

[54] **COMBINED TACHOMETER AND
MAXIMUM SPEED LIMITING DEVICE**

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[22] Filed: **Feb. 8, 1971**

[21] Appl. No.: **113,170**

[52] U.S. Cl. **123/118, 123/102**
[51] Int. Cl. **F02p 9/00**
[58] Field of Search **123/102, 117 R, 118, 148 E**

[56] **References Cited**

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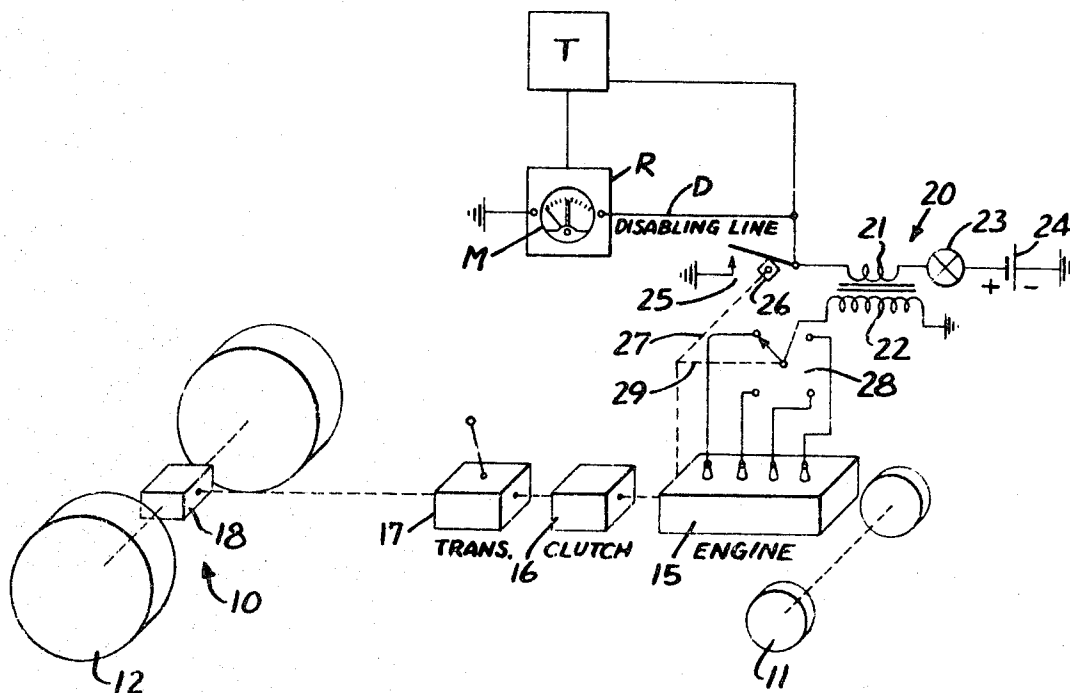
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[57] **ABSTRACT**

A combined tachometer and maximum speed limiting device for cutting off the engine of a hot rod vehicle for a predetermined short time interval upon reaching a predetermined limiting speed to signal to the driver that the transmission should be shifted to the next higher gear and to provide time to make the shift. A tachometer receiver in the form of a meter type relay provides contacts which are closed at a set maximum engine speed. The meter coil is energized by variable direct voltage from a tachometer transmitter which is coupled to the primary of the ignition coil of the vehicle. Closure of the meter contacts energizes an output relay having contacts which are connected to short out the ignition system. Capacitor discharge means are provided for insuring positive closure of the meter contacts and for delaying drop-out of the output relay for a predetermined but adjustable time interval. In an alternate embodiment means are provided for cutting out the engine until intentionally reset.

17 Claims, 9 Drawing Figures



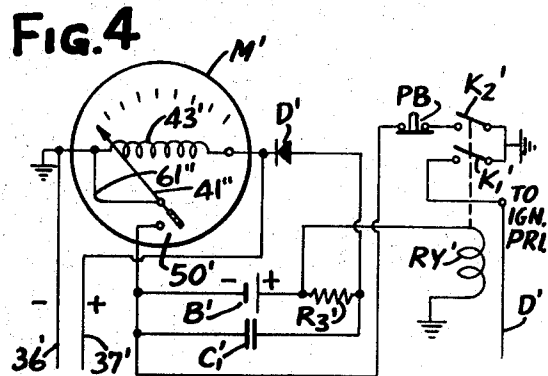
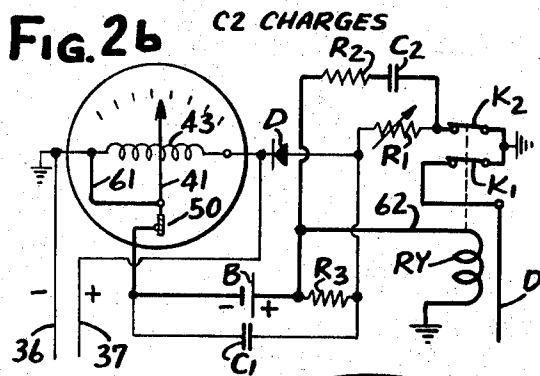
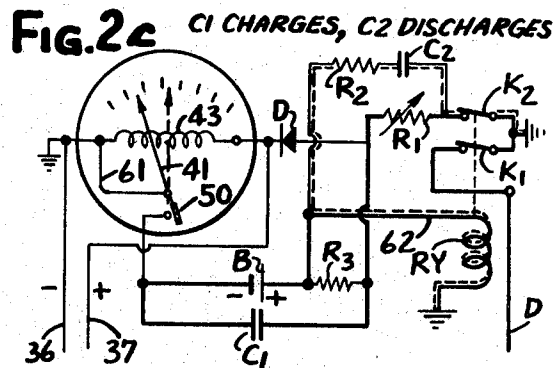
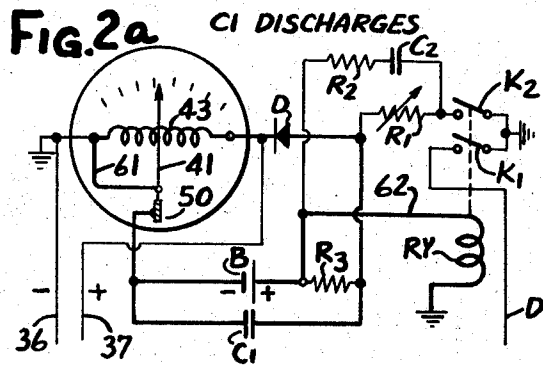


FIG. 3

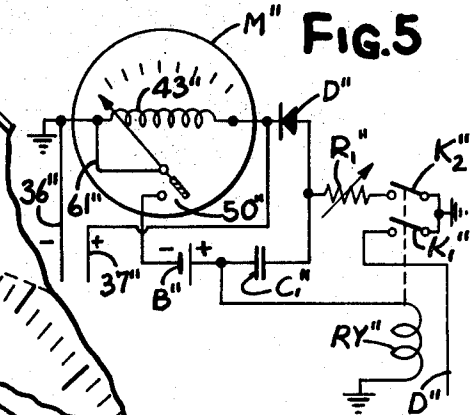
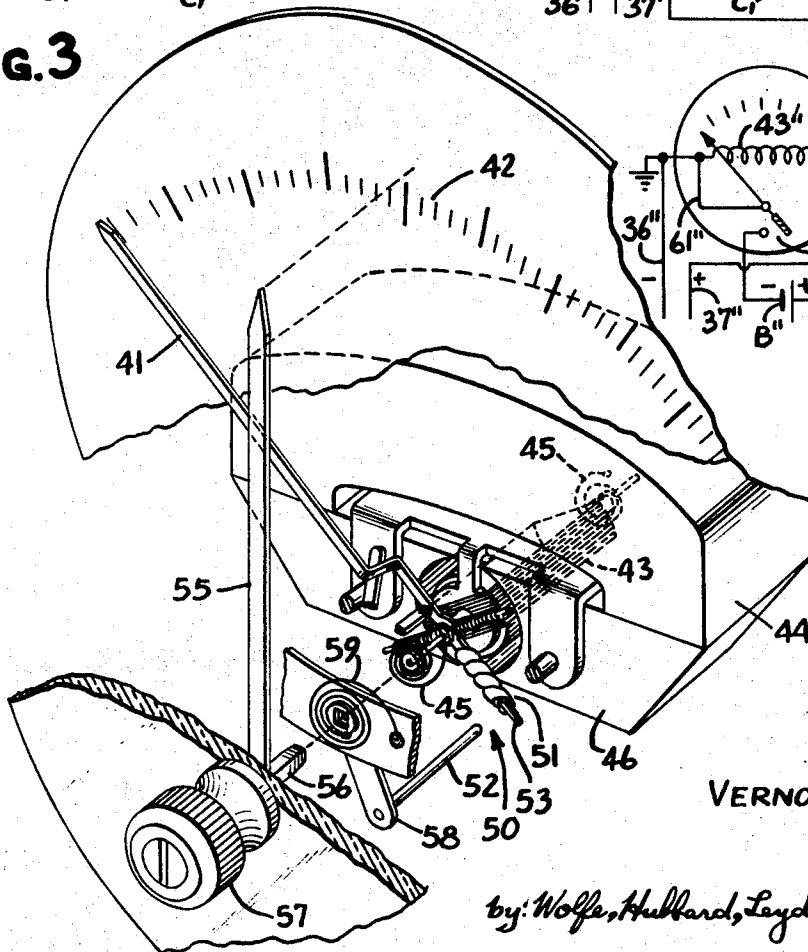
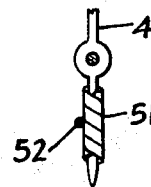


FIG. 3a



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COMBINED TACHOMETER AND MAXIMUM SPEED LIMITING DEVICE

In the operation of hot rod vehicles to achieve maximum acceleration over a measured course it is desirable to "rev" the engine up to a maximum limit r.p.m. in each gear in the most rapid possible succession. Since the maximum limit r.p.m. is just short of that which may produce self destruction of the engine, the driver must be highly skilled and must watch the tachometer closely to avoid exceeding the limiting r.p.m. in each of the gears. This constitutes a burden upon the driver and runs a severe risk that a costly engine may, through a momentary inadvertence, be damaged by "over-revving." Efforts have been made in the past to provide automatic means for limiting the engine speed, but prior devices have not been reliable and have been characterized by a dropping off in the power of the engine as the limiting speed is approached.

Accordingly it is an object of the invention to provide a maximum speed limiting device which is highly precise and reliable, which can be depended upon to cut off the engine at a precise r.p.m., and which maintains the engine cut off for a precisely predetermined but adjustable fraction of a second, in any event a length of time just adequate to permit manual shifting from one gear to the next. It is an important object to provide an improved speed limiting device employing a meter type relay but which avoids the indecisive, chattering contact generally associated with such relays and which provides, instead, a positive and immediate low resistance contact for prompt energization of an output relay having ignition-shortening contacts.

It is a more specific object of the present invention to provide a combined tachometer and maximum speed limiting device in which a tentative making of contact in the meter relay triggers discharge of a capacitor into the meter coil in an additive sense so as to urge the meter contacts more forcefully together for minimum contact resistance. It is a related object to employ subsequent charging of the capacitor, by passage of the charging current through the associated output relay, to prevent drop-out of the relay for a predetermined, short but adjustable time interval.

It is yet another object of the present invention to provide an auxiliary capacitor which is normally in the discharged state but which is charged upon the making of contact in the meter relay and subsequently, upon opening of the meter relay, discharged through the coil of the output relay for further inhibiting drop-out.

It is another object of the invention in one of its aspects to provide a maximum speed limiting device employing an improved meter type relay in which the movable contact serves as a counterbalancing weight for the needle of the meter in addition to performing its contact function.

It is still another object of the present invention to provide a maximum speed limiting device which employs the transmitting and receiving elements of a conventional tachometer system and which achieves the speed limitation and a precise de-powered interval with relatively minor modification of the existing components and at minor additional expense. It is an object of the invention to provide a combined tachometer and maximum speed limiting arrangement which permits the engine to be fully powered up to the instant that the predetermined maximum r.p.m. is reached and zero-powered for a predetermined time interval thereafter, following which full power is again available, and which consequently avoids the erratic operation and "missing" which characterizes the previous efforts to secure speed limitation.

It is a related object to provide a combined tachometer and speed limiting arrangement which is as easily installed as a conventional tachometer of the electrical type, requiring only the addition of a single wire leading from the receiving unit to the primary terminal of the ignition coil.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 is a schematic diagram showing the power train and ignition system of a typical hot rod vehicle with the present tachometer and speed limiting device connected thereto.

FIG. 2 is a schematic electrical diagram of the transmitter and receiver portions of the tachometer-limiter system.

FIG. 2a is a diagram corresponding to FIG. 2 showing the making of contact in the meter and subsequent capacitor discharge.

FIG. 2b corresponds to FIG. 2a and shows the resulting closure of the relay occurring immediately thereafter to produce engine cut-off and charging of the auxiliary capacitor.

FIG. 2c shows opening of the meter contacts, with the relay being held in by charging of the main capacitor and discharging of the auxiliary capacitor.

FIG. 3 is an isometric, fragmentary, and partially exploded, view of the meter relay assembly.

3a is a fragment showing the making of contact in the meter relay.

FIG. 4 is a schematic diagram of a modification of the circuit providing speed limitation but which requires manual resetting

FIG. 5 is a schematic diagram showing a modification in which capacitor rush current is used in the opposite sense.

While the invention is described in connection with certain preferred embodiments, it will be understood that I do not intend to be limited to the particular embodiment shown but intend, on the contrary, to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to FIG. 1 there is shown, in diagrammatic form, a hot rod vehicle 10 having front wheels 11 and rear wheels 12. The latter are driven by a power train including an engine 15, a clutch 16, transmission 17 and differential 18. The ignition system, indicated at 20, includes an ignition coil having a primary 21 and high voltage secondary 22. The primary is fed by a switch 23 from the regular vehicle battery 24. The flow of current is interrupted by breaker points 25 operated by a cam 26 having a connection 27 to the engine. The high voltage from the secondary winding 22 is applied to the spark plugs via a distributor 28 having a mechanical connection 29 to the engine. The tachometer and maximum speed limiting device includes a transmitter T and receiver R, the latter having an indicating meter type relay M to which more detailed reference will be made. A disabling line D extends from the receiver to the junction between the primary winding 21 and the breaker points 25.

Referring next to FIG. 2, the transmitter T will be seen to consist of a relay 30 having a double throw contact blade 31 which makes normal contact with an upper contact 32 and which is, upon energization, drawn downwardly against the lower contact 33. Connected to the lower contact 33 is a battery 34 which may, for example, be of the long-lived mercury type. Connected to the central terminal 31 is a commutated capacitor 35. The contact 32 and the right hand end of the capacitor 35 are connected to output lines 36, 37. Each time the points open, a closing pulse is applied to the relay winding 30 causing the capacitor 35 to be commutated back and forth from the battery 34 to the output lines 36, 37 and with the current in the output lines being proportional to the speed of commutation, i.e., to the speed of the engine. For direct and constant indication of speed the receiver R includes meter M which may be of d'Arsonval type constructed as shown in FIG. 3. The pivoted indicating needle, indicated at 41, cooperates with a scale 42 calibrated directly in r.p.m. Secured to the needle is a moving coil 43 which is rockable in the field of a permanent magnet 44, restoring force being provided by springs 45. For the purpose of making electrical contact upon achieving a predetermined r.p.m., meter contacts 50 are provided consisting of a movable contact 51 which is mounted on the lower end of the indicating needle 41 and a relatively fixed contact 52 which is adjustably interposed in the path of movement of the contact 51. The movable contact 51 is preferably in the form of a few turns of good conducting flattened wire slidably mounted upon the lower extension 53 of the needle. Thus, in addition to serving as a movable contact, the member 51, being slideably adjustable, serves as a counterweight for the needle. It is of sufficient length as to insure engagement with the fixed contact 52 in all of its positions of adjustment.

For the purpose of mounting the fixed contact 52, an indicator or "red line" pointer 55 is used which is coaxially pivoted on a shaft 56 which is recessed in any opening formed coaxially in the meter cover glass. At its outer end the shaft terminates in a limit setting knob 57 which at its inner end the shaft has a registering connection with an arm 58 which mounts the adjustable contact 52. Any lost motion between the shaft 56 and arm 58 is taken up by a small helical spring 59. The red line pointer 55 is set to indicate a predetermined limit r.p.m. on the scale 42 and the parts are so arranged that contact occurs when the needle 41 reaches such r.p.m. level.

In accordance with one of the aspects of the present invention an output relay RY is provided having a disabling or grounding contact which is connected by the disabling line D to the end of the primary winding 21 of the ignition coil to make the ignition system inoperative, and means including a capacitor are provided in a loop circuit so that closure of the meter contacts produces a powerful additive pulse of current through the meter coil forcefully bringing the contacts together in a low resistance connection. Thus, referring to FIG. 2, a capacitor C1 is provided which is connected at its left hand end to the meter contact 52 and at its right hand end through a diode D to the right hand end of the meter coil 43. The loop is completed by an internal meter connection 61 which extends from the movable contact 51 to the left hand end of the meter coil. for the purpose of making the capacitor C1 normally charged, a battery B is provided having, connected in series, a relatively high value resistor R3. A line 62 completes a connection from the battery to the winding of the relay RY. The relay has normally open grounding contacts K1 and K2, contacts K1 being connected via disabling line D to the ignition coil.

Thus, as the speed of the engine increases, producing a proportional increase in current in the lines 36, 37, the needle 41 advances along the scale 42 until the pre-set limiting speed is reached, whereupon the movable contact 51 engages the fixed contact 52. Where initial touching between the contacts is of an indecisive or chattering nature, as, for example, where the rate of movement of the needle 41 is very slight as it eases into limit position, even tentative contact is sufficient to produce an immediate avalanche of current from the discharging capacitor C1 through the meter coil 43, causing the coil to apply to the movable contact a high level of torque so that the contacts are forcibly brought together to complete a low resistance connection through the battery and via the line 62 to the coil of the relay RY. The discharge of the capacitor, triggered by the initial contact between the meter contacts, produces an effect which may be likened to a high value of positive feedback. While the peak current through the coil 43 may be high, its duration is short because of low resistance in the discharge loop, which produces a short time constant. The capacitance of the capacitor C1 and the voltage of the battery B are chosen so that the total energy content of the current pulse is low enough so that no objectionable temperature rise occurs in the meter coil 43. In a typical case the battery may have a voltage of 4.2 volts and the capacitor C1 may have a capacitance of 500 mfd.

It will be apparent that when the relay contacts K1 are closed the relay 30 in the transmitter T is disabled along with the ignition coil so that current no longer flows in the output lines 36, 37 causing the needle 41 in the meter to immediately drop back, thereby breaking contact between the contacts 51, 52 in the meter. Means are, however, provided for preventing immediate drop-out of the output relay RY. This, in accordance with the present invention, is brought about by providing capacitor switching contacts, indicated at K2, to establish a charging circuit for the capacitor C1 which includes the battery B, the coil of the output relay and an adjustable charging resistor, with the polarity of the connection being such that the charging current tends to maintain the relay RY closed for an additional time interval which depends upon the setting of the charging resistor. Thus referring to FIG. 2 it will be noted that the charging circuit for capacitor C1, starting from ground, proceeds through switching con-

tacts K2, charging resistor R1, capacitor C1, battery B to the coil of relay RY and back to ground. The existence of the diode D interposed between the charging circuit and the meter coil prevents the tachometer signal from T from being shunted through resistor R3 and relay RY to ground during normal operation of the tachometer.

In order to be able to achieve a desired maximum drop-out interval, which, in a practical case, may be up to one second in duration, while nevertheless keeping the capacitor C1 to a level of capacitance which is safe as regards the meter coil 43, an auxiliary capacitor is employed which is charged during the time that the meter contacts are closed and which is additively discharged through the coil of the output relay after the meter contacts open to assist in maintaining the output relay temporarily closed. The auxiliary capacitor, indicated at C2, is connected, through a charging resistor R2, between the capacitor switching contacts K2 of the relay and the positive terminal of the battery B. Thus when the meter contacts are closed, and contacts K2 are closed, the capacitor C2 is charged to the polarity shown. A moment thereafter, when the meter contacts open, the capacitor C2 discharges through capacitor switching contacts K2, through resistor R2 and line 62 through the coil of the output relay RY to ground. Such discharge current, being polarized the same as the charging or inrush current to the capacitor C1, augments the effect of capacitor C1 in providing a desired drop-out interval. By varying the value of the resistor R1, and by proper choice of output relay RY, a matter well within the skill of the art, the drop-out time interval may be set anywhere within a range of approximately 0.1 second to 1.0 second, or somewhat more if desired.

After the main capacitor C1 is substantially charged and the auxiliary capacitor C2 substantially discharged, the current through the winding of the output relay will fall to a value which is no longer sufficient to hold the armature in, and relay will drop out, opening the disabling contacts K1 and removing the grounding circuit from the primary of the ignition coil. The ignition coil will then be able to function as usual to build up the engine speed, once again, toward the limiting value. It will be apparent that the driver of the vehicle need no longer keep his eye on the tachometer needle. He may simply floor the accelerator and be in readiness for clutching and shifting into the next higher gear as soon as he hears the engine falter at maximum speed, with the interval that the engine is de-powered, by the holding in of relay RY, being just sufficient to permit a change of gears. This process is automatically repeated through an entire set of gears from lowest to highest. The function of the driver becomes simply the mechanical one of shifting as promptly as possible during the de-powered intervals. The engine is worked at maximum average power short of a speed which will cause it to self-destruct with a high degree of reliability and safety and without exercise of any care or judgment on the part of the driver.

While the operation of the circuit shown in FIG. 2 will be apparent from the foregoing description, the operation may be summarized briefly in connection with FIGS. 2a, 2b and 2c which set forth the three successive states of the circuit during a typical cycle. In these figures the active, or conductive, portions of the circuit are indicated by the heavy lines.

Referring to FIG. 2a, which shows the condition of the circuit upon initial contact, the charge from capacitor C1 is discharged through the diode D into the meter coil 43. Current begins to flow from the battery through line 62 to the coil of the output relay, but the relay contacts have not yet closed because of the slight time delay which is inherent in any relay of the electromagnetic type.

FIG. 2b shows the effect of closure of the contacts K1, K2. The contacts K1 ground the disabling line D. Closure of contacts K2 completes the circuit through capacitor C2, resistor R2, battery B and meter contacts 50 which, at that moment have not yet opened. Charging of the capacitor C2 takes place with great rapidity because of the relatively low time constant.

Since the grounding of the disabling line D disables the transmitter T and shuts off current flow in lines 36, 37, and since the current from the capacitor C1 has spent itself, the current in the meter coil falls abruptly, opening the meter contacts as shown in FIG. 2c. Contacts K2 remain closed establishing a charging circuit for capacitor C1 via charging resistor R1, capacitor C1, battery B and line 62 to the coil of the output relay RY. At the same time a discharge circuit for the capacitor C2, shown dotted, may be traced through contacts K2, capacitor C2, resistor R2 and line 62 to the relay coil. The respective charging and discharge currents are additive and serve to hold in the relay for a de-powered time interval which depends upon the adjustment of the resistor R1 (as well as the value of resistor R2). As soon as the interval has expired and the capacitor currents have been dissipated, the current through the relay coil drops to a level which causes the relay to open, thereby opening the contacts K2 and the disabling contacts K1, restoring the function of the ignition coil so that the engine is fully repowered and restoring operation of the tachometer, with the status of the circuit again being set forth in FIG. 2. In such state the capacitor C1 is fully charged and the capacitor C2 is fully discharged in readiness for a new cycle when the engine speed again achieves its limiting value.

While the preferred form of the invention has particular utility in connection with the operation of hot rod vehicles, it will be apparent that the control system is not limited to such usage but is useful wherever it is desired to de-power an engine for a predetermined time interval upon achieving a predetermined rotational speed. The system is not intended for use on a highway where automatic de-powering may create risk in a high speed traffic situation.

Typical circuit values may be as follows:

C1 500 mfd.
C2 500 mfd.
R1 500 ohms
R2 470 ohms
R3 10,000 ohms
meter coil 160 ohms
RY 65 ohms
Batt. B 4.2 volts
Batt. 34 6.75 volts
Cap. 35 0.16 mfd.

In one of the aspects of the invention it is, however, contemplated to turn off the engine and to maintain it in the off condition until intentionally reset. Thus, referring to FIG. 4 a modified engine control system is disclosed in which the second set of contacts K2' on the relay are employed, not for capacitor switching purposes, but for sealing in purposes to maintain the output relay energized, and the engine de-powered, indefinitely until the circuit is reset by a pressing of a normally closed push button. Thus, turning to FIG. 4 in which corresponding reference numerals, with the addition of a prime, represent corresponding parts, it will be seen that the relay contacts K2' are connected by a push button PB to the left hand or negative side of the battery B' thereby to maintain the battery B' in the circuit of the relay coil. The operation of the circuit shown in FIG. 4 is similar to that described above, in that closure of the meter contacts 50' upon achieving of a preset speed causes discharge of the capacitor C1' into the coil 43' to bring the meter contacts forcibly together for immediate and positive energization of the relay RY'. Closure of the disabling contacts K1' disables the engine and the tachometer transmitter so that the needle 41' of the meter falls away from its maximum position breaking meter contacts 50'. However the sealing contacts K2', through the push button and battery, maintain output relay RY' pulled until the sealing circuit is broken by momentarily pressing the push button.

Thus the arrangement shown in FIG. 4 performs a valuable protective function wherever it is necessary or desirable to protect engine from an over speed condition as might result, for example, by the dropping of the load regardless of whether the engine is fixed, for example on a test stand, or in automotive usage.

It is one of the features of the invention, in both of the modifications discussed above, that the same calibrated scale is used with the meter needle for speed indication and with the red line pointer for speed limitation. It will be apparent, however, that where only the protective function is of interest the needle may be dispensed with but the meter contacts retained for automatic de-powering. The term "meter" as used in the claims is therefore employed in a general sense to include a sensitive calibrated relay. Also while it is preferred to disable the invention by grounding the primary of the ignition coil, it will be apparent that the invention is not limited thereto and that a normally closed contact may be provided on the output relay in series with the regular ignition switch for open circuiting the ignition coil primary when the relay is energized.

Finally while it is preferred to obtain positive feedback through the meter coil for achieving forcible engagement between the meter contacts, it will be apparent that such feedback may be achieved, without departing from the present invention, by making use of the inrush current to a normally uncharged capacitor. An example of such an arrangement is shown in FIG. 5 in which similar components are indicated by the same reference numerals as in FIG. 2, but doubly primed. Thus the main capacitor C1'' instead of being effectively connected in parallel with the battery and maintained normally charged may be in a loop circuit which includes the battery and which is kept in a normally uncharged state. When the limiting speed is achieved and contacts 50'' close, current flows through a loop consisting of the battery B'', the capacitor C1'' and diode D'' to the meter coil 43'' causing the torque exerted upon the meter contacts to be greatly increased to provide a low resistance circuit, through the battery, to the relay RY''. This causes closure of contacts K1'' and disabling of the ignition system and tachometer transmitter just as described, thereby opening the meter contacts. Simultaneous closure of capacitor switching contacts K2'' with closure of contacts K1'' creates a capacitor discharging circuit through resistor R1'', the capacitor C1'', and the coil of relay RY'', causing the relay to hold in for an additional time interval, with the actual time interval depending upon the adjustment of the resistor R1. The relay then drops out to repower the engine. The capacitor C1'' is, at the end of such de-powering cycle, left in the uncharged state in readiness for recharging when next the meter contacts close.

It will be apparent upon comparing the circuits of FIG. 2 and FIG. 5 that the invention contemplates employing the inrush and outrush currents of the capacitor interchangeably. Thus in FIG. 2 it is the discharge, or outrush, current of the capacitor C1 which makes forcible contact within the meter and it is the inrush current, upon recharging, which is utilized to inhibit drop-out of the output relay. In FIG. 5, the situation is reversed; it is the inrush current of the capacitor C1'' which produces a high force level at the meter contacts and it is the subsequent outrush which is utilized to inhibit drop-out of the relay.

Because of the interchangeability in the utilization of inrush and outrush capacitor currents, the term "rush" current has been utilized as a generic term and is employed in the generic sense in the following claims.

I claim as my invention:

1. In a combined tachometer and maximum speed limiting device for an automotive engine having a transmission as well as an ignition coil and breaker points, the combination comprising a tachometer transmitter electrically connected to the breaker points and having means for producing a direct current output signal in accordance with engine speed, a tachometer receiver in the form of a meter having a coil connected to the transmitter driving a needle which cooperates with a scale calibrated in terms of engine speed, meter contacts including a movable contact on the needle and an adjustable contact cooperating with the calibrated scale and adjustably interposable in the path of the movable contact for making contact when the speed reaches a predetermined level, an output relay having a coil and disabling contacts controlled thereby, means for disablingly connecting the disabling

contacts to the ignition coil, a battery connected in series with the meter contacts and the relay coil, a capacitor chargingly connected to the battery and connected in a loop circuit which includes the meter coil and meter contacts so that when the meter contacts close upon achieving the predetermined speed the capacitor rush current through the meter coil urges the meter contacts forcibly together thereby to insure a reliable level of current flow to the relay coil so that the engine is fully powered up to the predetermined speed and completely de-powered upon reaching the predetermined speed thereby to signal to the driver that the engine is in condition for shifting to the next speed of the transmission, and means for delaying drop-out of the relay for a predetermined time interval to permit shifting by the driver into the next higher speed of the transmission prior to the re-powering of the engine which accompanies drop-out of the relay.

2. In a combined tachometer and disabling device for an automotive engine having an ignition coil and ignition points, the combination comprising a tachometer transmitter coupled to the ignition coil and points and having means for producing a direct current output in accordance with engine speed, a tachometer receiver in the form of a meter having a coil and a needle and calibrated in terms of engine speed, meter contacts including a movable contact coupled to the needle and a relatively fixed but adjustable contact in the path of movement thereof for making contact when the speed reaches a predetermined level, a relay having a coil and first and second sets of relay contacts, a battery connected in series with the meter contacts and the relay coil, a capacitor connected in a loop circuit which includes the meter coil and meter contacts so that when the meter contacts close upon achieving the predetermined speed capacitor rush current through the meter coil urges the meter contacts forcibly together thereby to insure a reliable level of current flow to the relay, the first set of relay contacts being connected to the ignition coil for disabling the same when the relay closes, the second set of relay contacts being connected in a loop circuit which includes the capacitor, battery and relay coil so that when the second set of relay contacts closes capacitor rush current flows through the relay coil thereby to maintain the coil closed for a predetermined time interval with automatic resumption of the operation of the engine following such time interval.

3. The combination as claimed in claim 2 in which an adjustable resistor is interposed in series with the circuit of the capacitor so as to permit variation of the time interval during which the relay remains closed.

4. In a combination tachometer and disabling device for an automotive engine having ignition coil, the combination comprising a tachometer transmitter coupled to the engine and having means for producing a direct current output in accordance with engine speed, a tachometer receiver including a meter having a coil and a needle, meter contacts including a movable contact coupled to the needle and a relatively fixed but adjustable contact in the path of movement thereof for making contact at a predetermined limiting speed, an output relay having a coil and relay contacts, a battery connected in series with the meter contacts and the relay coil, a capacitor chargingly connected to the battery and connected in a loop circuit which includes the meter coil and meter contacts so that when the meter contacts close upon achieving the predetermined speed capacitor rush current through the meter coil urges the meter contacts forcibly together thereby to insure a reliable level of current flow to the relay, and means connected to the relay contacts for at least temporarily disabling the ignition coil and preventing any further increase in engine speed above the predetermined level.

5. The combination as claimed in claim 4 in which the transmitter is coupled to the ignition coil so that when the ignition coil is disabled the meter contacts in the tachometer receiver are opened permitting the output relay to drop out thereby permitting the engine to resume functioning after brief disablement.

6. The combination as claimed in claim 4 in which means are provided for causing the output relay to hold in for a predetermined and adjustable time interval following the opening of the meter contacts so that the engine is disabled for a brief but predetermined time interval.

7. The combination as claimed in claim 4 in which one of the output relay contacts is connected in parallel with the meter contacts to maintain the relay in closed condition.

8. The combination as claimed in claim 4 in which one of the output relay contacts is effectively connected in parallel with the meter contacts and which a normally closed switch is provided connected in series with the relay coil for achieving drop-out upon momentary manual operation of the switch.

9. In a combined tachometer and maximum speed device or the like, the combination of a transmitter having means for producing a variable direct current signal, a receiver in the form of a meter having a coil and a pivoted needle cooperating with a calibrated scale, meter contacts including a movable contact on the needle and a relatively fixed contact adjustably interposed in the path of movement thereof, means including an electric circuit for responding to closure of the meter contacts, a capacitor, a battery for charging the capacitor, said capacitor being connected in a loop circuit including the coil and meter contacts with the charge on the capacitor having a polarity which is the same as the polarity of the signal current so that when the meter contacts close the rush current of the capacitor flows through the coil in a direction to urge the meter contacts forcibly together thereby to insure the making of positive contact for the responsive means.

10. In a combined tachometer and maximum speed device or the like, the combination of a transmitter having means for producing a variable direct current signal, a receiver in the form of a meter having a coil and a pivoted needle cooperating with a calibrated scale, meter contacts including a movable contact on the needle and a relatively fixed contact adjustably interposed in the path of movement thereof, means including an electric circuit for responding to closure of the meter contacts, a capacitor, a battery and series resistor for charging the capacitor, said capacitor being connected in a loop circuit including the coil and meter contacts with the charge on the capacitor having a polarity which is the same as the polarity of the signal current so that when the meter contacts close the capacitor is discharged through the coil in a direction to urge the meter contacts forcibly together thereby to insure the making of positive contact for the responsive means.

11. The combination as claimed in claim 9 in which the pivoted needle has an arm extending beyond the pivot and in which the movable contact is in the form of a counterweight slidably adjustable on the arm, the fixed contact being so arranged as to make contact with the movable contact in all of the adjusted positions of the latter.

12. The combination as claimed in claim 10 in which the capacitor is shunted by the battery with a high value charging resistor interposed for maintenance of charge on the capacitor following the opening of the relay.

13. In a combined tachometer and maximum speed limiting device for an automotive engine having an ignition coil and breaker points, the combination comprising a tachometer transmitter coupled to the engine and having means for producing a direct current output signal in accordance with engine speed, a tachometer receiver in the form of a meter having a coil connected to the transmitter driving a needle and calibrated in terms of engine speed, meter contacts including a movable contact on the needle and a relatively fixed contact adjustably interposed in the path of movement thereof for making contact when the speed reaches a predetermined level, an output relay having a coil and ignition disabling contacts as well as capacitor switching contacts, a battery connected in series with the meter contacts and the relay coil, a first capacitor connected in series with the meter contacts and meter coil so that when the meter contacts tentatively come together upon reaching the predetermined speed the capacitor is discharged through the meter coil to urge the meter con-

tacts more forcibly together thereby to insure a reliable level of current flow to the relay coil and prompt closure of the relay contacts, a second capacitor connected in series with the meter contacts, battery, and capacitor switching contacts so that when the meter contacts and capacitor switching contacts close the second capacitor is charged, the second capacitor being connected in addition in a loop circuit which includes the capacitor switching contacts and relay coil so that when the meter contacts subsequently open the second capacitor is connected for discharge through the relay coil to hold in the relay for a predetermined short time interval and means connected to the ignition disabling contacts for temporarily disabling ignition.

14. In a combination tachometer and maximum speed limiting device for an automotive engine having an ignition coil and breaker points, the combination comprising a tachometer transmitter coupled to the breaker points and having means for producing a direct current output signal in accordance with engine speed, a tachometer receiver in the form of a meter having a coil connected to the transmitter and driving a needle and calibrated in terms of engine speed, meter contacts including a movable contact on the pointer and a relatively fixed contact adjustably interposed in the path of movement thereof for making contact when the speed reaches a predetermined level, an output relay having a coil and ignition disabling contacts as well as capacitor switching contacts, a battery connected in series with the meter contacts and the relay coil, a capacitor connected in series with the meter contacts and meter coil so that when the meter contacts tentatively come together upon reaching the predetermined speed the capacitor is discharged through the meter coil to urge the meter contacts forcibly together thereby to insure a reliable level of current flow to the relay coil and prompt closure of the relay contacts, the capacitor having a charging resistor and a charging circuit which includes the capacitor switching contact, charging resistor, battery and relay coil so that closure of the capacitor switching contact causes charging current to flow through the relay coil thereby to delay drop out of the relay when the meter contacts open, and means for coupling the ignition disabling contacts to the circuit of the ignition coil for disabling the latter.

15. In a combined tachometer and maximum speed limiting device for an automotive engine having an ignition coil and breaker points, the combination comprising a tachometer transmitter connected to the breaker points and having means for producing a direct current output signal in accordance with engine speed, a tachometer receiver in the form of a meter having a coil connected to the transmitter driving a pivoted needle and calibrated in terms of engine speed, meter contacts including a movable contact on the pointer and a relatively fixed but adjustable contact interposed in the path of movement thereof for making contact when the speed reaches a predetermined level, an output relay having a coil and ignition disabling contacts as well as capacitor switching

contacts, means connected to the disabling contacts for disabling the ignition coil, a battery connected in series with the meter contacts and the relay coil, a first normally charged capacitor connected in a loop circuit which includes the meter contacts and meter coil so that when the meter contacts come together upon achieving the predetermined speed the first capacitor is discharged through the meter coil to urge the meter contacts forcibly together, a second capacitor having a loop circuit which includes the capacitor switching contacts, the battery, and the meter contacts for charging the second capacitor, the first capacitor having a charging resistor and a charging circuit which includes the capacitor switching contacts, the battery and relay coil so that when the meter contacts open as a result of disabling of the ignition charging current passes through the relay coil to delay drop-out of the relay, the second capacitor having a discharge circuit which includes the capacitor switching contacts and relay coil so that when the meter contacts open the second capacitor is discharged through the relay coil for achieving additional delay in the drop-out of the relay.

16. In a combined tachometer and maximum speed limiting device for an automotive engine having an ignition coil and breaker points the combination comprising a tachometer transmitter electrically coupled to the ignition points and having means for producing a direct voltage output in accordance with engine speed, a tachometer receiver in the form of a meter having a coil connected to the transmitter and driving a needle calibrated in terms of engine speed, meter contacts including a movable contact coupled to the needle and a relatively fixed contact adjustable interposed in the path of movement thereof for making contact when the speed reaches a predetermined level, an output relay having a coil and ignition disabling contacts as well as capacitor switching contacts, means for interconnecting the ignition disabling contacts and ignition coil for disabling the latter, a battery connected in series with the meter contacts and the relay coil, a first capacitor connected in a loop circuit which includes the meter coil and meter contacts so that when the meter contacts close upon achieving the predetermined speed the first capacitor is discharged through the meter coil to urge the meter contacts forcibly together thereby to insure a reliable level of current flow to the relay coil, a second capacitor connected to the meter contacts and battery for charging when the meter contacts close, both of the capacitors being connected in loop circuits which include the capacitor switching contacts and the relay coil so that when the meter contacts open incident to disabling the ignition coil the first capacitor is charged through the relay coil and the second capacitor is discharged through the relay coil thereby to inhibit drop-out of the relay for a delay interval.

17. The combination as claimed in claim 16 in which the capacitors each have a series resistor for determining the drop-out delay interval.

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