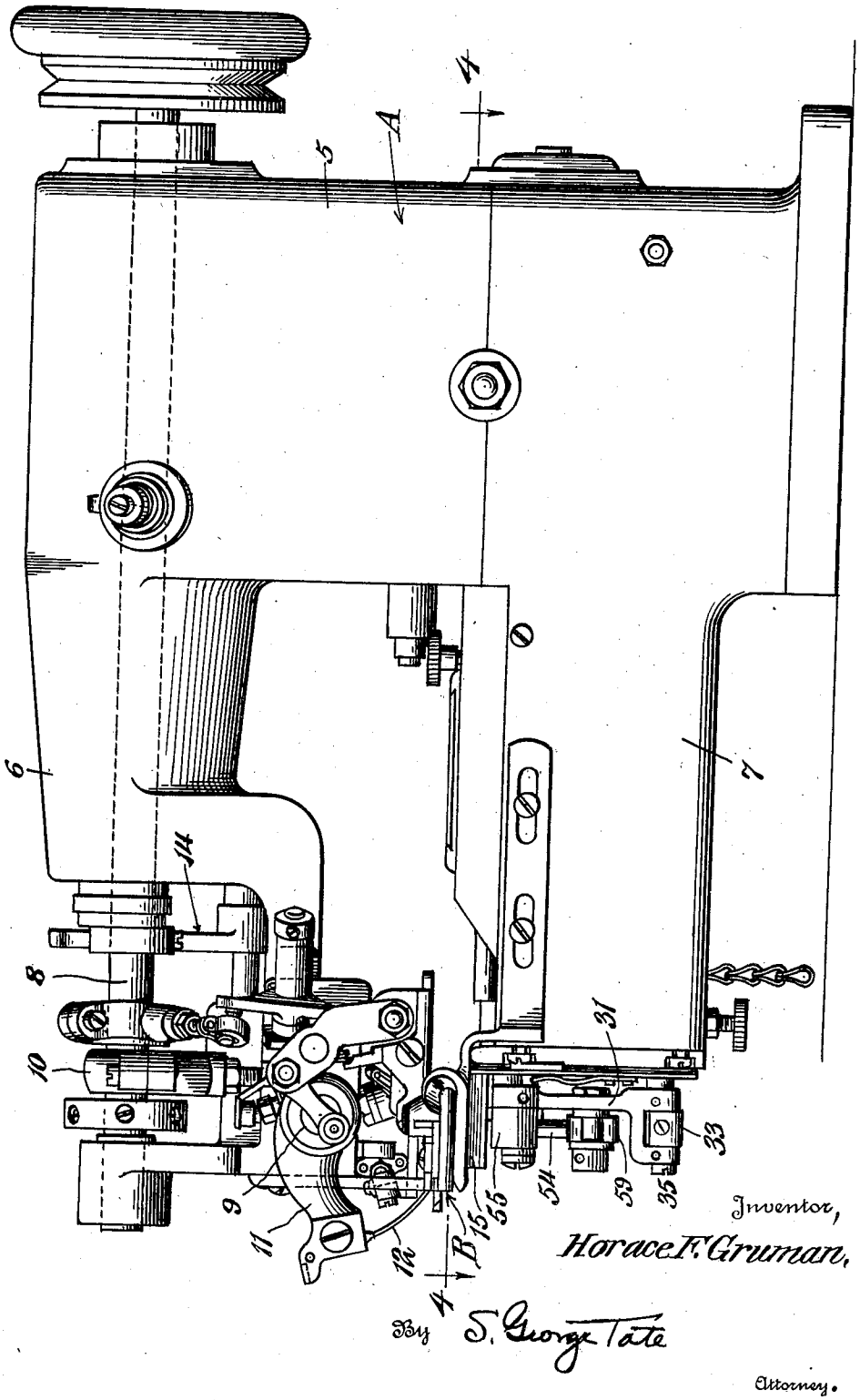
April 30, 1940. H. F. GRUMAN 2,199,174

DIFFERENTIAL FEEDING MECHANISM FOR SEWING MACHINES

Original Filed April 12, 1937 5 Sheets-Sheet 1

Fig. 1.



Inventor,
Horace F. Gruman,
By S. George Tate
Attorney.

April 30, 1940. H. F. GRUMAN 2,199,174

DIFFERENTIAL FEEDING MECHANISM FOR SEWING MACHINES

Original Filed April 12, 1937 5 Sheets-Sheet 2

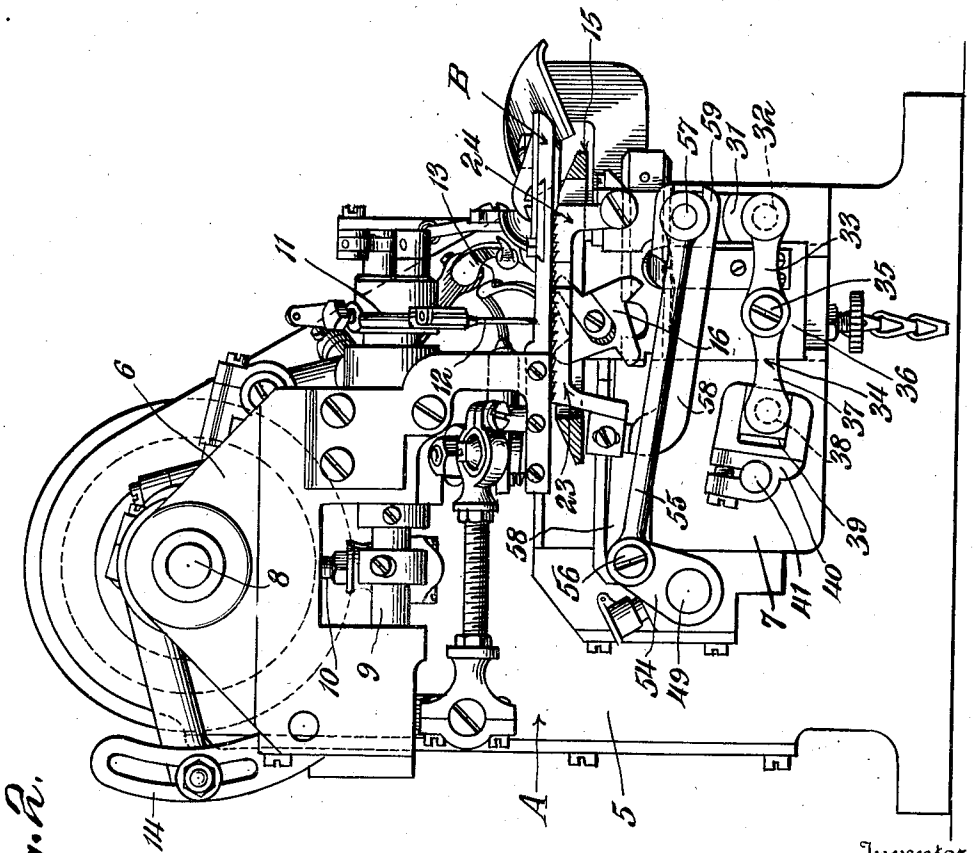


Fig. 2.

Inventor,

Horace F. Gruman,

By S. George Tate

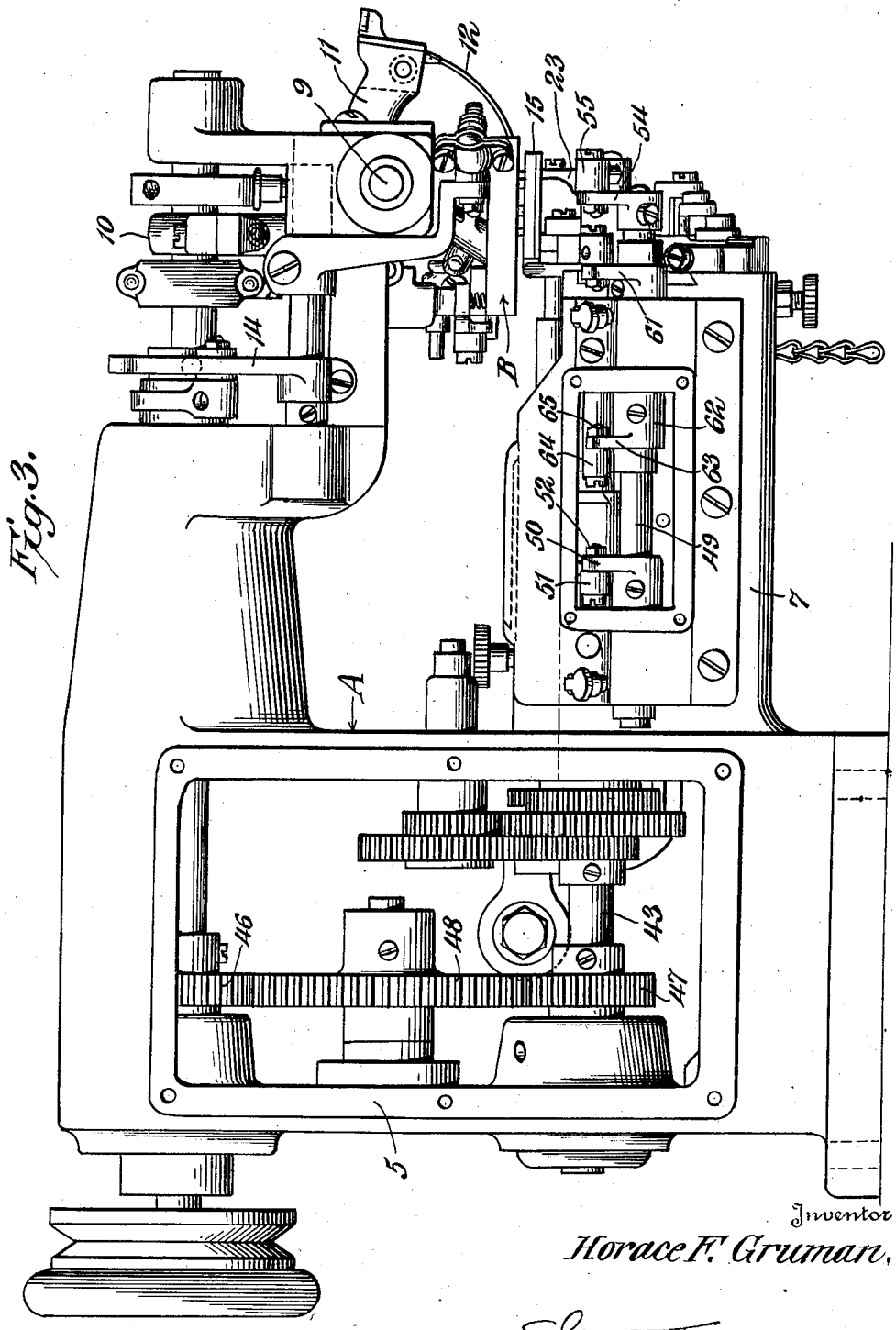
Attorney

April 30, 1940. H. F. GRUMAN 2,199,174

DIFFERENTIAL FEEDING MECHANISM FOR SEWING MACHINES

Original Filed April 12, 1937 5 Sheets-Sheet 3

Fig. 3.



Inventor,
Horace F. Gruman,
By S. George Tate
Attorney

April 30, 1940. H. F. GRUMAN 2,199,174

DIFFERENTIAL FEEDING MECHANISM FOR SEWING MACHINES

Original Filed April 12, 1937 5 Sheets-Sheet 4

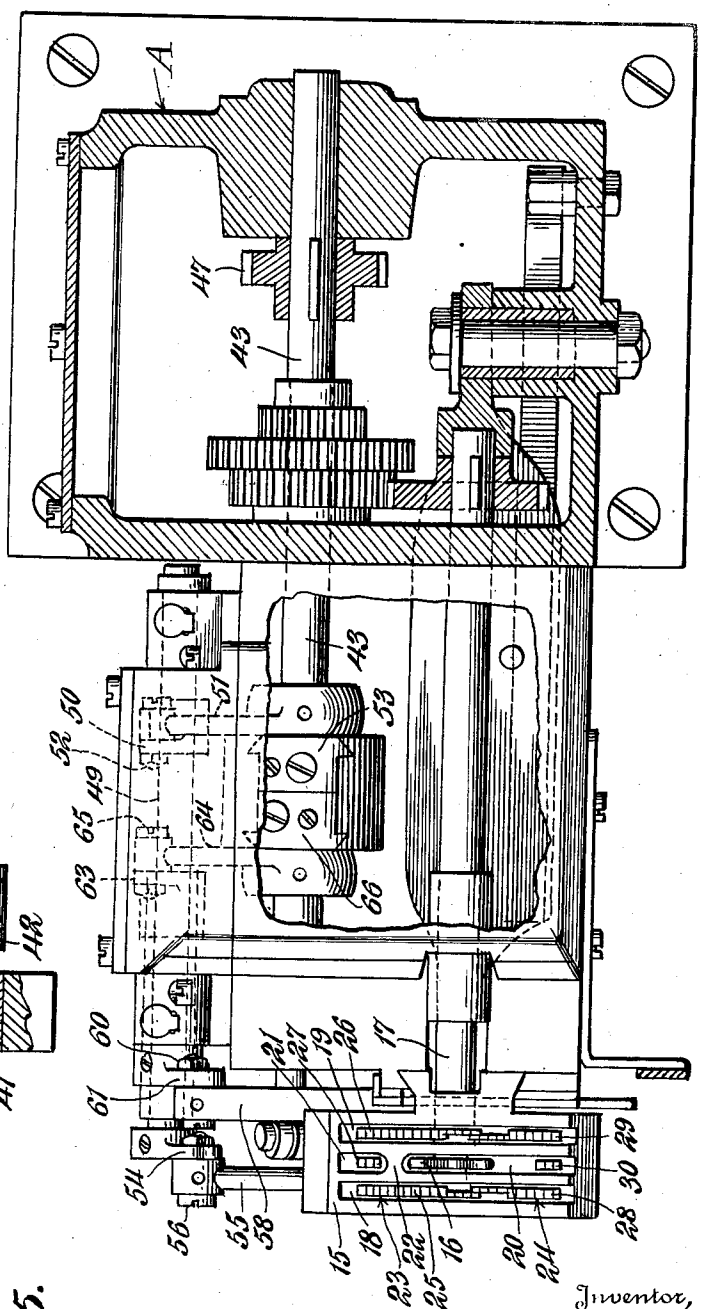


Fig. 4.

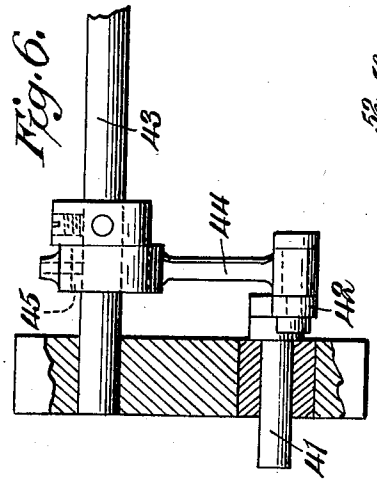


Fig. 6.

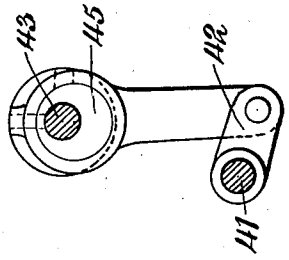


Fig. 5.

Inventor,
Horace F. Gruman,
By S. George Tate
Attorney,

April 30, 1940. H. F. GRUMAN 2,199,174

DIFFERENTIAL FEEDING MECHANISM FOR SEWING MACHINES

Original Filed April 12, 1937 5 Sheets-Sheet 5

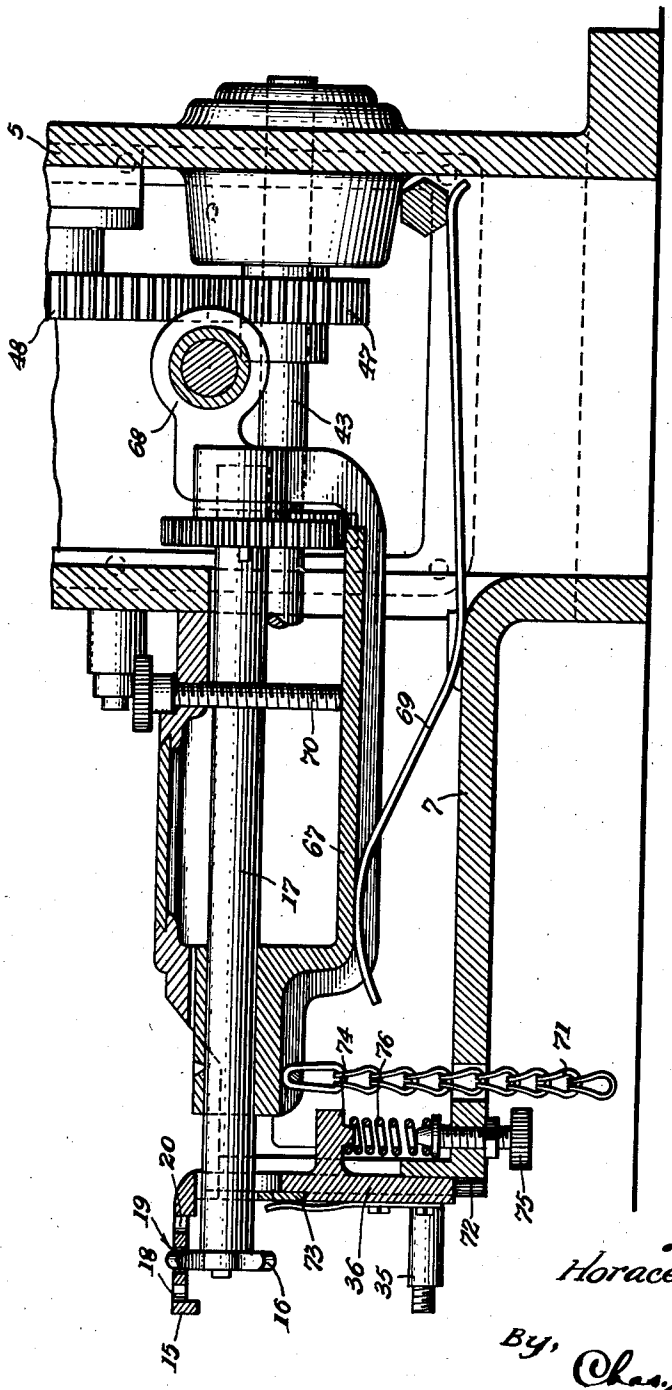


Fig. 7.

Inventor;
Horace F. Gruman.

By, Chas. J. Dillon
Attorney

Patented Apr. 30, 1940 2,199,174

UNITED STATES PATENT OFFICE

2,199,174

DIFFERENTIAL FEEDING MECHANISM FOR SEWING MACHINES

Horace F. Gruman, St. Louis, Mo., assignor to Geoffrey Stevenson, Buffalo, N. Y.

Original application April 12, 1937, Serial No. 136,466. Divided and this application October 25, 1937, Serial No. 170,918

11 Claims. (Cl. 112—208)

This invention relates to new and useful improvements in blind stitch sewing machines adapted especially for hemming operations, although more particularly to a differential feeding mechanism therefor.

This application constitutes a division of my parent application Serial No. 136,466, filed April 12, 1937, for Improvements in sewing machines.

The principal object of the invention is to provide a differential feeding mechanism which is simple in construction and which is especially adapted for feeding the fabric from the hemmer to the stitch forming mechanism.

With the above and other objects in view which will more fully appear, the nature of the invention will be more clearly understood by following the description, the appended claims, and the several views illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a front elevation of a sewing machine embodying my invention,

Figure 2 is a left end elevation thereof,

Figure 3 is a rear elevation of the machine, cover plate portions being removed for the purpose of better illustration,

Figure 4 is a horizontal section taken on the line 4—4 of Figure 1,

Figures 5 and 6 are detail views showing the driving connection for the feed lift rock shaft, and

Figure 7 is a fragmentary vertical section taken through the work support and the lower portion of the frame standard at the axis of the ridge forming element carrying shaft.

Like reference numerals designate corresponding parts throughout the several figures of the drawings.

The sewing machine which embodies my invention includes a main frame A having a hollow standard 5 and upper and lower hollow arms 6 and 7 which extend laterally from the left side of the standard. A main shaft 8 extends longitudinally along the upper arm 6 and across the standard 5. A horizontal presser foot B having an opening, is rigidly attached to the free end of the upper arm 6. An oscillatory horizontal needle shaft 9 extends at right angles to the main shaft 8 and is journaled in the upper arm 6 above the presser foot B, said needle shaft being driven from the main shaft by connections indicated generally at 10. A needle arm 11 is fixed to the shaft 9 and attached to said arm is a needle 12 which reciprocates across the presser foot opening. A looper 13 which cooperates with the needle to form connected blind stitches, is driven from the main shaft 8 by connections indicated generally at 14. A vertically yieldable work supporting clamp 15 cooperates with the bottom of the foot B. A rotatable ridge forming element 16 functions to project nodes of fabric upwardly through the presser foot opening into needle penetrating position, the element 16 being mounted on a shaft 17 which is journaled in the lower frame arm 7 and is driven from the main shaft 8 by suitable connections.

The work clamp 15 is provided with three parallel and longitudinally extending feed slots of equal length, there being two side slots 18, 19 and an interrupted intermediate slot comprising a front portion 20, a rear portion 21, and a "chaining-off" bridge 22. These slots extend from a point well in front of the needle path to a point well in rear thereof.

Cooperating with the under face of the presser foot B to feed the fabric rearwardly are a 4-motion main feed dog 23 and a 4-motion differential feed dog 24. The main feed dog 23 includes two long side sections 25, 26 and a short intermediate section 27 which operate in the rear portions of the feed slots of the work clamp. The side sections are disposed on opposite sides of the presser foot opening and extend forwardly to a point slightly in front of the needle path, but the intermediate section is disposed wholly in rear of the needle path in rear of said opening. The differential feed dog includes two long side sections 28, 29 and a short intermediate section 30 which operate in the front portions of the feed slots in the work clamp. The side sections 25, 28 and 26, 29 of the feed dogs are arranged in overlapping relation for engaging the body fabric throughout the combined length of both dogs.

The differential feed dog 24 is attached to the upper end of a vertically disposed differential feed bar 31 which is fulcrumed at its lower end as at 32 to the front arm 33 of a horizontal feed lift lever 34 which is fulcrumed as at 35 on the shank 36 of the vertically movable work clamp 15. Pivotally mounted on the rear arm 37 of the lever as at 38 is a slide block 39 which is slidably mounted in a forked rock arm 40. The arm 40 is fixed to and extends from a feed lift rock shaft 41 which is journaled in the rear portion of the lower frame arm 7. The shaft 41 is provided with a rock arm 42 located within the frame arm 7 and this arm 42 is oscillated from a horizontal countershaft 43, which extends lengthwise of the arm 7 and across the standard, by a pitman 44

which is pivotally connected at its lower end to the rock arm and has its upper end engageable with a driving eccentric 45 fixed to said countershaft as shown in Figs. 5 and 6. The shaft 43 is driven from the main shaft 8 by a 1-to-1 gear coupling located within the standard 5 and comprises a driving gear 46 fixed to the main shaft, a driven gear 47 fixed to the driven countershaft 43, and an intermediate gear or idler 48 journaled on the standard. Although I have specifically shown and described a gear coupling between the main shaft 8 and the countershaft 43, any other known mechanical driving means having a 1-to-1 ratio may be employed and I therefore use the term "gear coupling" in its broadest sense. Thus during each rotation of the main shaft the differential feed dog will be raised and lowered. Journaled in the lower frame arm 7 in rear of the rock shaft 41 is a differential feed travel rock shaft 49 which is actuated from the driven shaft 43 by means of a rock arm 50 located within the lower frame arm 7 and fixed to the shaft 49, and a pitman 51 which is pivotally connected as at 52 to said rock arm and has operative connection with the driven shaft through the medium of an adjustable eccentric fixed to said driven shaft and indicated as an entirety by the numeral 53. Fixed to the left hand end of the rock shaft 49 is a rock arm 54 and a horizontal link 55 is pivotally connected at its rear end as at 56 to said rock arm and is pivotally connected at its front end to a stud or pin 57 fixed to the differential feed bar 31. Consequently a back and forth movement will be imparted to the differential feed dog 24 during each rotation of the main shaft, and by adjusting the eccentric 53 the feed stroke of the dog may be varied.

The main feed dog 23 is attached to a forwardly and slightly downwardly inclined main feed bar 58. The front end of the bar is provided with a fork 59 which has sliding engagement with the pin 57 fixed to the differential feed bar 31 and consequently the front end of the main feed bar is supported by and moves upwardly and downwardly with said differential feed bar. The rear end of the main feed bar 58 is pivotally connected as at 60 to a rock arm 61 fixed to a sleeve or tubular feed travel shaft 62 which surrounds the differential feed travel shaft 49. A rock arm 63 is fixed to the tubular shaft 62 and this arm is oscillated from the driven countershaft 43 by a pitman 64 which is pivotally connected as at 65 with said rock arm and has operative connection with the driven shaft through the medium of an adjustable eccentric fixed to said driven shaft and indicated as an entirety by the numeral 66. Consequently a back and forth movement will be imparted to the main feed dog during each rotation of the main shaft, and by adjusting the eccentric 66 the feed stroke of the dog may be varied.

From the foregoing, it will be seen that both feed dogs are moved upwardly and downwardly in unison, and that the feed travels of the dogs are independently adjustable.

The shaft 17 on which the ridge forming element 16 is mounted is rotatably supported in a lever arm 67 which is swingable in a vertical plane about a fulcrum designated 68 and disposed within the frame standard 5. The lever arm 67, the shaft 17, and the ridge forming element 16 are urged upwardly toward the presser foot B by a leaf spring 69, and this upward movement is limited by an adjustable screw stop element 70, as illustrated in Figure 7 of the drawings. A treadle or knee-press operated chain 71 is connected with and depends from the free end of the lever arm 67, and by this means the lever arm can be depressed against the urge of the spring 69.

The shank 36 of the work support clamp 15 is vertically slidable in the guideway 72 and carries an interponent or bar element 73 which engages beneath the shaft 17 so that downward movement of the shaft 17 will be imparted through the element 73 to the shank 36. A lug 74 is extended from the shank 36 and is opposed by an adjustable abutment screw 75 rotatably mounted in the lower frame arm 7. A compression spring 76 is interposed between the lug 74 and the screw 75 and yieldably retains the shank and work supporting clamp against depression. It will be observed by reference to Figure 7 of the drawings that the fulcrum 35 on which the horizontal lift lever 34 is supported projects from and is movable with the shank 36.

In the operation of the feeding mechanism, let it be assumed that the differential feed bar 31 is beginning its upward stroke. The lever 34 is rocked about its fulcrum 35 and the feed bar is lifted until it engages the under face of the presser foot. The lever 34 then shifts its fulcrum to the pin 32 and consequently the original fulcrum 35 is moved downwardly taking the work clamp 15 therewith. This frees the fabric from its clamped condition between the foot and the work clamp, and permits the feed dogs to function. At the end of the feed stroke, the original fulcrum is moved upwardly while the auxiliary feed bar is moved downwardly, whereby the work clamp will be restored to its initial clamping position.

It will be obvious that by exerting a downward pull on the chain 71 the lever arm 67 and the shaft 17 can be depressed, and the downward movement of the shaft 17 will act through the interponent or bar element 73 to depress the shank 36 and the fulcrum 35 projecting therefrom and on which the horizontal lift lever is mounted, against the tension of the spring 76.

It is of course to be understood that the details of structure and arrangement of parts may be variously changed and modified without departing from the spirit and scope of my invention.

I claim:

1. In a differential feeding mechanism for sewing machines, the combination with a horizontal lift lever fulcrumed intermediate its ends, of a vertically disposed differential feed bar pivoted at its lower end to one end of said lift lever, a differential feed dog mounted on the upper end of said feed bar, means cooperating with the other end of said lift lever for oscillating said lever, a main feed travel rock shaft, a differential feed travel rock shaft, a rock arm fixed to the differential feed travel shaft, a link connecting said rock arm and said differential feed bar, a rock arm fixed to the main feed travel shaft, a link pivotally connected at one end to the last mentioned rock arm and having sliding pivotal connection at its other end with the differential feed bar, a main feed dog mounted on the last mentioned link, and separate means for rocking said shafts.

2. In a differential feeding mechanism for sewing machines, the combination with a horizontal lift lever fulcrumed intermediate its ends, of a vertically disposed differential feed bar pivoted at its lower end to one end of said lift lever, a differential feed dog mounted on the upper end

of said feed bar, means cooperating with the other end of said lift lever for oscillating said lever, a main feed travel rock shaft, a differential feed travel rock shaft, a rock arm fixed to the differential feed travel shaft, a link connecting said rock arm and said differential feed bar, a rock arm fixed to the main feed travel shaft, a link pivotally connected at one end to the last mentioned rock arm and having sliding pivotal connection at its other end with the differential feed bar, a main feed dog mounted on the last mentioned link, a rotary shaft, and separate driving connections between the rotary shaft and said feed travel shafts, one of said connections including an adjustable eccentric mounted on said rotary shaft.

3. In a sewing machine, the combination with a frame including a standard having upper and lower arms extending laterally therefrom, of a horizontal presser foot supported on the upper arm and a differential 4-motion feeding mechanism supported on the lower arm for cooperation with the under face of the foot and comprising main and differential feed dogs, a lift lever fulcrumed on the end of the lower arm and common to both dogs, means mounted on the lower arm for rocking said lever for imparting up and down movements to said dogs, and separate means mounted on the lower arm for imparting forward and backward feed movements to said dogs.

4. In a sewing machine including a lower arm, a rotary shaft journaled in said arm, main and differential feed dogs located at the outer end of said arm, a lift lever fulcrumed on the end of said arm and common to both feed dogs, means operated by said shaft for rocking said lever for imparting up and down movements to said dogs, and separate driving connections mounted on said arm between the shaft and the dogs for imparting forward and backward movements to said dogs.

5. In a sewing machine including a lower arm, a rotary shaft journaled in said arm, main and differential feed dogs located at the outer end of said arm, a lift lever fulcrumed on the end of said arm and common to both feed dogs, means including a rock shaft operated by said shaft for rocking said lever for imparting up and down movements to said dogs, and separate driving connections mounted on said arm between the shaft and the dogs for imparting forward and backward movements to said dogs.

6. In a sewing machine including a lower arm, a rotary shaft journaled in said arm, main and differential feed dogs located at the outer end of said arm, a lift lever fulcrumed on the end of said arm and common to both feed dogs, means operated by said shaft for rocking said lever for imparting up and down movements to said dogs, and separate driving connections mounted on said arm between the shaft and the dogs for imparting forward and backward movements to said dogs, said driving connections including two feed travel rock shafts and connections between said rock shafts and the rotary shaft.

7. In a sewing machine including a lower arm, a rotary shaft journaled in said arm, main and differential feed dogs located at the outer end of said arm, a lift lever fulcrumed on the end of said arm and common to both feed dogs, means operated by said shaft for rocking said lever for imparting up and down movements to said dogs, and separate driving connections mounted on said arm between the shaft and the dogs for imparting forward and backward movements to said dogs, said driving connections including two feed travel rock shafts journaled one within the other, and connections between said rock shafts and the rotary shaft.

8. In a sewing machine including a lower arm, a rotary shaft journaled in said arm, main and differential feed dogs located at the outer end of said arm, a lift lever fulcrumed on the end of said arm and common to both feed dogs, means operated by said shaft for rocking said lever for imparting up and down movements to said dogs, and means for imparting backward and forward movements to said dogs comprising separate feed travel rock shafts journaled on the lower arm and extending longitudinally thereof, separate driving means between the feed dogs and said feed travel shafts, and separate driving connections between the rotary shaft and the feed travel shafts.

9. In a sewing machine including a lower arm, a rotary shaft journaled in said arm, main and differential feed dogs located at the outer end of said arm, a lift lever fulcrumed on the end of said arm and common to both feed dogs, means operated by said shaft for rocking said lever for imparting up and down movements to said dogs, and means for imparting backward and forward movements to said dogs comprising separate feed travel rock shafts journaled on the lower arm and extending longitudinally thereof, separate driving means between the feed dogs and said feed travel shafts, and separate driving connections between the rotary shaft and the feed travel shafts, each connection including an adjustable eccentric mounted on the rotary shaft for varying the travel of the associated feed dog.

10. In a differential feeding mechanism for sewing machines, the combination with a main feed dog and a differential feed dog, of a vertically movable support, means for yieldably retaining the support against depression, a horizontal lift lever fulcrumed on said support intermediate its ends and common to both dogs, means for rocking said lever for imparting simultaneously up and down movements to said dogs, separate means for imparting forward and backward feed movements to said dogs, and means for depressing said support and said dogs against the tension of said yieldable means.

11. In a differential feeding mechanism for sewing machines, the combination with a main feed dog and a differential feed dog, of a vertically movable support, means for yieldably retaining the support against depression, means for limiting the upward movement of said support, a horizontal lift lever fulcrumed on said support intermediate its ends and common to both dogs, means for rocking said lever for imparting simultaneously up and down movements to said dogs, separate means for imparting forward and backward feed movements to said dogs, and means for depressing said support and said dogs against the tension of said yieldable means.

HORACE F. GRUMAN.