(No Model.) 3 Sheets—Sheet 1.

# E. HECHT, P. RASCHE & B. KRUG.

## VEHICLE BRAKE.

No. 548,542. Patented Oct. 22, 1895.

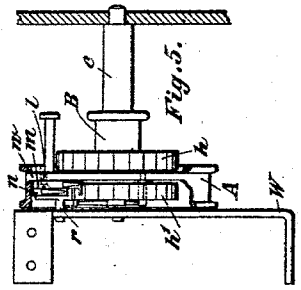
Fig. 5.

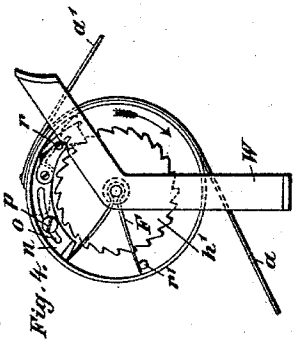
Fig. 4.

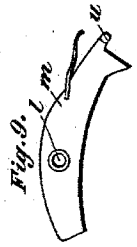
Fig. 9.

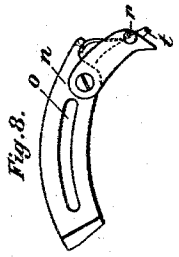
Fig. 8.

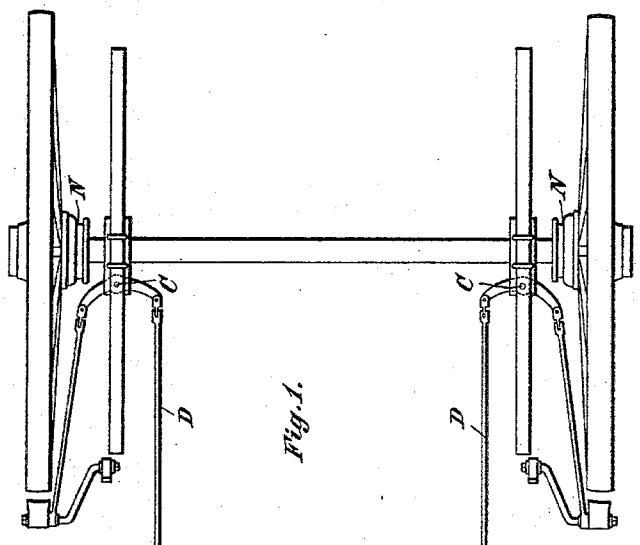
Fig. 1.

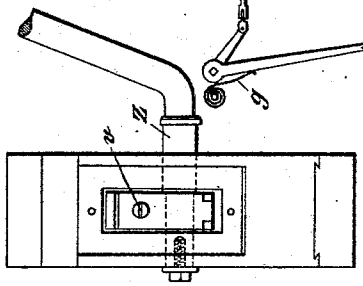
Fig. 11.

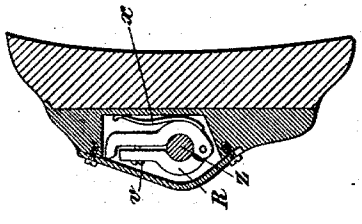
Fig. 12.

Witnesses
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(No Model.) 3 Sheets—Sheet 2.

# E. HECHT, P. RASCHE & B. KRUG.

## VEHICLE BRAKE.

No. 548,542. Patented Oct. 22, 1895.

Fig. 3.

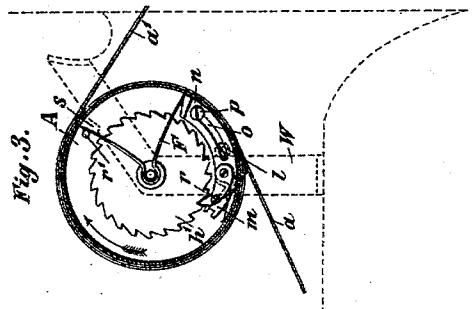
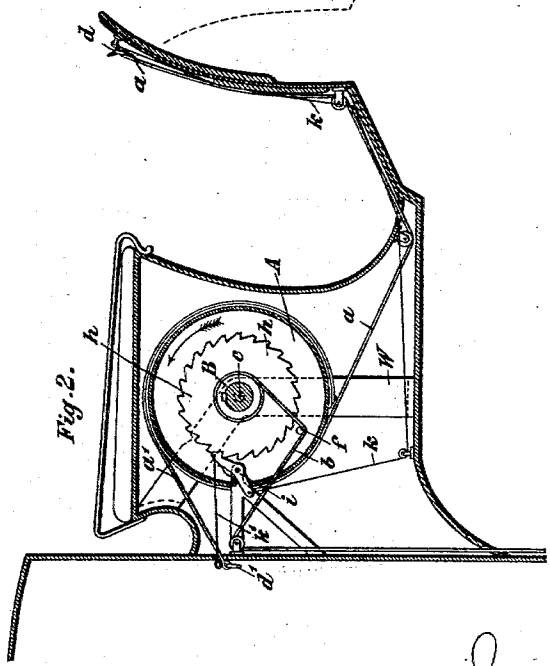


Fig. 2.



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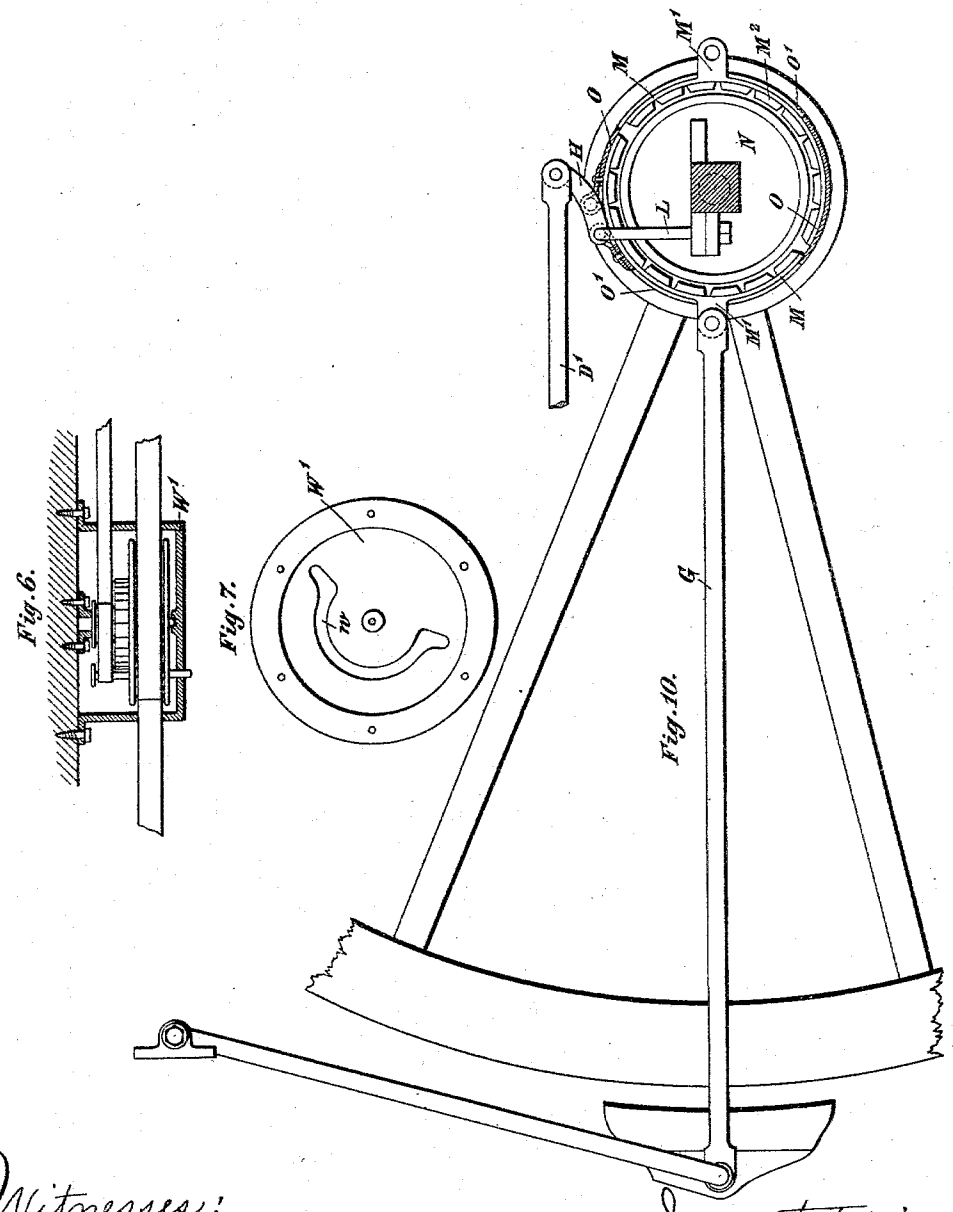
(No Model.) 3 Sheets—Sheet 3.

# E. HECHT, P. RASCHE & B. KRUG.

## VEHICLE BRAKE.

No. 548,542. Patented Oct. 22, 1895.




Witnesses:
C. M. Ott.
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# UNITED STATES PATENT OFFICE.

ERNST HECHT, PAUL RASCHE, AND BERTHOLD KRUG, OF TEMPELHOF, GERMANY.

## VEHICLE-BRAKE.

SPECIFICATION forming part of Letters Patent No. 548,542, dated October 22, 1895.

Application filed February 23, 1894. Serial No. 501,214. (No model.) Patented in England January 31, 1894, No. 2,141; in Switzerland February 10, 1894, No. 8,316; in Belgium February 15, 1894, No. 108,346; in France April 22, 1894, No. 235,942; in Austria May 31, 1894, No. 44/2,032; in Italy No. 35,729/104, and in Canada July 5, 1894, No. 46,495.

*To all whom it may concern:*

Be it known that we, ERNST HECHT, PAUL RASCHE, and BERTHOLD KRUG, of Tempelhof, near Berlin, in the Kingdom of Prussia, Germany, have invented new and useful Improvements in Brakes for Carriages of Any Kind, (for which we have obtained Letters Patent in Great Britain, No. 2,141, dated January 31, 1894; in Austria, No. 44/2,032, dated May 31, 1894; in France, No. 235,942, dated April 22, 1894; in Belgium, No. 108,346, dated February 15, 1894; in Switzerland, No. 8,316, dated February 10, 1894; in Italy, No. 35,729/104, and in Canada, No. 46,495, dated July 5, 1894,) of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to an improved brake apparatus for vehicles, and has for its object means for the application of the brake in a convenient and safe manner with a minimum expenditure of power. We attain this end by the apparatus illustrated by the accompanying drawings, in which—

Figure 1 is a view in plan of the apparatus applied to an ordinary road-vehicle. Fig. 2 is a view in side elevation, partly in section, of the operating mechanism. Figs. 3, 4, and 5 are views showing the details of the construction of this operating mechanism. Figs. 6 and 7 are views showing a modification in the arrangement of the said mechanism. Figs. 8 and 9 are further views showing details of the construction of the operating mechanism. Fig. 10 is a broken view in side elevation showing a modification of the brake-gear. Figs. 11 and 12 are views of an improved form of brake-shoe.

Throughout the views similar parts are marked with like letters of reference.

All brakes are, with the exception of pneumatic brakes, operated either by means of a crank or by means of a lever. When a brake is operated by means of a crank, the person who wishes to apply the brake is compelled, in order to overcome the dead points of the crank-axle, to change his position, which is especially dangerous when the brake has to be applied in case of danger, as in such cases the person is often obliged to divert his attention from the mere application of the brake. When the brake is operated by means of levers, the person who has to put the apparatus into operation must, for that purpose, change its position. In fact, experience has shown that even with properly-constructed lever-brakes numerous accidents are caused by the lever flying back. Now all these drawbacks are obviated by the employment of a brake as hereinafter described, because the said brake is operated, not by means of cranks or levers, but by simply drawing a band from off a drum.

The principle of this brake apparatus consists in that a band wound on a drum is drawn off when it is desired to apply the brake, which causes the aforesaid drum to rotate. Connected with this drum is another drum of smaller diameter, which is consequently also caused to rotate and thereby to wind up a band, which is connected to the brake-gear and serves to press the brake-blocks against the rims of the wheels. The most simple arrangement of this type of brake is that illustrated by Fig. 2, in which the band *a* is attached at one end to the periphery of the drum A, adapted to rotate about the axis of the shaft *c*, the band *a* becoming thus wound up in the direction of the arrow, while the band *b* is fastened either to a second drum B concentric with A or to the shaft *c* itself. The band *a* is provided with a ring *d* or other handle at its free end. On pulling the handle the band *a* becomes unwound and causes the drum A to revolve, which causes the drum B connected therewith to also revolve, so that the band *b* is wound up, and as the said band is connected at *e* to the brake-gear it operates it.

In some cases—for example, in carriages—it may be advisable to be able to actuate the brake from various places. For this purpose a second band *a'* is wound over or next to the band *a* on the drum A, and it is provided at its free end with a handle, such as *d'*. This band is led over suitable guide-pulleys to any desired point.

In order to be able to apply the brake with

a minimum exertion of power, the diameter of the drum B is made very small in proportion to that of A, the consequence of which is that the band *a* must be pulled out to a great distance in order that the band *b* may become wound several times around the drum B. The brake-shoe will generally be at a greater or less distance from the periphery of the wheel; but in order that a brake shall work properly it is important that the brake-shoe shall be easily and quickly applied to the periphery of the wheel and then be pressed against the same with a gradually-increasing force. This is effected in a simple manner, according to the present invention, by making the radius of the drum B—that is to say, the leverage of the load—greater at the corresponding point. This is done by means of the bolt *f*, which is screwed into the drum A parallel to the shaft *c*, and the operation of which is clearly shown in Fig. 2. The brake is restored to its original position by means of the springs *g*, when the pull on *d* or *d'* ceases, the band *b* then becoming unwound and the bands *a* and *a'* becoming wound up.

Unintentional release of the brake is prevented by the ratchet-wheel *h* and the pawl *i*. The ratchet-wheel *h* may be formed on or fixed to the drum A, or it may, when A is keyed on the shaft *c*, also be fastened on the said shaft.

The pawl *i* is mounted independently of the drum and it is thrown out of engagement by a cord *k* or *k'* when the braking action is to be diminished or stopped.

By properly proportioning the diameters of the drums and the amount of eccentricity of the bolt *f* the length of the band *a* to be wound off can be easily kept within proper limits.

After a long period of use the band or strap *b* may stretch and the brake-shoes may become worn, so that the strap *a* will have to be pulled out to a correspondingly-greater extent in order to apply the brakes properly. Now in order to remedy this drawback the drum A is made as a hollow cylinder, and in the said hollow cylinder there is arranged the hereinafter-described device, which winds the band *b* automatically to such an extent onto the drum B that the length of band *a* to be drawn off is always of the same length and the brake-shoes are always kept at one fixed distance from the periphery of the wheel. In using this device the drum A is mounted so as to be capable of easily rotating on the shaft *c*, while the ratchet-wheel *h* and the drum B are keyed or bolted onto the said shaft. A second ratchet-wheel *h'*, Figs. 3, 4, 5, 8, and 9, is keyed onto the shaft *c* and serves to transmit the rotation of the drum A to the said shaft through the medium of the pawl *m* and the bolt *l*, fixed in the wall *w*. Next to the pawl *m* is another pawl *n*, so arranged that can be moved concentrically. This pawl is guided in the slot *o* by means of the pin *p*, which is also screwed into the wall *w*. The spring F keeps the pawl *n* normally engaged with the ratchet-wheel *h'*. The angle-piece W serves as a support for the shaft *c* and also to limit the rotation of the drum through the pawl *n*, carrying a projection *r*.

When the brake is placed out of operation, both drums are rotated backward by the springs *g g* to such an extent that the projection *r* comes to bear against the lower leg of the angle-piece W.

When the brake is applied, the brake-shoes should find sufficient friction against the peripheries of the wheels before the projection *r* comes in contact with the upper limb of W.

When the brake-shoes are worn away or the band *b* has become too long, then *a* must be pulled farther out in order to be able to produce the proper braking effect. This will at last bring the projection *r* into the notch *s* in the upper limb of W, and the pawl *n* will thus be thrown out of engagement. If the band *a* be pulled farther out, the entire brake apparatus still operates through the pawl *m*, (which is still in engagement,) while the pawl *n*, in the arrangement shown in Fig. 4, is kept back, and the spring F is thus tightened. On releasing the strap the pawl *n* and the shaft *c*, which is held by the ratchet-wheel *h* and the pawl *i*, (see Fig. 2,) will remain stationary, while the drum A will be rotated backward by the spring F, pressing against the pin *r* to an amount equal to the teeth skipped by the pawl *n*, which was out of engagement. The return of the drum A must also be followed by the pawl *m*, which therefore moves back as many teeth as the spring F has rotated the drum backward.

In order to be able to clearly understand the series of operations in this automatic adjusting device, it should be noted that the one band is wound on in a right-hand direction and the other band in a left-hand direction, so that the band *b* will always be unwound when *a* is being wound up, and vice versa. The mechanism hereinbefore described thus allows of winding up the band *a* without unwinding the band *b* when that portion of the band *b* to be wound up has become unnecessarily long. When the brake is once applied, the aforesaid mechanism cannot act any longer, because the brake then is able to operate further in the usual manner, this showing that the strap *b* can never be wound up too far. Therefore when this device is used the case of the brake being unable to act can never happen.

In renewing the brake-blocks the band *b* must be removed from the drum B. This is effected by pressing the pawl *n*, with the aid of the projection *r*, against the periphery of the drum, so that the nose *t* bears against the projection *u*, Fig. 9, of the pawl *m* and also places the latter out of engagement. By pulling on the cord or line *k* or *k'* the pawl *i* is placed out of engagement, so that the springs *g g* can act and draw the band *b* away to such an extent as to leave sufficient space between

the periphery of the wheel and the brake-shoe, so that the brake-blocks fixed to the latter can be renewed.

Local conditions may frequently render it necessary to arrange the brake with the axis vertical. This may often be the case with tramways, for which this brake apparatus is especially suited. In such cases the operating mechanism may be arranged in a pot-like casing on the bottom of the vehicle, as shown in Figs. 6 and 7. The several parts of the brake remain exactly the same, with the exception that the angle-piece W is replaced by a recess *w* in the bottom of the casing.

The handle of the strap *a* may, in the case of road-vehicles, be fastened either to the splash-board of the carriage or, preferably, to the waist-belt of the driver, so that the latter, in case of its being necessary to put on the brake, shall not even require his hands, but can apply the brake by merely leaning his body backward.

In order to render the brake perfect in every respect, the brake-gear has also been substantially improved.

In almost all brake apparatus the pivot C, Fig. 1, must be located independently of the wheel-axle. Now the great advantage of the present invention consists in being able to lead the pulling-strap *a* and also the operating-band *b* to any desired point by means of guide-pulleys, thereby enabling the brake-gear to be constructed in any desired suitable manner without having to be limited by the consideration of a rigid connecting or operating rod. The pivots C are therefore fixed to the axle-brackets carrying the springs, thus entirely preventing the injurious twisting of the springs when applying the brake.

Fig. 10 shows a modification of the brake hereinbefore described, by which the whole apparatus can be operated by an extremely gentle pull on the band and also that excessive pressure on the axle that often causes the latter to become bent and twisted when applying the brake is entirely obviated. This modification may be properly termed an "indirect-acting friction-brake," and it will be found very suitable, not only for railways and heavy vehicles in general, but also for hoisting machinery, &c. The rod D, Fig. 1, is replaced by the rod D′, Fig. 10, altered correspondingly. Bolted to the spring-bracket or to any other fixed part of the wheel-axle or of the under frame is a plate L, which carries the pivot of the lever H. (See Fig. 10.)

The hub N of the wheel is formed with a grooved recess at its periphery, into which is loosely laid an elastic band M, which is smooth at its outer surface and is furnished with an eye M′. The band M is fitted on its inner surface with a friction-producing surface formed by screwing on small brake-blocks $M^2$, or their equivalents, which extend for about four-fifths round the periphery of the hub of the wheel. A band O of steel of the width of the recess is fastened at both its ends to the lever H by bolts and is formed at the proper place with slots O′ to allow of the eye M′ passing through. When the brake is "off," the band O is held by the pull-rod D′ in such a manner that it surrounds the wheel-hub but loosely. When the rod D′ is pulled to apply the brake, the steel band O, and consequently, also, the band M, is pressed against the periphery of the hub of the wheel, so that the band M is obliged to follow the motion of the hub. The rod G, which is fastened to the eye M′ and is connected with the brake-shoe in a manner to be hereinafter described, is pulled toward the wheel-axle, whereby the brake-shoe is pressed against the periphery of the wheel; but as the band M is held tight, so that the bands O and M form one, the hub N is also braked. In this arrangement the friction on the periphery of the wheel increases in direct proportion with the friction produced on the hub of the wheel, and only a small exertion of power is necessary to operate the brake, because the momentum of the rotating hub of the wheel aids in operating the brake.

When it is desired to brake the periphery of the wheel from both sides, the band M, which carries the small brake-blocks, is divided and each of these portions is provided with an eye M′, to which a brake-rod G is attached.

By the use of the movable brake-band M the direction of rotation of the hub becomes immaterial, which is of great importance—for instance, in the case of a vehicle proceeding up hill and suddenly starting to move backward.

If a brake-block is to act properly and not become worn on one side, it is necessary that it should be pressed with its entire frictional surface against the periphery of the wheel. To attain this end we mount the brake-shoe in the ordinary manner on a carrying-pin Z. The back of the brake-shoe is recessed and is adapted to receive a hinge-like clamping-ring R, Figs. 11 and 12, which is clamped on the carrying-pin Z, by means of the screw *v*, in such a manner that a force almost equal to the braking power is requisite to cause said ring to turn the said pin Z being arranged to rotate freely in the sides of the back of the shoe. When the brake-shoe which swings about a center situated on the carriage-body is pressed against the periphery of the wheel, the shoe is compelled to assume such a position that it acts against the wheel and with its entire frictional surface. When the brake-shoe is allowed to swing back, it would place itself obliquely, and to prevent this the ring R has fixed to it a spring *x*, which always keeps the brake-shoe in the proper position.

We wish it to be particularly understood that we do not limit ourselves to the precise details of construction hereinbefore described and illustrated by the accompanying drawings, but that we hold ourselves at liberty to

make such changes and alterations as fairly fall within the spirit and scope of our invention.

What we claim, and desire to secure by Letters Patent of the United States, is—

1. In a brake apparatus, the combination of a rotatable drum such as A, a rotatable drum such as B suitably connected with the drum A, suitable brake gear, a band such as *b* connected with the brake gear and the drum B, and an operating band *a* wound upon the drum A; whereby the drawing off of the band *a* from the drum A will cause the rotation of the drum B and the winding of the band *b* thereon for applying the brake substantially as set forth.

2. In a brake apparatus, the combination of the rotatable drum such as A, the drum B connected with the drum A so as to be rotated by it, the band *b* connected with the drum B the brake device connected with the band *b*, and two or more operating bands *a*, *a'*, wound on the drum A and having their ends passed to different points from which it is desired to actuate the brakes, substantially as and for the purpose set forth.

3. In a brake apparatus, the combination of the rotatable drum such as A, the operating band *a* working thereon, the drum B suitably connected with the drum A so as to be rotated with it, the brake device, the band *b* connected with the brake device and drum B, and a pin or projection such as *f* projecting from the end of drum A and adapted to engage the band *b*, for increasing the effectiveness of the device, substantially as described.

4. In a brake apparatus, the combination of the shaft *c*, drum A, band *a*, drum B and band *b*, with the device for automatically winding the band *b* on drum B and retaining the brake shoes in a certain fixed position with relation to the wheels, comprising the ratchet wheel *h'* fixed to the shaft *c*, a movable pawl *m*, and a spring F bearing at one end against the pawl *m* and at the other end against a projection *r'* on the drum A, substantially as set forth.

5. In a brake device, the combination of a band such as O loosely encircling the hub of a wheel and having one end attached to a fixed point, a loose band M located between band O and wheel hub, the brake shoe, a rod G connecting the brake shoe and the eye M' on the band M, a pivoted lever H having the opposite end of band O connected with it, and an operating rod such as D, substantially as and for the purpose set forth.

6. In a brake device, the combination of the brake lever the brake shoe mounted thereon, the clamp R secured to the brake lever, and a spring *x* secured to the clamp and engaging the shoe for holding it in position, substantially as set forth.

In witness whereof we have hereunto set our hands in presence of two witnesses.

ERNST HECHT.
PAUL RASCHE.
BERTHOLD KRUG.

Witnesses:
PAUL FISCHER,
MAX RAUTHE.