A. A. P. NEEL.

SELF STARTER FOR AUTOMOBILES.

APPLICATION FILED MAR. 31, 1914.

1,126,556.

Patented Jan. 26, 1915.

2 SHEETS—SHEET 1.

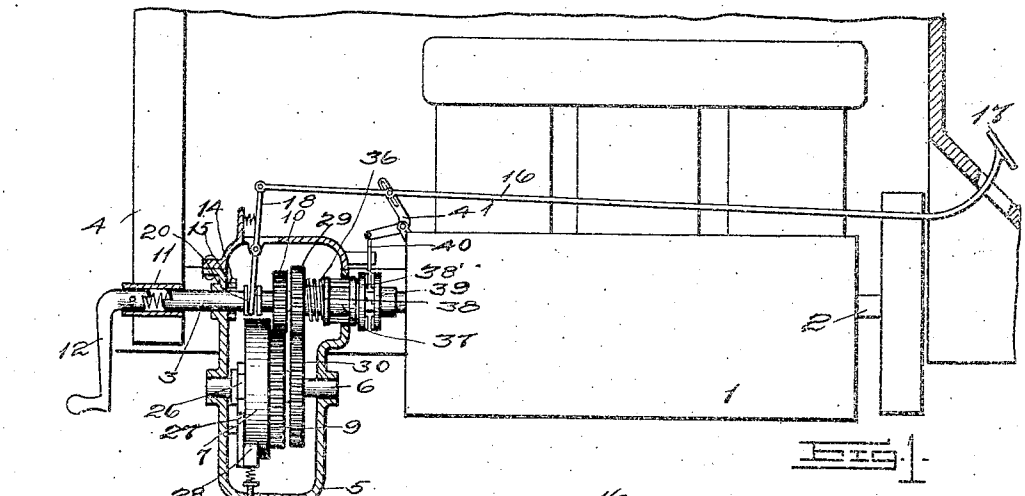


Fig. 1.

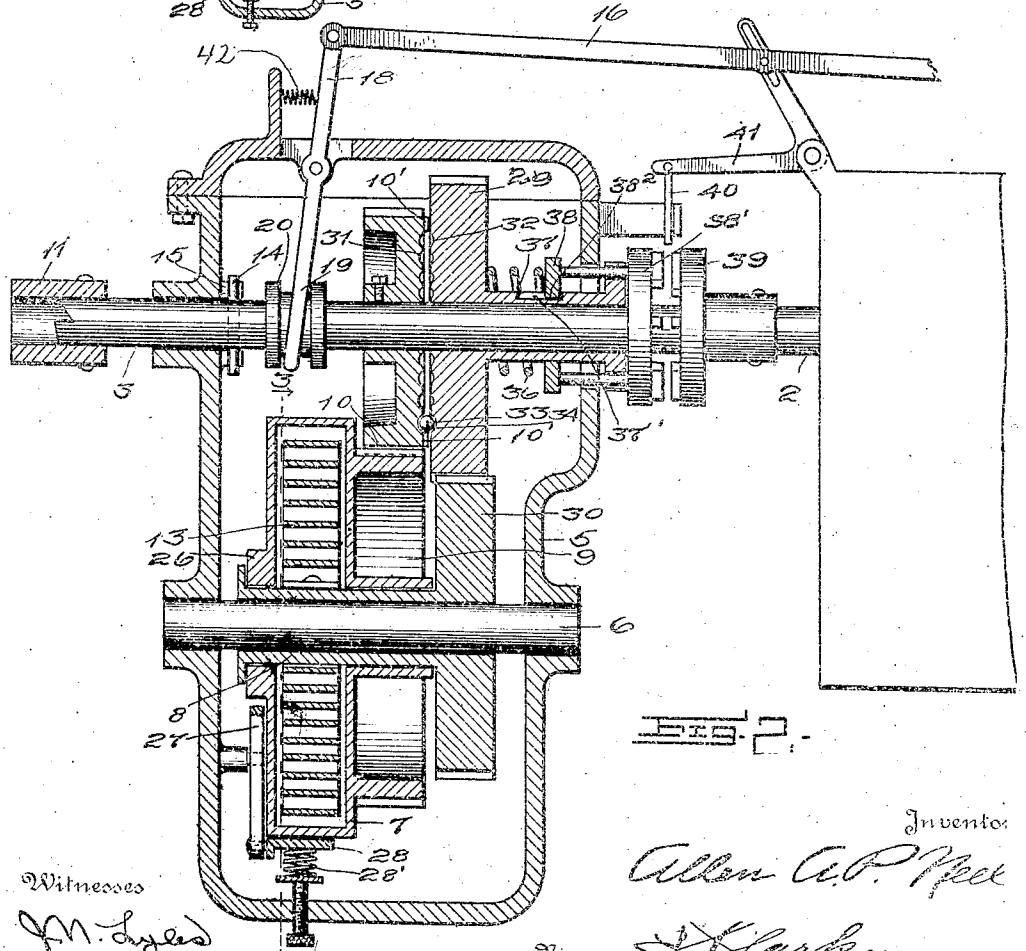


Fig. 2.

Witnesses

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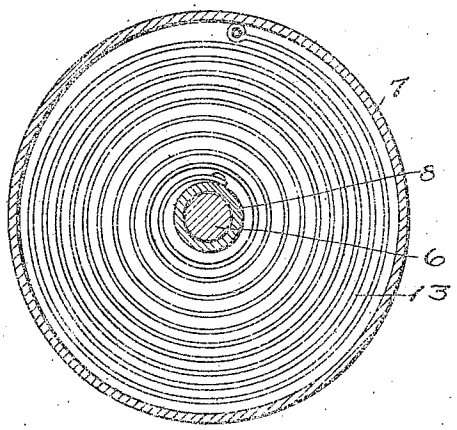


Fig. 2.

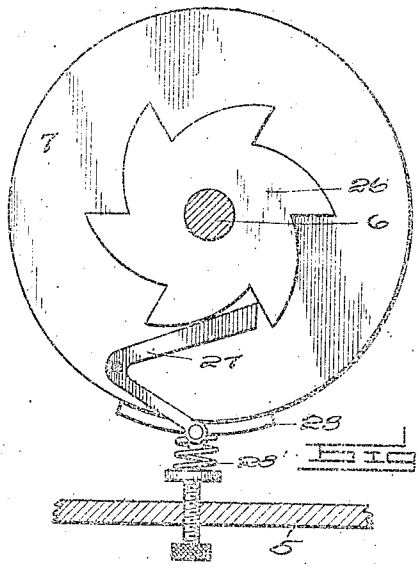


Fig. 4.

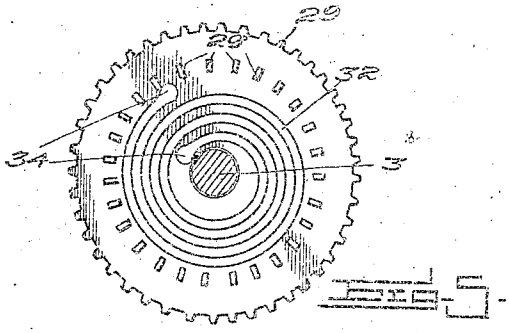


Fig. 5.

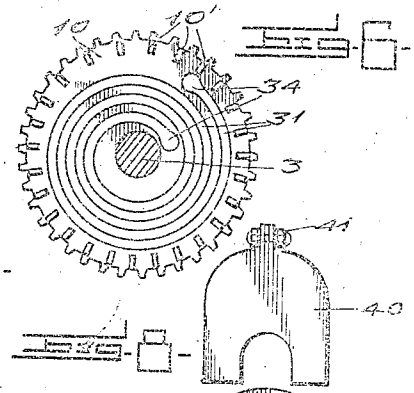


Fig. 6.

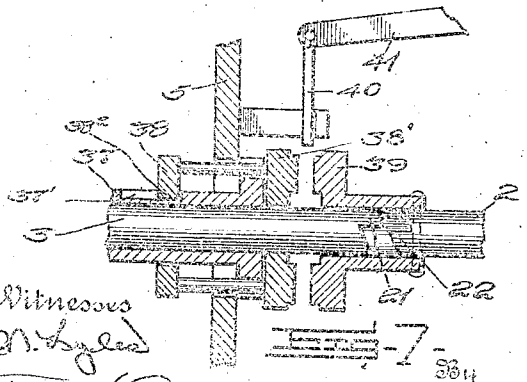
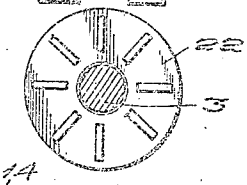


Fig. 7.



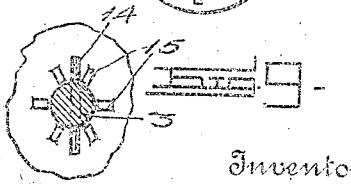


Fig. 9.

Witnesses

Inventor

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Attorneys

UNITED STATES PATENT OFFICE.

ALLEN A. P. NEEL, OF MARSHALL, VIRGINIA, ASSIGNOR OF ONE-HALF TO THOMAS HENDERSON MADDUX, OF MARSHALL, VIRGINIA.

SELF-STARTER FOR AUTOMOBILES.

1,126,556. Specification of Letters Patent. Patented Jan. 26, 1915.

Application filed March 31, 1914. Serial No. 828,642.

To all whom it may concern:

Be it known that I, ALLEN A. P. NEEL, a citizen of the United States of America, residing at Marshall, in the county of Fauquier and State of Virginia, have invented certain new and useful Improvements in Self-Starters for Automobiles, of which the following is a specification.

This invention relates to starters for motor cars, and more especially to starters of the type shown and described in my prior application, Serial Number 812,441, filed January 16, 1914. It proposes certain hereinafter described improvements in the construction and arrangement of parts, with a view to materially simplifying both the device itself and its operation.

An embodiment of the invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a side elevation partly in section, of the forward part of a motor car equipped with the improved starter; Fig. 2 is an enlarged vertical section of the starter; Fig. 3 is a vertical section through the drum, on line 3—3, Fig. 2; Fig. 4 is a detail view of the brake device associated with the drum; Figs. 5 and 6 are face views of the two members of the timing clutch on the starter shaft; Figs. 7 and 8 are detail views of the winding clutch on the starter shaft and its controller, respectively; and Fig. 9 is a detail view of the anchoring device for the starter shaft.

Referring to said drawing, 1 indicates, in a general manner, the motor of the car, 2 its shaft, 3 the starter shaft, and 4 the radiator, these parts or elements, with the exception of the starter shaft, being of the usual type and therefore requiring no special description.

The starting mechinsm, wherein the invention actually resides, as stated, is disposed within a dust-proof case 5, which is located in advance of the motor and either interiorly or exteriorly of the hood, according as may be preferred, the former position being illustrated. This case is supported in any desired manner, and through it passes the afore-mentioned starter shaft 3, and a counter-shaft 6, both shafts being arranged horizontally and in parallel relation, the former shaft above the latter and in axial alinement with the motor shaft 2. Shaft 6 carries a drum 7 which is loosely fitted on a sleeve 8, mounted thereon, said drum having rigidly connected to it a relatively-wide gear 9 that meshes constantly with a gear 10 affixed to shaft 3, the latter having its front end projecting into the usual sleeve 11 of the crank 12. Drum 7 contains the driving spring 13, which is secured at one end thereto, and at the other end to sleeve 8, as depicted in Fig. 3, and since this spring is normally in wound-up or tensioned condition, as hereinafter explained, it will, on unwinding, effect the rotation of said drum, such rotation being transmitted through the gears 9 and 10 to the starter shaft.

The shaft just mentioned is normally locked against rotation, however, through the agency of a suitable anchoring device, here shown as comprised by co-acting teeth 14 and 15, provided, respectively, upon the said shaft and upon the front wall of the case 5, or at some other suitable point, so that it is necessary, therefore, to move the shaft rearwardly before its rotation is possible. The means for effecting this movement may advantageously consist of a rod 16 which, as shown in Fig. 1, is disposed within the hood of the motor and projects at its rear end through an opening in the floor of the car, at which point it terminates in a pedal 17. The front end of the rod is pivoted to the upper end of a lever 18 which is suitably fulcrumed intermediate its ends and has a forked lower end 19 that loosely straddles a grooved collar 20 fast on shaft 3. Depression of the pedal will, therefore, produce a forward movement of rod 16, which will serve to rock the upper arm of lever 18 in the same direction, the lower arm thereof moving rearwardly and carrying with it the collar 20 and, consequently, the shaft 3, whereupon the tooth 14 on said shaft will be disengaged from the fixed teeth 15. The clutch face 21 on the rear end of shaft 3 will thus be brought into engagement with the clutch face 22 on the front end of the motor shaft 2, and since the former shaft will commence to rotate as soon as tooth 14 is released, it will transmit its rotation directly to the said motor shaft with the result that the motor is started, the rotation of the drum continuing until the driving spring is completely unwound, or the pedal 17 may be released when the engine starts thereby immediately starting the rewinding operation.

In order to prevent the motor shaft from racing during the time that the driving spring 13 is unwinding, a brake device is provided which may consist, as shown, of a wheel 26, affixed to the front face of the drum and having as many cam teeth as there are cylinders in the motor. With this wheel co-acts a two armed escapement pawl 27, which is pivoted at its apex to the front wall of case 5, and has one arm arranged in the path of the cam teeth, so that the pawl will be rocked by each tooth in succession as the wheel rotates. The other arm of the pawl engages a brake-band 28, which is mounted in such a way as to normally contact against the periphery of the drum with sufficient force, due to the tension of the controlling spring 28′, to exert a restraining action thereon. The parts are so arranged that the pressure of the band upon the drum is gradually decreased by the action of the pawl, as each tooth rides therealong, but resumes its full force immediately upon the release of said pawl when the point of the tooth passes beyond it, the timing being such that this release occurs exactly at the time when an explosion takes place. Accordingly, the full braking action of the band wheel is thus immediately imposed upon the drum at that time will tend to neutralize to some extent the additional impetus due to the explosion. With the drum, there is also associated a timing clutch which is mounted upon the starter shaft 3, and of which the gear 10 constitutes, one member, the rear-face of this gear being provided with an annular series of clutch teeth 10′, as shown in Fig. 6. The other member of the clutch is constituted by a second gear 29 that is fixed upon the front end of a sleeve 37, meshes with a gear 30 fixed upon the rear end of sleeve 8, and is formed upon its front face with a series of clutch teeth 29′, similar to and engageable with the teeth 10′, the said sleeve 37 being loosely fitted on shaft 3 for sliding movement. The two gears 10 and 29 are provided upon their confronting faces with mating grooves 31 and 32, respectively, and these grooves, which are here shown as of spiral conformation, unite in producing a track or case wherein a ball 33 travels, each groove terminating at its outer end in a socket 34. Gear 29 is normally pressed toward gear 10 by the action of an expansible spring 36, which encircles sleeve 37, but the depth of the grooves 31 and 32 is so regulated that the ball 33 holds the movable gear 29 too far away from the fixed gear 10 to permit engagement of the teeth 10′ and 29′, so that these gears will be coupled together only when the ball is at rest in the sockets 34, which is the position that it occupies prior to the starting operation. When the starting pedal 17 is actuated to bring about the rotation of the drum, as above described, the ball will commence to travel inwardly along its track, and will reach the inner end thereof just at the time that the unwinding of the driving spring is completed, but as soon as said ball leaves the sockets 34 and enters the grooves proper, it will uncouple gear 29 from gear 10, thus preventing the former gear and consequently, the gear 30 from rotating. During the reverse rotation of shaft 3, which is effected in the manner subsequently explained, the ball will travel toward the outer end of its track, and on reaching the sockets 34, will drop thereinto, thus permitting gear 29 to become coupled to gear 10. This coupling of the two gears takes place when the re-winding operation is about completed and it is utilized to positively terminate the same, thereby avoiding over-winding.

The re-winding operation is effected automatically from the motor shaft 2, after the motor has commenced to run and the pedal 17 has been released, preferably through the agency of the following instrumentalities:—The sleeve 37, whereon gear 29 is fixed, has keyed upon its rear end, for sliding movement, a collar 38 having connected with it a toothed clutch disk 38′ which coöperates with the similarly-toothed face of a disk 39 fastened to the front end of the motor shaft, the arrangement being such that when the two clutch collars are coupled together and the motor shaft is rotating, the said sleeve 37 will likewise rotate as will be apparent. The rotation of sleeve 37 will, of course, cause gear 29 to rotate, and the latter, in turn, will rotate sleeve 8 through the intermediary gear 30. Coupling of the two clutch disks just specified is, however, effected only during the return or rearward movement of rod 16 for the reason that when said rod is moved forward, there is interposed between said collars a vertically-arranged control 40 which serves to prevent their engagement. In the construction illustrated, this controller is constituted by a plate or the like, that is suspended from the lower arm of a bell-crank lever 41, whose other arm is connected with rod 16. When the rod moves forward, the plate is lowered, but on the return movement it is raised.

As shown in Fig. 1, the expansion spring 36 bears at one end against gear 29, and at the other end against collar 38 and thus tends to move the latter and its disk 38′ toward disk 39, in addition to moving the said gear 29, (and also the sleeve 37 whereon the same is fixed), toward gear 10. Now when rod 16 is forced forward by the actuation of pedal 17, the plate 40 will immediately be depressed, as already stated, so that during the resultant rearward movement of shaft 3, gear 10 will force gear 29 and sleeve 37 in the same direction, thereby bringing disk 38′

against plate 40. In consequence during the remainder of the movement of shaft 3, spring 36 will be compressed. Assuming that this movement of shaft 3 has produced the rotation of the motor shaft in the manner already described, then when pedal 17 is released, spring 36 will immediately expand, and in so doing, will not only force gears 29 and 10, sleeve 37 and shaft 3 forward, but will force the sliding collar 38 and disk 38′ rearward on said sleeve. The forward movement of shaft 3 will result in its being again locked against rotation, due to the reëngagement of teeth 14 and 15, while the rearward movement of collar 38 will cause its disk 38′ to engage the clutch face of the disk 39 on the motor shaft, the plate 40 having previously been raised out of the path of the first named disk by the rearward movement of rod 16 which is produced by reason of the engagement of the forked end 19 of lever 16 with collar 20. When the two disks 38′ and 39 are thus coupled together, the rotation of the motor shaft will be transmitted directly to sleeve 37, as will be understood, and thence through the intermeshing gears 39 and 30 to sleeve 8, to which the inner end of the driving spring 13 is attached; the drum itself being held against rotation by the anchoring of shaft 3. As the rotation of gear 8 proceeds, the spring will be wound up, while at the same time the ball 33 will be caused to travel toward the outer end of its track, thus maintaining the two gears 29 and 10 uncoupled, but when said ball reaches the socket 34, it will fall thereinto, thereby permitting the clutch teeth 29′ on gear 29 to engage the clutch teeth 10′ on gear 10 and consequently, effecting the coupling of said gears, under the influence of spring 36. This coupling action takes place just as the winding up of spring 13 is completed, the length of the grooves 31 and 32 being proportioned with that object in view, and since gear 10 is motionless at that time, gear 29 will immediately become locked thereby and in turn, will terminate the rotation of gear 30 and sleeve 8. At the same time that the gears 29 and 10 are coupled, the uncoupling of the disks 38′ and 39 will be produced, the latter operation being effected by the forward pull exerted upon collar 38 consequent upon the engagement of the rear end of the key-groove 37′ with the key 38ª provided upon said collar. When the starter shaft is in its normal position represented in Fig. 2, the enlarged rear end of sleeve 37 abuts against the rear wall of case 5 and thus closes the opening at that point.

The entire operation is believed to be apparent from the foregoing for which reason further description is deemed unnecessary and is, accordingly, omitted. It may be stated however, that to facilitate the return or rearward movement of rod 16, and consequently, the forward movement of shaft 3 into reëngagement with its anchoring device, the upper arm of lever 18 may have connected to it one end of an expansible spring 42, the other end of which is connected to the front wall of case 5. The crank 12, after having once been used to effect the initial starting of the motor, need not again be used except in the event of injury to the starting mechanism, since the winding up of the driving spring will be accomplished by the motor after the latter has commenced to run.

What I claim is:-

1. A starter for motors comprising, in combination, an endwise movable starter shaft arranged in alinement with the motor shaft and having a clutch connection therewith; means for normally locking the starter shaft against rotation; an operating member connected with said starter shaft for moving the same in one direction to release said locking means; a counter-shaft; a drum mounted on the counter-shaft and provided with a driving spring; and gear connections between said drum and said starter shaft for automatically rotating the latter from the former consequent upon such release.

2. A starter for motors comprising, in combination, an endwise-movable starter shaft arranged in alinement with the motor shaft and having a clutch connection therewith; an anchor for normally locking the starter shaft against rotation; an operating rod connected with said starter shaft for moving the same toward and into clutch with said motor shaft and simultaneously releasing it from said anchor; and mechanism connected with said starter shaft for automatically rotating it when such release takes place.

3. A starter for motors comprising, in combination, an endwise-movable starter shaft arranged in alinement with the motor shaft and having a clutch connection therewith; a gear fast on the starter shaft; an anchor for normally locking the starter shaft against rotation; a member connected with said starter shaft for moving the same toward and into clutch with said motor shaft and simultaneously releasing it from said anchor; a countershaft, a drum loosely mounted thereon and provided with a driving spring; and a gear rigidly connected to said drum and meshing with the first-named drum, for rotating said starter shaft during the expansion of said spring consequent upon such release.

4. A starter for motors comprising, in combination, a starter shaft; means for coupling the same to the motor shaft, a drum connected with the starter shaft and provided with a driving spring; a brake device operative upon said drum and an escape-

ment device for periodically relieving the pressure exerted by said brake device.

5. A starter for motors comprising, in combination, a starter shaft; means for coupling the same with the motor shaft; a rotary element connected with the starter shaft for driving the same when thus coupled; a brake device operative upon said rotary element; and an escapement device for periodically relieving the pressure exerted by said brake device.

6. A starter for motors comprising, in combination, a starter shaft; means for coupling the same with the motor shaft; a rotary element connected with the starter shaft for driving the same when thus coupled; a multi-toothed wheel secured to said rotary element; a brake device operative upon said rotary element; and a pawl arranged in the path of the teeth on said wheel and connected with said brake device for periodically relieving the pressure exerted by the latter.

7. A starter for motors comprising, in combination, a starter shaft, means for coupling the same with the motor shaft; a rotary element connected with the starter shaft for driving the same when thus coupled; a multi-toothed wheel secured to said rotary element; a spring pressed brake band operative upon said rotary element, and a two armed pawl having one arm arranged in the path of the teeth on said wheel and the other arm connected with said brake band, for periodically relieving the pressure exerted by said brake device.

8. A starter for motors comprising, in combination, an endwise-movable starter shaft arranged in alinement with the motor shaft, each of said shafts having a pair of co-acting clutch elements; means for normally locking the starter shaft against rotation; an operating member connected with said starter shaft for moving the same toward the motor shaft, to release it from said locking means and simultaneously bringing one pair of clutch elements into action; a drum provided with a driving spring; connections between said drum and said starter shaft for rotating the latter from the former consequent upon such release and the expansion of said spring to start the motor shaft; means for returning said starter shaft to its normal position and simultaneously bringing the other pair of clutch elements into action; and means for rotating said drum in the opposite direction consequently upon the engagement of the second-named clutch elements, to re-wind said spring.

9. A starter for motors comprising, in combination, a starter shaft; means for coupling same to the motor shaft; a drum connected with the starter shaft; a driving spring carried by the drum for rotating the latter and said starter shaft during its unwinding; means for rotating said drum in the opposite direction to re-wind said spring; a timing device for automatically terminating the rotation of the drum when the re-winding is completed, said device embodying a pair of companion elements having mating spiral grooves formed on their confronting faces and terminating at their outer ends in sockets, one of said elements being movable toward and from the other and being rotated during such re-winding and the other element being fixed, a ball arranged to travel in said grooves and to enter said sockets at the conclusion of its travel in one direction, coöperating means provided upon said elements for coupling them together when said ball enters said sockets.

10. A starter for motors comprising, in combination a starter shaft; means for coupling same to the motor shaft; a drum connected with the starter shaft; a driving spring carried by the drum for rotating the latter and said starter shaft during its unwinding; means for rotating said drum in the opposite direction to re-wind said spring; and a timing device for automatically terminating the rotation of the drum when the re-winding is completed, said device embodying a relatively fixed element, an element movable toward and from the same and adapted to be rotated during re-winding, means for holding said movable element away from the fixed element while re-winding continues and for releasing it at the conclusion of the re-winding, and cooperating means provided upon said elements for coupling the same together consequent upon such release.

In testimony whereof I affix my signature in presence of two witnesses.

ALLEN A. P. NEEL.

Witnesses:
C. S. Coffman,
Edwin S. Clarkson.