Sept. 2, 1958 A. TEPLITZ 2,850,092

FLYING SHEAR

Filed March 1, 1956 3 Sheets-Sheet 1

FIG. 1.

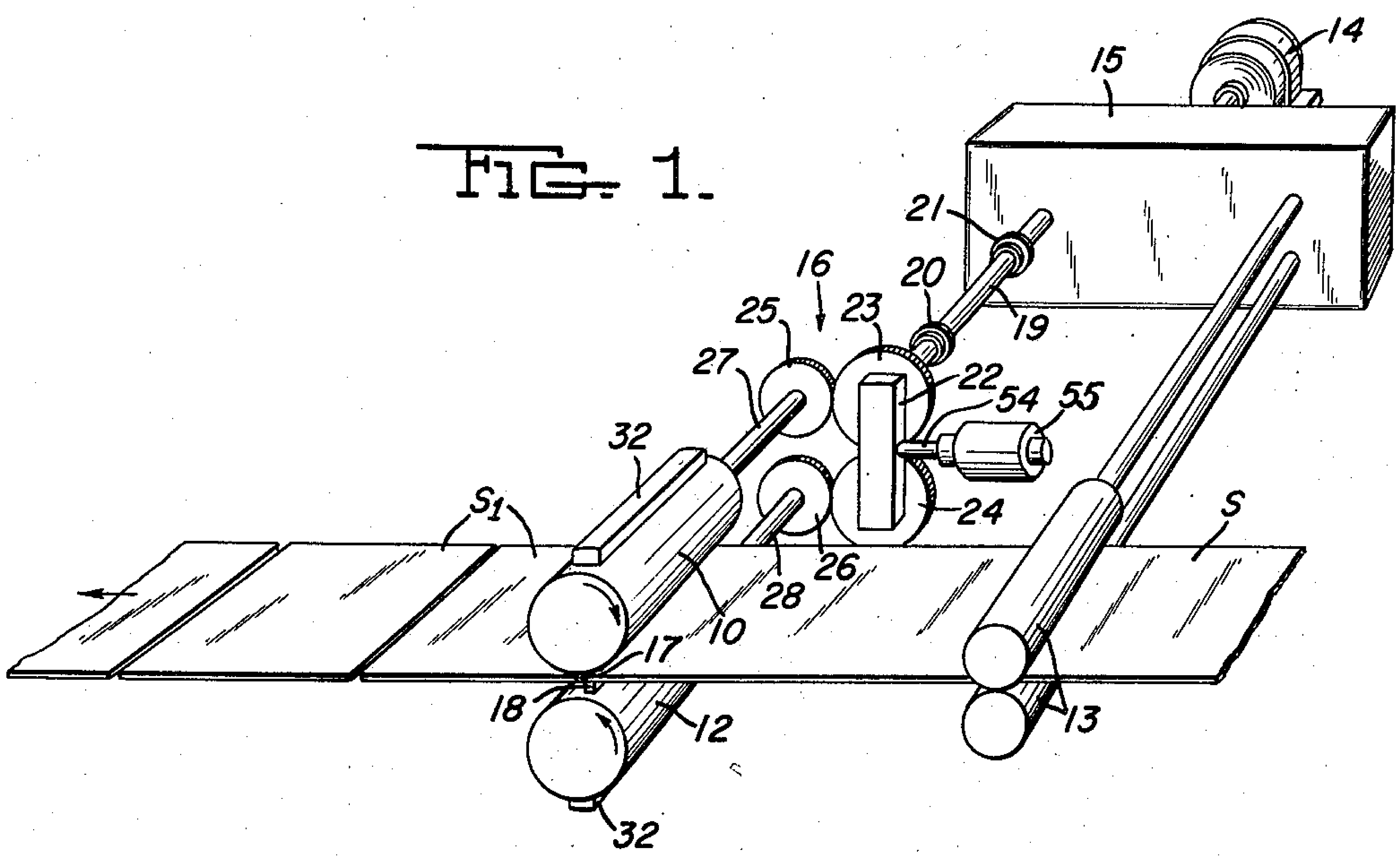

FIG. 2.

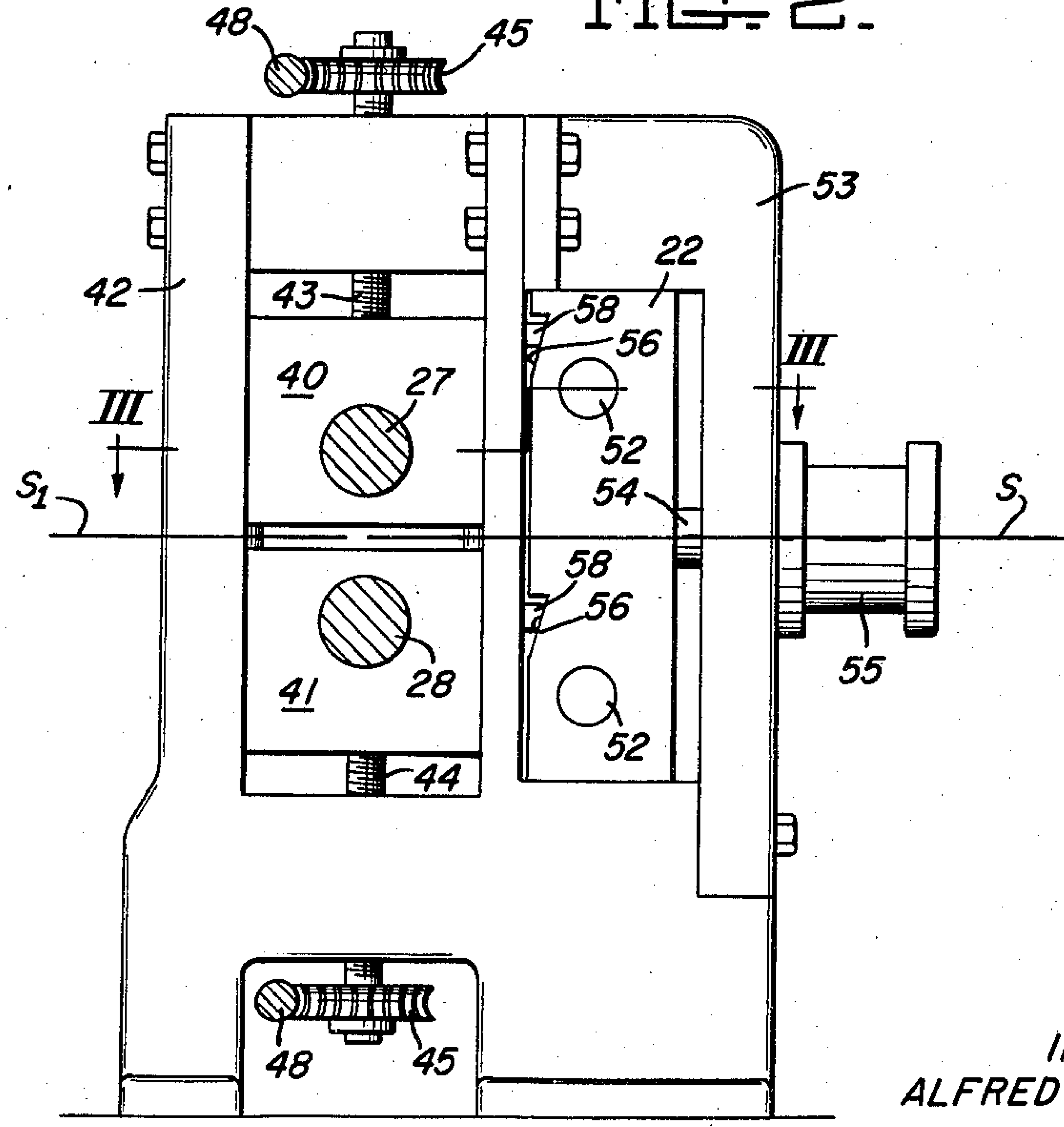

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FIG. 3.

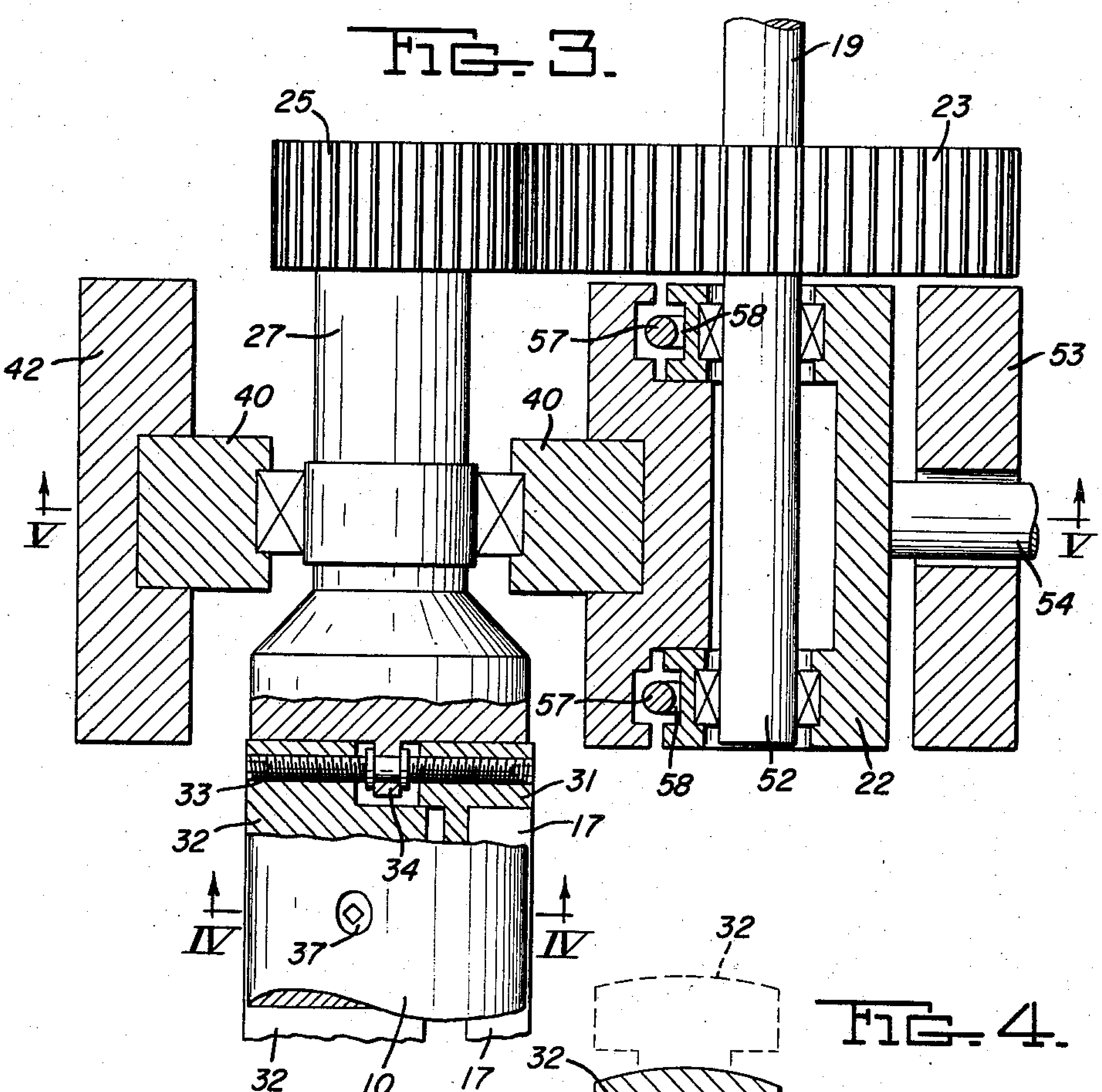

FIG. 4.

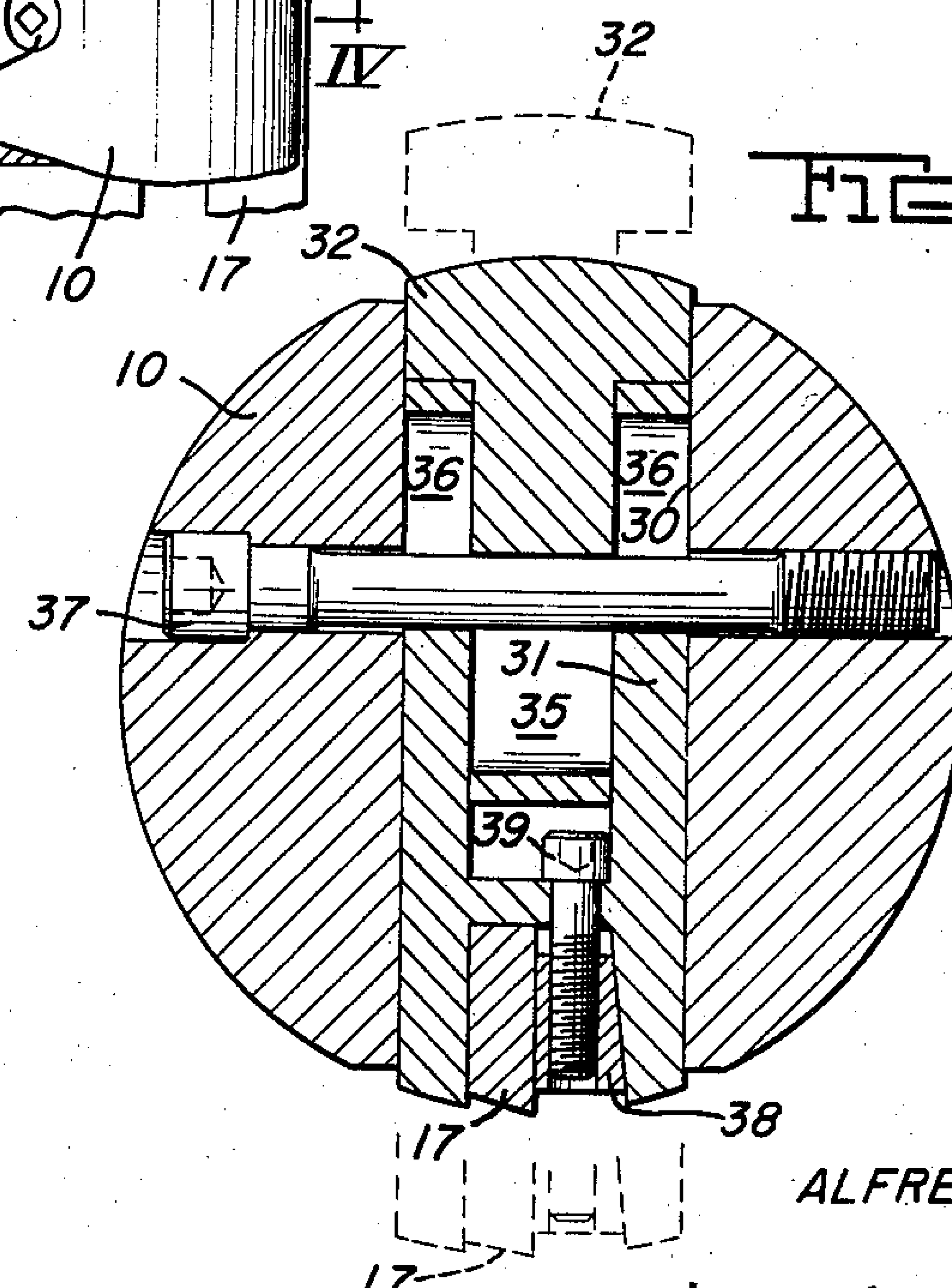

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FIG. 5.

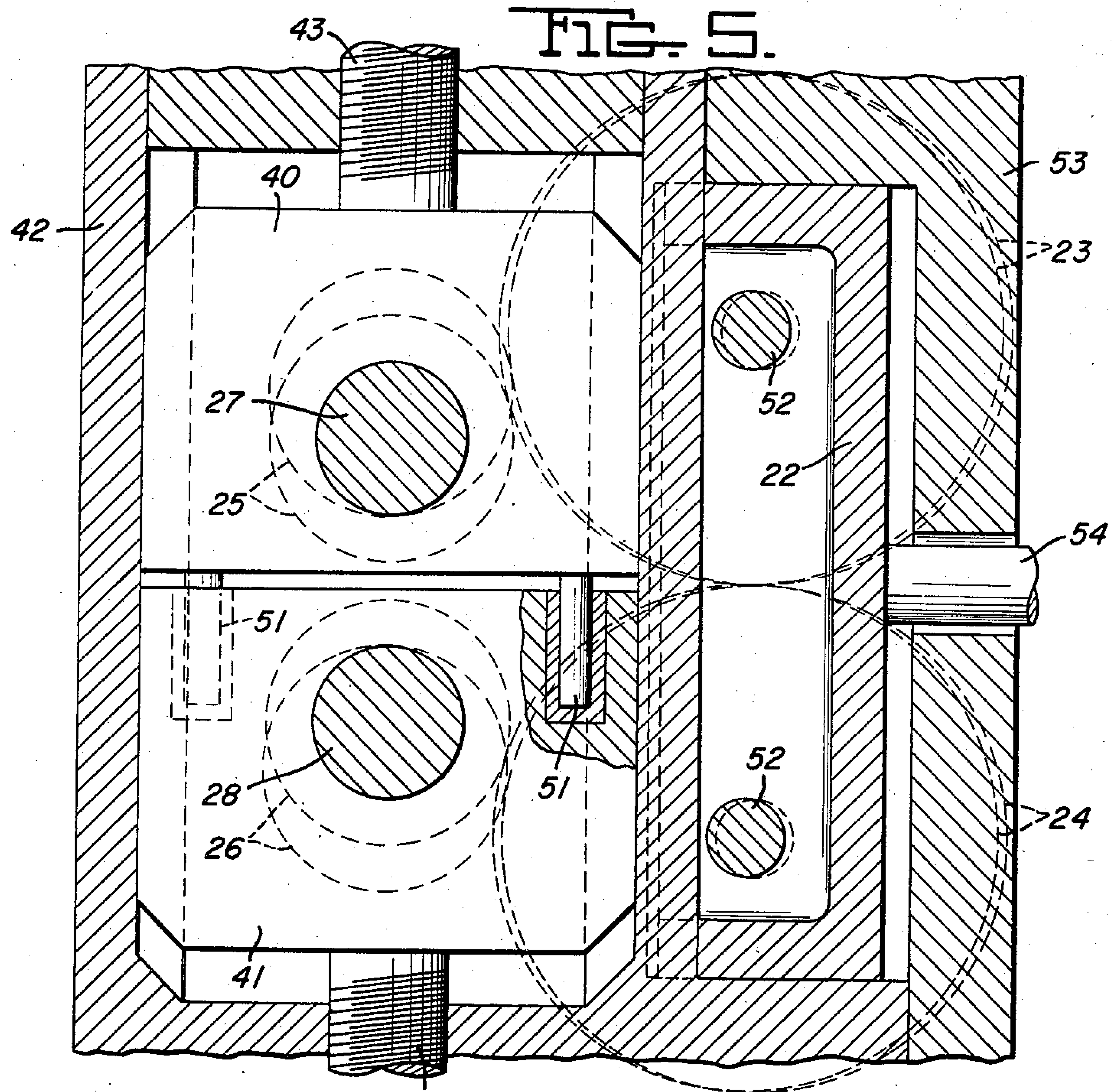
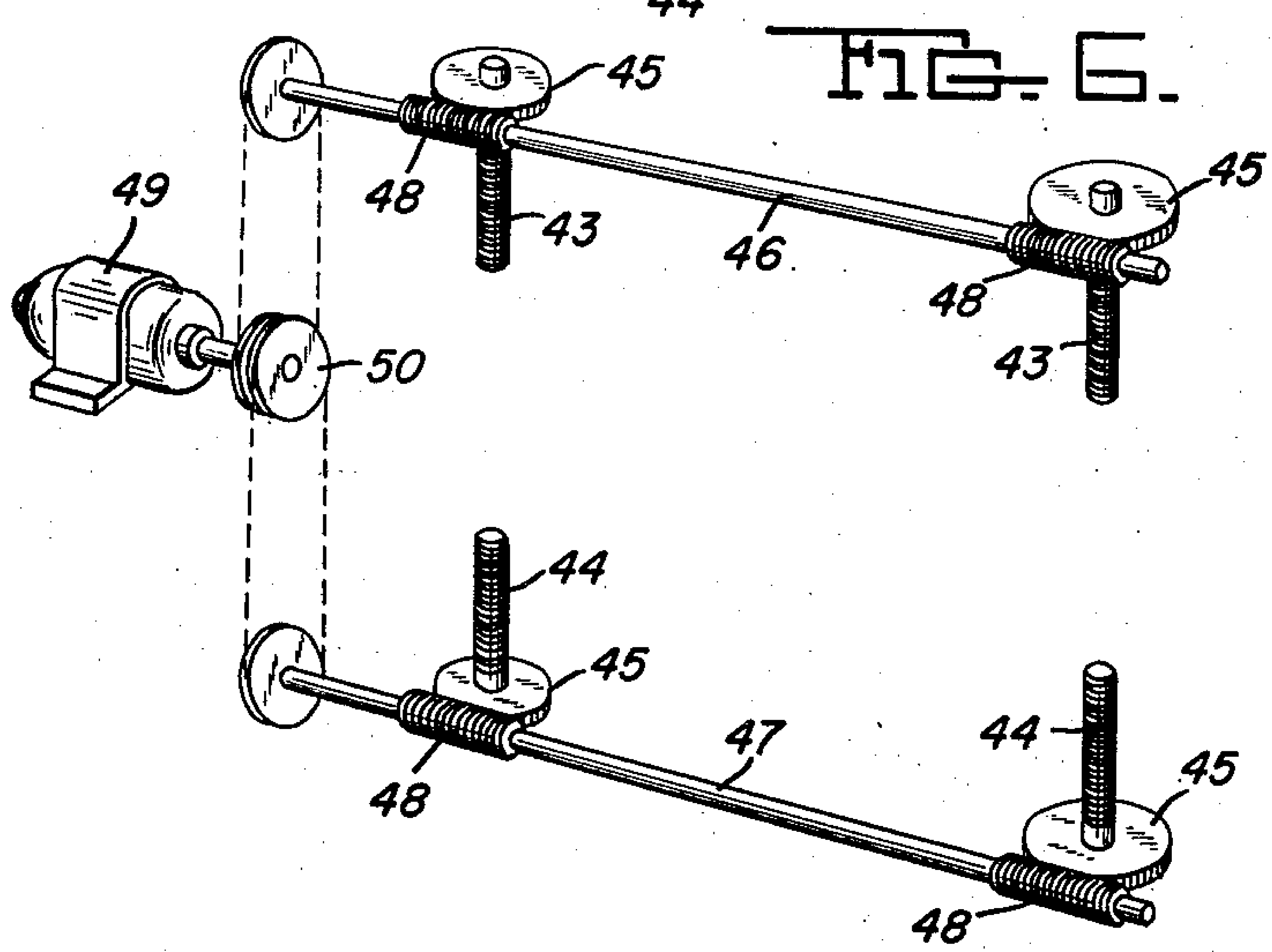


FIG. 6.



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2,850,092

FLYING SHEAR

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Application March 1, 1956, Serial No. 568,743

4 Claims. (Cl. 164—68)

This invention relates to an improved drum-type flying shear for cutting continuous strip material into individual sheets.

A drum-type flying shear includes a pair of opposed power driven drums, each of which carries a knife extending from its circumference parallel to its axis. A set of pinch rolls pushes a strip between the drums as the latter rotate. Once each drum revolution the two knives close on the strip and cut off a sheet, but otherwise the drums clear the strip. At times it is necessary to change the length of sheets cut from the strip to meet changing specifications. The sheet length of course equals the distance the strip travels per drum revolution, and can be changed by changing the relative speed of the strip and drums. At the moment of cutting, the linear speeds of the strip and knives must match to prevent the knives from buckling or stretching the strip. Since changes in the relative speeds would disturb this linear speed relation, some form of compensation is necessary, and conventionally is attained by varying the rate of drum rotation in different portions of each revolution. The speeds match only at the moment of cutting; during the remainder of each revolution the knife speed is different, whereby each drum revolution consumes exactly the interval needed for the strip to travel the requisite distance. Several arrangements are known for periodically varying drum speed during the course of each revolution, for example, elliptical or differential gearing in the drum drive, but all are quite complex. However, their main disadvantage is that parts must continually accelerate and decelerate, and hence are unduly stressed, a factor which limits the operating speed of such equipment.

An object of the present invention is to provide an improved flying shear whose drums rotate at a constant speed through out each revolution, and yet which allows changes to be made in the length of sheet cut from the strip.

A further object is to provide a flying shear in which no mechanism is necessary to synchronize drum speed with strip speed.

A further object is to provide an improved flying shear in which compensation for changes in relative speed or in length of sheets cut from the strip is attained by varying the radii of revolution of the knives.

A more specific object is to provide an improved flying shear in which the radii of revolution of the knives are adjustable, the axes of the drums are correspondingly adjustable to maintain the knives in proper cutting relation with the strip, and drive for the drums is adjustable to allow the other adjustments to take place.

In accomplishing these and other objects of the invention, I have provided improved details of structure, a preferred form of which is shown in the accompanying drawings, in which:

Figure 1 is a schematic perspective view of a flying shear constructed in accordance with my invention;

Figure 2 is a side elevational view of the inside of

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one of the housings and the chocks in which the shear drums are mounted;

Figure 3 is a horizontal section on a larger scale on line III—III of Figure 2;

Figure 4 is a vertical section on a still larger scale on line IV—IV of Figure 3;

Figure 5 is a vertical section on the same scale as Figure 3 on line V—V thereof; and

Figure 6 is a schematic view of the drive for adjusting the positions of the drum axes.

Figure 1 shows somewhat schematically a portion of a line for shearing continuous strip S, for example of metal, into individual sheets S1. The line includes upper and lower shear drums **10** and **12** constructed in accordance with my invention, a conventional set of pinch rolls **13** for pushing the strip between these drums, a motor **14** for driving both the drums and pinch rolls, conventional change speed gearing **15** for correlating the drum and roll speeds, and power transmission means **16** between the gearing and drums. As described in more detail hereinafter, drums **10** and **12** carry knives **17** and **18** respectively whose radii of revolution are variable. These knives are adjusted to positions where the circumferences of the circles their cutting edges describe equal the length of sheets S1. The change speed gearing **15** is adjusted to drive the drums at a constant rate at which the linear speed of the knives equals that of the pinch rolls and strip. Examples of suitable gearing for this purpose are a cone step gear system or that sold by the Link Belt Comany under the tradmark "P. I. V."

Adjustment of the radii of revolution of the knives necessitates a corresponding adjustment in the position of the drum axes to maintain the proper knife spacing for cutting. The transmission means **16** includes a shaft **19** which extends from the change speed gearing **15** and contains universal joints **20** and **21**. This transmission means also includes a yoke **22** on which a pair of meshing drive gears **23** and **24** are journaled, the upper drive gear **23** being connected to the shaft **19**. The gears **23** and **24** mesh with pinions **25** and **26** respectively keyed to shafts **27** and **28** which extend from the upper and lower drums **10** and **12**. As hereinafter described, the bearings for shafts **27** and **28** are vertically adjustable to afford the necessary adjustment in the drum axes. To drive the pinions **25** and **26** on these shafts through their range of vertical adjustment, the yoke **22** is mounted for horizontal adjustment. After the drums and their shafts are adjusted vertically to the desired position, the yoke is adjusted horizontally so that the drive gears **23** and **24** mesh with the pinions **25** and **26** respectively. The universal joints **20** and **21** furnish the necessary flexibility in the shaft **19** to transmit a driving torque to these gears despite variations in their position.

Figures 3 and 4 show in more detail the novel drum construction embodied in my invention. Since the two drums **10** and **12** are similar, only the upper drum **10** is shown. The drum body contains a diametric slot **30** in which a knife carrier **31** and counterweight **32** are mounted for radial adjustment. A pair of diametric spindles **33** are journaled in bearings **34** which project from the drum body into opposite ends of the slot **30**. These spindles have portions which carry right and left handed threads engaged respectively with the knife carrier **31** and counterweight **32**. These spindles can be turned in either direction with a suitable wrench to move both the knife carrier and counterweight outwardly or inwardly. The purpose of the counterweight is to assure that the drum remains balanced despite adjustments in the knife position. Preferably the knife carrier is U-shaped in cross section and the counterweight is T-shaped with its leg fitting between the arms of the U, as shown in Figure 4.

The leg of the counterweight and the arms of the U preferably contain slots 35 and 36 through which extends a transverse clamp screw 37, threadedly engaged with the drum body. The knife 17 can be fixed to the knife carrier by any suitable means, such as a lock wedge 38 and lock screws 39, as illustrated.

Figures 2, 3 and 5 show in more detail the mounting of the drum bearings to afford vertical adjustment. The drum shafts 27 and 28 are journaled in antifriction bearings in upper and lower chocks 40 and 41, which are mounted for vertical movement in upright main housings 42. Upper and lower vertical positioning screws 43 and 44 are threadedly engaged with the housings and are connected with the respective chocks for positioning the drums. Preferably the two upper and two lower screws have a common power drive, such as that shown schematically in Figure 6. This drive includes four worm gears 45 each carried by a different one of the screws 43 and 44. Upper and lower transverse shafts 46 and 47 are journaled in bearings at the top and bottom of the housings 42 and carry worms 48 which mesh with the respective worm gears. The two shafts 46 and 47 are driven in unison by a motor 49 through a chain and sprocket mechanism 50. The upper and lower chocks also can be held apart by hydraulic cylinders 51, similar to those conventionally used in rolling mills.

Figures 2, 3 and 5 also show in more detail the transmission means for driving the drums. As shown in Figure 3, the upper pinion 25 is keyed directly to the drum shaft 27. The upper drive gear 23 is keyed to a stub shaft 52 journaled in antifriction bearings in the yoke 22, and the shaft 19 is fixed to the other side of this gear. The corresponding lower elements are similar, except for the absence of the last named shaft. The yoke 22 is slidably supported in an auxiliary housing 53 mounted beside one of the main housings 42 and carries an operating rod 54 extending from its outer face. A fluid pressure cylinder 55 is mounted on the outside of the auxiliary housing and contains a reciprocable piston to which said operating rod is connected. The inner face of the yoke contains one or more notches 56 which afford wedge surfaces. One or more rods 57 are supported for vertical movement in guideways formed in the adjacent face of the main housing. Said rods carry wedges 58 cooperable with the wedge faces of the notches 56 for limiting movement of the yoke 22 toward the main housing 42 and thus preventing jamming of the gears 23 and 24 against the pinions 25 and 26.

To set up the shear to cut sheets of any chosen length, pressure on the cylinder 55 is released to allow the yoke 22 and drive gears 23 and 24 to retract. The motor 49 is operated to turn the positioning screws 43 and 44 to separate the drums 10 and 12. With the clamp screws 37 in the drums released, the spindles 33 are turned to move both knives 17 and 18 to positions where the circumferences of circles their edges describe as the drums rotate equal the sheet length. Knowing the desired circumference, the radii of revolution of the knives are of course easily determined. The counterweights 32 are adjusted automatically with the knives to maintain the drums in balance. The clamp screws 37 are tightened and the motor 49 operated to position the drums for cutting. The rods 57 are adjusted to a position where their wedges 58 prevent movement of the yoke 22 beyond where the drive gears 23 and 24 engage the pinions 25 and 26 without jamming. Pressure is applied to the cylinder 55 to engage the gears with the pinions. The change speed gearing 15 is adjusted to drive the drums 10 and 12 at a constant rate at which the linear speed of the knives 17 and 18 equals that of the pinch rolls 13.

From the foregoing description it is seen that the present invention affords a flying shear in which the drums can rotate at a constant rate in any position of knife adjustment, thus eliminating repeated acceleration and deceleration. The drive mechanism is much simplified over conventional drives which turn at varying rates. The arrangement also allows adjustment in the sheet length through a substantial range.

While I have shown and described only a single embodiment of my invention, it is apparent that modifications may arise. Therefore, I do not wish to be limited to the disclosure set forth but only by the scope of the appended claims.

I claim:

1. A flying shear for cutting moving strip into sheets of a selected length comprising spaced apart main housings, upper and lower rotatable drums journaled in said housings and between which the strip travels for cutting, a pair of knives mounted on the respective drums for radial adjustment to positions where they describe circles whose circumferences equal the selected sheet length, means carried by said drums for maintaining them in balance with adjustment of said knives, means for adjusting the separation of said drums to position said knives for cutting in any radial position to which they are adjusted, pinions connected to the respective drums, drive gears meshing with each other and with the respective pinions, a member which is supported for adjustment toward and away from said pinions and to which said gears are journaled, and power means for driving said drums through said gears and pinions at a constant rate at which the linear speed of the knives equals that of the strip, adjustment of said member maintaining said gears in mesh with said pinions as the drum separation is adjusted.

2. A drive for the drums of a flying shear comprising a pair of pinions connected to the respective drums, a pair of drive gears meshing with each other and with the respective pinions, a yoke to which said gears are journaled, a support on which said yoke is mounted for adjustment toward and away from said pinions, adjustment in the yoke position maintaining said gears in mesh with said pinions despite adjustment in the drum separation, means for driving said gears at a constant rate, and stop means for limiting movement of said yoke toward said pinions to prevent jamming.

3. In a flying shear for cutting moving strip into sheets of a selected length, said shear including spaced apart main housings, upper and lower chocks mounted in said housings for vertical adjustment toward and away from each other, power means for adjusting said chocks in unison, upper and lower rotatable drums journaled in said chocks, means for pushing the strip between said drums at a constant linear speed for cutting, a pair of knives mounted on the respective drums for radial adjustment to positions where they describe circles whose circumferences equal the selected sheet length, counterweights carried by said drums for maintaining them in balance with adjustment of said knives, vertical adjustment of said chocks adjusting the separation of said drums and thus positioning said knives for cutting in any radial position to which they are adjusted, the combination with said drums and one of said housings of a drive means for rotating the drums at a constant rate at which the linear speed of the knives equals that of the strip, said drive means comprising an auxiliary housing fixed to one side of one of said main housings, a yoke slidably mounted in said auxiliary housing for movement toward and away from said main housing, a pair of drive gears journaled to said yoke and meshing with each other, a pair of pinions connected to the respective drums and each adapted to mesh with a different one of said gears irrespective of the position of vertical adjustment of said chocks, means connected to said yoke and urging said gears into meshing relation with said pinions, stop means to prevent said gears from jamming against said pinions, and means for applying a driving torque to one of said gears.

4. A combination as defined in claim 3 in which said stop means includes at least one vertically adjustable

rod, and said rod and said yoke have cooperating wedge faces engageable to limit movement of said yoke toward said housing.

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