No. 845,005. PATENTED FEB. 19, 1907.

R. K. LE BLOND & W. F. GROENE.

VARIABLE SPEED MECHANISM.

APPLICATION FILED NOV. 2, 1906.

2 SHEETS—SHEET 1.

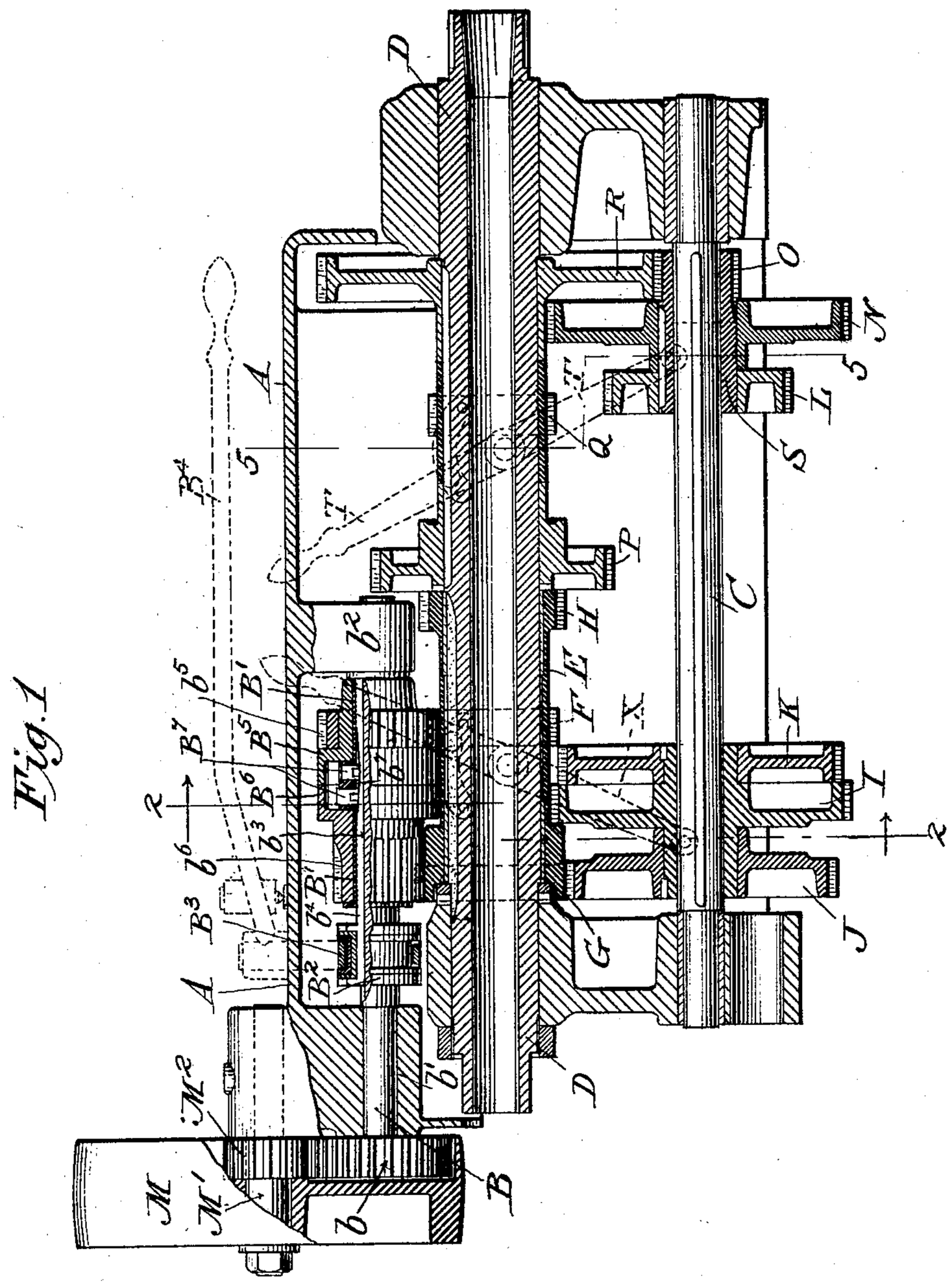

Fig. 1

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2 SHEETS—SHEET 2.

Fig. 2.

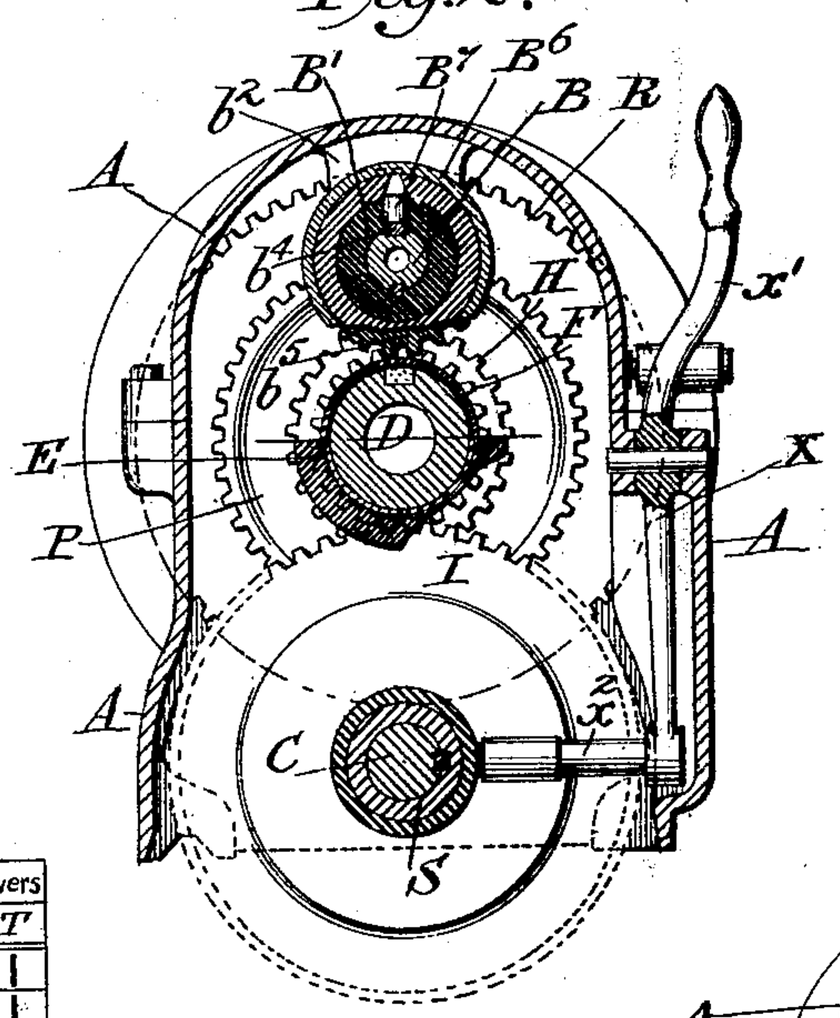


Fig. 4.

Spindle D Speeds.	Position of Levers B^4	X	T
300	—	/	|
248	—	\	|
202	—	|	|
160	\	/	|
131	\	\	|
107	\	|	|
90	—	/	/
73	—	\	/
61	—	|	/
48	\	/	/
39	\	\	/
32	\	|	/
27.5	—	/	\
22.7	—	\	\
18.5	—	|	\
14.7	\	/	\
12	\	\	\
9.6	\	|	\

Fig. 5.

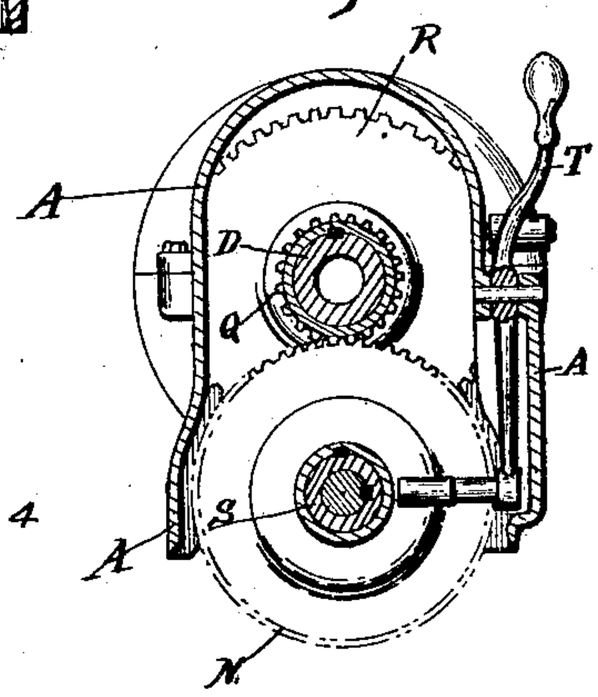
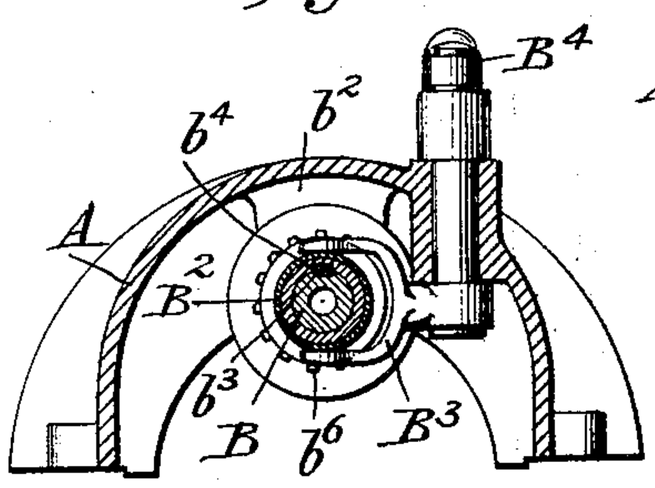


Fig. 3



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UNITED STATES PATENT OFFICE.

RICHARD K. LE BLOND AND WILLIAM F. GROENE, OF CINCINNATI, OHIO, ASSIGNORS TO THE R. K. LE BLOND MACHINE TOOL COMPANY, A CORPORATION OF OHIO.

VARIABLE-SPEED MECHANISM.

No. 845,005. Specification of Letters Patent. Patented Feb. 19, 1907.

Application filed November 2, 1906. Serial No. 341,727.

To all whom it may concern:

Be it known that we, RICHARD K. LE BLOND and WILLIAM F. GROENE, citizens of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Speed-Changing Devices, of which the following is a specification.

This invention relates to that class of speed-changing mechanisms described in our United States Patent No. 788,658, dated May 2, 1905, wherein, as in this application, the speed-changing devices are shown as applied to a lathe-head, whereby a number of different speeds may be imparted to the lathe-spindle from a source of power moving at a constant speed.

Our present invention is designed more particularly with a view to increase the number of possible changes in the rate of rotation of the spindle with respect to the constant speed of the power, and this we accomplish without increasing the size of the head or housing and, as will hereinafter appear, without multiplication of parts.

The invention consists in particulars of construction and combinations, which will be described hereinafter in detail and then particularly pointed out in the claims at the end of this specification.

In the accompanying drawings, wherein similar letters of reference are used to indicate corresponding parts in each of the several views, Figure 1 is a vertical longitudinal section taken through a lathe-head embodying our improvements. Fig. 2 is a transverse section on line 2 2 of Fig. 1. Fig. 3 is a sectional detail through the housing and main shaft, illustrating in elevation the primary shifting lever and its adjuncts; and Fig. 4 is a diagrammatic view illustrating changes in position of the shifting levers to attain varying speeds. Fig. 5 is a transverse section on the line 5 5 of Fig. 1.

The mechanism here shown corresponds in the main with that illustrated in our said prior patent embodying a suitable housing A, having bearings in which are journaled a driving-shaft B, a transmission-shaft C, and the spindle D, carrying the loose sleeve E, all provided with gears adapted for manipulation to transmit motion at greater or less speed from the driving-shaft B to the spindle D, as will be hereinafter more particularly described.

The lathe-head illustrated is fitted with a hollow spindle to admit of the passage therethrough of a long rod or bar of stock to be operated upon, and to employ a driving-pulley M of proper diameter and give clearance to the spindle we have mounted said pulley on a stub-shaft M′, properly secured in the housing A, and employed a pinion M^2, keyed to said shaft adjacent to the pulley, to impart motion to the driving-shaft B through gear *b*, keyed on the outer end thereof, as shown in Fig. 1; but we wish it understood that the general adaptation of our invention contemplates mounting the pulley M directly on the outer end of the driving-shaft, thus eliminating the shaft M′ and gears M^2 and *b*, as will be apparent.

The driving-shaft B is mounted in suitable bearings *b′* b^2, carried by or forming part of the housing, and securely keyed thereon is a sleeve B′, provided with a longitudinal channel b^3 to receive a shifting blade b^4, which is given longitudinal movement through engagement with a shifting collar B^2, mounted on said shaft, said collar being shifted to give longitudinal movement to the blade by means of the yoke B^3 and lever B^4. (Shown in detail in Fig. 3 and in dotted lines in Fig. 1.)

Mounted to rotate on the sleeve B′ are two sister gear-shells B^5 and B^6, carrying gears b^5 and b^6, these shells being conjointly arched centrally and being provided internally with a locking-notch (see Fig. 2) to engage dogs B^7, seated in hollow lugs b^7 in the sleeve B′ and adapted to be projected therefrom into engagement with the locking-notch of one or the other of the gear-shells, according as the shifting blade is moved in one direction or the other to lock one or the other of the gears b^5 or b^6 to the sleeve, and therefore to the shaft.

The sleeve E, which is loosely mounted on the spindle, is provided with three fixed gears F G H of different diameters, the gears F and G being constantly in mesh with the gears b^5 and b^6, respectively, which normally run idle, being brought into action only on the shifting of the collar B^2 upon operation

of the lever B^4 to one limit or the other of its movement.

The transmission-shaft C, journaled beneath the spindle, carries three gears I, J, and K, splined to rotate therewith, but shiftable longitudinally thereon to engage selectively the gears F, G, and H of loose sleeve E of the spindle. The longitudinal shifting of the gears I, J, and K on shaft C is in the instance shown attained by a lever X, pivoted in the housing, (see Fig. 2,) the outer end of which carries an operating-handle x', while on the inner end is a pin x^2, carrying a roller x^3, projecting between the gears I and J. As shown, the gear I is provided with an elongated hub, upon which the gears J and K are keyed. The transmission-shaft C is further provided with gears L N O, splined to rotate therewith, but movable longitudinally of the shaft, as in the case of the gears I, J, and K before described. These gears are designed to mesh selectively with gears P, Q, and R, carried by a sleeve S, keyed or non-rotatively secured to the spindle, and are shifted into engagement with one or other of said gears by means of a lever T, having a pin and roller similar to the pin x^2 and roller x^3 on the lever X, extending between the gears L and N.

With the operating-levers B^4, X, and T positioned as shown in Fig. 1 the shifting blade b^4 has projected a dog B^7 into engagement with the locking-notch of the gear-shell B^6, thereby locking the shell to the moving shaft and sleeve and imparting rotation through gear b^6 to gear G of the sleeve E, which, as stated, is rotatably mounted on the spindle. From gear G motion is transmitted through gear J to the transmission-shaft C and thence through gears O and R to the spindle. With the lever B^4 at the central position of its throw the gears b^5 and b^6 run idle; but upon movement to one or the other limits of its movement one or the other of the gears b^5 or b^6 will be locked to and rotate with the shaft B and being normally in mesh with gears F and G will impart movement through these gears or through gear H, also fast on the sleeve E, to that one of the gears I, J, or K which has been thrown by the lever X into engagement therewith, thus rotating shaft C at greater or less speed according to the gears selected to intermesh. In the same manner the gears L, N, and O of shaft C are selectively thrown into mesh with the fixed gears P, Q', and R of sleeve S, which is keyed to rotate with the spindle, thus admitting of many changes of speed to the spindle through the proper manipulation of the levers B^4, X, and T, as is clearly indicated by the diagram Fig. 4. It will thus be seen that when the levers B^4, X, and T occupy the relative positions indicated in Fig. 4 we may cause to be imparted to the spindle D eighteen changes in speed.

Having thus fully described our invention what we claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a speed-changing device, a driving-shaft, selectable gears thereon, a transmission-shaft, a plurality of independent sets of shiftable gears thereon, a spindle, a plurality of fixed and loose gears thereon, and means for shifting the gears on the transmission-shaft.

2. In a speed-changing device, a driving-shaft, selectable gears thereon, operative connections between the selected gear and the driving-shaft, a transmission-shaft, a plurality of independent sets of shiftable gears thereon, a spindle, a plurality of fixed and loose gears thereon, and means for shifting the gears on the transmission-shaft.

3. In a speed-changing device, a driving-shaft, selectable loose gears thereon, means for locking any one of said gears to the driving-shaft, a transmission-shaft, a plurality of independent sets of shiftable gears thereon, a spindle, a plurality of fixed and loose gears thereon, and means for shifting the gears on the transmission-shaft.

4. In a speed-changing device, a driving-shaft, selectable gears thereon, a transmission-shaft, a plurality of independent sets of shiftable gears thereon, a spindle provided at one part thereof with a loose sleeve and at another part with a fixed sleeve, fixed gears on said loose and fixed sleeves, and means for shifting the gears on the transmission-shaft.

5. In a speed-changing device, a driving-shaft, selectable loose gears thereon, means for locking any one of said gears to the driving-shaft, a transmission-shaft, a plurality of independent sets of shiftable gears of varying diameters thereon, a spindle, a plurality of fixed and loose gears of varying diameters thereon, and means for shifting the gears on the transmission-shaft.

6. In a speed-changing device, a driving-shaft, selectable loose gears thereon, means for locking any one of said gears to the driving-shaft, a spindle, a plurality of fixed and loose gears thereon, two of said loose gears being constantly in mesh with the gears of the driving-shaft, a transmission-shaft, a plurality of sets of shiftable gears thereon, the gears of one set adapted to mesh with the loose gears of the spindle and the gears of another set adapted to mesh with the fixed gears of the spindle, and means for shifting the gears on the transmission-shaft.

7. In a speed-changing device, a driving-shaft, selectable loose gears thereon, means for locking any one of said gears to the driving-shaft, a spindle, a loose sleeve on one end thereof, fixed gears on said loose sleeve, two of which are constantly in mesh with the gears of the driving-shaft, a sleeve fast to the other end of the spindle, fixed gears on said sleeve, a transmission-shaft, shiftable gears at one end of the transmission-shaft adapted

to mesh with the gears on the loose sleeve of the spindle, shiftable gears on the other end of the transmission-shaft adapted to mesh with the gears on the fixed sleeve of the spindle, and means for shifting said gears.

8. In a speed-changing device, a driving-shaft, a plurality of selectable gears thereon, a spindle, a loose sleeve thereon, a plurality of gears carried by said loose sleeve, two of which are in constant mesh with the gears of the driving-shaft, a transmission-shaft, shiftable gears thereon at one end adapted to mesh with the gears on the spindle-sleeve, a plurality of gears fixed to the spindle, shiftable gears on the other end of the transmission-shaft adapted to mesh with the gears fixed to the spindle, and means for shifting the gears of the driving and transmission shaft, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

RICHD. K. LE BLOND.
WILLIAM F. GROENE.

Witnesses:
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