Oct. 13, 1959 B. COOPER 2,908,895

AUTOMATIC TOLL COLLECTION SYSTEM

Filed March 22, 1955

FIG. 1.

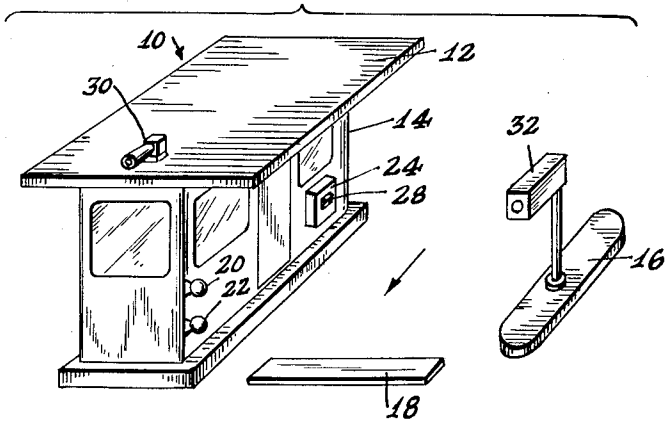


FIG. 2.

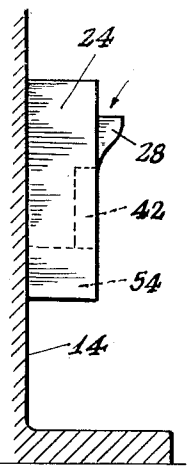
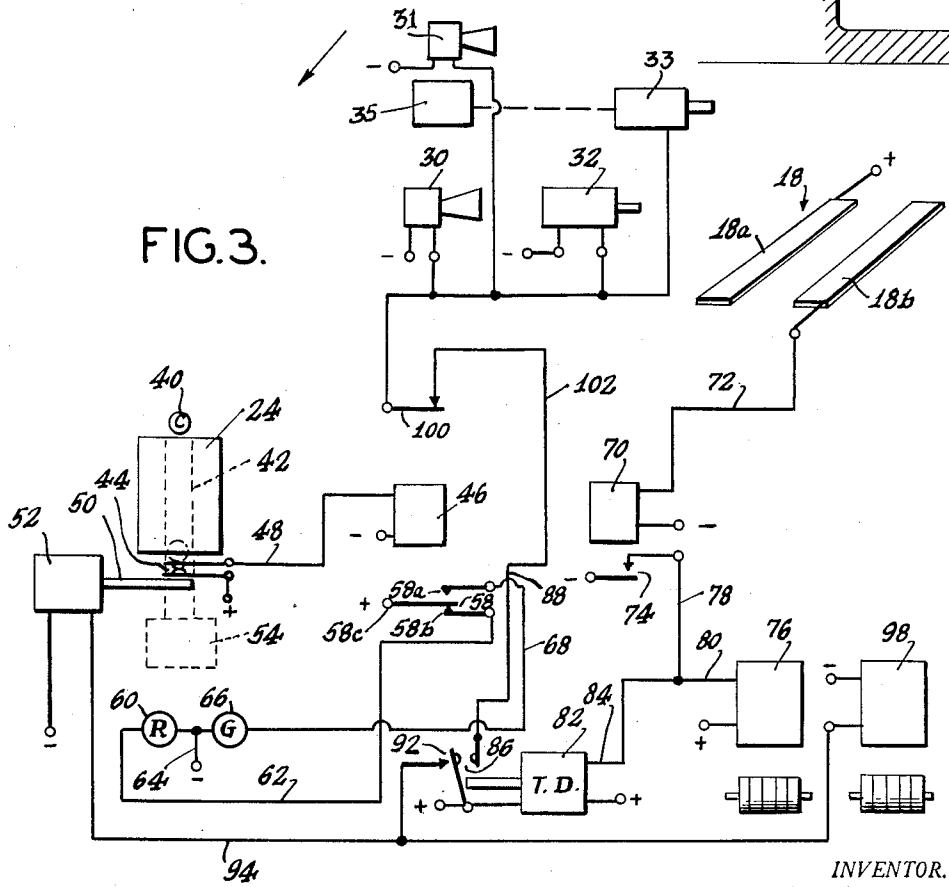


FIG. 3.



INVENTOR.
BENJAMIN COOPER
BY J. B. Feeslin
ATTORNEY.

United States Patent Office

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AUTOMATIC TOLL COLLECTION SYSTEM

Benjamin Cooper, Brooklyn, N.Y.

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9 Claims. (Cl. 340—213)

This invention relates generally to toll collection systems and in particular to a novel toll collection system that is automatic in operation and eliminates the need for manual toll collection.

Heretofore automatic toll collection equipment has failed for the simple reason that no means were provided to apprehend dishonest users of the toll facilities.

The present invention provides a novel system of toll collection wherein failure of anyone to pay the toll and attempted use of the toll facilities will result in the sounding of an audible alarm and also the production of a permanent record of identification of the surreptitious offender.

Accordingly one of the principal objects of the invention resides in the provision of an automatic toll collection device having means to record identification of a vehicle failing to pay the required toll and attempting to use the toll facilities.

Another object of the invention is to provide, in a system of the class described, means to disable the audible warning system and recording system upon proper payment of the prescribed toll.

Still another object of the invention is to provide, in a system of the class described, traffic signalling means responsive to the depositing of the prescribed toll in a receptacle therefor.

Yet another object of the invention is to provide counting means for remotely recording the number of vehicles utilizing the toll facilities and the amount of tolls collected.

Other ancillary objects will be, in part, hereinafter apparent and will be, in part, hereinafter pointed out.

In the drawings:

Figure 1 is an isometric projection of a toll interchange illustrating the various components of the invention.

Figure 2 is a sectional detail of the coin collecting mechanism mounted on the side of the toll booth.

Figure 3 is a schematic wiring diagram of the invention.

Referring to the drawings in detail, **10** generally designates a toll interchange conventionally disposed at the entrance or exit of a toll facility such as a bridge, tunnel, etc. and having a canopy **12** supported by a booth **14** thereunder. Toll booth **14** is so disposed that vehicles utilizing the toll facilities must pass alongside thereof or, in the case of multiple booths, therebetween. The passageway between the toll booth **14** and an island **16** of the present instance is of such size that the vehicle must roll over a treadle switch **18** imbedded transversely in the roadway. The treadle **18** may be of a construction shown in my patent, No. 2,251,351, dated August 5, 1941, entitled Treadle Process. Vehicles approaching the toll booth **14** in the direction of the arrrow shown in Figure 1 must stop in accordance with the traffic signals **20** and **22** and drop a coin in the robot toll collector **24** affixed to booth **14**. The traffic signals **20** and **22** are red and green respectively, and accordingly the red signal will normally be energized to stop vehicles from proceeding

through the toll facilities. A hopper **28** is provided to facilitate the receiving or depositing of a coin in the coin receiving robot **24**. Upon the depositing of a coin in the hopper **28**, hereinafter described in detail, the traffic signal lights **20** and **22** will change from red to green signalling to the driver of the vehicle that he may proceed through the toll facilities.

In the absence of a barrier, not shown, the vehicle driver may be tempted to proceed through the toll facilities without paying the prescribed toll. In such an event means, hereinafter described in detail, will effect the sounding of an audible alarm, such as shown at **30**, and concurrently therewith actuate a photographic recording device **32**. Device **32** is a camera that has been especially developed and designed for the recording of vehicles and is completely disclosed in applicant's copending application, Serial Number 317,468, filed October 29, 1952, which has matured into Patent No. 2,736,630, issued February 28, 1956.

Referring to Figure 3 of the drawings there is shown a schematic diagram of the circuit which interconnects the various components of the system. A coin **40** is dropped in the coin collecting equipment **24** which is simply illustrated as a chute **42** having a pair of normally open contacts **44** therein. The weight of the coin **40** effectively closes the contacts **44** and establishes a circuit which energizes a relay **46**. The circuit may be traced as follows: From a source of positive potential through the closed contacts **44** over a conductor **48** to one terminal of the coil of relay **46**. The other terminal of the coil of relay **46** is connected to a source of negative potential. A plunger **50** of a solenoid **52** is disposed under the contacts **44** when said solenoid is de-energized and combined with the weight of the coin **40** assists in retaining the contacts **44** in closed relationship. Energization of solenoid **52** by means hereinafter described in detail effects the wtihdrawal of the plunger **50** from supporting engagement of the contacts **44** and the weight of the coin **40** spring-urges said contacts out of the chute **42** permitting said coin to drop into a suitable bank **54** disposed below the chute. The dropping of the coin permits the contacts **44** to resume their initial position in normally open relationship. In operation, the vehicle approaches the booth **14** and prior to the wheels of the vehicle engaging the treadle **18**, the driver deposits a coin in the hopper **28**. As hereinbefore set forth relay **46** is energized upon the depositing of the coin **40** in hopper **28**.

Associated with relay **46** is a set of contacts **58** comprising a pair of spaced contacts **58***a* and **58***b* respectively. A common swinger **58***c* is normally disclosed in engagement with contact **58***b* and completes a circuit to energize the red traffic signal **60**. This circuit may be traced as follows: From a source of positive potential through swinger **58***c*, through contact **58***b* over conductor **62** to one terminal of the red or stop traffic signal **60**. The other terminal of the traffic signal **60** is connected by conductor **64** to a source of negative potential. Therefore the red or stop traffic signal **60** is normally energized. Upon energizing the relay **46**, swinger **58***c* of contacts **58** moves from engagement with contact **58***b* to engagement with contact **58***a* and in so doing extinguishes or de-energizes the stop traffic signal lamp **60** and subsequently energizes the green or go traffic signal lamp **66**. This circuit may be traced as follows: From a source of positive potential through swinger **58***c* through contact **58***a* over conductor **69** to one terminal of the green traffic signal lamp **66**. The other terminal of the traffic signal lamp **66** is connected by the common conductor **64** to a source of negative potential. Thus it will be apparent that upon the depositing of a coin **40** in the hopper **28** the traffic signal lamp **60** will de-energize and the traffic signal lamp

66 will energize. The energizing of traffic signal lamp 66 gives the vehicle driver the go ahead signal and he will proceed through the toll interchange 10. In so doing, the wheels of the vehicle will roll over treadle switch 18 and close the normally opened contacts 18*a* and 18*b* therein to complete a circuit which will energize treadle relay 70. This circuit may be traced as follows: From a source of positive potential through the closed contacts 18*a* and 18*b* of treadle 18 over conductor 72 to one terminal of the coil of relay 70 and from the other terminal of said coil the circuit continues to a source of negative potential. A pair of normally open contacts 74 associated with relay 70 closes upon the energization thereof and completes the circuit to an axle counter 76. This circuit may be traced as follows: From a source of negative potential through the closed contacts 74 over conductors 78 and 80 to one terminal of the coil of the electromagnetic counter 76. The other terminal of the coil of electromagnetic counter 76 is connected to a source of positive potential. Electromagnetic counter 76 is completely disclosed in Patent Number 2,293,934, issued to applicant on August 25, 1942, and need not be described in detail herein. Concurrently with the energizing of counter 76 a parallel circuit is established which energizes a time delay mechanism 82 over a circuit that may be traced from a source of negative potential through closed contact 74, conductor 78, conductor 84 to one terminal of an actuating electromagnet in time delay mechanism 82. The other terminal of the time delay electromagnet is connected to a source of positive potential. Time delay mechanism 82 is conventional in structure and well known to those skilled in the art and is of the type wherein contacts 86 associated therewith are immediately closed upon the energizing thereof and upon de-energization, the delay mechanism 82 retains said contacts closed for a period of time. This delayed period of time may be predetermined and of sufficient duration to permit the rear wheels of a vehicle to cross over the treadle 18 before the contacts 86 have opened as a result of the time delay mechanism reaching the end of its time delaying cycle. Contacts 86 are of the normally open type and are included in a circuit which may be traced as follows: From a source of positive potential through contacts 86 when closed over conductors 88 and 102, closed contacts 100, to the positive terminals of alarm 30 and camera 32. Also associated with the time delay mechanism 82 is a pair of momentary contacts 92, normally open, but which momentarily engage upon the de-energization and the end of the time cycle of the time delay mechanism 82. The momentary engaging of the contacts 92 completes a circuit through said contacts and over a conductor 94 to the solenoid 52. The positive potential thus supplied to the solenoid 52 energizes said solenoid wherein plunger 50 retracts sufficiently to enable the coin 40 to drop into the bank 54. Contacts 44 immediately open and since contacts 86 are open, the relay 46 de-energizes permitting the contacts associated therewith to return to their initial positions. A money counter 98 may be connected in parallel with the solenoid 52 circuit and actuated therewith to record the number of coins 40 dropped in the bank 54. Associated with the relay 46 is a pair of contacts 100 which are normally closed and are included in a circuit which energizes the audible alarm 30 and the camera 32. The circuit is so arranged that upon the energization of relay 46 contacts 100 are held open and alarm 30 and the camera 32 cannot be actuated. However upon failure of a vehicle driver to deposit a coin in hopper 28, the contacts 100 remain closed and upon the front wheels of the vehicle rolling over the treadle 18 a circuit is established through the resulting closed contacts 86 over conductor 88 and conductor 102 through the closed contacts 100 to the positive terminals of the respective alarm 30 and camera 32 thereby causing the alarm 30 to sound and the camera 32 to photographically record the vehicle. The alarm continues as long as the time delay mechanism is operative in its time delay cycle. This alarm period is sufficient to alert policing personnel who may intercept the surreptitious driver.

It is readily apparent that any dispute as to whether or not the arrested driver paid his proper toll or not may be settled with the photographic evidence for the camera does not record the honest toll-paying driver's identification. Further, should the dishonest driver escape detection by policing personnel a permanent record is available and a warning may be communicated to him from the identification on the camera film. It will be understood that while the coin receiving means herein disclosed is simple in operation, it is obvious that more complex coin devices may be employed without departing from the scope of the invention. Coin devices may include such features as slug rejection, change-making, etc. and are well known to those skilled in the art.

It is also proposed that in conjunction with the camera 32, a television camera 33 may be operative to photographically record the image of an offending vehicle. This image may be transmitted by conventional means, not shown, to a television receiver designated as 35 in Figure 3 which would be disposed remotely from the toll booth 10 in the direction in which the offending vehicle was traveling. Further, a second alarm means designated at 31 may be disposed at the remote location so that the attention of policing personnel at the remote location will be called to the image of the offending vehicle on the television receiver 35. It is readily apparent that such policing personnel may intercept the offending vehicle from the identification thereof disclosed in the television receiver 35. While simple controls have been shown for the television receiver and camera, it will be understood that the conventional television controlling would be utilized. Such television controls are well known to those skilled in the art and need not be described herein. It is sufficient to say that the television camera may be continuously operative or intermittently operative as shown.

Thus, it has been shown and disclosed an automatic toll collection system wherein the several objects of the invention have been achieved which is adapted to meet the conditions of practical use.

The invention claimed is:

1. In a toll checking system for checking toll collections for a vehicle moving forwardly in a lane past a toll station, a vehicle actuated means at said station, a coin receiving means at said station in advance of said vehicle actuated means, so positioned relative to the vehicle actuated means that the operator of the vehicle moving forwardly in the lane reaches the coin receiving means for a deposit of a coin therein, before advancing the vehicle in the lane further relative to the vehicle actuated means to a position where said vehicle will actuate said vehicle actuated means after the coin has been deposited in the coin receiving means, vehicle image reproducing means positioned to reproduce images of vehicles actuating said vehicle actuated means, means to actuate said vehicle image reproducing means upon actuation of said vehicle actuated means, to reproduce the image of the actuating vehicle, if no coin is inserted in the coin receiving means in advance of actuation of said vehicle actuated means, and means responsive to a coin deposited in said coin receiving means in advance of actuation of said vehicle actuated means, to render said image reproduction actuating means inoperative so that it will not reproduce the image of the vehicle when the vehicle actuated means is actuated by said vehicle.

2. In a toll checking system for checking toll collections for a vehicle moving forwardly in a lane past a toll station, a vehicle actuated means at said station, a coin receiving means at said station in advance of said vehicle actuated means, so positioned relative to the vehicle actuated means that the operator of the vehicle moving forwardly in the lane reaches the coin receiving

means for a deposit of a coin therein, before advancing the vehicle in the lane further relative to the vehicle actuated means to a position where said vehicle will actuate said vehicle actuated means after the coin has been deposited in the coin receiving means, vehicle image reproducing means positioned to reproduce images of vehicles actuating said vehicle actuated means, means to actuate said vehicle image reproducing means upon actuation of said vehicle actuated means, to reproduce the image of the actuating vehicle, if no coin is inserted in the coin receiving means in advance of actuation of said vehicle actuated means, and means responsive to a coin deposited in said coin receiving means in advance of actuation of said vehicle actuated means, to render said image reproduction actuating means inoperative so that it will not reproduce the image of the vehicle when vehicle actuated means is actuated by said vehicle, said coin receiving means being located in advance of the vehicle actuated means so that a coin can be inserted therein before the vehicle can actuate said vehicle actuated means.

3. In a toll checking system for checking toll collections for a vehicle moving forwardly in a lane past a toll station, a vehicle actuated means at said station, a coin receiving means at said station in advance of said vehicle actuated means, so positioned relative to the vehicle actuated means that the operator of the vehicle moving forwardly in the lane reaches the coin receiving means for a deposit of a coin therein, before advancing the vehicle in the lane further relative to the vehicle actuated means to a position where said vehicle will actuate said vehicle actuated means after the coin has been deposited in the coin receiving means, vehicle image reproducing means positioned to reproduce images of vehicles actuating said vehicle actuated means, means to actuate said vehicle image producing means upon actuation of said vehicle actuated means, to reproduce the image of the actuating vehicle, if no coin is inserted in the coin receiving means in advance of actuation of said vehicle actuated means, means responsive to a coin deposited in said coin receiving means in advance of actuation of said vehicle actuated means, to render said image reproduction actuating means inoperative so that it will not reproduce the image of the vehicle when vehicle actuated means is actuated by said vehicle, and means to deactuate the rendering means after said vehicle actuating means is actuated.

4. In a toll checking system for checking toll collections for a vehicle moving forwardly in a lane past a toll station, a vehicle actuated means at said station, a coin receiving means at said station in advance of said vehicle actuated means, so positioned relative to the vehicle actuated means that the operator of the vehicle moving forwardly in the lane reaches the coin receiving means for a deposit of a coin therein, before advancing the vehicle in the lane further relative to the vehicle actuated means to a position where said vehicle will actuate said vehicle actuated means after the coin has been deposited in the coin receiving means, vehicle image reproducing means positioned to reproduce images of vehicles actuating said vehicle actuated means, means to actuate said vehicle image reproducing means upon actuation of said vehicle actuated means, to reproduce the image of the actuating vehicle, if no coin is inserted in the coin receiving means in advance of actuation of said vehicle actuated means, means responsive to a coin deposited in said coin receiving means in advance of actuation of said vehicle actuated means, to render said image reproduction actuating means inoperative so that it will not reproduce the image of the vehicle when the vehicle actuated means is actuated by said vehicle, means to deactuate the rendering means after said vehicle actuating means is actuated, said coin receiving means being provided with a coin actuated means, and means controlled by said vehicle actuated means to deactuate said coin actuating means after the vehicle actuated means has been actuated.

5. In a toll checking system for checking toll collections for a vehicle moving forwardly in a lane past a toll station, a vehicle actuated means at said station, a coin receiving means at said station in advance of said vehicle actuated means, so positioned relative to the vehicle actuated means that the operator of the vehicle moving forwardly in the lane reaches the coin receiving means for a deposit of a coin therein, before advancing the vehicle in the lane further relative to the vehicle actuated means to a position where said vehicle will actuate said vehicle actuated means after the coin has been deposited in the coin receiving means traffic signal means including a normally actuated "stop" indicator and a normally deactuated "go" indicater, means responsive to the depositing of a coin in said coin control means in advance of actuation of said vehicle actuated means to actuate said "go" indicator and deactuate said "stop" indicator, and means responsive to the actuation of said vehicle actuating means by a vehicle subsequent to depositing a coin into the coin receiving means, to actuate said "go" indicator and actuate said "stop" indicator.

6. In a toll checking system for checking toll collections for a vehicle moving forwardly in a lane past a toll station, a vehicle actuated means at said station, a coin receiving means at said station in advance of said vehicle actuated means, so positioned relative to the vehicle actuated means that the operator of the vehicle moving forwardly in the lane reaches the coin receiving means for a deposit of a coin therein, before advancing the vehicle in the lane further relative to the vehicle actuated means to a position where said vehicle will actuate said vehicle actuated means after the coin has been deposited in the coin receiving means, traffic signal means including a normally actuated "stop" indicator and a normally deactuated "go" indicator, alarm means, means responsive to the actuation of said vehicle without previously depositing a coin in the coin receiving means, actuated means by a vehicle to actuate said alarm, and means controlled by a coin in said coin receiving means to deactuate said normally actuated "stop" indicator and to actuate said "go" indicator and to render said alarm means inoperative upon said vehicle actuated means being actuated after depositing the coin in said coin receiving means.

7. In a toll checking system for checking toll collections for a vehicle moving forwardly in a lane past a toll station, a vehicle actuated means at said station, a coin receiving means at said station in advance of said vehicle actuated means, so positioned relative to the vehicle actuated means that the operator of the vehicle moving forwardly in the lane reaches the coin receiving means for a deposit of a coin therein, before advancing the vehicle in the lane further relative to the vehicle actuated means to a position where said vehicle will actuate said vehicle actuated means after the coin has been deposited in the coin receiving means, traffic signal means including a normally actuated "stop" indicator and a normally deactuated "go" indicator, alarm means, means responsive to the actuation of said vehicle actuated means by a vehicle without previously inserting a coin in said coin receiving means, to actuate said alarm, means controlled by a coin in said coin receiving means to deactuate said normally actuated "stop" indicator and to actuate said "go" indicator and to render said alarm means inoperative upon said vehicle actuated means being actuated, and means responsive to the actuation and subsequent de-actuation of said vehicle actuated means with a coin previously deposited in the coin receiving means, to deactuate said "go" indicator and actuate said "stop" indicator and to restore said alarm means to normal.

8. In a toll checking system, in combination, a treadle, coin controlled means, in advance of the treadle, a camera positioned to photograph vehicles traversing said treadle, means to actuate said camera to photographically record

the image of a vehicle rolling over said treadle without previously depositing a coin in the coin controlled means, and means responsive to a coin in said coin controlled means to render said camera inoperative upon subsequently traversing the treadle.

9. In a toll checking system, in combination, a treadle, coin controlled means, in advance of the treadle, a camera positioned to photograph vehicles traversing said treadle, means to actuate said camera to photographically record the image of a vehicle rolling over said treadle without previously depositing a coin in said coin controlled means, means responsive to a coin in said coin controlled means to render said camera inoperative upon subsequently traversing the treadle, and means responsive to the actuation and de-actuation of the treadle to restore said camera to operative relation after the vehicle has rolled over said treadle.

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