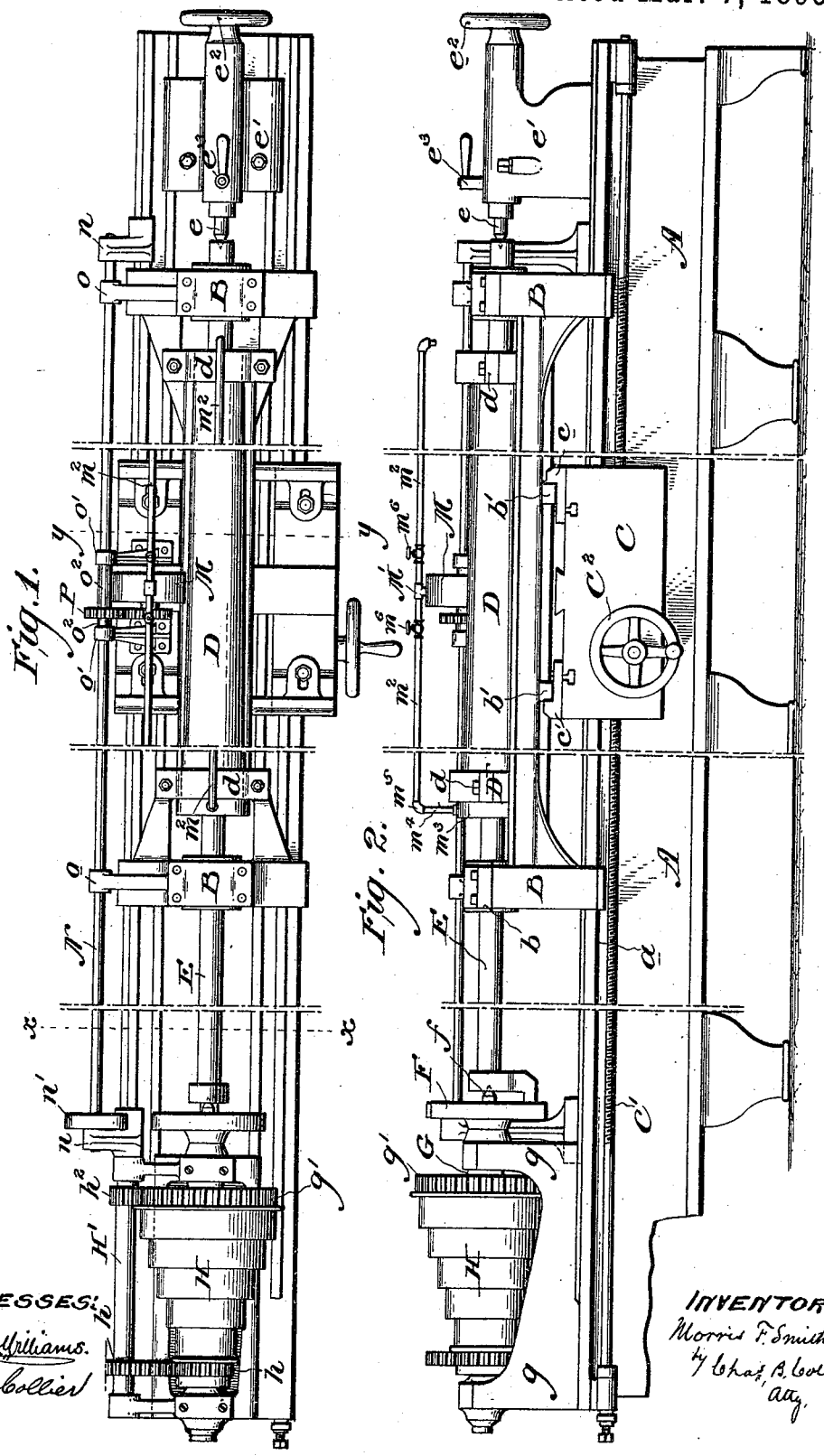
(No Model.) 3 Sheets—Sheet 1.

M. F. SMITH.

MACHINE FOR FINISHING BORES OF LARGE GUN TUBES OR CANNON.

No. 493,191. Patented Mar. 7, 1893.



WITNESSES:
David S. Williams.
Chas. C. Collier

INVENTOR:
Morris F. Smith
by Chas. B. Collier
atty.

(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

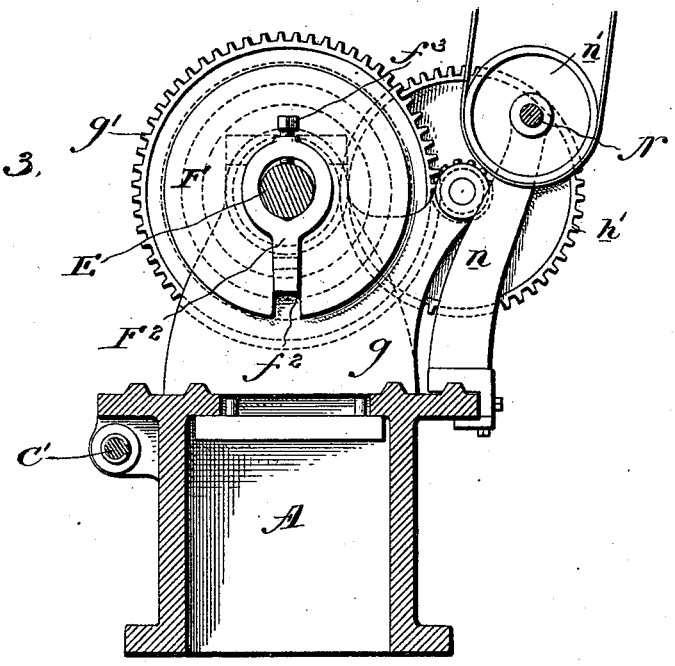
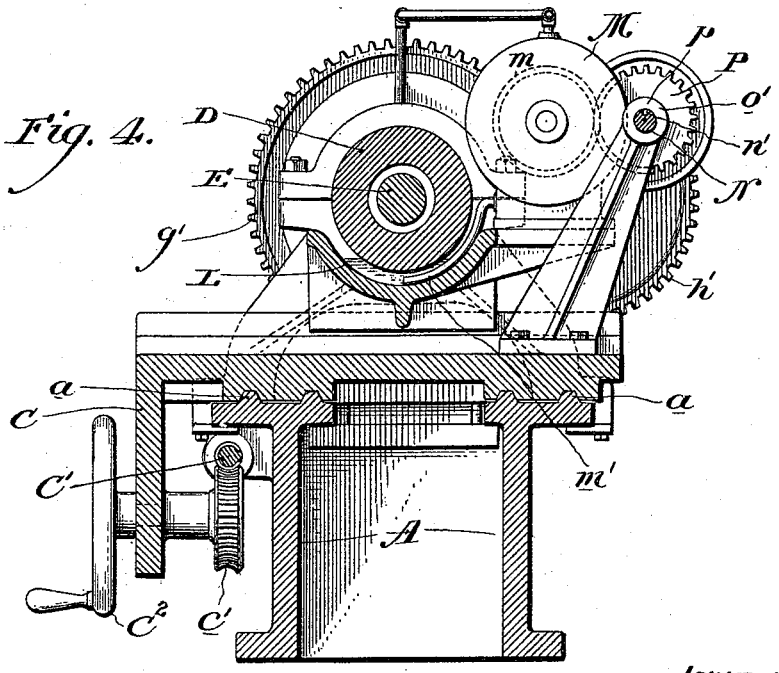


Fig. 4.



WITNESSES:
David S. Williamson
Chas. C. Collier

INVENTOR:
Morris F. Smith
by Chas. B. Collier, Atty.

(No Model.) 3 Sheets—Sheet 3.

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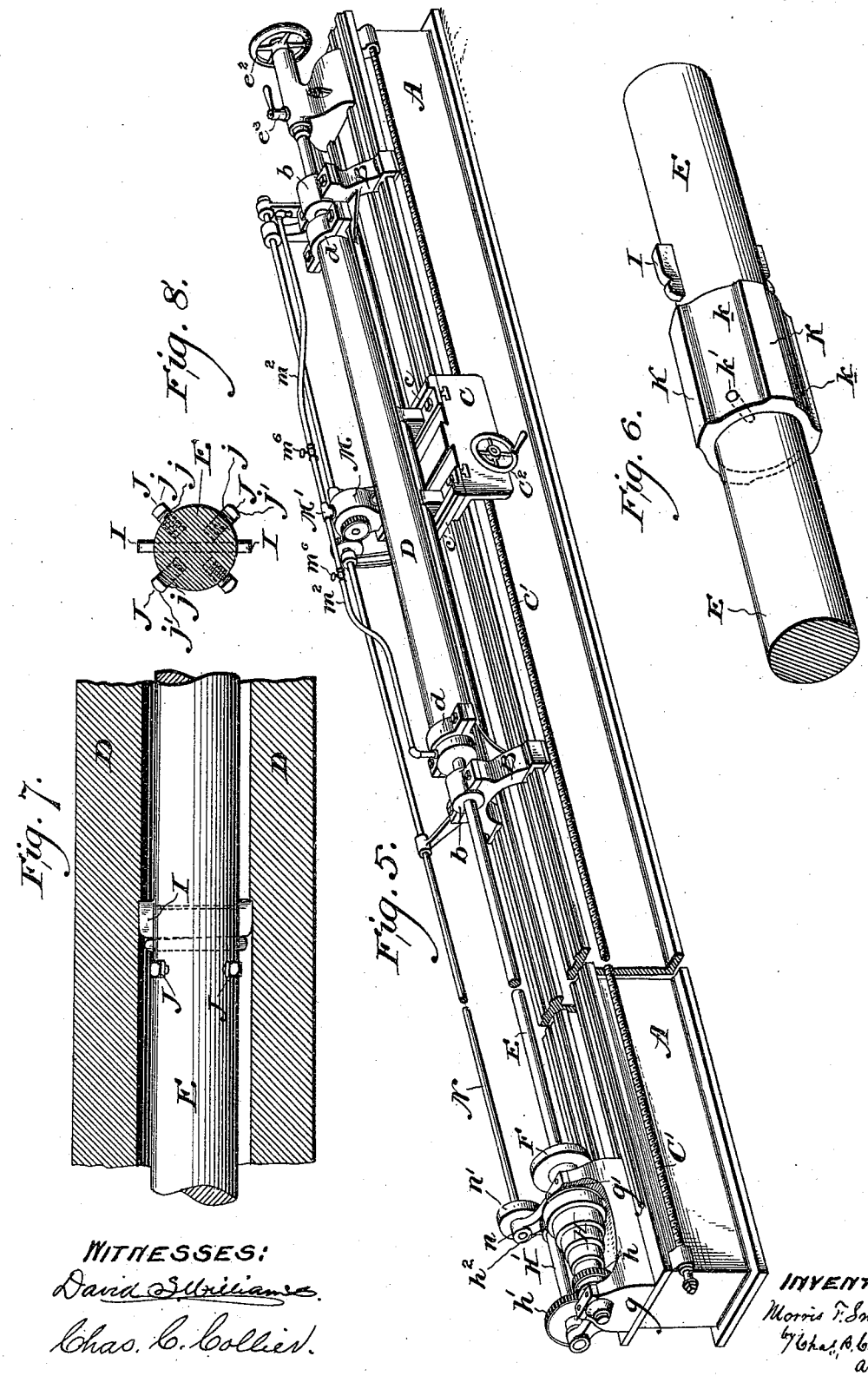

UNITED STATES PATENT OFFICE.

MORRIS F. SMITH, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO THE WILLIAM CRAMP & SONS SHIP AND ENGINE BUILDING COMPANY, OF PENNSYLVANIA.

MACHINE FOR FINISHING BORES OF LARGE GUN-TUBES OR CANNON.

SPECIFICATION forming part of Letters Patent No. 493,191, dated March 7, 1893.

Application filed March 12, 1892. Serial No. 424,709. (No model.)

To all whom it may concern:

Be it known that I, MORRIS F. SMITH, a citizen of the United States, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Machines for Finishing the Bores of Large Gun-Tubes or Cannon, of which the following is a specification, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

In the ordinary methods heretofore employed to finish the bore in a large gun tube or cannon, it has been customary to give the tube a rotary movement only, and to feed a reamer into and through it. This method is, however, far from satisfactory, inasmuch as the reamer is liable to be deflected owing to irregularities in the metal, and to the fact that the bar carrying the reamer is not adequately supported. The consequence is that many tubes are spoiled and great difficulty is experienced in effecting a true bore.

My invention is designed to remedy these defects, and in order to do so I propose to pass through the bore of the tube as it comes from the foundry or forge, a long boring-bar, and to support this bar at both ends and give it a rotary movement. The tube will be supported on a suitable carriage or table movable longitudinally of the rotating bar. The bar will be provided with a suitable cutter rigidly secured thereto, and, immediately in the rear of the cutter a suitable device will be secured to the bar and project therefrom a sufficient distance to have slight contact with the surface of the bore. The object of this last named device is to steady and reinforce the bar close to the cut and so prevent any deflection of the cutter or any irregularity of its cut. I also provide suitable means to furnish a constant circulation of oil through the interior of the tube for the purpose of lubricating the cutter and carrying off the chips.

My invention will be fully described in the following specification and particularly pointed out in the claims.

In the accompanying drawings:—Figure 1, is a plan view of my improved machine. Fig. 2, is a side elevation. Figs. 3 and 4 are vertical transverse sections taken on the lines x x and y—y, respectively, of Fig. 1. Fig. 5, is a perspective view of the machine; Fig. 6, a perspective view of a portion of the boring bar, cutter and bushing. Fig. 7, is a longitudinal sectional view of a portion of the gun tube with the boring bar, cutter and adjustable supports in the bore; and Fig. 8, is a section on the line z—z of Fig. 7.

Similar letters of reference indicate similar parts in the respective figures.

A represents the main supporting frame of the machine, and B a table adapted to move on the ways a, on the frame. The table is provided with downwardly projecting lugs b' which engage lugs c on a carriage C, the latter being provided with a worm c' which engages a threaded rod C′ supported on the main frame. By operating the hand wheel C^2 the worm may be turned in either direction and the carriage C and table B correspondingly moved.

D represents the gun tube supported at each end in the bearings d on the table B.

E represents a boring bar extending from end to end of the frame and passing loosely through bearings b on the table B so as to rotate freely therein. The boring bar is supported at one end on the centering pin e supported in suitable bearings e' on the main frame. The pin e is adjustable longitudinally by the hand wheel e^2 and held in position by the set screw e^3. The other end of the boring bar is supported on the centering pin f of the head F, carried by the main driving shaft G. This shaft G is supported in suitable bearings g g on the main frame and carries a gear g' keyed to revolve with it. Belt pulleys H are mounted to revolve on the shaft G and carry with them the gear h. This gear h meshes with a larger gear h' on the shaft H′, which also carries at its opposite end a pinion h^2 meshing with the gear g'. As the gear g' is many times larger than the pinion h^2 a very slow movement will be imparted to the main driving shaft G, while the belt pulleys may be run at a high speed. The boring bar E is provided with a key F^2 which enters slot f' in the head F and thereby causes the boring bar to rotate with the shaft G.

The key F^2 is held in position on the boring bar E by the set screw f^3.

I, represents the cutter secured to the boring bar E in any suitable manner.

J, J, are set screws fitted into suitable threaded holes $j\ j$ in the boring bar just in rear of the cutter. The heads of these set screws are squared on their sides to permit the use of a wrench to turn them in the holes j, but their top surfaces are rounded off, as shown at j', for the purpose of offering the least resistance possible when they are set to bear on the surface of the bore. These set screws are used during all the several cutting operations, except the last. When the last cut is to be made I remove the set screws and substitute the bushing K. This bushing is provided with a series of grooves k, the object of which will be referred to hereinafter. The bushing is hardened and ground on the inside to fit on the boring bar E but to turn freely thereon. It is also ground on the outside to fit the standard size of bore freely, and, with the lubricant employed, to form a close working joint with the bore. The bushing K is held in place on the boring bar E by a small pin k' which passes through the bushing into the bar. In case the cutter becomes worn so that it does not cut the bore to the standard size, the bushing will gradually become wedged in the bore, and if it is so securely attached to the boring bar as to continue its rotation with the latter a great deal of damage will result either to the gun tube or the machine. To prevent this danger the pin k' is of such strength only as to hold the bushing and bar together when the former is turning freely in the bore, but as soon as the bushing encounters any resistance to its rotation the pin k' will break and thereby permit the boring bar to turn in the bushing and so prevent any damage to the gun tube or to the machine. The pin k' may, therefore, properly be termed a frangible securing device.

The table B is provided with a concaved portion L, (see Fig. 4) which forms an oil reservoir beneath the gun.

M is a pump supported on the table B, and operated by the pinion m. A pipe m' connects the pump with the oil in the reservoir. The oil is discharged by the pump into the T-coupling M' from which it is led in either direction, as may be desired, by the pipes m^2 m^2. A suitable cap m^3 adapted to fit on either end of the gun tube, is provided with a short pipe m^4 which is connected by a coupling m^5 to either of the pipes m^2 as occasion requires. The pipes m^2 are each provided with a suitable cock m^6 in order that the oil may be pumped in either direction and be discharged into one end of the gun tube through which it will be forced and discharged from the opposite end into the reservoir. A constant circulation of oil will be maintained through the gun tube during the entire process of boring for the double purpose of lubricating the cutter and washing out the chips. The spaces between the pins J, and the grooves k in the bushing K, permit the free passage of the oil, and it is my intention during the preliminary cuts to introduce the oil to the bore at the end of the tube in front of the cutter and wash the chips out at the end of the tube in the rear of the cutter, but at the final cut to introduce it at the end in rear of the bushing and the cutter and wash the chips out in front of the cutter.

The pump is operated by the following mechanism: N is a shaft supported parallel to the boring bar E, in fixed bearings $n\ n$ attached to the main frame, and provided with a belt pulley n', through which it receives a rotary movement. The shaft N is also supported in sliding bearings $o\ o$, $o'\ o'$, attached to the table B. The bearings $o\ o$ are located one at each end of the table and the bearings $o'\ o'$ are located one on each side of the pump. The shaft N is provided with a spline way n' into which a spline p on the pinion P projects. (See Fig. 4.) The pinion P will, therefore, rotate with the shaft N. This pinion P meshes with the pinion m on the pump and is held in position to maintain its engagement as the carriage B moves by the sleeves $o^2\ o^2$ which fit loosely on the shaft N between the bearings $o'\ o'$ and hold the pinion P between them. It will therefore be seen that the pinion P will be moved longitudinally on the shaft N by the movement of the carriage B, and will also have a rotary movement with the shaft.

The operation is as follows:—The gun tube as it is received from the foundry or forge, is secured in proper position on the table so that the boring bar when passed through the rough bore and secured in its proper position will be central of the tube. The set screws J are adjusted to lightly engage the surface of the bore as it is formed by the first cut. The cap m^3 Fig. 2 is placed on the end of the tube toward which the cut is being made, and placed in communication with the pump. The boring bar is then caused to revolve, the pump is started and the table moved slowly to feed the gun to the revolving cutter. As the cutting proceeds, the circulation of oil will lubricate the cutter and also wash out all the chips. When the first cut is completed the cutter and set screws will be set out for the next cut and the operation repeated, and so on until the last cut is to be made. I then remove the set screws and place the bushing on the boring bar in rear of cutter. I also change the cap m^3 to the opposite end of the gun tube and cause the oil to circulate in the opposite direction to wash the chips out in advance of the cutter. The object of doing this is, that inasmuch as the bushing presents a much greater contact surface to the bore than the set screws, if the chips were washed out in the rear of the cutter some of them would be liable to work in between the bushing and the surface of the bore, and thereby scratch the surface of the bore and possibly wedge the bushing. At the final cut it is also preferable to use the bush-

ing as its increased bearing surface prevents the slightest deviation of the boring bar from a straight line and the final cut will be absolutely true.

The following advantages, among others, may be mentioned as arising from the use of my improved method of boring. The boring bar and cutter having a rotary movement only will have a natural tendency to maintain a true central position relative to the gun tube by supporting the shaft against the surface of the bore immediately in rear of the cutter and any deflection of the bore from a straight line is rendered almost impossible. In the old methods, owing to the liability of the reamer to become deflected from the central line of the gun tube, it was necessary to make the rough tube much heavier than was absolutely needed for a finished gun in order that the outer surface of the tube could be planed off to correspond with the bore, or in other words, the finished bore would often be oblique to the central line of the tube and consequently the metal would not be of uniform thickness. As, however, by my invention the bore will always be made exactly on the true central line of the tube, the latter can be made much lighter and consequently a great saving be effected.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a machine for boring guns, a boring bar adapted to pass through the bore of the gun tube, and a cutting device carried by the bar, combined with a series of supports carried by the boring bar in rear of cutter, and adapted to engage the surface of the bore, for the purpose specified.

2. In a machine for boring guns, a boring bar adapted to pass through the bore of the gun and a cutting device carried by the boring bar, combined with a series of supports carried by the boring bar in rear of the cutter, said supports being adjustable to engage the surface of the bore at each successive cut, substantially as described.

3. In a machine for boring guns, a boring bar adapted to pass through the bore of the gun and a cutting device rigidly attached to the said bar, combined with a bushing mounted on the boring bar in rear of the cutter and secured thereto by a frangible device, said bushing being adapted to engage the surface of the bore substantially as described.

4. In a machine for boring guns, a main frame, a table movable on the frame and adapted to support the gun, combined with a boring bar passing through the bore of the gun and supported at each end of the main frame, a cutting device carried by the boring bar, a pump supported on the table, an oil reservoir, suitable pipe connections between the pump, the reservoir and the bore of the gun, a rotating shaft supported on the main frame parallel with the boring bar, said shaft being provided with a spline way, a gear mounted on said shaft and provided with a spline to enter said spline way, a gear on the pump engaging the gear on the shaft, suitable devices to move the gear on the shaft longitudinally thereof with the table, suitable means to rotate the shaft, and suitable means to rotate the boring bar and move the table, substantially as described.

In witness whereof I have hereunto subscribed my name, in the presence of two witnesses, on this 26th day of February, A. D. 1892.

MORRIS F. SMITH.

Witnesses:
CHAS. C. COLLIER,
GEO. W. REED.