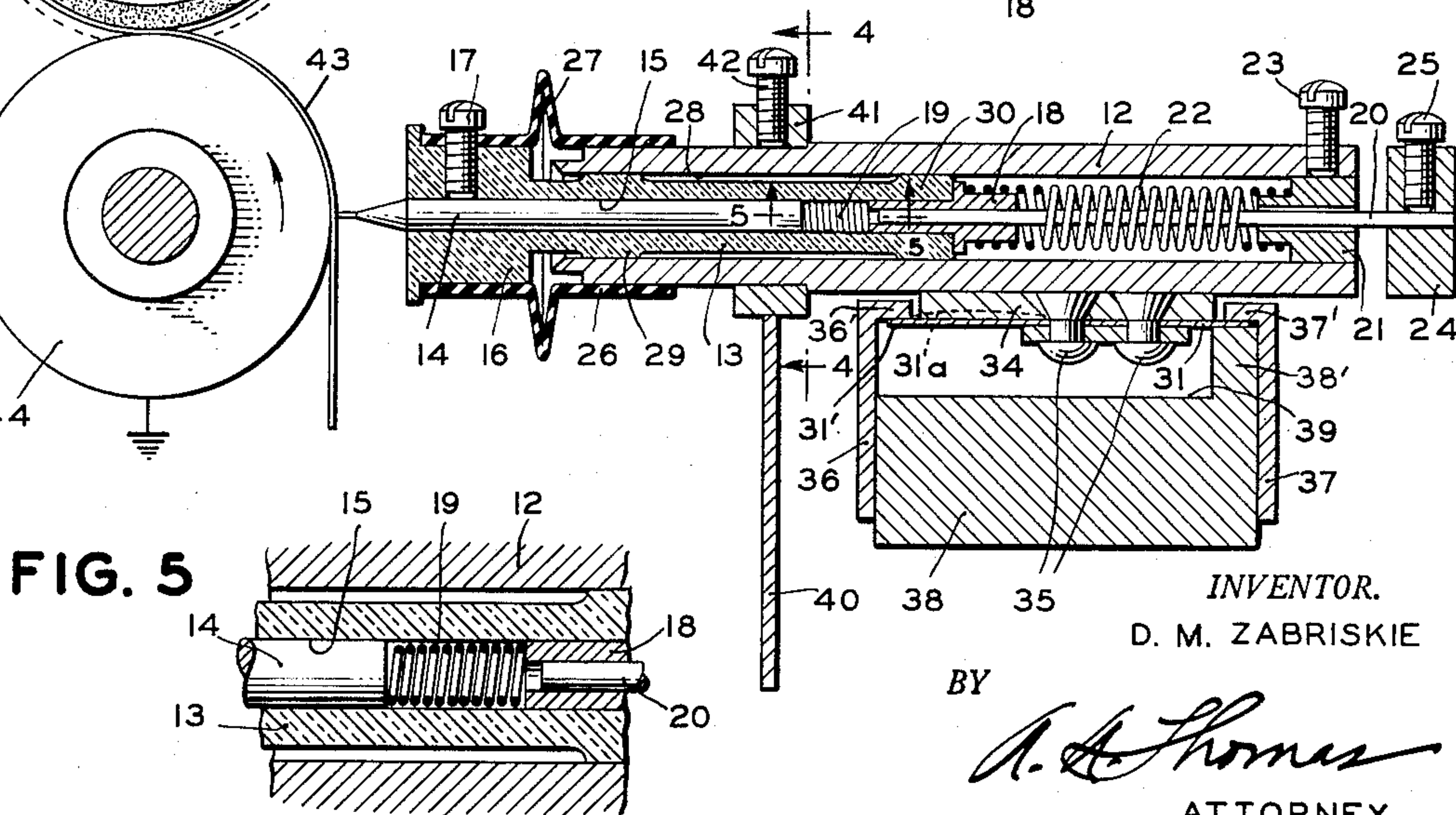
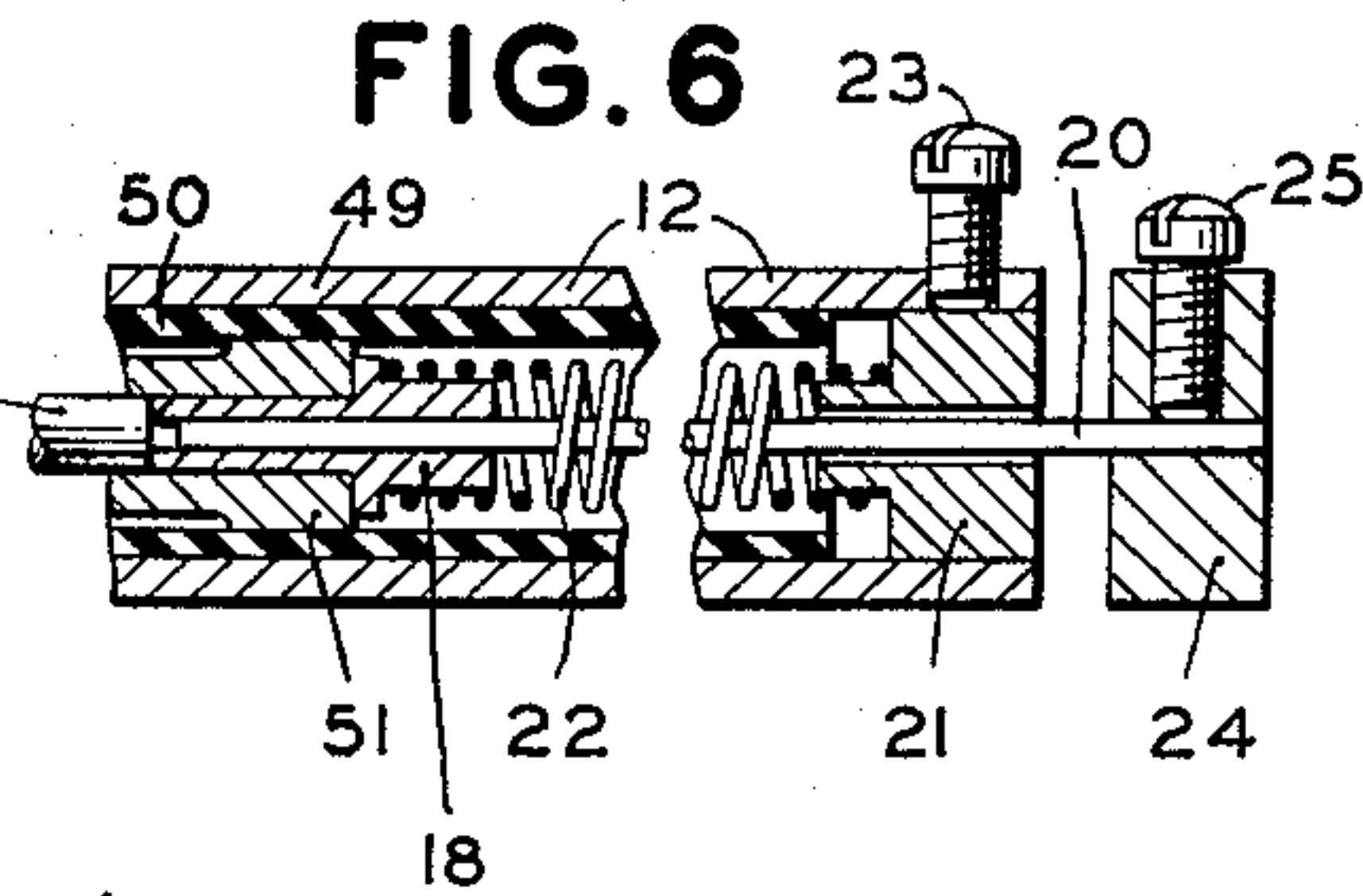
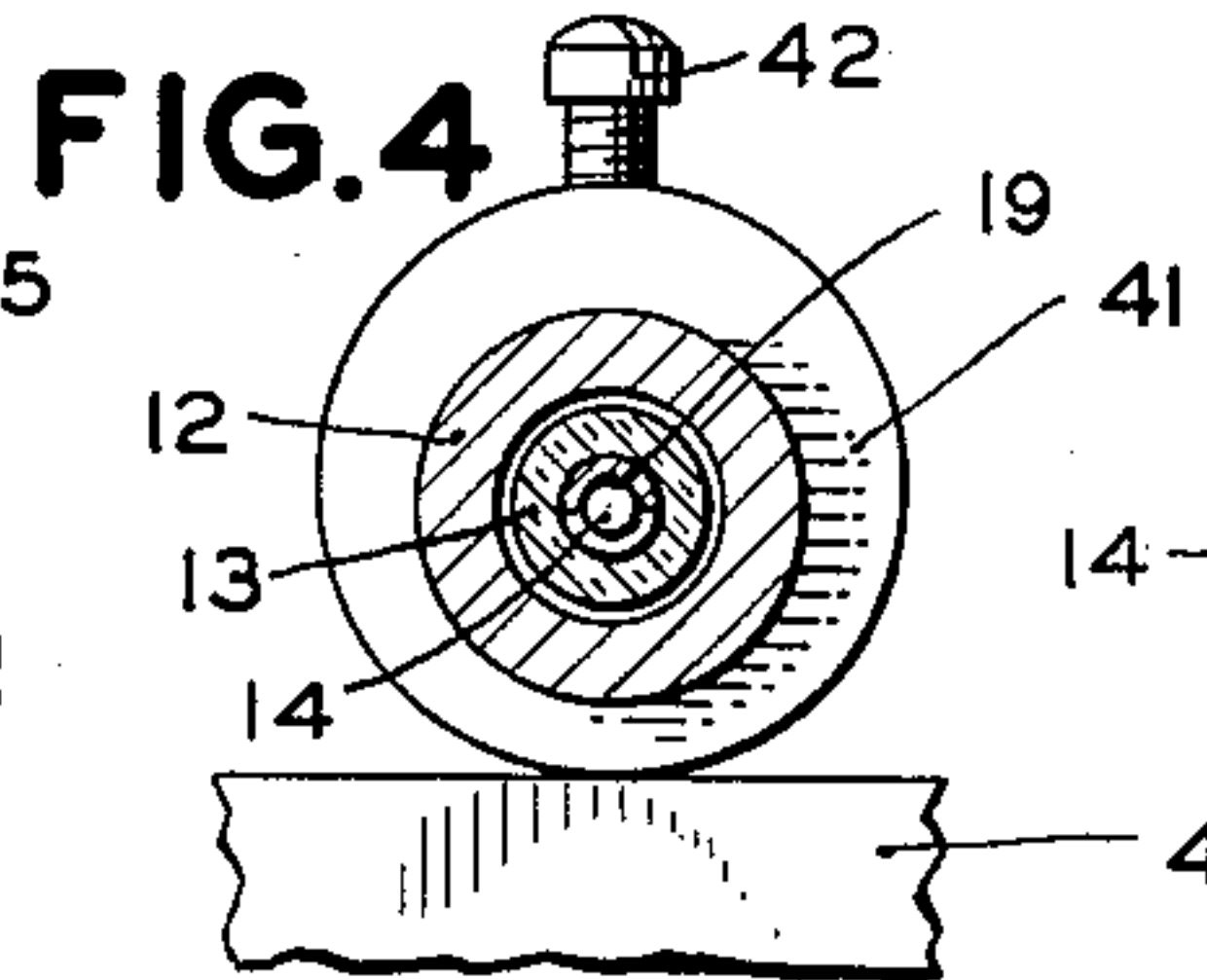
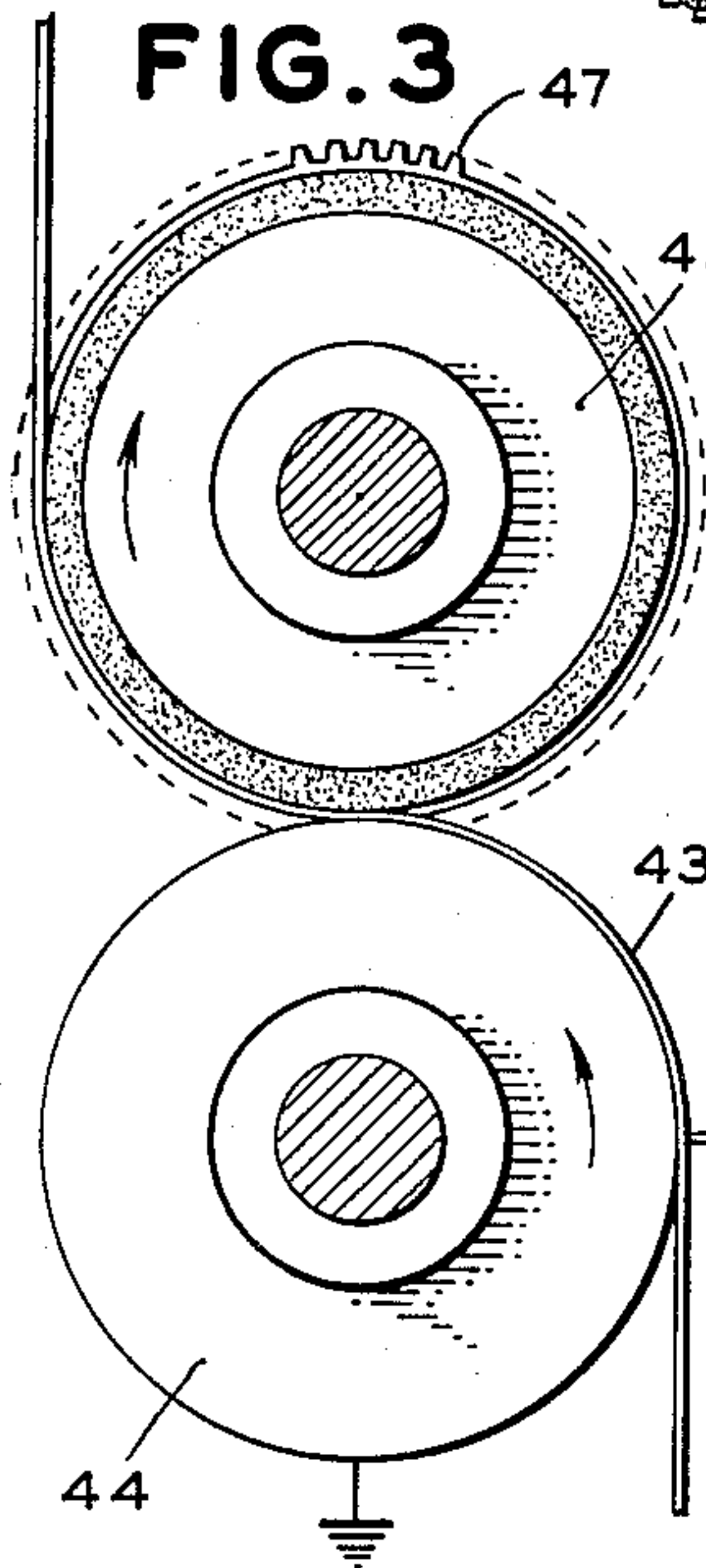
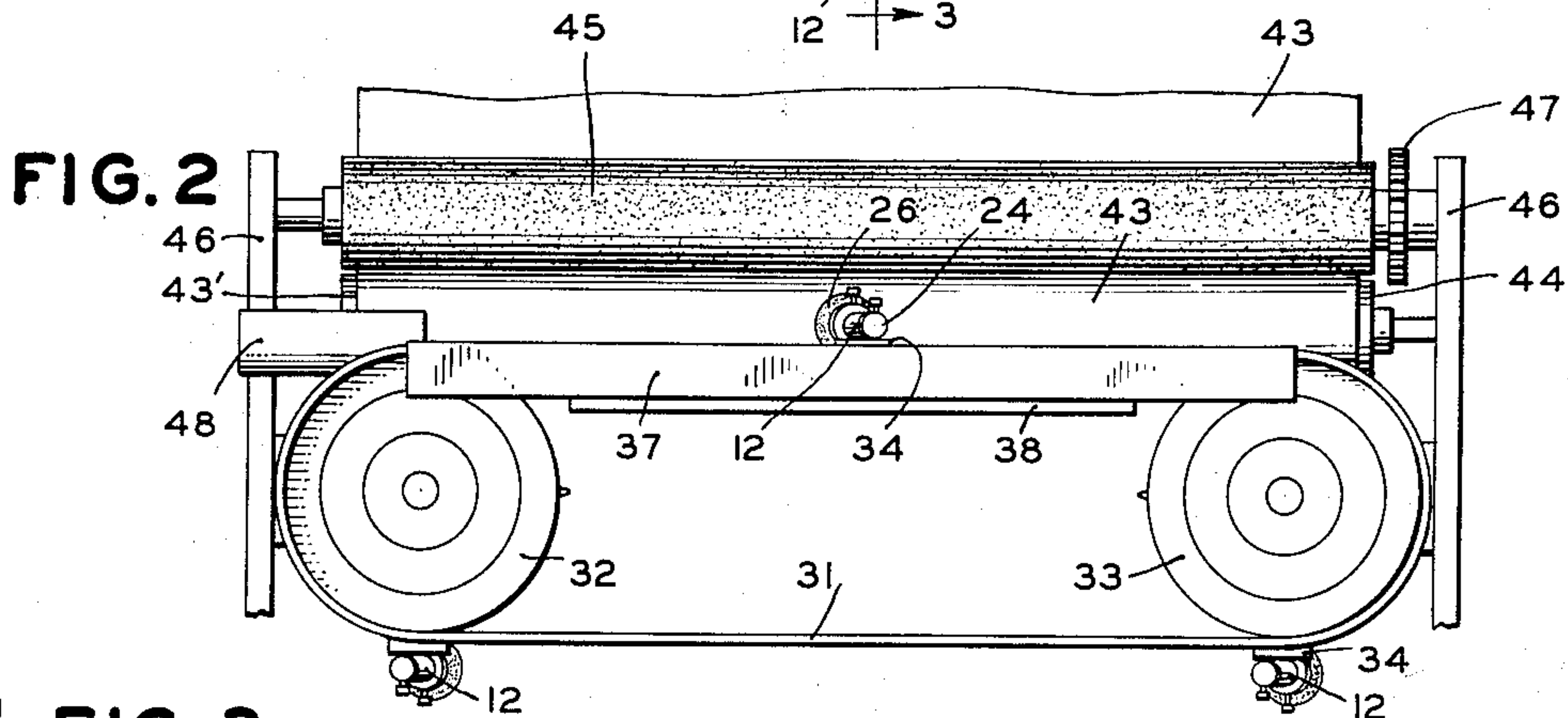
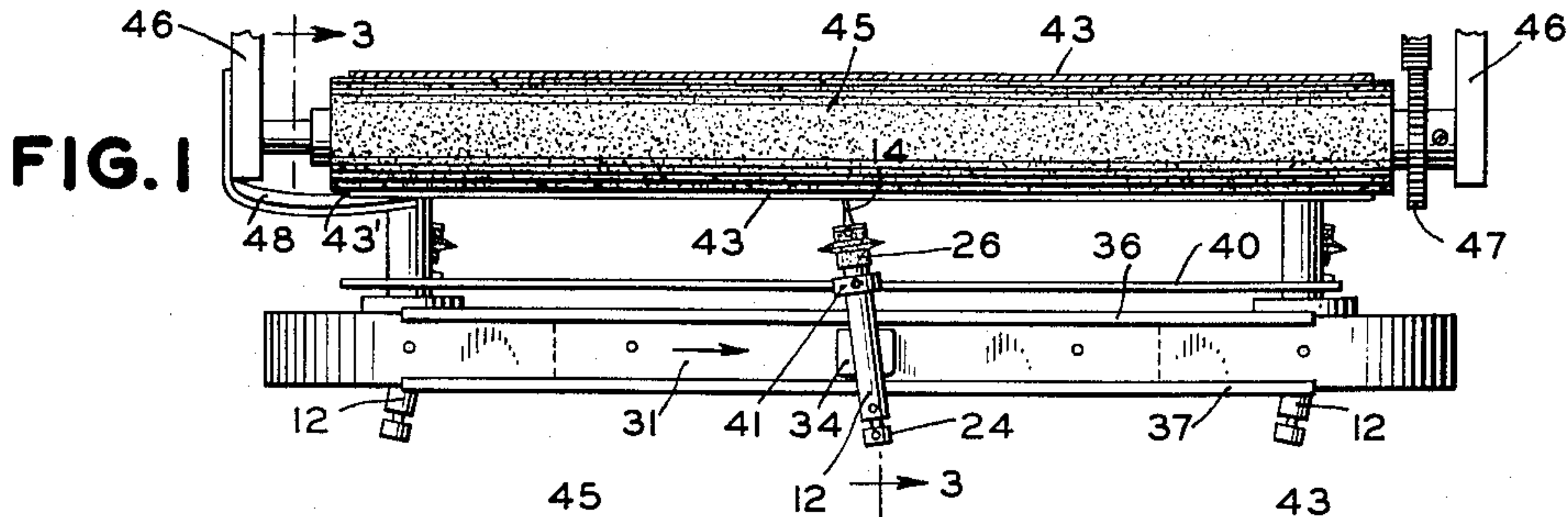


Nov. 15, 1955

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STYLUS SCANNING DEVICES FOR
FACSIMILE MACHINES
Filed July 15, 1950

2,723,897



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STYLUS SCANNING DEVICES FOR FACSIMILE MACHINES

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Application July 15, 1950, Serial No. 173,965

9 Claims. (Cl. 346—139)

My invention relates to facsimile machines employing stylus scanners, and its general object is to provide a novel stylus assembly particularly adapted for multi-stylus page recorders and transmitters. A special purpose of this invention is to provide certain improvements in belt-driven scanning mechanisms like that set forth in the copending application of Hallden and Zabriskie, Serial No. 83,333, filed March 25, 1949.

Briefly stated, the stylus assembly of the present invention comprises a cylinder, a piston reciprocable in the cylinder, and a stylus seated in an axial bore of the piston which has a set screw for easy replacement of a stylus. A spring in the cylinder constantly urges the piston forward and thus holds the stylus in uniform pressure contact with a sheet supported on a rigid platen. An adjustable collar in the cylinder permits regulation of the stylus pressure on the paper. When the stylus is out of contact with the paper, a stop limits the forward movement of the piston.

Several of these stylus units (usually three) are mounted on a spring metal belt to which the metal cylinders are rigidly secured in such position that the resiliently supported styluses are placed in operative relation to the paper on the rigid platen. A fixed guide bar is arranged in the scanning path of the cylinders which are held in pressure contact with the bar by an automatic deflection of the belt. This pressure engagement of the cylinders with the guide bar compels the styluses to traverse the same linear scanning path across the slowly moving sheet, so that the successive scanning lines are uniformly spaced. Each cylinder preferably carries an eccentric collar which engages the guide bar and is adjustable to determine accurately the correct vertical position to the stylus tip.

The practical advantages and various features of novelty characterizing my invention will be fully understood from a detailed description of the accompanying drawings, in which

Fig. 1 shows in plan a portion of a multi-stylus facsimile machine provided with my new stylus assembly;

Fig. 2 is a front elevation of Fig. 1;

Fig. 3 represents a greatly enlarged sectional view on line 3—3 of Fig. 1;

Fig. 4 is a section on line 4—4 of Fig. 3;

Fig. 5 shows an enlarged sectional view on line 5—5 of Fig. 3; and

Fig. 6 is a fragmentary sectional view of a modified form of cylinder and piston.

Referring to the magnified sectional view in Fig. 3, it will be seen that the stylus is a unitary structure comprising a cylinder 12, a piston 13 reciprocable therein, and a stylus 14 firmly seated in an axial bore 15 of the piston. The enlarged outer head 16 of the piston has a radial hole for a set screw 17 to clamp the stylus in place. A depth gauge may be used for the correct positioning of the stylus in the piston bore.

The cylinder 12 is made of suitable metal, preferably

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bronze which is a good conductor and is easily soldered to the belt of the driving mechanism, as will presently appear. The piston 13 can be made of conducting material such as rustproof steel or graphite, or it may consist of a single piece of insulating material like nylon, Lucite or similar plastics capable of being accurately machined to the required form. A nylon piston has certain advantages, as I shall explain later. If the piston is made of metal, it is desirable to have a film of lubrication between the cylinder and piston.

The inner end of piston 13 carries a metal bushing 18 which is attached in any practical way, as by cementing. A conducting coil spring 19 is seated in the piston bore 15 between the bushing 18 and the inserted stylus 14. When the stylus is inserted into the piston to the proper depth, it rightly compresses the spring 19 which thus establishes a good electric connection between the stylus (usually of tungsten) and the metal bushing 18. A metal rod 20 is attached at its inner end to the bushing 18, as by a forced fit, and this rod passes freely through a metal collar 21 adjustably mounted in the rear end of cylinder 12.

An expanding coil spring 22 of conducting metal surrounds the rod 20 and bears at its ends against the bushing 18 and the collar 21, so that the spring constantly tends to push the piston 13 and stylus 14 forward out of the cylinder. The spring 22 forms a resilient electric connection between the inserted stylus 14 and the cylinder 12, this connection being unaffected by the axial movements of piston 13. The initial pressure of spring 22 against the piston 13 is regulated by adjusting the collar 21 axially of the cylinder. A set screw 23 secures the collar 21 in adjusted position. The forward axial movement of piston 13 when the stylus is not in scanning position is restricted by a stop collar 24 mounted on the outer end of rod 20. The maximum length of the forward travel of piston 13 under the action of spring 22 can be accurately determined by adjusting the stop 24 along the rod 20. A set screw 25 or the like locks the stop 24 in adjusted position.

On the forward ends of cylinder 12 and piston 13 is mounted an elastic cover in the form of a rubber sleeve 26 which has a bellows extension 27 adapted to yield readily to the axial movements of the piston. One end of sleeve 26 is stretched over the front end of piston 12 and is firmly held in place by its own tension without extra fastening means. The other end of sleeve 26 goes over the piston head 16 and is pierced by the set screw 17. The elastic cover 26 not only serves to seal off the bearing surfaces of the piston and cylinder against stylus fumes and foreign matter, but also prevents rotation of the piston without interfering with its axial movements. To reduce the surface contact between piston and cylinder to a minimum, the piston is preferably formed with a circumferential recess 28 to provide a pair of spaced bearing collars 29 and 30 which make slidable contact with the inner surface of the cylinder.

The stylus assemblies are mounted in properly spaced relation on an endless belt 31 which is operatively supported on a pair of pulleys 32 and 33. It will not be necessary to show or explain the driving connections for the pulleys because such connections are not a part of the present invention. Reference may be had to the aforementioned application Serial No. 83,333 for details of a practical driving mechanism between an electric motor and one of the pulleys. It will therefore be understood that the belt 31 is driven at predetermined speed during a scanning operation. The stylus belt 31 is a thin steel band slightly flexible or deformable transversely for a purpose that will presently appear.

Each cylinder 12 is soldered or otherwise secured to a metal block 34 in an angular position accurately determined by a jig. The blocks 34 are each fastened to the belt by rivets 35 along a transverse contact line, so that the flexible belt is free to bend around the pulleys. The two longitudinal edges of the belt engage a pair of flanged guide plates 36 and 37 which are secured to a stationary block 38. A recess 39 in this block provides room for the rivets 35, and it goes without saying that the pulleys 32—33 are grooved to let the rivets pass.

As seen in Fig. 3, the right hand edge of belt 31 (that is, the rear edge with respect to the stylus) is held for steady movement in a narrow channel formed between the overlying flange 37' of plate 37 and an extension 38' of block 38. However, the forward edge 31' of the belt runs underneath the flange 36' of plate 36 and is not supported at the bottom. This supporting and guiding arrangement for the belt 31 extends between the pulleys 32—33 along the upper or scanning section of the belt. It will be noted that the two rivets 35 of block 34 are located off center toward the rear of the belt and block. This rearward location of the rivets cooperates with the belt supporting plates 36 and 37 to permit a slight transverse flexure of the belt across the forward half of its width.

A stationary bar or rail 40 is supported alongside the belt 31 in a position to be engaged by a bearing collar 41 mounted on each cylinder 12. The collar 41 is preferably eccentric and is secured in radially adjusted position by a set screw 42. The straight top edge of the guide bar 40 is at such a height with respect to the stylus cylinders 12 that as each cylinder encounters the bar it is tilted slightly upward at the forward end. This automatically deflects the spring belt across the forward half of its width (as indicated symbolically by the dotted line 31a) and places the belt under a transverse tension which exerts a downward pressure on the cylinder 12 and holds it in firm sliding contact with the bar 40. Consequently, each stylus is compelled to travel in the same linear path along the upper run of the belt. The ends of the guide bar 40 are curved to ease the stylus assemblies into and out of engagement therewith.

The paper 43, which may be a recording blank or bear copy for transmission, passes over a rigid platen 44 shown here as a metal cylinder in frictional driving engagement with a rubber feed roller 45. The shafts of the cylindrical members 44 and 45 are supported in plates 46, and the shaft of roller 45 carries a gear 47 which is connected to a motor for slowly feeding the paper upward (or downward) on platen 44. The paper 43 may be a continuous sheet fed from a supply roll for recording, or it may consist of separate sheets fed into the machine for transmission.

In the scanning operation of the machine the resiliently mounted styluses 14 are carried by the belt in a predetermined straight path across the supported sheet. The stylus units are so spaced on the belt that, as one stylus leaves the paper, the next stylus enters upon the sheet. Each stylus is guided without deviation across the paper by the steady pressure engagement of the cylinders 12 (or the collar 41) with the stationary bar 40. The result, in the case of recording, is a facsimile page record with uniformly spaced lines; and, in the case of transmitting a message, the copy is accurately scanned to produce a clear facsimile in the connected recorder.

As each stylus assembly approaches the left or entry edge 43' of the paper, the stylus tip engages a stationary cam 48 which forces the stylus backward against the action of spring 22 and carries it past the edge of the paper. The moment the stylus leaves the cam 48, the spring pressure behind the stylus instantly drops it onto the paper surface in position to record or to scan the copy on the paper. Since the styluses travel at com-

paratively high speed (about 23 inches per second in one instance), it is essential to have the piston 13 as light and as smoothly movable as possible, so that it can respond instantly for axial movement in either direction. I have found that a piston of nylon gives an excellent performance in that respect, not only on account of its low inertia, but also because it possesses inherent anti-friction qualities and is not subject to corrosion.

Further, the quick responses of piston 13 as an axial resilient mounting for the stylus automatically take up irregularities (such as minute depressions or elevations) liable to occur in the surface of the paper. Under such conditions, the continuous pressure of spring 22 against the light piston will hold the fast-moving stylus point in uniform pressure contact with the irregular surface of the paper during a scanning operation.

The collar 41, while not absolutely necessary in the broader aspect of my invention, is of practical advantage in two particulars. For one thing, it is an inexpensive part that takes up the wear of the pressure engagement with the guide bar 40 and can easily be replaced when necessary, thereby making the life of cylinder 12 permanent. Secondly, by making the collar 41 eccentric, as shown, it serves to provide an accurate adjustment for the vertical position of the stylus.

As the stylus tip wears down, the spring 22 automatically adjusts the stylus axially and thus assures uniform stylus pressure on the paper. The stop collar 24 is so adjusted on the piston rod 20 that it permits a forward travel of the piston equal to the wearable length of the stylus plus a slight safety margin (say, a few thousandths of an inch) to guarantee contact with the paper when the stylus is at its shortest usable length.

Fig. 6 illustrates a modified form of cylinder and piston assembly in which the cylinder consists of a metal outer shell 49 and an inner insulating sleeve or lining 50 secured thereto, while the piston 51 is of light conducting material like carbon or graphite. Otherwise what has been said for the stylus assembly of Fig. 3 should be considered applicable to the modification of Fig. 6, except that the contact spring 19 for the stylus is not necessary when the piston 13 is of conducting material.

It must not be supposed from the amplified illustration in Fig. 3 that this stylus assembly is a bulky device. On the contrary it is actually a tiny compact unit, which in its present commercial form has a cylinder only $1\frac{3}{8}$ inches long and $\frac{1}{4}$ of an inch wide, while the piston 13 is less than one inch long. These figures, of course, are given merely by way of example and not in a restrictive sense. I might add that this assembly has been proved by actual tests to fulfill the strict requirements of a multi-stylus facsimile machine.

It is to be understood that my invention is not limited to the particular constructions herein set forth, for various changes are possible within the scope of the appended claims.

I claim:

1. In facsimile scanning mechanism, a stylus holder comprising a piston provided with an axial bore adapted to receive a stylus, means on the front end of said holder for removably securing a stylus in the piston bore, a metal cylinder in which said piston is slidably mounted, a metal piece attached to the rear end of said piston, a coil spring arranged in said bore between said metal piece and the inner end of an inserted stylus, which is thereby placed in electric pressure contact with said metal piece, and a second coil spring in said cylinder for constantly urging the piston and stylus forward as a unit, whereby the stylus is held in yieldable pressure contact with a sheet to be scanned.

2. In a scanning device for facsimile machines, a stylus assembly comprising a metal cylinder, a piston slidably supported in said cylinder and having an axial bore

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adapted to receive a stylus, a metal piece secured to the inner end of said piston, a spring conductor arranged in the piston bore between said metal piece and the inner end of an inserted stylus, and means for maintaining a permanent electric connection between said metal piece and said cylinder irrespective of the piston movements.

3. In a scanning device for facsimile machines, a stylus assembly comprising a metal cylinder provided at its rear end with an abutment, a piston of insulating material slidably supported in said cylinder and having an axial bore adapted to receive a stylus, a metal piece attached to the end of said piston, an expanding coil spring mounted in said cylinder between said metal piece and said abutment whereby said spring constantly urges the piston forward and forms a permanent electric connection between the metal piece and the cylinder irrespective of the piston movements, and a second coil spring arranged in the piston bore between said metal piece and the inner end of the stylus, which is thereby electrically connected to the metal cylinder.

4. Multi-stylus scanning mechanism for facsimile machines comprising a belt of flat spring metal operatively mounted, said belt being slightly flexible transversely, a plurality of stylus assemblies carried by said belt, each assembly comprising a cylinder rigidly secured to the belt and extending transversely thereof, a stylus operatively supported by each cylinder, a fixed bar arranged parallel to said belt in a position to be engaged by each cylinder throughout the scanning path, said bar being so placed that the engagement of said cylinders with the bar produces a transverse flexure in the belt which thereby holds each cylinder in pressure contact with said bar, and adjustable means carried by each cylinder for regulating the vertical position of the stylus in its linear scanning path.

5. Multi-stylus scanning mechanism for facsimile machines comprising a belt which carries a plurality of stylus assemblies, each assembly comprising a cylinder in which a stylus is supported, an eccentric collar adjustably mounted on each cylinder, and a fixed bar arranged to be engaged by said collars in pressure contact during the scanning movements of the cylinders, the angular position of each collar determining the vertical position of the cylinder and therefore the position of the linear scanning path traced by the supported stylus.

6. In a facsimile scanning device, a stylus assembly comprising a cylinder, a piston therein having an axial bore and constructed of an insulating material having low frictional characteristics, an axial rod affixed to said piston and extending rearwardly beyond said cylinder, a forwardly extending metal stylus within the bore of said

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piston extending beyond said cylinder, a contact making spring within said bore pushing against said rod and against said stylus, a locking member engaging said stylus to prevent its ejection under pressure of the said spring, a piston spring within the cylinder for applying constant forward pressure to said piston, means to adjust the forward pressure on said piston, means to limit the forward motion of said piston, and means to prevent the rotation of said piston in said cylinder.

7. In a facsimile scanning device, a stylus assembly constructed according to claim 6 wherein the said means to limit the forward motion of the said piston comprises an adjustable collar on said rod.

8. In a facsimile scanning device, a stylus assembly constructed according to claim 6 in which the said means to prevent rotation of said piston in said cylinder consists of a resilient conduit of flexible material attached to said piston at one end and to said cylinder at the other end thereof.

9. Multi-stylus scanning mechanism for facsimile machines comprising a belt of flexible spring metal operatively supported, a plurality of stylus assemblies carried by said belt, each assembly comprising a cylinder, a forwardly spring urged piston therein having a stylus seat and a stylus projecting forwardly therefrom and a fixed cylinder supporting bar out of contact with the piston the said bar being immovably secured at the stylus-bearing end of the said cylinders for cylinder-supporting contact during scanning operation, and being oriented in a direction parallel to the run of said belt at a distance from the line of centers of the supports thereof sufficient to produce a substantial belt-deflecting normal force between said cylinders and said cylinder supporting bar at the point of contact therebetween.

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