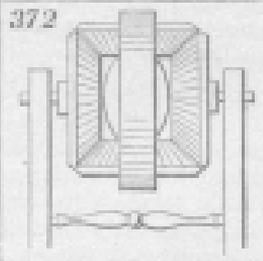
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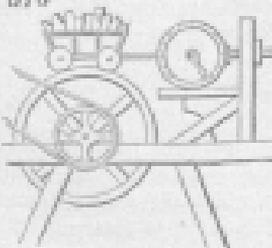
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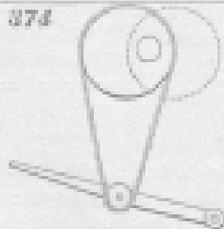
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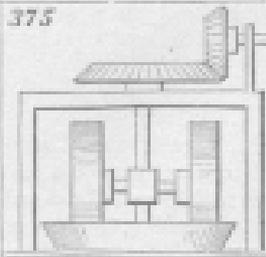
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367. A parallel ruler with which lines may be drawn at required distances apart without setting out. Lower edge of upper blade has a graduated ivory scale, on which the incidence of the outer edge of the brass arc indicates the width between blades.

368. Describing spiral line on a cylinder. The spur-gear which drives the bevel-gears, and thus gives rotary motion to the cylinder, also gears into the toothed rack, and thereby causes the marking point to traverse from end to end of the cylinder.

369. Cycloidal surfaces, causing pendulum to move in cycloidal curve, rendering oscillations isochronous or equal-timed.

370. Motion for polishing mirrors, the rubbing of which should be varied as much as practicable. The handle turns the crank to which the long bar and attached ratchet-wheel are connected. The mirror is secured rigidly to the ratchet-wheel. The long bar, which is guided by pins in the lower rail, has both a longitudinal and an oscillating movement, and the ratchet-wheel is caused to rotate intermittently by a click operated by an eccentric on the crank-shaft, and hence the mirror has a compound movement.

371. Modification of mangle-wheel motion. The large wheel is toothed on both faces, and an alternating circular motion is produced by the uniform revolution of the pinion, which passes from one side of the wheel to the other through an opening on the left of the figure.

372. White's dynamometer, for determining the amount of power required to give

rotary motion to any piece of mechanism. The two horizontal bevel-gears are arranged in a hoop-shaped frame, which revolves freely on the middle of the horizontal shaft, on which there are two vertical bevel-gears gearing to the horizontal ones, one fast and the other loose on the shaft. Suppose the hoop to be held stationary, motion given to either vertical bevel-gear will be imparted through the horizontal gears to the other vertical one; but if the hoop be permitted it will revolve with the vertical gear put in motion, and the amount of power required to hold it stationary will correspond with that transmitted from the first gear, and a band attached to its periphery will indicate that power by the weight required to keep it still.

373. Robert's contrivance for proving that friction of a wheel carriage does not increase with velocity, but only with load. Loaded wagon is supported on surface of large wheel, and connected with indicator constructed with spiral spring, to show force required to keep carriage stationary when large wheel is put in motion. It was found that difference in velocity produced no variation in the indicator, but difference in weight immediately did so.

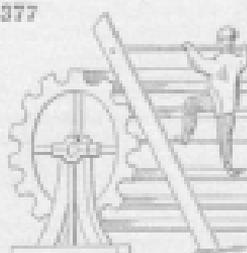
374. Rotary motion of shaft from treadle by means of an endless band running from a roller on the treadle to an eccentric on the shaft.

375. Pair of edge runners or chasers for crushing or grinding. The axles are connected with vertical shaft, and the wheels or chasers run in an annular pan or trough.

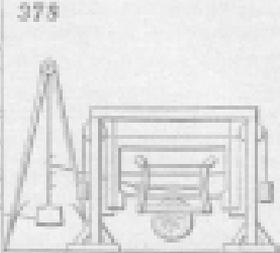
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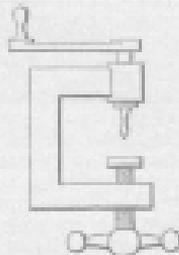
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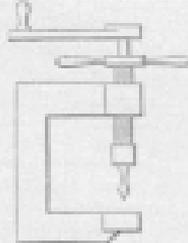
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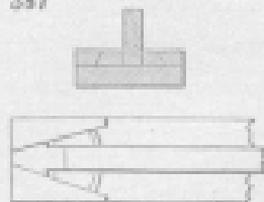
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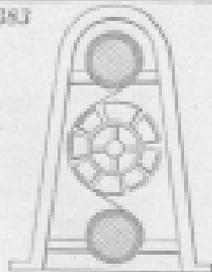
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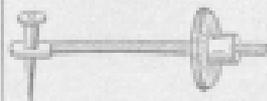
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376. Tread-wheel horsepower turned by the weight of an animal attempting to walk up one side of its interior; has been used for driving the paddle-wheels of ferry-boats and other purposes by horses. The turnspit dog used also to be employed in such a wheel in ancient times for turning meat while roasting on a spit.

377. The tread-mill employed in jails in some countries for exercising criminals condemned to labor, and employed in grinding grain, etc.; turns by weight of persons stepping on tread-boards on periphery. This is supposed to be a Chinese invention, and it is still used in China for raising water for irrigation.

378. Saw for cutting trees by motion of pendulum, is represented as cutting a lying tree.

379 and 380. Portable cramp drills. In 379 the feed-screw is opposite the drill, and in 380 the drill spindle passes through the center of the feed-screw.

381. Bowery's joiner's clamp, plan and transverse section. Oblong bed has, at one end, two wedge-formed cheeks, adjacent sides of which lie at an angle to each other, and are dovetailed inward from upper edge

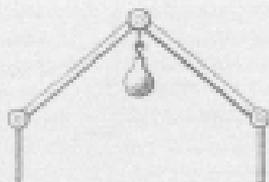
to receive two wedges for clamping the piece or pieces of wood to be planed.

382. Adjustable stand for mirrors, etc., by which a glass or other article can be raised or lowered, turned to the right or left, and varied in its inclination. The stem is fitted into a socket of pillar, and secured by a set screw, and the glass is hinged to the stem, and a set screw is applied to the hinge to tighten it. The same thing is used for photographic camera-stands.

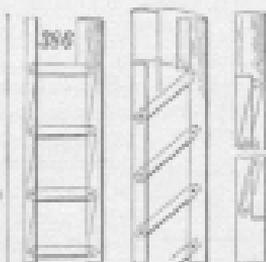
383. Represents the principal elements of machinery for dressing cloth and warps, consisting of two rollers, from one to the other of which the yarn or cloth is wound, and an interposed cylinder having its periphery either smooth-surfaced or armed with brushes, teasels, or other contrivances, according to the nature of the work to be done. These elements are used in machines for sizing warps, gig-mills for dressing woolen goods, and in most machines for finishing woven fabrics.

384. Helicograph, or instrument for describing helices. The small wheel, by revolving about the fixed central point, describes a volute or spiral by moving along the screw-threaded axle either way, and transmits the same to drawing paper on which transfer-paper is laid with colored side downward.

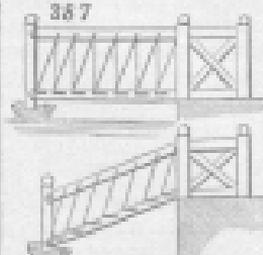
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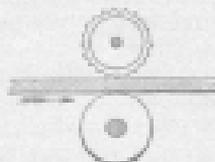
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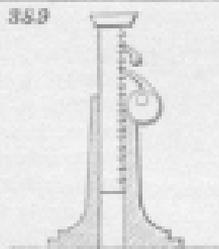
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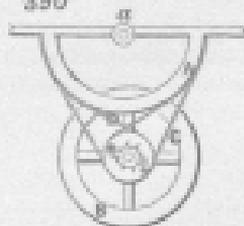
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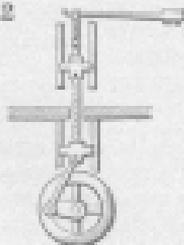
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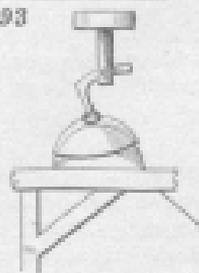
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385. Contrivance employed in Russia for shutting doors. One pin is fitted to and turns in socket attached to door, and the other is similarly attached to frame. In opening the door, pins are brought together, and weight is raised. Weight closes door by depressing the joint of the toggle toward a straight line, and so widening the space between the pins.

386. Folding library ladder. It is shown open, partly open, and closed; the rounds are pivoted to the side-pieces, which are fitted together to form a round pole when closed, the rounds shutting up inside.

387. Self-adjusting step-ladder for wharfs at which there are rise and fall of tide. The steps are pivoted at one edge into wooden bars forming string-pieces, and their other edge is supported by rods suspended from bars forming hand-rails. The steps remain horizontal whatever position the ladder assumes.

388. Feed-motion of Woodworth's planing machine, a smooth supporting roller, and a toothed top roller.

389. Lifting-jack operated by an eccentric, pawl, and ratchet. The upper pawl is a stop.

390. Device for converting oscillating into rotary motion. The semicircular piece, A, is attached to a lever which works on a fulcrum, *a*, and it has attached to it the ends of two bands, C and D, which run around two pulleys, loose on the shaft of the fly-wheel, B. Band, C, is open, and band, D,

crossed. The pulleys have attached to them pawls which engage with two ratchet-wheels fast on the fly-wheel shaft. One pawl acts on its ratchet-wheel when the piece, A, turns one way, and the other when the said piece turns the other way, and thus a continuous rotary motion of the shaft is obtained.

391. Reciprocating into rotary motion. The weighted racks, A, A', are pivoted to the end of a piston-rod, and pins at the end of the said racks work in fixed guide-grooves, *b*, *b*, in such manner that one rack operates upon the cog-wheel in ascending and the other in descending, and so continuous rotary motion is produced. The elbow lever, C, and spring, *d*, are for carrying the pin of the right-hand rack over the upper angle in its guide-groove, *b*.

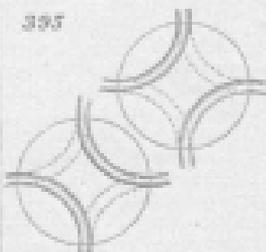
392. Gig-saw, the lower end connected with a crank which works it, and the upper end connected with a spring which keeps it strained without a gate.

393. Contrivance for polishing lenses and bodies of spherical form. The polishing material is in a cup connected by a ball-and-socket joint and bent piece of metal with a rotating upright shaft set concentric to the body to be polished. The cup is set eccentric, and by that means is caused to have an independent rotary motion about its axis on the universal joint, as well as to revolve about the common axis of the shaft and the body to be polished. This prevents the parts of the surface of the cup from coming repeatedly in contact with the same parts of surface of the lens or other body

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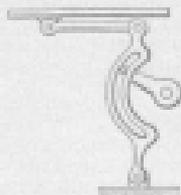
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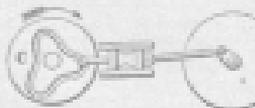
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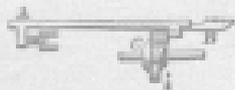
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394. C. Parsons's patent device for converting reciprocating motion into rotary, an endless rack provided with grooves on its side gearing with a pinion having two concentric flanges of different diameters. A substitute for crank in oscillating cylinder engines.

395. Four-way cock, used many years ago on steam engines to admit and exhaust steam from the cylinder. The two positions represented are produced by a quarter turn of the plug. Supposing the steam to enter at the top, in the upper figure the exhaust is from the right end of the cylinder, and in the lower figure the exhaust is from the left—the steam entering, of course, in the opposite port.

396. G. P. Reed's patent anchor and lever escapement for watches. The lever is so applied in combination with chronometer escapement that the whole impulse given balance in one direction is transmitted through lever, and whole impulse in opposite direction is transmitted directly to chronometer impulse pallet, locking and unlocking the escape-wheel but once at each impulse given by said wheel.

397. Continuous circular into intermittent rectilinear reciprocating. A motion used on several sewing machines for driving the shuttle. Same motion applied to three-revolution cylinder printing-presses.

398. Continuous circular motion into intermittent circular—the cam, C, being then driver.

399. A method of repairing chains, or tightening chains used as guys or braces. Link is made in two parts, one end of each is provided with swivel-nut, and other end with screw; the screw of each part fits into nut of other.

400. Four-motion feed (A. B. Wilson's patent), used on Wheeler & Wilson's, Sloat's, and other sewing machines. The bar, A, is forked, and has a second bar, B (carrying the spur or feeder), pivoted in the said fork. The bar, B, is lifted by a radial projection on the cam, C, at the same time the two bars are carried forward. A spring produces the return stroke, and the bar, B, drops of its own gravity.

401. E. P. Brownell's patent crank-motion to obviate dead-centers. The pressure on the treadle causes the slotted slide, A, to move forward with the wrist until the latter has passed the center, when the spring, B, forces the slide against the stops until it is again required to move forward.

402. G. O. Guernsey's patent escapement for watches. In this escapement two balance-wheels are employed, carried by the same driving-power, but oscillating in opposite directions, for the purpose of counteracting the effect of any sudden jar upon a watch or time-piece. The jar which would accelerate motion of one wheel would retard the motion of other. Anchor, A, is secured to lever, B, having an interior and exterior toothed segment at its end, each one of which gears with the pinion of balance-wheels.