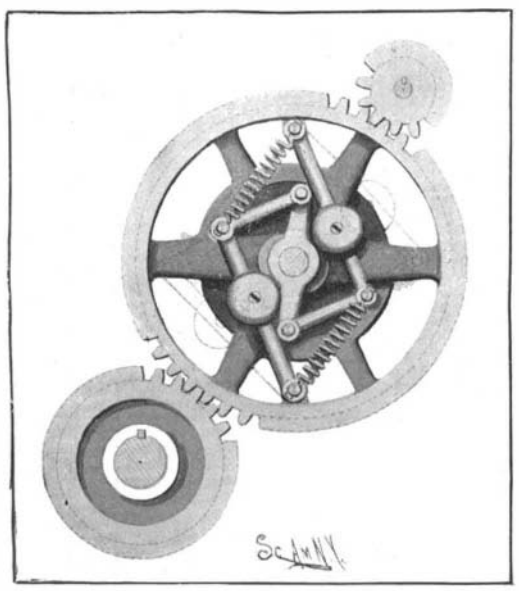
movement of the shipper, which is transmitted to the carbureter lever through the long lever pivoted in the casing of the gear and seen running across the front of the picture of the motor. A link connects this lever with that on the carbureter.

The carbureter is of the usual float-feed atomizer type. Inside it are two sleeves, one acting as the throttle and cutting down the mixture at the same time that it throttles the air; the other, an auxiliary throttle that the driver can set at any point at which it is desired to have the governor cut off. Beyond setting this throttle according to the speed at which he wishes to travel, the driver has nothing to do with the control of the motor. Moreover, the valves in the carbureter are so arranged that when the auxiliary throttle is wide open, the size of the port in the carbureter leading to the motor is the same as that of the inlet pipe, even when the governor throttle valve has shut off to its full extent. Consequently, the governor has no effect, and the motor will develop its full power.

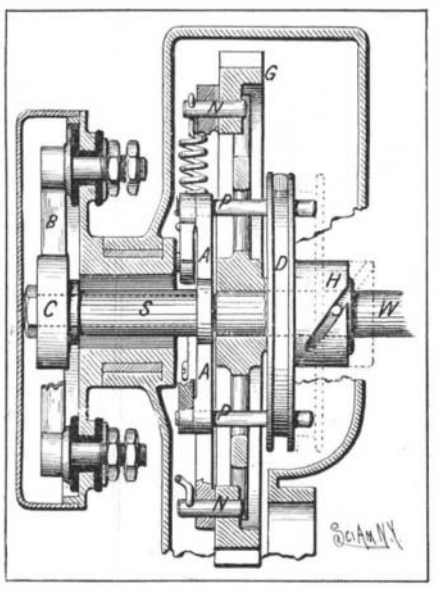
The transmission gear of the Riker machine is of the usual French type, giving three speeds forward and one reverse, with a direct drive from motor to countershaft on the high gear. Referring to the illustration of the gear, the reader will see its construction and main points. *M* is the sleeve and flange, bolted to the usual friction clutch in the flywheel of the motor. This sleeve has a square hole the greater part of its length, into which fits a short shaft extending through bearing, *E*, and terminating in a wide pinion, *I*. The shaft, *JJ*, also squared, has one bearing in pinion, *I*, and the other at *H*. Gears 4 and 6 are slid on it by means of shipper, *K*, and movable rod, *F*; and it drives the differential, *D*, on the countershaft, through the bevel pinion, *L*, and bevel gear, *B*. The side thrust of the bevel gear is taken up by a corrugated, propeller thrust bearing in the gear case. Parallel with the main shaft is another shaft, *O*, carrying gears 2, 5, 3, and 7, keyed to it. Gear 2 is always in mesh with pinion 1. Consequently, shaft *O* is always in motion when pinion 1 is turning. The illustration shows the position of the gear on the slow speed—1 driving 2, and 3 driving 4, which is squared on main shaft, *J*. The middle speed is obtained by sliding gears 6 and 4 along on *J* till 6 meshes with 5. For the high speed, 6 and 4 are slid still further to the left, when the teeth of pinion 1 engage with similar internal teeth cut in 6 on that side, and hence lock shaft, *J*, to the short driving shaft carrying 1. This gives the high speed. The reverse is obtained by means of an idle pinion 8, with which 4 meshes, and which is driven by gear 7. *C* is the shipper of the flywheel clutch, which is operated by the rotating rod, *N*. The bearing of the lever arm that moves the shipper, *K*, is seen in the case at *P*. The arrangement used makes it possible to have no sliding parts projecting through the gear case. *A* is the band brake drum, and *G* the female portion of the Oldham universal coupling employed to allow for any misalignment of the countershaft due to straining of the frame. The end of the shaft attached to the frame also has a grooved flange, while in the position in which the male floating member rests between them, their grooves are set at right angles. These universal couplings are plainly to be seen in the rear view of the chassis.

The car is steered by a wheel, connected to the steering knuckles of the front wheels through a worm gear and segment.

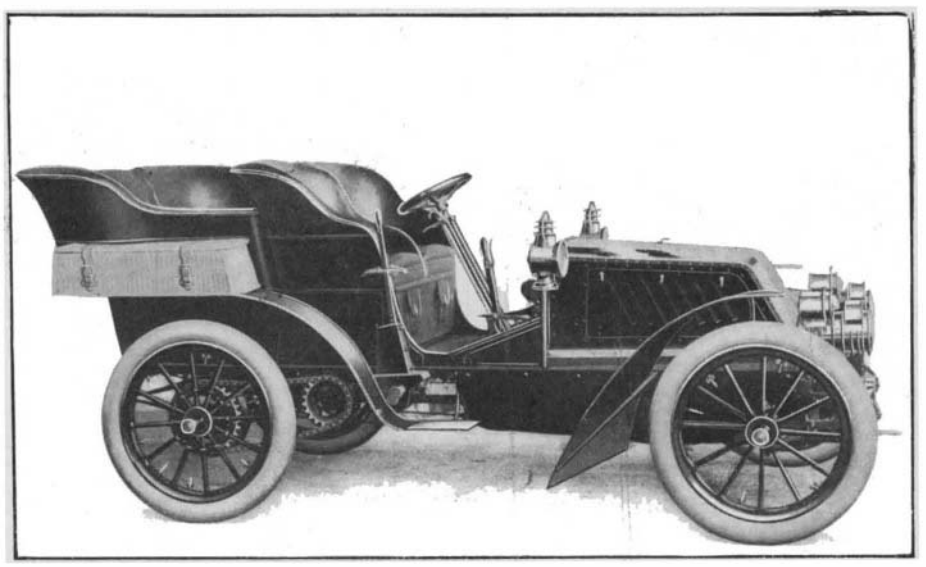
Two pedals and two levers control all the mechanism from the driver's seat. The pedal for the left foot draws forward the lever *X* by means of a rod connection, thus withdrawing the clutch as explained above. The right pedal does the same thing, but, having a greater movement, also applies the band brake, the lever of which is also connected to *X*. The shorter lever changes the gears, the rocker arm, *Y*, on its shaft being connected by a link to another depending arm, *P*, joined to the upwardly projecting arm, *P'*, within the case, which slides the shipper-carrying rod, *F*. The powerful band brakes on the rear wheels are set by the outer lever, which moves arm, *Z*, connected to the transverse brake shaft. The forwardly-projecting arm of *Z* pushes against a special arm on *X*, thus moving *X* forward sufficiently to throw out the clutch before the brakes are applied. The cars are fitted with artillery wood wheels having plain bearings. The cap on each wheel forms an oil reservoir, and in the end of the box is a curved groove that scoops up the oil and leads it to the oil groove on top of the axle. The only balls used throughout the whole machine are in a thrust



CENTRIFUGAL GOVERNOR OF RIKER CAR.



CROSS-SECTION OF GOVERNOR.



COLUMBIA 24 H. P. TOURING CAR.

ring on the clutch, in use only when the clutch is withdrawn. The wheels are fitted with 34 x 3½ inch detachable tires. The wheel-base of the large car is 84 inches; the tread is standard; and its weight complete is 2,150 pounds. The chassis can be fitted with any style of body desired to suit the taste of the purchaser.

THE COLUMBIA GASOLINE TONNEAU.

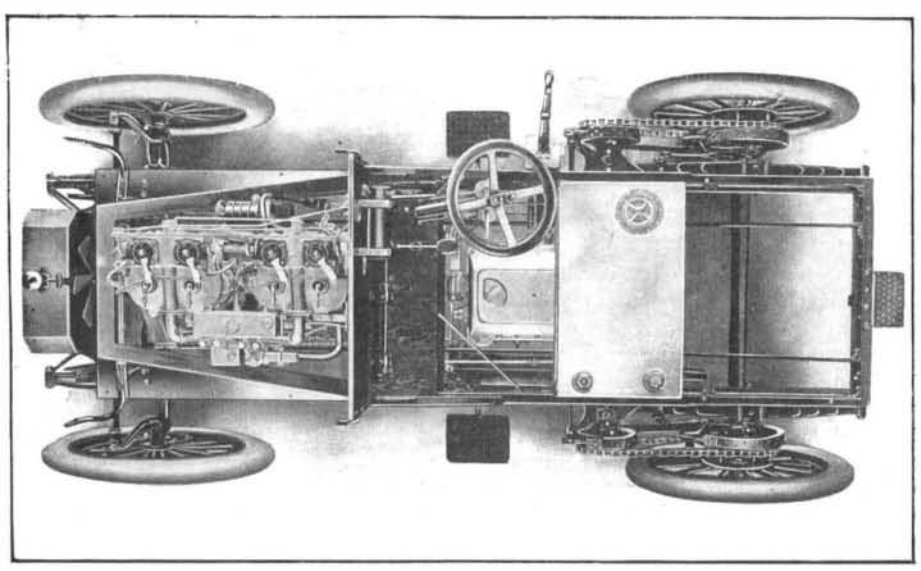
The new gasoline automobile that is being manufactured this year by the Electric Vehicle Company, of Hartford, Conn., is the invention of Mr. Fred A. Law. The chief idea of the inventor in designing it, was instant accessibility of all parts that may require attention.

The main clutch is of the usual leather-faced, flywheel type, having eight brass spring-pressed shoes or plungers in its face. By means of the novel arrangement of plunger shoes, it is possible to slip the clutch without damaging its leather facing, which is 2 inches wide, and subject to very slight wear.

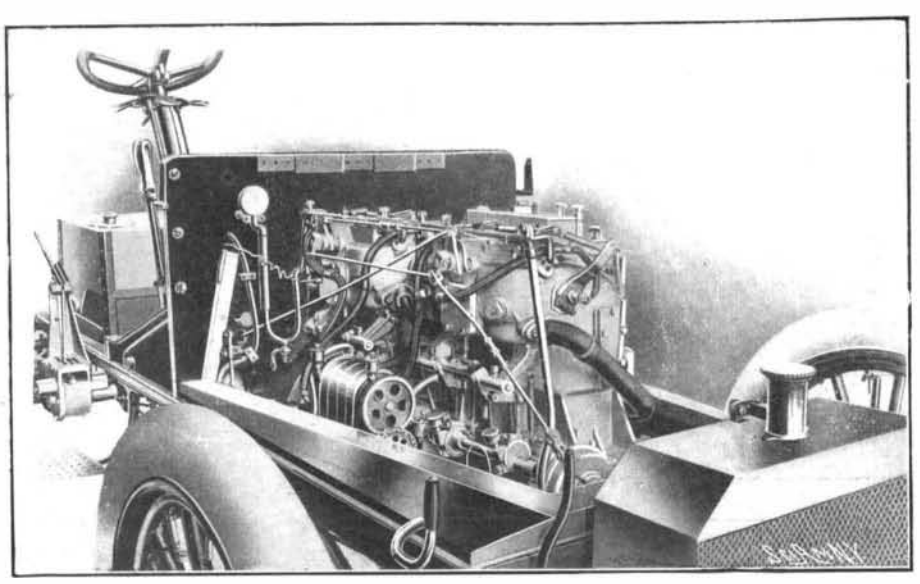
The flywheel clutch is connected to the main driving shaft through a sort of universal joint; and the transmission gears driven by this shaft are of the usual sliding French type, giving four speeds ahead and one reverse, with a direct drive to the countershaft on the high gear. This latter shaft is driven through the usual bevel gear with ball-bearing side thrust, and is fitted with a special jaw clutch by which both rear wheels may be driven together without the differential operating, if the machine should become stuck with one wheel on a muddy or icy patch of road, and the other on more favorable ground. By jacking up the rear axle and throwing in this clutch, one rear wheel can be belted to a dynamo or any other machinery it is desired to drive, and the automobile be made to serve as a stationary source of power. The countershaft has a band brake drum and radius rod on each end, beside the driving sprockets; and the rear wheels are also fitted with band brakes operated by the short lever located beside the steering column. The brake drum, sprocket, and clamping ring which is fastened to the spokes, form three concentric rings of the same size, connected together by pins. The body is hung on a pivot on the rear springs, so that the latter will not be strained if tilted a little by the radius rods in tightening the chains. Wheel steering through rack and steel pinion and a universally jointed connection to the steering knuckles is employed.

The transmission gear has two sets of sliding gears, operated by a single lever. By moving the lever back and forth in the two legs of an H-shaped slot, any gear desired may be thrown in. The lever can be moved to the other position, or *vice versa*, from any gear it may be on, without passing through any of the other gears. This, although the movement of the lever is not quite so simple as a straightforward movement, is advantageous, as any gear desired can be immediately selected. An interlocking arrangement makes it impossible for any other gears than the ones in use to engage.

The motor has four 5 x 5-inch cylinders, and is rated at 20 horse power at 900 revolutions per minute. It is said to have developed 26 horse power in a brake test, however. The cylin-



CHASSIS OF COLUMBIA TOURING CAR.



MOTOR OF COLUMBIA TOURING CAR.

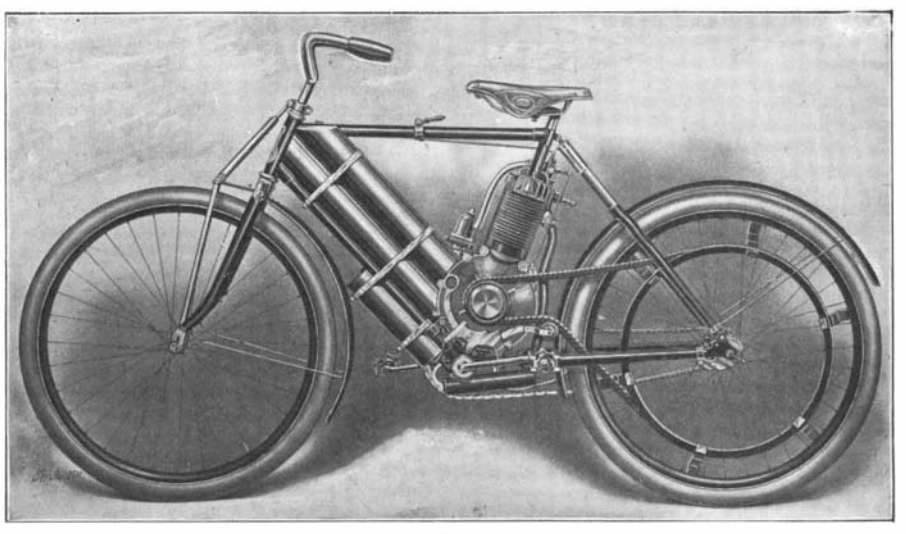
ders are cast integrally, in pairs, and aluminium plates on the sides, covering openings into the water jackets, offer the advantage that they would give way, should the water freeze in the cylinders in winter, and hence protect the latter from cracking. In the plan view of the chassis, the four inlet valves, with their handles for removing, held from turning by springs, can be seen. The side view of the motor shows one of the spark plugs similarly fitted. The small eccentrics on the main shaft are also visible. Two springs, depending from a cross arm on the valve stem, bind the latter to the eccentric rod and hold the valve down on its seat. The eccentric rod raises the valve through a small bell crank, and the valve follows the motion of the latter in closing, being bound to it by the two springs till the valve seats, when the bell crank moves away and the pressure of the springs clamps the valve to its seat. The arrangement causes the valves to close quietly and without the blow that is usual with the ordinary exhaust valves.

The inclined rod at the front of the motor connects the shipper of the ball governor on the motor shaft with the throttle valves for each pair of cylinders. Rotating cylindrical valves are used, having long slots that match similar slots in the sleeves in which they turn. The governor rotates the valve sufficiently entirely to close these slots, which are tapered on the cutting off edge, so as to close the ports gradually. By rotating the sleeves sufficiently to correspond to the valve movement, which may be done by a small hand lever on the steering column, the governor can be thrown out of action completely, or the motor speed be partially accelerated, as desired.

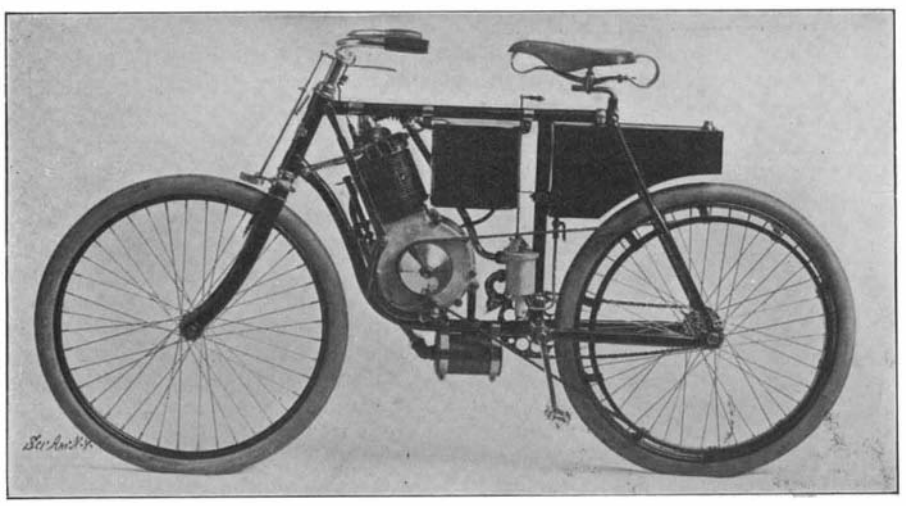
The German Eisemann magneto system of ignition is employed. A rotary gear pump circulates the water through the engine jackets and radiator, behind which a fan makes a forced draft. Strainers are placed in the water and gasoline pipes, and are readily removable for cleaning. The spraying nozzle of the carbureter may also be easily removed. The auxiliary air pipe of the latter is fitted with a weighted butterfly valve that opens proportionally as the speed and suction of the pistons increase. This is intended to maintain the mixture constant. The spark, the mixture, and the throttle are all also controllable from the seat by levers on the steering pillar.

Our illustration gives a good idea of the general appearance of the car. Its wheel base is 93 inches, and its tread is 56 inches. Wood wheels shod with 4-inch detachable tires are used.

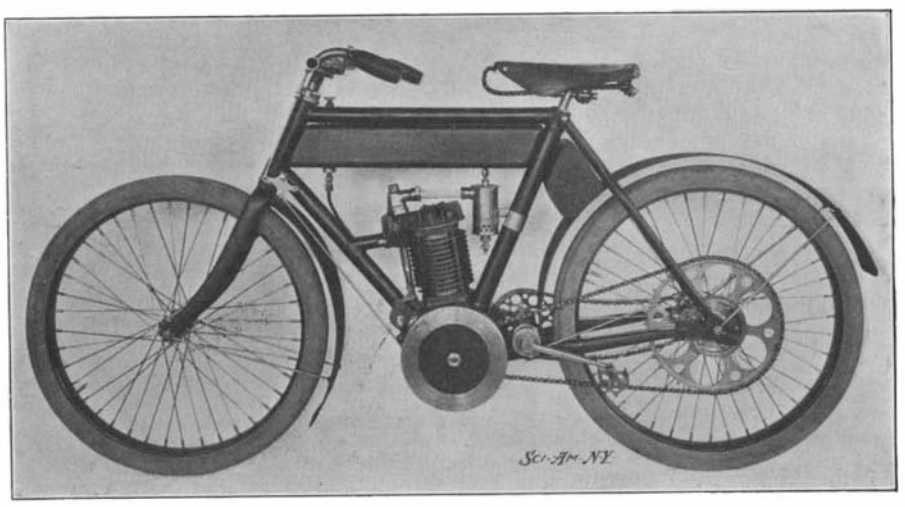
The "Indian" Motor Bicycle.



The Thomas Motor Bicycle.



The "Orient" Motor Bicycle.



The Metz Motor Bicycle.

THE LATEST TYPES OF MOTOR BICYCLES.

The increasing interest in motor bicycles manifested of late among cyclists is directly attributable to the numerous improvements which have brought various makes of these machines up to a high standard of excellence. These improvements are so many and varied that we cannot attempt to discuss them all in the brief space at our disposal. We will, however, mention some prominent types of motor bicycles and review their principal features.

The Thomas "Auto-Bi" shown in our first illustration comprises a number of important details. The cushion spring fork absorbs all concussions and handle-bar vibration, relieving strain on the mechanism and frame, and eliminating all fear of broken forks, which has been dreaded so much in the past. The machine is driven by a 2½ horse power motor through a peculiarly constructed belt. By an ingenious combination of leather and steel, this belt is made to have the unstretchable qualities of steel, while preserving all the elasticity of leather. This to a large extent reduces strain on the motor and tires, and prevents skidding, at the same time increasing the speed of the motor and the hill-climbing capacity of the bicycle. The machine is provided with large flywheels. These, as well as the bearings and the connecting rods, are one-piece forgings. The bearings are all large, and are hardened and ground. All details are built for strength and durability, and yet the total weight of the machine is but 95 pounds.

A great deal of ingenuity has been exercised on the "Metz" motor bicycle in arranging the necessary parts in the most compact manner. Tubing of very large diameter has been used for the purpose of resisting strains peculiar to motor-driven bicycles. At the same time the inner space of the frame is utilized for various purposes. The top frame tube serves as a reservoir for lubricating oil, while the induction coil is neatly incased in the seat mast, where it is safe from injury. The lower tube serves as a muffler, through which burnt gases pass from the cylinder. The motor crank case is built integrally with the frame of the bicycle, and this, while reducing weight, adds to the staunchness of the machine and prevents those numerous troubles attributable to a continual vibration of the motor. The flywheels are placed outside of the crank case, which allows them to be of larger diameter than is usual, and therefore to have greater effect. The driving sprocket is fastened to the crank shaft by a flexible connection. This flexibility may be adjusted to any desired degree of tension. The durability of the chain is increased, owing to its relief from violent impulses of the motor. Means are provided for oiling the motor while riding. Another important feature is to be found in the constant-level, float-feed carbureter. Three spray nozzles are provided at equi-distant points around the mixing chamber which encircles the float chamber, so that whether the machine be going up or down hill, a proper suction level is kept. There is also a trap for catching water and sediment in the gasoline.

The "Indian" motocycle is another type of machine which has become quite popular in the cycling world. Great care has been exercised in the construction of the motor used in this machine, and, by thorough testing under all conditions, it has been brought up to a high state of efficiency. The problem of power transmission to the rear wheel is solved by using two chains; one chain of short length is run from the motor to a countershaft mounted on a hanger bracket, and the other chain transmits power from this countershaft to the rear wheel. In the hanger is an eccentric for adjusting the chains. A speed reduction is made on each chain, and they are so constructed and arranged that it is impossible to break either one of them, even though the speed lever be thrown over to its full limit at the start. The entire power of the motor is communicated to the rear wheel, and a steady positive drive is obtained without any slip whatever. The "Indian" motocycle has one lever control. This is important to the beginner and even to the experienced cyclist, for in threading one's way through a crowded street, even the best of operators is liable to be confused by a multiplicity of levers. The single lever on this bicycle starts and stops the machine and increases its speed. The same lever lifts the exhaust valve, permitting the machine to be started with but slight compression in the cylinder, and it also governs the time of the spark. The carbureter used on the "Indian" motocycle, which is constructed on the float and constant-level principle, embodies a number of new and important details. It allows of a steady flow of gasoline under all conditions of travel. The air is taken in through a hood at the bottom, and is adjusted by a regulator at the top. It has been found that a better mixture is obtained by taking the hot air off the cylinder. The gas lever, which can be operated without taking the hands from the bars, is arranged to admit a larger flow of gas into the engine when extra speed or power is required. The machine has a very narrow tread, which offers the advantage of a nearly natural position when riding. Its total weight is only 98 pounds.

In contrast to this light machine is the heavy "Orient" motor bicycle, which weighs about 160 pounds. The makers of this machine have worked on the principle that even the lightest of motocycles is too heavy to pedal in case of a break in the motor, and that consequently the reduction of weight is not of such importance as a heavy but strong construction, which would prevent such accidents and at the same time furnish

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The twelfth census, 1900, divulges the fact that there were 27,029 photographers enumerated in the United States, of whom 23,442 were males and 3,587 females.