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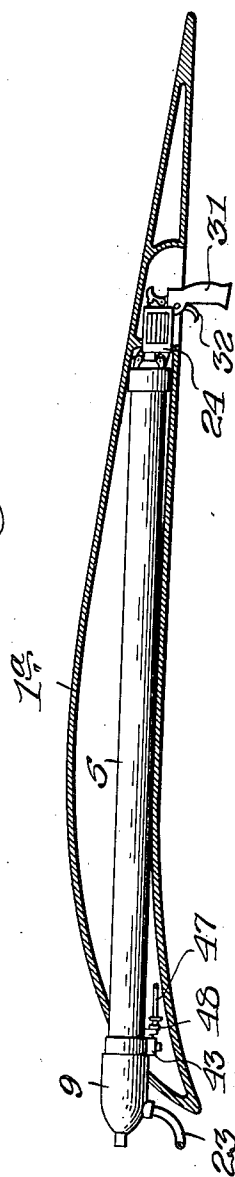
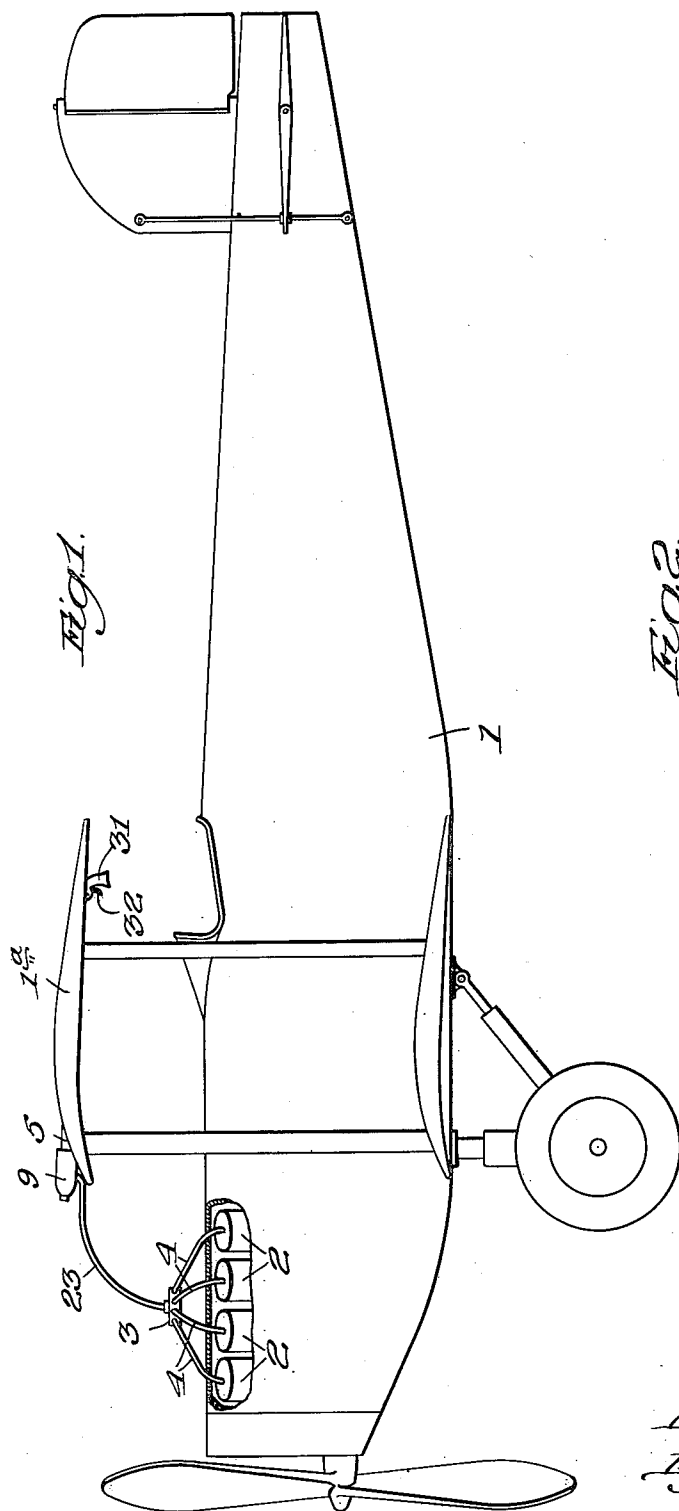
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MEANS FOR PRODUCING COMPRESSED STARTING CHARGES FOR ENGINES

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2 Sheets-Sheet 1



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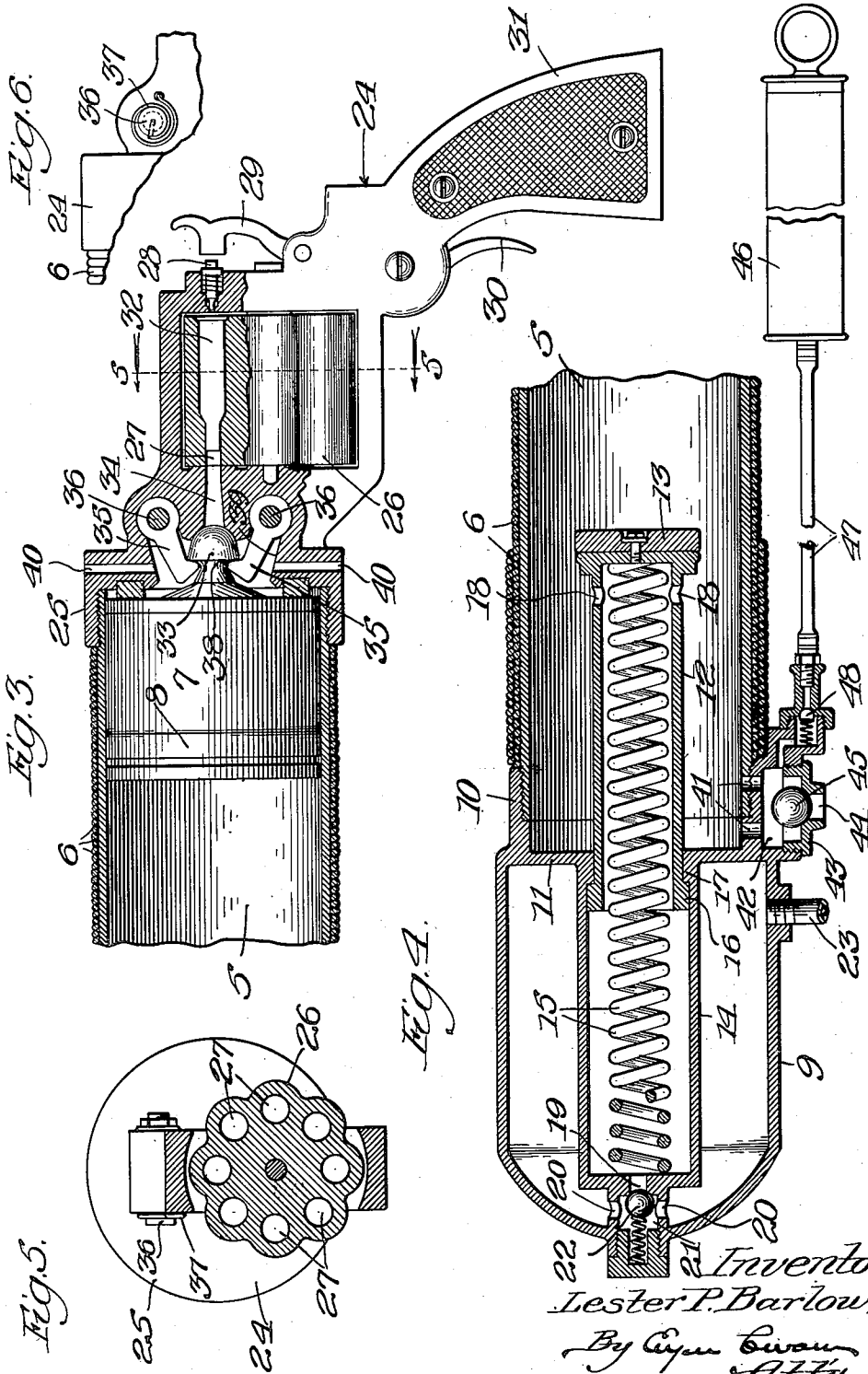
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UNITED STATES PATENT OFFICE

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MEANS FOR PRODUCING COMPRESSED STARTING CHARGES FOR ENGINES

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This invention relates to means whereby separate charges of compressed air or other desired fluid gases for starting internal combustion engines may be compressed at the will of the operator at the moment it is desired to use the charges.

The invention is particularly usable in connection with air craft motors and especially those employed for military purposes where lightness of weight and certainty of performance of a fluid compressive device are essential.

The device contemplated by my invention consists generally of a relatively light metal cylinder of brass or other non-corrosive material of high tensile strength and in which fits a suitable piston, which is forced under considerable pressure toward one end of the cylinder by an explosive charge at the will of the operator for the purpose of compressing air in the cylinder for creating the charge required to start the engine, thereby making the charge developed the instant that it is required and thus avoid the necessity of making any provision for carrying a storage of compressed air or other suitable gases for engine starting purposes. The device includes means for quickly returning the piston to its starting position so that the piston will be in a position to be shot forward to compress another charge of compressed air whenever desired.

The invention consists further in the matters hereinafter described and claimed.

In the accompanying drawings—

Fig. 1 is a side view of an aeroplane equipped with the device of my invention;

Fig. 2 is an enlarged sectional view through one of the wings of the plane and showing the device of my invention mounted therein;

Fig. 3 is an enlarged vertical longitudinal sectional view through the rear or gun end of my device;

Fig. 4 is a similar view through the forward end of the device;

Fig. 5 is a vertical sectional view through the gun on line 5—5 of Fig. 3; and

Fig. 6 is a view showing a detail of construction to be later described.

The aeroplane shown in Fig. 1 has a body or fuselage 1 supporting at its forward end the propelling motor of the plane. Said motor is of the internal combustion engine type and has a multiplicity of cylinders 2, 55 2. For distributing compressed air or other suitable compressed gases to the cylinders for starting the motor, a suitable distributing valve 3 is associated with the cylinders and is connected therewith by a plurality 60 of pipes or conduits 4, 4, one leading to each of the cylinders, as shown.

The device of my invention for creating the compressed starting charges comprises a cylinder 5, preferably made of brass or 65 other non-corrosive metal of high tensile strength, suitably mounted on the plane as in or on one of the wings 1^a thereof, as shown in Figs. 1 and 2.

The cylinder 5 may be wound on its exterior with piano wire 6 so as to strengthen 70 the cylinder and thereby permit the cylinder to be retained relatively light in weight by making it of relatively thin gauge metal. At the compression end of the cylinder the wire wrappings 6 may be multiplied into a number of layers so as to provide an extra strength where the cylinder undergoes a considerable pressure in compressing a charge during the operation of 75 the device. A free piston 7 is fitted within the cylinder 5 and has back and forth movement therein. The piston is provided with a cup washer 8 of leather or other flexible material surrounding the same and bearing 85 against the inner wall of the cylinder so as to prevent the passage of gases from one side of the piston to the other, especially in the movement of the piston on its forward or compression stroke.

Arranged at the forward end of the cylinder 5 is a receiver 9 consisting of a hollow casing having a rearward extension 10, by means of which the receiver may be 95 screwed on or otherwise secured to the adjacent end of the cylinder. Adjacent this end of the cylinder the receiver 9 has an end wall 11, which divides the receiver from the cylinder. Slidably mounted in this wall is a tubular member 12, which extends into 100

the cylinder and carries at its inner end a pad of leather or other compressible material 13, against which the piston 7 strikes on its compression stroke so as to cushion the impact of the piston against said member 12. The latter when struck by the piston 7 is forced thereby into a tubular casing or chamber 14 arranged in the receiver 9 in line with the member 12 and carried by the partition wall 11 thereof, as shown in Fig. 4. A coiled spring 15 normally holds the member 12 extending into the cylinder 5 so as to receive the impact of the piston and also to return the piston to its starting position after having compressed said spring by forcing the member 12 into the chamber 14. The members 12 and 14 have stop shoulders 16, 17 whereby the distance that the member 12 is extended into the cylinder 5 by the spring 15 is limited. Said member 12 opens at its outer end into the chamber 14 and is provided adjacent its inner end with a number of port holes 18, 18 whereby air compressed in the cylinder by the piston 7 on its forward stroke may enter the chamber 14 and from there flow into the receiver 9 through port holes 19, 20 at the outer end of said chamber. These port holes open into an intermediate chamber 21, in which is a spring pressed ball valve 22 for normally closing the port hole 19 and thus prevent the return of any air from the receiver 9 to the cylinder 5. The air compressed by the piston on its forward stroke unseats the valve 22 and opens the receiver to the cylinder 5 for receiving the charge of compressed air therefrom.

The receiver 9 is connected by a pipe 23 with the inlet port of the distributing valve casing 3, as shown in Fig. 1. This valve has a rotary member (not shown) in which there is a single passage, one end of which is in constant communication with the supply pipe 23 and the other end of which is moved into successive registration with the conduits 4 in the rotation of the valve, so as to successively supply the compressed charge furnished by the device of my invention to the respective cylinders of the engine in their firing order. This valve forms no part of my invention, so it need not be further described, as any suitable form of structure that will accomplish the purpose set forth may be employed.

For actuating the piston 7 for compressing a charge of air in the forward or compression end of the cylinder 5, I provide a mechanism at the opposite end of the cylinder whereby an explosive charge may be fired for moving the piston on its forward or compression stroke. This mechanism comprises a gun device 24, which by a flange 25 is attached to the adjacent end of the cylinder 5, as shown in Fig. 3. The gun device 24 is provided with the conventionally

revolvably mounted cylinder 26 having a multiplicity of blank cartridge receiving chambers 27 arranged circumferentially about the axis of the same, and adapted to be brought successively into register with the passage 34 of the gun device in the operation of the same, as shown in Fig. 5. The gun device also has a firing pin 28 and associated hammer 29 which is operated through a suitable trigger 30 arranged adjacent the handle or grip 31 of the device. When mounted in the wing 1^a, as shown in Fig. 1, the cylinder 5 is arranged to extend across the wing from front to rear with the gun device 24 at the rear and its grip or handle 31 directly above the cockpit of the plane so as to be within convenient reach of the aviator or pilot for actuation.

The piston 7 has a centrally disposed projection 33 on its rear side. This projection may be rounded or curved to fit into and close the outer end of a passage 34 in the body of the gun between the cylinders 5 and 26, respectively. The passage 34 aligns with the chamber 27 in which a cartridge 32 is fired by the pin 28, and serves to direct the gases of the explosion against the projection 33 of the piston 7 to drive it forward on its compression stroke. In having the projection 33 so arranged, the full power or force of the exploded charge is concentrated on the projection, and thus the piston in its initial movement is shot forward rapidly and with considerable speed. As soon as the projection 33 leaves the passage 34, the gases enter the cylinder and act on the entire rear surface of the piston to further force it forward and effect a compression of a charge of air by the piston in the forward end of the cylinder.

To normally hold the piston 7 at the rear or firing end of the cylinder so as to be in a position ready to receive the exploded charge, I provide a pair of dogs 35, 35 pivoted in the body of the gun and extending into the cylinder 5. These dogs are secured to pivot pins 36, 36 rockably mounted in the gun body and extending outward to one side thereof, as shown in Fig. 6. Here each pin is surrounded by a spiral spring 37 which has one end fixed to the gun body and the other end fixed to the pin. The coiling of the springs is such that they normally swing the free ends of the dogs toward each other so as to engage behind a shoulder 38 on the projection 33. The ends of the dogs where they engage this shoulder are beveled or inclined so that the dogs will be moved outward from the projection as the latter passes between them. The gases of the explosion being under considerable pressure will force the dogs outward against the adjacent walls 39 of the gun body and close the ports or passages 40, 40 which open to the atmosphere

through said walls. When the dogs are forced into these positions, the exploded gases entering the cylinder 5 can not escape and thus must force the piston forward. As the piston moves forward, the chamber provided by the cylinder for the gases increases and the pressure of the gases drops. The springs 37 overcome this lowering pressure and move the dogs 35 toward each other so as to open the passages 40 and allow the cylinder to exhaust to the atmosphere on the return stroke of the piston, which is effected through the expansion of the spring 15. This forces the piston back to its starting point and the dogs 35 snap over the projection 33 and retain the piston with its projections extending into and closing the passage 34 in readiness for the next explosion.

The cylinder 5 is provided adjacent its forward or compression end with one or more ports 41, 41 which open into a small chamber 42 which is closed at its outer end by a screw cap 43 which has a single air inlet port 44. There is a ball valve 45 in this chamber for the port 44. The valve 45 unseats by the suction created by the piston 7 on its return stroke, and a charge of air is drawn into the cylinder 5 in front of the piston to be ready for compression on the next forward stroke of the piston. The valve 44 is tightly closed against the port 44 by the air compressed in the cylinder on the forward stroke of the piston and thus prevents the loss of any of the compressed charge through ports 41 or 44.

As an auxiliary for the cylinder 5, I provide a hand operated air pump 46. This may be mounted in the cockpit of the plane, as on the instrument-board, so as to be within convenient reach of the aviator or pilot for operation whenever desired. This pump is operated to force air into the cylinder 5 through its ports 41 to move the piston back to its starting position should it at any time fail to return either by failure of the spring 15 to act through breakage or otherwise or by sticking of the piston in the cylinder or in case the plane is flying in a position that would cause the piston to drop into the compression end of the cylinder by gravity. The outlet of the pump is connected by a pipe 47 with the chamber 42 to the rear of the valve 45, as shown in Fig. 4. There is a spring pressed check valve 48 in the connection so as to prevent the return of air from the cylinder to the pump. Failure of the piston 7 to return to its starting position would be indicated should the gun 24 be fired to compress a charge of air and the engine fail to start. The aviator or pilot would then actuate the pump and again fire the gun, the engine in turning over being indicative that the piston was in action.

The device of my invention is so propor-

tioned that a single charge of compressed air as furnished by the piston on its forward stroke is sufficient under ordinary circumstances to turn over the engine and effect the starting of the same. Should additional charges be required they may be quickly created by firing the gun 24 as many times as necessary. The gun will be made so that a sufficient number of cartridges may be carried to take care of almost any contingency. The gun may be easily reloaded without taking down the device, and thus the aviator may keep the barrel 26 full of charges. With my device, the compressed starting charges are created at the instant required and are used as soon as created, thereby making full use of the entire power of the charges. There is no opportunity afforded for the pressure of the charges to fall much below that as originally created, because the charges are supplied directly to the cylinders as soon as formed and not stored up for future use in tanks or containers as is required when using a compressor pump coupled to and driven by the engine. With my device, all of these heavy parts are eliminated, which is especially advantageous for aeroplane uses. On planes for military uses, the device of my invention provides the aviator or pilot with means whereby the engine may be quickly and easily started the instant desired by merely grasping the gun and firing it. Should the plane be a bomber, for example, and be sliding quietly at night over its objective with the motor off, the operator can quickly start the motor and get away the moment desired without being required to accelerate the propeller by dropping to a lower altitude and risk going farther in the range of gun-fire whenever observed by searchlights from the ground, as heretofore.

The details of structure and specific arrangement of parts shown and described may be variously changed and modified without departing from the spirit and scope of my invention.

I claim as my invention:

1. A compressor, comprising a cylinder, a free piston therein, a mechanism at one end of the cylinder whereby an explosive charge may be fired for forcing the piston toward the opposite end of the cylinder for compressing air therein, means for automatically returning the piston to the firing end of the cylinder, means at the latter end of the cylinder for automatically engaging the piston on its return stroke for normally holding it at the firing end of the cylinder, and means whereby air may be supplied to the cylinder on the compressing side of the piston on its return stroke.

2. A compressor, comprising a cylinder, a free piston therein, means at one end of the cylinder whereby an explosive charge

may be fired for forcing the piston toward the opposite end of the cylinder for compressing air therein, means for automatically returning the piston to the firing end of the cylinder, pivoted dogs at the firing end of the cylinder and adapted to automatically engage the piston on its return stroke for normally retaining the piston in its starting position, and means whereby air may be supplied to the cylinder on the compressing side of the piston.

3. A compressor, comprising a cylinder, a free piston therein, a mechanism at one end of the cylinder whereby an explosive charge may be fired for forcing the piston toward the opposite end of the cylinder for compressing air therein, exhaust ports for the cylinder at the firing end thereof, means acted on by the explosion of an explosive charge for automatically closing said ports during the explosion of said charge, and means whereby air may be supplied to the cylinder on the compressing side of the piston.

4. A compressor, comprising a cylinder, a free piston therein, a mechanism at one end of the cylinder whereby an explosive charge may be fired for forcing the piston toward the opposite end of the cylinder for compressing air therein, exhaust ports for the cylinder at the firing end thereof, spring pressed members for opening and closing the exhaust ports, said members closing the ports under the explosion of the explosive charge and opening the ports on the diminishment of the pressure of the explosive charge, and means whereby air may be supplied to the cylinder on the compressing side of the piston.

5. A compressor, comprising a cylinder, a free piston therein, a mechanism at one end of the cylinder whereby an explosive charge may be fired for moving the piston toward the opposite end of the cylinder for compressing air therein, means in the cylinder for automatically returning the piston to its firing end, exhaust ports at the firing end of the cylinder, spring controlled pivoted members at the latter end of the cylinder and subject to the explosion of the explosive charge for closing said ports and opening the ports on the diminishment of the pressure of the charge, said members automatically engaging the piston on its return movement for normally retaining the piston at the firing end of the cylinder.

6. A compressor, comprising a cylinder, a free piston therein, a device at one end of the cylinder whereby an explosive charge may be fired for forcing the piston toward the opposite end of the cylinder for compressing air therein, means in the cylinder for automatically returning the piston to its firing end, said device having a passage for conducting the exploded gases into the cyl-

inder, said piston having a rearward projection aligned with said passage and adapted to normally close the same when the piston is at the firing end of the cylinder, said cylinder having means whereby air may enter the same on the return stroke of the piston.

7. A compressor, comprising a cylinder, a free piston therein adapted to compress air at one end of the cylinder, a device at the other end of the cylinder whereby an explosive charge may be fired for forcing the piston toward the compression end of the cylinder, a telescopic device at the latter end of the cylinder and including a slidably mounted tubular member to receive the impact of the piston on its compression stroke, said tubular member having a passageway opening to the cylinder for conveying compressed air therefrom, and a coiled spring associated with said tubular member for normally holding it extended toward the piston and for automatically returning the piston to the firing end of the cylinder.

8. A compressor, comprising a cylinder, a free piston therein adapted to compress air at one end of the cylinder, a device at the other end of the cylinder whereby an explosive charge may be fired for moving the piston toward the compression end of the cylinder, said cylinder having a valve controlled port at its latter end whereby air may enter the cylinder on the return stroke of the piston, means for automatically returning the piston to the firing end of the cylinder, and an auxiliary air pump device connected with the compressing end of the cylinder whereby the piston may be returned to its firing end in case the automatically returning means fails to function or the piston sticks in the cylinder.

9. A compressor, comprising a cylinder made of relatively thin gauge metal, a piston in the cylinder, means at one end of the cylinder whereby an explosive charge may be fired to force the piston toward the opposite end of the cylinder for compressing air therein, means for automatically returning the piston to the firing end of the cylinder, means whereby air may be supplied to the cylinder on the compressing side of the piston, and a relatively strong wire wrapped about the cylinder on the outside thereof from end to end and with a multiple layer of wrappings at the compression end of the cylinder.

In testimony whereof I affix my signature.
LESTER P. BARLOW.