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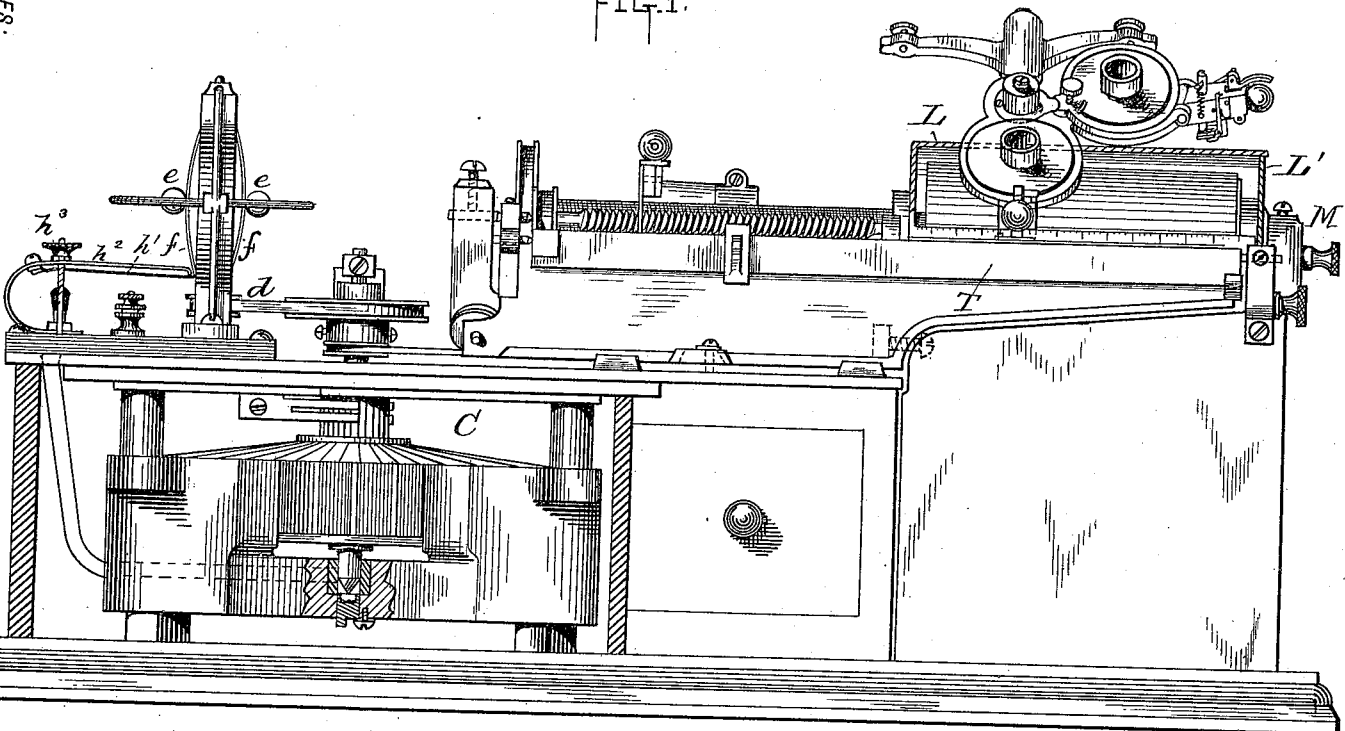
T. A. EDISON,  
PHONOGRAPH.

4 Sheets—Sheet 1.

No. 430,276.

Patented June 17, 1890.

FIG. 1.



WITNESSES:  
*Ed. J. Rowland*  
*William Egan*

BY *Thomas A. Edison*  
INVENTOR  
*John A. ...*  
ATTORNEYS

(No Model.)

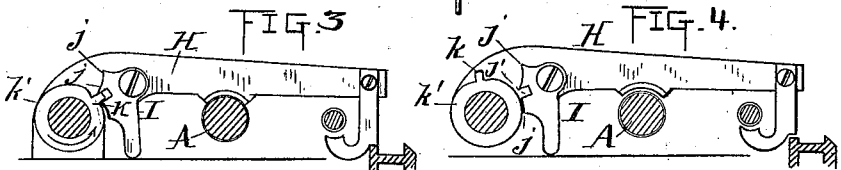
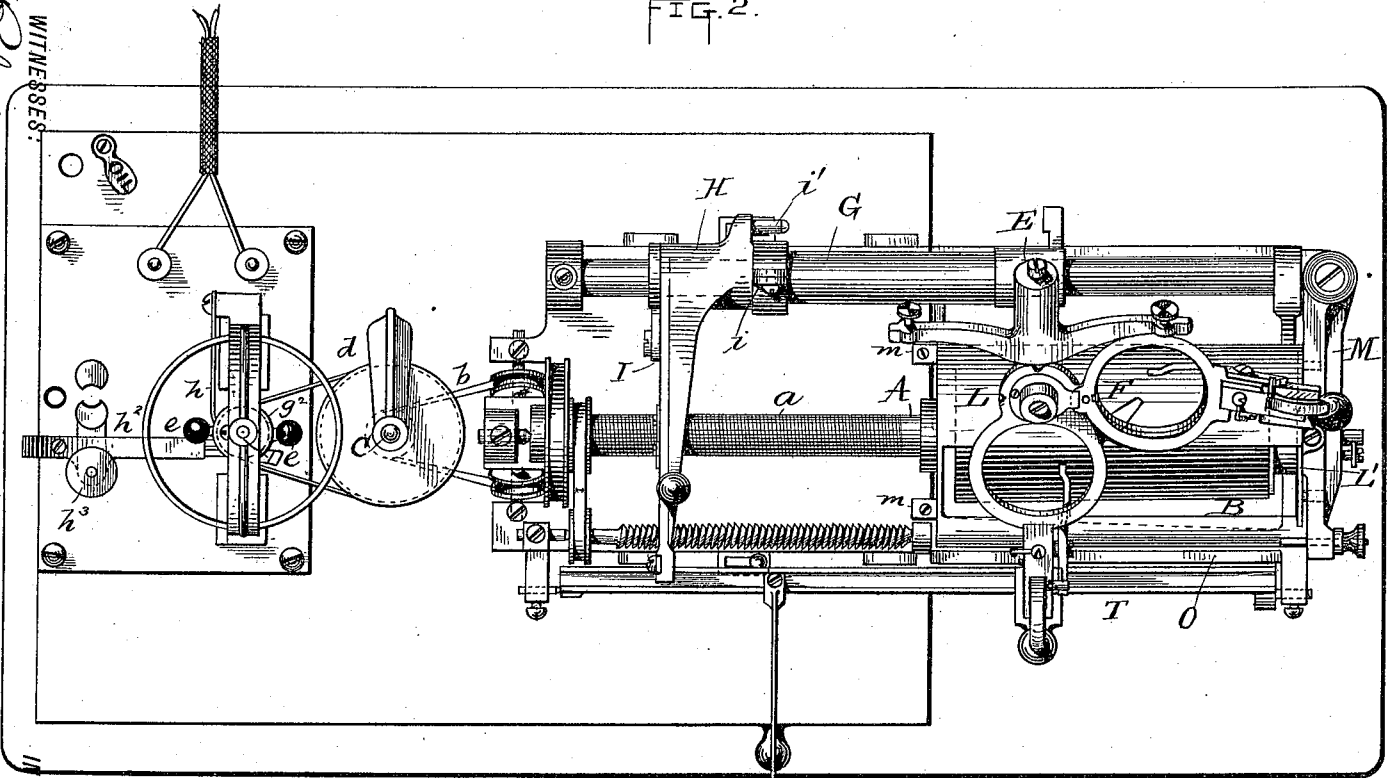
T. A. EDISON.  
PHONOGRAPH.

4 Sheets—Sheet 3.

No. 430,276.

Patented June 17, 1890.

FIG. 2.



*W. H. Woodbury*  
*William Coyne*  
WITNESSES:

BY *Thomas A. Edison*  
*John H. Poy*  
ATTORNEYS.

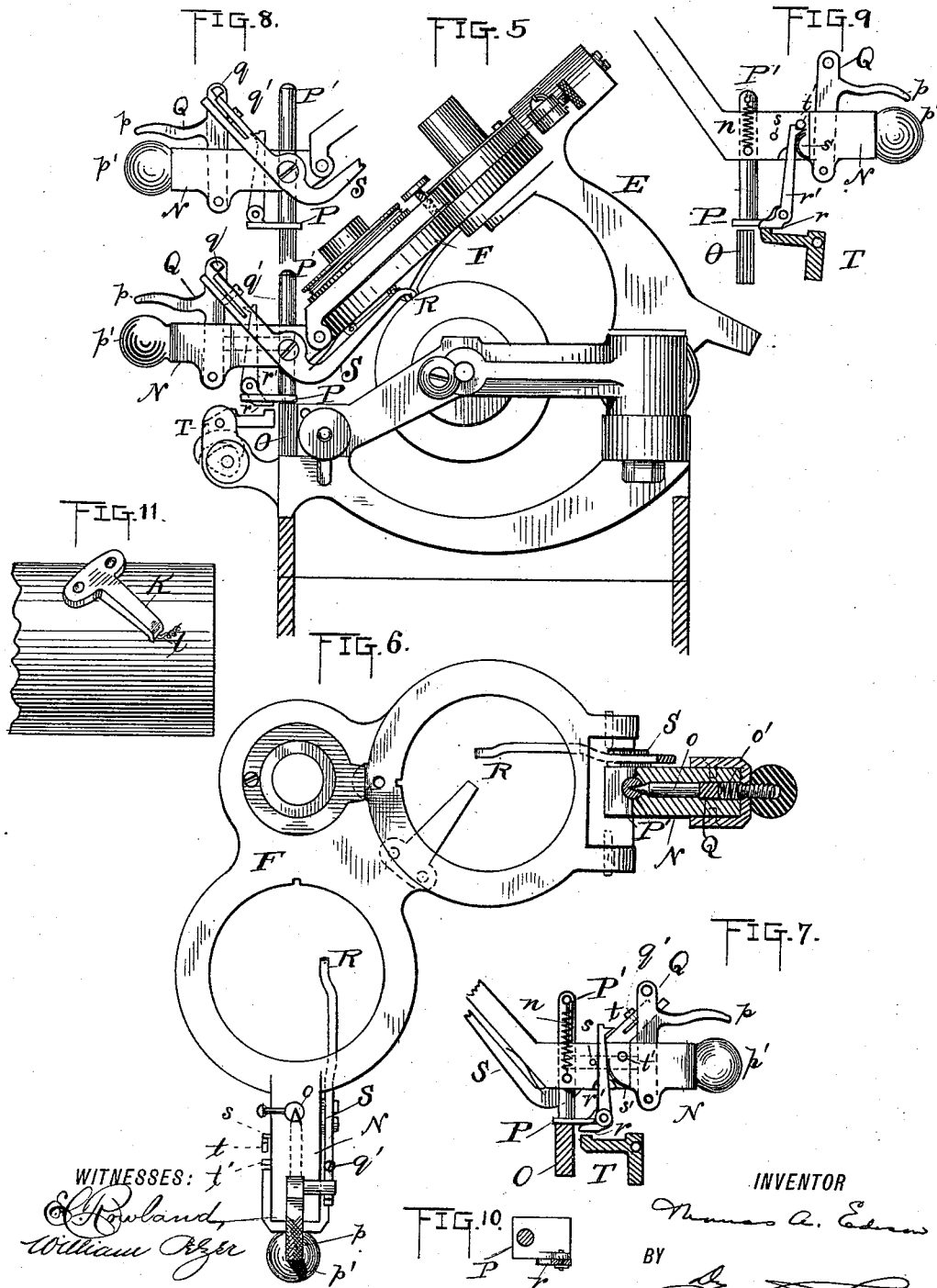
(No Model.)

4 Sheets—Sheet 3.

# T. A. EDISON. PHONOGRAPH.

No 430,276.

Patented June 17, 1890.



WITNESSES:  
*Ed. Howland,*  
*William Rizer*

INVENTOR  
*Thomas A. Edison*  
 BY  
*[Signature]*  
 ATTORNEYS.

T. A. EDISON.  
PHONOGRAPH.

No. 430,276.

Patented June 17, 1890.

FIG. 12.

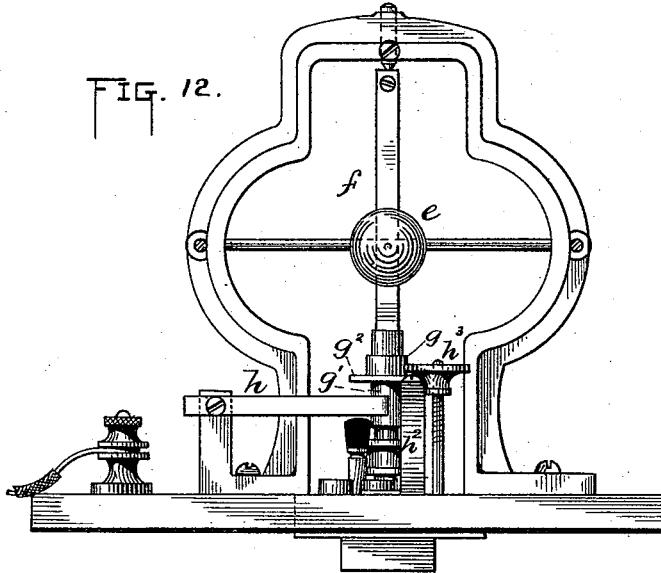
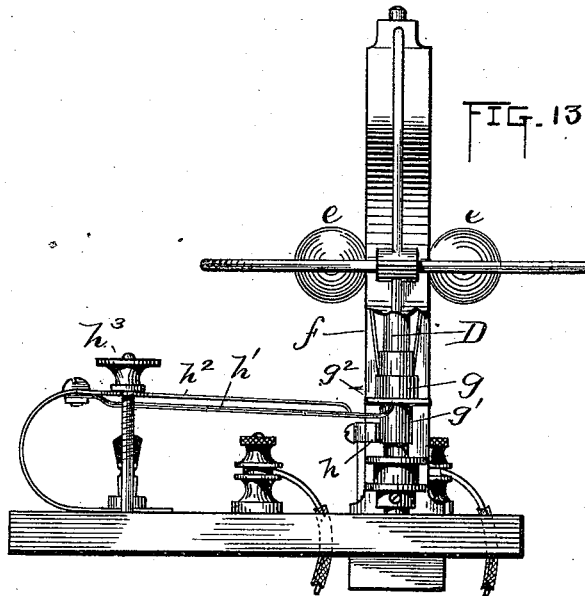


FIG. 13.



WITNESSES:

*Ed. Roland*  
*William B. ...*

INVENTOR

*Thomas A. Edison*

BY

*John ...*

ATTORNEYS.

# UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

## PHONOGRAPH.

SPECIFICATION forming part of Letters Patent No. 430,276, dated June 17, 1890.

Application filed January 15, 1889. Serial No. 296,420. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Phonographs, (Case No. 818,) of which the following is a specification.

My invention relates to improvements in the mechanism of my phonograph, whereby it is made more convenient and efficient in operation.

My object, especially, is to provide the phonograph with devices for determining automatically the exact position of the recording and reproducing points on the phonogram-cylinder, whether thick or thin, thereby avoiding the necessity of adjusting the presser-foot upon the guide-rest, in order to secure this relation each time a new or different size recording blank is used.

My object, further, is to provide a more efficient form of cutting-knife for turning off the surface of the phonogram-blank, to provide a more sensitive governor for regulating the speed of revolution of the phonograph-shaft, also to provide devices for disengaging the traveler-nut from the feeding-screw when the recorder or reproducer is lifted off of the surface of the blank, so as to prevent the wearing out of the feeding-screw thread by dragging the traveler-nut over it, and also to provide a suitable protecting-cover for the phonogram-blank, which will direct the wax cut into a receptacle beneath the cylinder, which will be so adapted to the machine as to enable the phonogram-blanks to be removed from and placed on the cylinder without removing the cover from the machine.

The invention consists in the several novel devices and combinations of parts, as fully hereinafter explained, and pointed out by the claims.

In the accompanying drawings, forming a part hereof, Figure 1 is a side elevation of the phonograph with the motor-box in section. Fig. 2 is a top view of the phonograph. Figs. 3 and 4 are views showing the two positions of the device for disengaging the traveler-nut from the screw-thread. Fig. 5 is an end view of the phonograph. Fig. 6 is a top view of the spectacle-frame with one of its

arms in section, showing the spring-lock for the presser-foot. Fig. 7 is a side view of one of the arms of the spectacle-frame, showing the automatic determination and locking devices. Fig. 8 is a view similar to Fig. 7, but from the other side of the arm. Fig. 9 is a view illustrating one of the functions of the automatic locking devices. Fig. 10 is a top view of the presser-foot, showing the attachment of the auxiliary presser-foot thereto. Fig. 11 is a perspective view illustrating the construction of the cutting-knife. Figs. 12 and 13 are views of the governor.

A is the phonograph-shaft carrying the phonogram-cylinder B, and provided with the fine feeding-screw *a*. The phonograph-shaft is rotated by an endless belt *b* from the motor C. Another endless belt *d* from the vertical shaft of the motor rotates the spindle D of the governor. This spindle carries centrifugal governor-balls *e*, mounted upon springs *f*, which move a sleeve *g* up and down upon the governor-spindle according to the position of the governor-balls. This sleeve *g* has an extended plain surface *g'*, upon which bears a circuit-spring *h*. It also has a disk *g<sup>2</sup>*, upon the under side of which bears the upwardly-turned end of another circuit-spring *h'*, which is mounted upon a spring *h<sup>2</sup>*, and is adjusted vertically by means of a nut *h<sup>3</sup>*. Now it will be seen that as the governor-balls lift the sleeve *g* the instant that the disk *g<sup>2</sup>* leaves the point of the circuit-spring *h'* the circuit will be broken. The spring *h* maintains a constant and perfect connection with the sleeve *g* by bearing upon its plain surface *g'*, so that the circuit is broken only at one point. By this form of governor I can maintain a more sensitive regulation of the speed of the motor. I do not find it necessary to use the magnet which I have heretofore employed, and as described in my application, Serial No. 281,453, filed July 30, 1888; but I can connect this governor directly with the armature of the motor and produce a more sensitive regulation without the intervention of the magnet. The rocking holding-arm E, which carries the swinging spectacle-frame F, is secured upon a sleeve G, upon which is loosely sleeved the traveler-arm H, having a sectional nut engaging with the feeding-screw *a*, as has been made plain by applications for patents al-

ready filed by me, and especially by said application, Serial No. 281,453. The traveler-nut is disengaged from the feeding-screw by the striking of the projection  $i$  on the sleeve G against the stud  $i'$  on the traveler-arm; but this does not occur until the spectacle-frame is thrown back to near the limit of its movement.

I have found it a convenient practice in using the phonograph to raise the spectacle-frame a short distance and move it along laterally by hand, so as to bring the recording or reproducing point at a different place upon the phonogram; but this movement drags the traveler-nut over the feed-screw and wears that screw out, since when the spectacle-frame is raised only part way the projection  $i$  does not strike the stud  $i'$ , and the traveler-nut is still in engagement with the feed-screw. To overcome this difficulty, I pivot upon the side of the traveler-arm H a prop-arm I, provided with two curved surfaces  $j$ , and a notch  $j'$ , engaging with a stud  $k$  and with the surface of a cam  $k'$ , mounted upon the end of the sleeve G. When the parts are in the position shown in Fig. 3, the spectacle-frame is lowered and the recording and reproducing point is in engagement with the phonogram. The traveler-nut also engages with the feeding-screw  $a$ . Now if the spectacle-frame is lifted the sleeve G is turned, and this turns the cam  $k'$  on the end of the sleeve, and the stud  $k$  in leaving the notch  $j'$  tilts the prop-arm I into a vertical position, and this prop-arm, having its lower end bearing upon the base-plate of the phonograph, lifts the traveler-arm a slight distance, sufficiently so to disengage the traveler-nut from the feeding-screw. The prop-arm is maintained in this position by the engagement of the curved surface  $j$  with the surface of the cam  $k'$ . The spectacle-frame can now be moved laterally to bring the recording or reproducing point to a new place on the phonogram, and the traveler-nut, being out of engagement with the feed-screw, will not wear such screw. In this movement the lower end of the prop-arm I slides along on the base of the phonograph. Now if the spectacle-frame is dropped the cam  $k'$  will be turned and the stud  $k$  will again engage the notch  $j'$ , tilting the prop-arm I into an inclined position and lowering the traveler arm, so that the traveler-nut will engage the feed-screw.

My improved cutting-knife K (shown particularly in Fig. 11) is placed obliquely to the line of record, as shown. It is secured to the spectacle-frame in this position, and has its cutting end  $l$  curved, as shown, to conform to the shape of the surface of the cylindrical phonogram. By giving it this shape it cuts a wider chip, and the result is a greater smoothness in the surface of the phonogram-blank.

On account of the electrification of the chips or shavings which are cut from the surface of the phonogram-blank by the knife, I have found it necessary to cover the phono-

gram-blank as completely as possible with a protecting-cover L, to direct said particles into the receptacle provided for them and prevent them from becoming scattered over the machine and surrounding objects. This covers the entire upper half of the phonogram-blank with the exception of an opening on the front side of the cover, through which the recording and reproducing points act upon the surface of the blank, and so prevents the electrified particles from escaping and directs them into the receptacle provided for them beneath the cylinder. This cover L has lugs  $m$ , which are secured to the base of the phonograph, so as to support the cover from that end. At the other end of the cover a closing-plate  $L'$  is secured to the swinging arm M, which carries the movable center for the phonograph-shaft. The other end of the cover L is closed permanently. By mounting the closing-plate  $L'$  upon the swinging arm the phonogram-cylinder is entirely inclosed on its top side and ends, except for the opening through which the recording and reproducing devices act, and by swinging the arm outwardly the end of the cover will be opened, so that the phonogram-blank can be removed from the machine and a new one substituted for it without removing the cover entirely from the machine.

The principal feature of my present invention relates to means for determining automatically the precise relation which the recording or reproducing point should bear to the surface of the phonogram-blank. The spectacle-frame F has two arms N, one for each eye of the frame, and these project forward over a guide-rest O, each arm N having a presser-foot P, which bears upon the guide-rest and supports the spectacle-frame as it moves laterally in a definite relation to the surface of the phonogram-blank. Heretofore I have employed an adjustable screw, passing through each of the arms N of the spectacle-frame and bearing at its lower end upon the guide-rest. This construction made it necessary to adjust the spectacle-frame to the guide-rest every time a new phonogram-blank was placed upon the machine or the thickness of the blank reduced by cutting while on the machine. I find that it is possible to provide the machine with devices whereby each time the spectacle-frame is lowered the exact position of that frame with relation to the phonogram-blank will be automatically determined, so as to obtain the proper exact adjustment without skill on the part of the operator of the instrument. I have tried many different constructions of devices for this purpose, some of which were provided with a fixed determining-point, which would strike the surface of the phonogram-blank as the spectacle-frame is lowered, holding it in that position until a lock was operated by hand to fix the relation of the parts, when the determining-point would be moved away from the surface of the wax to prevent it from

wearing such surface, either by an independent movement or by the movement necessary to lock the presser-foot. I have also used devices having a movable determining-point, as one mounted upon a pivoted lever, the movement of which determining-point would either lock the presser-foot by its direct movement or release a spring-lock. Upon a number of these forms I propose to make separate applications for patents. The preferred construction is illustrated in the drawings by Figs. 5 to 10, and is one in which the determining-point is movable, and by its movement releases a spring-lock. The presser-foot P is a plate mounted upon the lower end of a bar P', which passes up through arm N. A spring *n* is connected with a pin at the upper end of the bar P' and with another pin upon the side of the arm N, and drawing downwardly upon the bar P' tends to project the presser-foot downwardly to the lowermost limit of its movement. The bar P' is provided with a V-shaped slot extending longitudinally, and into this slot projects the beveled end of a locking-bolt *o*, which is attached to a pivoted lever Q, projecting above the arm N and having a finger-piece *p* projecting forward over the end of the lifting-knob *p'* on the end of the arm N. A spring *o'* throws the locking-bolt *o* forward into engagement with the bar P'. The determining-point R is carried by a lever S and strikes the surface of the phonogram-blank close to the recording or reproducing point and approximately in line laterally therewith. The lever S is pivoted on the side of the arm N, and from that point projects upwardly, where its upper end engages with a stud *q*, projecting laterally from the upper end of the lever Q. The engaging end of the lever S is split and is provided with an adjusting-screw *q'*, so that the exact point in the adjustment of the parts at which the end of the lever will be engaged and disengaged by the stud *q* can be accurately determined. The engagement of the stud *q* of the lever Q with the end of the lever S holds the bolt *o* out of engagement with the V-shaped slot of the sliding bar P'. The retracting movement is very slight, so that there will be little or no loss of movement in effecting engagement of the bolt with the sliding bar. The bolt being thus locked in a retracted position, if the spectacle-frame is lifted the presser-foot P will be projected to its lowermost position by the spring *n*, and as the spectacle-frame is lowered the presser-foot will strike the guide-rest O and the bar P' will slide upwardly through the arm N against the tension of the spring *n*. The downward movement continues against the tension of the spring *n* until the determining-point R strikes the surface of the phonogram-blank, when the slightest further movement disengages the end of the lever S from the stud *q* of the lever Q and the spring-lock is released, the bolt *o* being projected forward into engagement with the sliding bar P', and

the presser-foot being locked rigidly in the position of adjustment, which is determined by the determining-point R. The lever S is then free, except for a slight forward spring-pressure, so that the point R, which is rounded, will ride over the surface of the phonogram-blank without injury thereto, the point being sufficiently wide to bridge a number of the lines of record. By having the finger *p* of the lever Q project over the lifting-knob *p'* the finger *p* will be pressed downwardly each time that the spectacle-frame is lifted, and the result will be the locking of this lever by the lever S and the releasing of the presser-foot each time the spectacle-frame is lifted, so that when the spectacle-frame is lowered again a readjustment of the parts will be had. As will be understood from applications for patents already filed by me, and especially from said application, Serial No. 281,453, my machine is provided with a tilting-bar T, placed in front of the guide-rest O and designed to raise the spectacle-frame and the traveler-arm simultaneously, so as to effect a retracting movement. It is obvious that if this tilting-bar T is accidentally left in a tilted position, so as to engage the presser-foot before it strikes the guide-rest, as shown in Fig. 9, the adjustment would be secured with relation to this tilting-bar and not with relation to the guide-rest, and the operator then turning the tilting-bar down the result would be the throwing of the recording or reproducing point too far into the surface of the phonogram-blank. To prevent such an accident, I provide an auxiliary presser-foot *r*, forming the lower end of the lever *r'*, which is pivoted upon the presser-foot P. The auxiliary presser-foot *r* projects normally below the presser-foot P. The lever *r'* is held against the pin *s* by means of a spring *s'*, and thus secures this advance position of the auxiliary presser-foot. The upper end of the lever *r'* is provided with a tooth *t*, which engages with a pin *t'* on the side of the arm N. When the tilting-bar T is in its normal position, the auxiliary presser-foot *r* does not strike it, and the lever *r'* slides up and down, with the sliding bar P' against the pin *s*, without the engagement of the tooth *t* with the pin *t'*; but should the tilting-bar be accidentally left in a tilted position the lowering of the spectacle-frame will cause the auxiliary presser-foot *r* to first strike the tilting-bar, and this will throw the lever *r'* to one side, so that the tooth *t* will pass under the pin *t'*. This will hold the spectacle-frame in an elevated position and prevent it from being lowered. The operator will then observe the difficulty and turn the tilting-bar, the effect of which will be to cause the spring *s'* to throw the lever *r'* over against the pin *s*, when the presser-foot will strike the guide-rest and the proper adjustment will be secured. These devices for automatically determining the adjustment are mounted upon each of the arms N of the spectacle-frame, so that the adjustment will be per-

formed for the recorder as well as for the reproducer.

While the devices that I have described for determining automatically the adjustment of the recording and reproducing point with relation to the surface of the phonogram are preferred by me, I do not wish to limit the scope of my invention to such special devices, since many other forms can be employed, as I have before indicated.

What I claim as my invention is—

1. In a phonograph, the combination, with a frame carrying the recorder or reproducer and movable toward and away from the surface of the phonogram-blank and a guide-rest maintaining its relation with the phonogram-surface, of a determining-point carried by such frame adjusted with relation to the point of the recorder or reproducer and determining by contact with the phonogram-surface the proper relation of the recording or reproducing point therewith, substantially as set forth.

2. In a phonograph, the combination, with a frame movable toward and away from the surface of the phonogram-blank and carrying the recorder or producer, a guide-rest, and an adjustable presser-foot for supporting said frame from the guide-rest, of a determining-point carried by said frame, and determining by contact with the phonogram-surface the exact position of adjustment of the recording or reproducing point therewith, and a lock for locking the position of the presser-foot at such point of adjustment, substantially as set forth.

3. In a phonograph, the combination, with a frame carrying the recorder or reproducer and movable toward and away from the phonogram-surface, a guide-rest and an adjustable presser-foot supporting the frame from the guide-rest, of a movable determining-point carried by said frame, and determining automatically by contact with the phonogram-surface the proper adjustment of the recorder or reproducing point with said surface, and a lock for locking the presser-foot in that position of adjustment and for releasing the determining-point, substantially as set forth.

4. In a phonograph, the combination, with a frame movable toward and away from the phonogram-surface and carrying the recorder or reproducer, a guide-rest, and an adjustable presser-foot supporting the said frame from the guide-rest, of a movable determining-point carried by the frame, and determining automatically by contact with the phonogram-surface the adjustment of the recorder or reproducer therewith, and a lock for locking the presser-foot, automatically controlled or operated by the movement of the determining-point, substantially as set forth.

5. In a phonograph, the combination, with a frame movable toward and away from the phonogram-surface and carrying the recorder or reproducer, a guide-rest, and an adjust-

able presser-foot supporting the said frame from the guide-rest, of a movable determining-point carried by said frame and making contact with the phonogram-surface, and a spring-lock locking the presser-foot and released by the movement of the determining-point after it touches the phonogram-surface, substantially as set forth.

6. In a phonograph, the combination, with a frame movable toward and away from the phonogram-surface and carrying the recorder or reproducer, a guide-rest, and an adjustable presser-foot supporting the said frame from the guide-rest, of a determining-point formed by the end of a lever pivoted upon said frame, and a spring-lock locking the presser-foot and released by the movement of the determining-lever, substantially as set forth.

7. In a phonograph, the combination, with the movable frame and the guide-rest, of the presser-foot carried by a sliding bar, a spring throwing such presser-foot downwardly, and a lock for locking the presser-foot at any point of adjustment, substantially as set forth.

8. In a phonograph, the combination, with the movable frame, of the presser-foot thrown outwardly by a spring, a determining-point carried by the frame, and a lock for locking the presser-foot at the point of adjustment determined by the determining-point, substantially as set forth.

9. In a phonograph, the combination, with the movable frame and the automatic determining-point, of the presser-foot, a lock therefor, and a releasing-finger, which is grasped in raising the frame, substantially as set forth.

10. In a phonograph, the combination, with the movable frame, guide-rest, and tilting-bar, of the presser-foot projected outwardly by a spring and an auxiliary presser-foot having a locking-tooth and acting to lock the frame in an elevated position when the tilting-bar is turned, substantially as set forth.

11. In a phonograph, the combination, with a spectacle-frame carrying the recorder and reproducer in its two eyes, of separate arms for such eyes and the automatic adjustment-determining devices mounted upon each of such arms, substantially as set forth.

12. In a phonograph, a cutting-knife having an oblique cutting-point curved to conform to the curvature of the cylindrical phonogram-surface, substantially as set forth.

13. In a phonograph, the combination, with the rocking holding-arm, the traveler-arm, and the feed-screw, of a lifting-arm moved by the movement of the rocking holding-arm and serving to disengage the traveler-nut from the feed-screw, substantially as set forth.

14. In a phonograph, the combination, with the rocking holding-arm and the traveler-arm connected loosely together, of a cam moved by the lifting of the rocking holding-arm and a prop-arm worked by the movement of such cam, and serving to lift the traveler-arm



whenever the rocking holding-arm is lifted, substantially as set forth.

5 15. In a phonograph, the combination, with the phonogram-cylinder, of a cover covering its entire upper half, both top and ends, except for an opening through which the recording and reproducing devices act, substantially as set forth.

10 16. In a phonograph, the combination, with the phonogram-cylinder, of a cover covering

the top and ends of such cylinder, the outer end plate of such cover being mounted upon the swinging arm carrying the center, substantially as set forth.

This specification signed and witnessed this 15  
12th day of January, 1889.

THOMAS A. EDISON.

Witnesses:

WILLIAM PELZER,

E. C. ROWLAND.