

The invention relates to a light plant for bicycles according to the preamble of the first patent claim.

Such plants are known in a variety of designs, specifically also as parking light plants. In this respect attention is drawn to DE-A-31 14 767 and DE-A-31 06 569 as well as to WO-A 89 07 856. Therefrom the problem relating to strongly fluctuating supply voltages and corresponding small or fluctuating, respectively, light yield of the bulbs operated therewith is already known. As a remedy electronic voltage and current limiting devices in form of Zener diodes have been proposed, by means of which harmful voltage peaks were kept away from the bulb. On the other hand, it was foreseen in case of a supply by batteries to switch additional batteries in upon a decrease of the voltage. In these earlier known plants it was necessary to limit the voltage to the lower level of the battery voltage, whereby in case of higher voltages the electrical power remained unused or was dissipated, respectively. This is inefficient, specifically if the light plant for bicycles shall also lend itself to be operated by rechargeable batteries.

In GB-A-2 161 040 a plant is described in which the lamp is either fed by a dynamo or by a rechargeable battery. Here, however, the problem arises that the battery is continuously charged in driving operation, which leads in many situations, especially at intermediate speeds, to a large load for the dynamo and an undesired braking of the bicycle.

Therefore, it is an object of the invention to provide a light plant for bicycles, in which at any operational condition an optimum light yield at all speeds can be combined with a minimum dynamo resistance and optimum charging conditions such that the lifetime of the battery can be increased and generally the bulbs are protected.

Further, it is an object of the invention to provide a light plant for bicycles, which lends itself to be designed based on the same basic circuitry to various modifications which are compatible with already existing parts of plants such that also existing bicycles may be equipped therewith.

Finally, it is an object of the invention to provide a light plant for bicycles, in which low inherent losses occur and which can be switched in such a way that it runs continuously without substantially influencing the resistance to driving. These objects are reached by the features according to the patent claims.

The use of a dynamo with an nearly linear characteristic line in combination with a switching regulator which stabilizes the voltage allows a specifically efficient operation of the bicycle light plant, may such be in combination with a rechargeable battery or without such a battery.

By stabilizing of the voltage at a predetermined level corresponding to the nominal value of the lamps the excess power is not dissipated, it is rather not taken from the dynamo at all or then possibly used for the charging of batteries. Correspondingly, not only the voltage but also the resistance of the dynamo to rotation are stabilized to an optimum value.

The output voltage of the dynamo is measured by means of a threshold switch and converted into at least three switching states of the plant, which states each are adjusted optimally to the respective generated voltage.

The dynamo can be designed as continuously running hub dynamo. The output generated therewith is sufficient at an optimal utilization for a running operation as well as for a parking light operation.

In the highest design level a charging apparatus for the rechargeable batteries is switched via the control logic, depending on the prevailing running and

operating state of the bicycle to various loading cycles. By means of such, the charging procedure as well as the operating state of the lamps may be optimally adjusted to the driving state such that during a normal, cyclic driving behavior the driving light as well as the parking light corresponding to standards of the law are guaranteed.

In the following embodiments of the inventive arrangements are described in more detail by referring to the figures, wherein

Fig. 1 shows a base circuit for a first arrangement, whereby a second design level is drawn with broken lines;

Fig. 2 is a schematic illustration of the circuitry of the switching controller of Fig. 1;

Fig. 3 is a diagram illustrating the operation of the switching controller according to Fig. 2;

Fig. 4 illustrates a circuit for a second arrangement having only one bulb in the front light and rechargeable batteries;

Fig. 5 is a block diagram of a part of the circuit in accordance with Fig. 4 in order to illustrate the charging control;

Fig. 6 is a diagram illustrating the switching conditions in dependence upon the speed;

Fig. 7 is a voltage-speed-diagram in accordance with Fig. 6;

Fig. 8 is a voltage-time-diagram of the circuit in accordance with Figs. 4 and 5 for a driving cycle;

Fig. 9 is a block diagram of a third arrangement in accordance with Fig. 4, however with two different lamps in the front light and further elements, such as braking light;

Fig. 10 is a block diagram of an additional indicating device;

Fig. 11 is an assembly of the components of a fully equipped plant;

Fig. 12 is a correspondingly equipped bicycle; and

5 Fig. 13 illustrates a bicycle, in which the plant is combined with generally available lamps and dynamo.

10 Firstly, the operation of a basic circuit of the light plant will hereinbelow be explained with reference to Figs. 1 to 3. This basic circuit represents at the same time a first design level of the plant.

The light plant comprises a generator G, designed as dynamo for a bicycle such as will be explained more in detail below. This dynamo supplies after a corresponding rectification a DC-voltage U_E or a DC-current, respectively, of which the magnitude increases with driving speed. By means of a condenser K at the output the output voltage U_E can additionally be smoothened and by means of a Zener diode the electronics can be protected from an overvoltage.

25 The voltage-speed-characteristic curve K of the used dynamo (see Fig. 6) causes that overvoltages are generated at higher driving speeds, which would destroy the bicycle lamps and which would not correspond to the legal standards.

In accordance with the invention, however, it is specifically the generation of overvoltages which is used for an efficient operation of the light plant. In order to achieve this, a switching regulator 1 is arranged between the dynamo G and the lamps R_L (tail light) and VL_1 , and VL_2 (front light), respectively, which switching controller 1 can be switched on and off via a switch 2. If it is switched off, the switching controller 1 acts as an opened switch and the bulbs are not connected to the dynamo G. If it is switched on, it stabilizes the voltage almost without any losses to a selectable value.

With reference to Figs. 2 and 3 the operation of such a switching controller will be explained in an exemplary manner.

Up to a desired output voltage U_A (in the present example 5.8 V) an electronic switch 3 is continuously closed. The voltage of the dynamo can increase in this range without any losses until the desired output voltage U_A has been reached. If the voltage of the dynamo increases still further (Fig. 3), the electronic switch is opened and again closed by an oscillator 11 in a set switching frequency of e.g. 100 KHz.

Thereby, the pulse duty factor t_e/T is changed as a function of the input voltage U_E and specifically such that the mean value of the voltage impulses which are led to pass through correspond to the stabilized output voltage U_A . At the same time a current limitation is also coupled therewith. The voltage impulses are converted in a LC-filter to a DC-voltage U_A . A corresponding control circuit for the adjustment of the pulse duty factor by means of an operational amplifier 4 and a reference voltage source 5 is shown in Fig. 2. The control amplifier is preferably designed in C-MOS-technology and operates at an efficiency above 90%.

If the voltage U_E of the dynamo exceeds the desired output voltage U_A , the electrical output is accordingly not dissipated, but the dynamo is relieved, wherewith also the electromotive force in the dynamo and accordingly the driving resistance are correspondingly limited to an optimum value. If the dynamo G operates in this range, the bulbs of the front light and the rear light burn at a constant brightness. The nominal values for the lamps are e.g. 6 V/2.5 W for the front light and 6 V /0.6 W for the rear light, which values are adjusted to this stabilized voltage.

If the driving speed decelerates, a voltage is generated depending on speed which lies between 0 and 5.8 V. The more the voltage falls below the nominal volt-

age of the bulbs, the less bright they burn. Accordingly, there exists the danger of light that is too weak, and this is specifically increased because the larger the deviation from the nominal value of the lamps is, the more the light yield decreases. In order to prevent this, a threshold switch 6 is foreseen in a second design level of the described plant (see Fig. 1 or 4), which senses the voltage of the dynamo. In the example of Fig. 1 completed by broken lines, the threshold switch 6 generates two states and the front light includes two bulbs (or one bulb having two filaments) having differing nominal voltages. The switching regulator includes two stabilizing stages corresponding to these nominal voltages. Hereinbelow these two levels are differentiated from each other by the identification switching regulator 1 for the first and switching regulator 1' for the second stage. If the voltage is below a value V_{X1} ($= 4.5$ V in this example), it is stabilized by the switching regulator 1' to 3.6 V and is connected via a switch 7 to the first bulb of the front light V_{L1} having a low nominal voltage (in the example 3.6 V, 1 W). If the voltage exceeds the value V_{X1} , it is switched via the switching regulator 1 to the second bulb V_{L2} which has a higher nominal voltage ($= 6$ V; 2.5 W in this example). If the voltage falls from above below a value V_{X2} (4.2 V in this example), the procedure runs in the opposite way. A hysteresis of about 0.3 V between the switching voltages V_{X1} and V_{X2} avoids a continuous switching back and forth and thus a flickering of the light in case the generated voltage of the dynamo fluctuates in the corresponding range.

Therefore, if two bulbs are used for the front light, it is possible to differentiate basically between three states of operation. If the voltage of the dynamo is in a range between 0 and 4.5 V, the voltage is stabilized at a low level, and the first bulb is operated at a low nominal voltage, which secures in this range a good light yield. If the voltage of the dynamo exceeds

the value 4.5 V, a switching to the second bulb (or filament, respectively) and the higher stabilized voltage level occurs. By means of such, an overvoltage at both bulbs is prevented in that a voltage limitation at their nominal voltage is active for both.

In the range below the respective nominal voltages the bulbs are operated at a fluctuating voltage of the dynamo, but yet at a relative good light yield.

In Figs. 4 and 8 a further application of the principle of the circuitry is illustrated, whereby now the switching conditions which are adapted to the voltage of the dynamo are not generated at the side of the bulbs, but rather at the side of the supply or the charging control, respectively, and are utilized for the stabilization of the voltage or optimal charging of a battery, respectively. Accordingly, in this embodiment rechargeable batteries 8 (with a nominal voltage of 3.6 V) are provided at the supply side, which batteries 8 are connected via a battery charging converter 9, which is illustrated in detail in Fig. 5, to the dynamo G. The dynamo G has a voltage-speed-characteristic line K (Figs. 6, 7). At the user side a front light V_L with only one lamp as well as a rear light R_L are provided, such that this plant can be operated with commonly available bicycle lights.

In the here disclosed embodiment of the light electronics a differentiation between three operational states is made when the light is switched on, which operational states are hereinbelow identified by the letters A, B and C. In Fig. 6 these operational states are illustrated in dependence upon the speed of the bicycle. The first line in Fig. 6 depicts the voltage-speed-characteristic line K of the dynamo G. The second line depicts the switching from the operational state A to the operational state B according to the logic signal from a first threshold switch 6^I . The third line presents the corresponding logic signal of a second threshold switch 6^{II} . Finally, at the lowermost line the charging current I for

the battery 8 is shown. The dependence of the output voltage U_A present at the bulbs can be seen in Fig. 7.

The operational state A is present at standstill or at a slow driving speed (up to e.g. 7 km/h) as long as the output voltage of the dynamo G remains below a first threshold value I of e.g. 3.6 V. In the operational state A the energy for the lamps is taken from the battery 8, and the energy generated by the dynamo is charged after a suitable DC/DC-conversion in the charging converter 9 to the battery 8.

If mentioned threshold value I is exceeded at a higher driving speed, a switching to the operational state B occurs as long as the full bulb voltage has not been reached yet. In this range the charging converter 9 operates as constant-small-current converter for a generation of a constant charging current of about 10 mA for the battery 8. This load corresponds roughly to the normal bulb-resistance tolerances and is thus allowable. It is, however, of importance for the battery 8 that it is also charged at the (most common) driving speed between about 6 to 14 km/h.

At driving speeds above about 15 km/h the voltage U_E of the dynamo exceeds the rated voltage of the bulbs of 6 V. Here now the operational state C is used as soon as a threshold value II of about 5.8 V of the dynamo voltage is reached. In this operational state the electronics operate to hold the voltage constant because when the rated voltage of the bulbs is exceeded, their lifetime decreases very strongly. The excess dynamo energy is charged into the battery 8. The charging current which is accordingly attainable can reach up to 250 mA (high speed-charging).

A corresponding design of a circuit is illustrated in Fig. 4. The standard dynamo G is connected via a rectifier 30 with a filtering to the electronics. This electronics includes on the one hand a threshold switch 6 having a first threshold value I of the voltage U_E of the

dynamo at about $V_x = 3.6$ V and a second threshold value II at about $V = 5.8$ V. In the Figs. 4 and 5 the threshold-switch 6 is graphically separated correspondingly into two blocks. The threshold switch 6 determines mentioned threshold values of the dynamo voltage and sends corresponding control signals to a control logic 10. The control logic 10 possesses three control loops 31, of which every one is allocated to one of mentioned operational states and which accordingly are illustrated in Fig. 5 by corresponding blocks A, B, C. Depending upon the prevailing operational state one of these control loops is connected via a logic 32 to the charge converter 9 and supplies corresponding control signals to same, such as can be seen in Fig. 5.

The charge converter is switched between the rectifier 30 and the battery 8 and possesses also a switching regulator 33, which receives via a feedback-input F_B the control signals of the control loops 31. The correspondingly controlled output signal of this switching regulator reaches the battery 8 via a transformer 34 and a rectifier arrangement (cf. Figs. 1 to 3) as DC current, such as can be seen specifically from Fig. 5.

In the operational state A the controlling of the load occurs such by an adjustment of the resistance that the energy of the dynamo generated in this range is optimally charged into the battery 8. The bulb receives thereby all its energy from the battery, for which reason the voltage of the bulb does not fall below the voltage of the battery of 3.6 V. The control loop 31 A operates in such a way that upon reaching the first threshold voltage I the load of the dynamo corresponds approximately to the load of the bulb (of about 12Ω). This is in order to keep the switching hysteresis ΔU while the switching into the operational state B small, such that no large fluctuation of the brightness in the bulbs V_L and R_L occurs.

The switching from the operational state A into the operational state B proceeds via hysteresis, such as specifically illustrated in Figs. 6 and 7.

Switching up from A to B proceeds at a somewhat higher
 5 voltage V_{x1} than switching back from B to A at the lower voltage V_{x2} . By means of such a continuous switching back and forth and accordingly a flickering of the light in this driving range can be prevented.

In the operational state B the bulb receives
 10 the current from the dynamo (Fig. 7). Until the full bulb voltage has been reached, it should not be use too strongly for the charging of the battery. In spite of this, it is important for the energy balance that a charging occurs also in this frequent range of speed.
 15 Such as already explained, the switching controller 33 is, therefore, controlled such by the control loop B that a small constant charging current of e.g. 10 mA is generated. Since this corresponds merely roughly to the normal bulb-resistance-tolerances, the light yield is not
 20 markedly decreased by this.

If the nominal voltage of the bulbs of 6 V is reached at driving speeds of about 15 km/h, the threshold switch 6^{II} switches the control loop 31 C onto the charging converter 9. This control loop controls the use of
 25 the dynamo in such a way, that a voltage of 6 V by means of the controller load is not exceeded in any case. The energy of the overvoltage is charged into the battery (see Figs. 6 and 8). When rolling downwards at a high speed it is thus possible to generate a charging current
 30 up to 250 mA and to achieve a high speed charging of the battery.

A switching controller 1' is arranged between the battery 8 and the bulbs. It stabilizes the voltage or the current, respectively, from the battery 8 or from the
 35 charging converter 9, respectively, which reaches the bulbs, to a value of e.g. 3.2 V, such that a constant brightness of the bulbs, which is positive for the

safety, is guaranteed. It becomes active in the operational state A at a low dynamo voltage.

When driving with the dynamo and switched off light (= charging), the circuit operates in the operational state A, i.e. the load of the dynamo corresponds approximately to the load of the bulbs. The batteries are nearly charged with the energy that the bulbs would consume. The fully charged state is then detected by a battery control circuit 36 and indicated via the control logic 10 by means of a light emitting diode LED.

The light emitting diode indicator allows the driver to recognize the state of the light plant in any phase of the operation. The indication proceeds for example as follows:

The diode is continuously lighted when the light is switched on and the capacity of the battery is between about 30 % and 90 %.

The diode is blinking in a 1 Hz-cycle when the capacity of the battery falls below about 30 % while driving with light.

The diode is blinking at a 4 Hz-cycle if the light is switched off and the batteries are being charged until a battery capacity of about 90 % is reached.

If the battery capacity is more than 90 %, the LED-indicator is inactive.

The battery control circuit 36 has, furthermore, the function of a control for the presence of the battery. If the battery 8 is not present or is largely discharged, this is determined by a presence-control logic and stored in the control logic 10. In this case the described electronics remains inactive. The bulbs V_L , R_L are in this case connected via a relay R_1 , r_1 directly to the dynamo G (Fig. 4). The battery charging converter operates in this case in the operational state B, i.e. it generates a small charging current. By means of such, a low discharging protection for the battery 8 is achieved while it is always possible to drive with a light.

The control logic can be operated by means of the key 2. If the key is depressed for a longer time (longer than e.g. 0.25 sec), the memory in the control logic 10 can be set to "on", whereby the light plant is switched on via the control logic 10. If the key is depressed for a short time (less than 0.25 sec), the memory is set to "off" and the plant is shut off. Furthermore, a parking light timer 13 is connected to the control logic 10, the function of which will be described below.

10 An advantage of the described embodiment with battery support is the generation of a parking light. When the bicycle is stopped and accordingly the output voltage of the dynamo G falls to zero, the operational state of a battery supply with a voltage stabilized to 15 3.2 V is used in accordance with the above description. Therefore, the light keeps on burning at a reduced consumption in case it is switched on. If the voltage of the dynamo falls below a minimal value V_0 (of e.g. 1 V), this is determined in the threshold switch 6 and a signal for 20 the control logic 10 is generated. This control logic 10 is connected to a timer circuit 13, which starts at this moment and counts during a predetermined time T (of e.g. 4 min). During this time span the switching controller 1' remains switched on and the light continues to burn. If 25 the time has expired, the control logic switches the switching controller 1' off and the light is extinguished, although the on/off-memory 12 is still in the state ON. If the dynamo generates again a voltage which exceeds V_0 (= 1 V) or if the key is operated longer than 30 0.3 sec, the timer circuit 13 is set back and the switching controller 1' is switched on again, such that the light burns again stabilized at 3.2 V. By using this automatic means for switching on and switching off automatic, the parking light operation can be guaranteed 35 without excessive battery consumption and without any special operation by the operator.

The described operational states are schematically combined in a plurality of corresponding diagrams in Fig. 8 to an arbitrary running profile.

As it can be derived from this illustration, the bicycle light plant is designed such that at the consumer side as well as at the supply side a switching between various operational states occurs during the entire driving cycle, each of which states is optimally adjusted to the respective operational situation. By means of such it can be guaranteed that good light is always available during normal driving cycles, that the batteries are always charged and the resistance to driving remains limited.

Up till now plants have been described in which switching between different operational states occurred alternatively only at the consumer side or at the supplier side, which allows either the use of a common dynamo or of common bulbs, and now a plant is illustrated in Fig. 9, in which switching between the operational states occurs at the supply side as well as at the consumer side. Hereto reference can be made extensively to the above description, whereby each switching regulator 1 or 1' is connected with its own lamp (or filament, respectively) V_{L1} and V_{L2} , respectively, of the front light. Thereby halogen lamps having two filaments of a different nominal power are preferably used for the front light. For the rear light R_L , furthermore, a switch 16 is provided, which connects the respective active switching regulator to the rear light. As for the rest the plant operates as described above with the difference that during the switching between the two switching controllers a voltage step from 3.6 V to about 4.5 V occurs because the light value of the bulb V_{L1} (3.6 V / 1.2 W) corresponds roughly to the one of the bulb V_{L2} (6 V / 2.5 W) at an operational voltage of 4.5 V. By means of such, no difference regarding brightness is discernible during the switching between the two bulbs (or filaments, respec-

tively). Furthermore, a braking light function is indicated in Fig. 9, which can be added to the rear light R_L . Hereto, on the one hand a brake contact 17 is provided in the area of the brakes and on the other hand a LED-rear light 18 with two segments (see Fig. 11). The one segment acts as rear light in the night and the other one as braking light. Both are supplied via the same wire, whereby the transmission of the braking light is modulated by an additional electronics 19 and is decoded in the braking light. By means of this arrangement the same supply can operate selectively the rear light and/or the braking light. The compatibility with a normal rear light is thereby guaranteed.

Finally, Fig. 10 illustrates as further option a control circuit 20 for an indicating and operating unit 21, which is connected to the control logic 10. It is possible to conclude from the measured dynamo-voltage U_E to the speed, from which the covered distance etc. can be calculated and indicated by means of a time measurement.

The bicycle light plant described so far can be operated by commonly available dynamos G.

The described bicycle light plant is composed of a plurality of components, which, depending on the design state of the plant, may be replaced partly by generally available components. The plant is illustrated in Fig. 11 in a general overview and with its components. Figs. 12 and 13 illustrate correspondingly equipped bicycles. The core part of the plant is an electronics housing 22, which contains the described electronics in its possible design levels. The electronic housing 22 acts preferably also as housing for the lamps of the front light in case it is equipped with two halogen lamps V_{L1} , V_{L2} (or one bulb having two filaments, respectively). If the electronics is operated by a generally available front light V_L' , it is possible to place a cover 23 onto the housing 22 in place of the lamp part. This is then

mounted to the frame of the bicycle at a suitable location (Fig. 13). Furthermore, a separate indicator unit 21 is provided, which is located in the field of vision of the driver (Fig. 12) and which includes the described

5 LED-indicators and switches 11. The rechargeable batteries 8 are usually located in the electronics housing 22. If an additional battery 8' or solar cells 24, respectively, are used, these can be located at the area of the baggage rack (Fig. 12). The electronics is connected to a

10 dynamo G, which e.g. may be a wheel hub dynamo. If a LED-rear light R_L together with a braking light B_L is used, this brake is correspondingly equipped with a feeler 17 for the braking light, which is connected as described to the electronic 22. It is, however, also possible to use a

15 common rear light R_L' .

A bicycle is illustrated in Fig. 12, which is equipped with a completely equipped bicycle light plant having a hub dynamo 32, electronic 22 with halogen bulbs V_{L1} , V_{L2} , built thereunto, indicator unit 21, LED-rear

20 light R_L and braking light B_L and solar cells 24. The electronics corresponds to the one of Fig. 6.

In contrast thereto Fig. 13 illustrates a bicycle plant in combination with a common front light V_L' , common dynamos G and a common rear light R_L . The electronics corresponds thereby to the one of Fig. 4.

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As results from the above description, the bicycle light plant allows an economical operation which uses optimally the electrical power that is available and which secures in all driving cycles of the bicycle a op-

30 timal light yield according to regulations. It can be integrated into already existing bicycle light plants at various design states.

Patent claims

5 1. Bicycle light plant with an electric circuit comprising at least one front light, a rear light, at least one rechargeable battery and a dynamo drivable by the bicycle, characterized in that the bicycle light plant comprises a charging converter (9) for charging the recharge-
10 able battery (8) and a control circuit (10), wherein the control circuit (10) and the charging converter (9) are designed such that in dependence of the voltage supplied by the dynamo (G)

 - at low dynamo voltage in a first range of operation (A) the lights are fed by the battery (8) and the
15 energy supplied by the dynamo is substantially fed to the battery (8),

 - at intermediate dynamo voltage in a second range of operation (B) a preponderant part of the dynamo
20 energy is fed to the lights and a small part of the dynamo energy is fed to the battery (8), and

 - at high dynamo voltage upon reaching or exceeding a nominal voltage of the lights in a third range of operation (C) the voltage of the lights is stabilized at
25 the nominal voltage by means of a switching regulator and the remaining dynamo energy is substantially fed to the battery (8).

 2. Bicycle light plant of claim 1, characterized in that when the lights are switched off all dynamo
30 energy is fed to the battery (8).

 3. Bicycle light plant of one of the preceding claims, characterized in that it comprises a threshold switch (6) for determining the voltage supplied by the dynamo (G) and the range of operation.

35 4. Bicycle light plant of claim 3, characterized in that the threshold switch (6) is designed such that it has a hysteresis, such that the transition between the first and the second range of operation occurs at a some-



what higher voltage (V_{x1}) than the transition (V_{x2}) from the second to the first range of operation.

5. Bicycle light plant of one of the preceding claims, characterized in that two switching regulators are provided, wherein the first stabilizes the voltage supplied by the dynamo (G) at a predefined higher light voltage and the second the voltage supplied by the batteries at a predefined lower light voltage.

6. Bicycle light plant of one of the preceding claims, characterized in that it is designed such that upon falling below a given minimum voltage of the dynamo (G) the lights are switched off.

7. Bicycle light plant of one of the claims 1 to 6, characterized in that it is designed such that each time upon falling below a given minimum voltage of the dynamo (G) a timer (13) is started and the lights are switched off after expiration of a predefined time interval.

8. Bicycle light plant of one of the preceding claims, characterized in that the front light possesses two lamps (V_{L1} , V_{L2}) or one lamp with at least two coils with differing nominal voltages, wherein depending on the voltage from the dynamo (G) one of the two lamps or coils, respectively, is in operation.

9. Bicycle light plant of one of the preceding claims, characterized in that the battery, the charging converter (9), the control circuit (10) and the additional electronic components required for driving the lights are assembled in a unit that can be combined with a front light and a rear light.

10. Bicycle light plant of one of the preceding claims, characterized in that the rear light (R_L) is combined with a stop light (B_L) wherein upon closing of a brake contact (18) the supply of the rear light is modulatable by means of a modulation circuit (19) such that upon occurrence of the modulated signal the stop light is operated, wherein the stop light supply always occurs through the battery.

