This invention relates to work-feeding mechanisms for sewing machines more particularly of the type known as puller-feed mechanisms which comprise feed-rollers arranged to engage the work in rear of the sewing machine needle and exert a pull on the work to assist the usual four-motion feed-dog in feeding the work through the machine.

The present invention has for an object to provide an upper work-engaging roller-rod which will readily ride over heavy cross-seams in the work and may be readily lifted and lowered at the will of the operator for the removal and insertion of work.

A further object of the invention is to provide a puller-feed mechanism, the feed-rolls of which will readily ride over heavy cross-seams in the work without slippage of the work-engaging rollers relative to the work and without cramping of the parts or working joints of the mechanism.

With the above and other objects in view, as will hereinafter appear, the invention comprises the devices, combinations, and arrangements of parts hereinafter set forth and illustrated in the accompanying drawings of a preferred embodiment of the invention, from which the several features of the invention and the advantages attained thereby will be readily understood by those skilled in the art.

In the accompanying drawings, Fig. 1 is a front elevation, partly in section, of a sewing machine embodying the invention. Fig. 2 is a rear elevation of the machine. Fig. 3 is a fragmentary top plan view of the machine bed. Fig. 4 is a sectional view on the line 4-4, Fig. 1. Fig. 5 is an end view of the drive-head on the upper main horizontal feed-wheel-driving shaft. Fig. 6 is a section on the line 6-6, Fig. 4. Fig. 7 is a section on the line 7-7, Fig. 2, and Fig. 8 is a section on the line 8-8, Fig. 2.

The machine has the usual frame including the bed 1 and standard 2 carrying the overhanging bracket-arm 3 terminating in the head 4. The bed 1 carries the usual cloth-plate 5.

The stitch-forming mechanism comprises the usual reciprocatory needle-bar 6 carrying the needles 7 which cooperate with the thread-carrying looper 8 actuated by suitable mechanism driven by the main shaft 9.

The machine has a four-motion feed-dog 10 which works in the feed-dog slots 11 in the throat-plate 12. The feed-dog 10 is mounted on the laterally offset bracket 13 mounted by screws 14 upon the feed-bar 15 which is full-crowned at 16 upon the feed-rocker 17; the latter being pivoted at 18 to the bed 1. The feed-rocker 17 is connected by the pitman 20 to the usual adjustable feed-eccentric 21 on the main-shaft 9. The feed-lift eccentric 22 on the main-shaft 9 is embraced by the eccentric follower 23 having rigid therewith the axially aligned diametrically opposed pins 24 which slantly carry the feed-bar 15 and bracket 13 rigidly mounted thereon and constituting a part thereof.

Journaled in bearings 25, 25 in the bed-casting 1 is the shaft 26 carrying the lower toothed puller-feed roller 27 which is disposed closely in rear of the feed-dog 10 and works in a slot 28 in the throat-plate 12. The shaft 26, Fig. 3, carries a spur-gear 29 meshing with a spur-gear 30 on the shaft 31 journaled in the bearings 32, 33 in the bed-casting. Step-by-step rotary feed-movements are imparted to the shaft 31 by the usual adjustable puller-feed-actuating eccentric 34 on the main-shaft 9. This eccentric 34 actuates a pitman 35 which drives the shaft 31 through the usual roller-clutch mechanism 36, such as disclosed in United States Patent No. 1,990,603, of Nov. 13, 1934.

The main puller-feed shaft 31 has fixed to its rearward end a bevel gear 37 with which meshes the bevel gear 38 fixed to the lower end of the vertical shaft 39 journaled in a bearing lug 40 on the standard 2. The shaft 39 is bevel geared at 41 to the horizontal shaft 42 journaled in a bearing lug 42' on the standard 2. The shaft 42 has fixed to it a shaft-head 43 formed with a socket 44 for the ball-shaped end 45 of an inclined shaft-section 46 in the form of a sleeve which slantly receives an axially aligned shaft-section 47 terminating in a ball-shaped end 48. The shaft-head 43 has cut therein the diametrically opposed co-planar slots 49 which receive the cross-pin 50 carried by the ball 45. This construction forms a universal joint connection between the shafts 42 and 46.

The sleeve-shaft-section 46 is formed with the diametrically opposed co-planar slots 51 which receive the cross-pin 52 carried by the shaft-section 47. A coiled expansion-spring 53 is arranged within the sleeve-shaft-section 46 to bear upon the end of the shaft-section 47 and yieldingly urge the shaft-sections 45, 47 in opposite directions to maintain the balls 45, 48 seated in their respective sockets 44, 54; the socket 54 being formed in the head 55 of the shaft 56 to which the toothed upper feed-roller 57 is fixed. The ball 48 carries a cross-pin 58 which works in the slots 59, Fig. 6, in the head 55.

The shaft 56 carrying the upper feed-roller
57 is journeled in bearings in the spaced forwardly extending arms 69 of a horizontally disposed lever 61 the slotted rear end of which is fulcrumed on the cross-pin 62 fixed to the lower end of the inclined arm 63, the upper end of which is formed as a split clamp 64 rigidly gripping the reduced lower end 65 of the bearing boss 66 for the vertically movable auxiliary presser-bar 67.

The auxiliary presser-bar 67 is formed at its lower end with a head 68 which is received in a pocket 69 and held therein by a top-plate or keeper 70 which is fastened to the lever 61 by a screw 71. A coiled spring 72 surrounding the presser-bar 67 urges the latter downwardly to yieldingly press the upper feed-roller 51 upon the work 73 passing from under the usual main presser-foot 74 carried by the main presser-bar 75.

The auxiliary presser-bar 67 has fixed thereto a block 76 carrying a roller 77 which is engaged by the arm 78 of a presser-lifting lever 79 fulcrumed at 80 on the frame lug 81 which rigidly carries the vertical guide-pin 82 embraced by the slotted end 83 of the block 78. A hand-operated spring-pressed latch-lever 84 is fulcrumed at 85 on the lever 78 and has at its lower end a lateral extension 86 which, when the presser-bar 67 and feed-roller 51 are lifted, engages the frame notch 87 to hold these parts lifted until released by the operator.

The bearing ratios of the gear-driven parts of the puller-feed mechanism are so chosen as to impart to the upper and lower feed-rollers 51 and 27 the same peripheral speed, so that neither will slip relative to the work 73. It will be observed that the carrier-lever 61 for the upper feed-roller 51 is disposed substantially horizontally with its fulcrum 62 at substantially the same level or elevation above the plane of the shaft 66 carrying the upper feed-roller 51. This provision enables the upper feed-roller 51 to readily rise and fall in riding over heavy cross-seams in the work, without any cramping or binding of the vertically movable parts against their bearings. The construction also permits the upper roller 51 to be raised and lowered, at the will of the operator, by manipulation of the hand-lever 73. The main presser-bar 15 carrying the presser-foot 14 may, of course, be lifted by the usual treadle-chain operated lifting lever 88 or hand-lever-operated lifting cam 89.

By providing a vertical shaft 39 on the standard 2, to drive the upper puller-feed roller 17, I am enabled to provide adequate space between the cloth-plate 5 and the upper feed-roller driving connections 46, 47 for the free passage and handling of the work.

Having thus set forth the nature of the invention, what I claim herein is:
1. In a sewing machine, a throat-plate and an overhanging bracket-arm, a work-feeder supported below said throat-plate, a presser-roller above said throat-plate, a lever extending rearwardly from said presser-roller and in which the latter is journeled, a fixed fulcrum for said lever carried by said bracket-arm, a presser-bar mounted in said bracket-arm and connected at its lower end to said lever to lift the latter, and manually operated means for lifting said presser-bar.
2. In a sewing machine, a throat-plate and an overhanging bracket-arm, a work-feeder supported below said throat-plate, a presser-roller above said throat-plate, a lever extending rearwardly from said presser-roller and in which the latter is journeled, a fixed fulcrum for said lever carried by said bracket-arm, a presser-bar mounted in said bracket-arm and connected at its lower end to said lever to both depress and lift the latter, a spring for depressing said presser-bar, and manually operated means for lifting said presser-bar and holding it in lifted position.
3. In a sewing machine, a throat-plate and an overhanging bracket-arm, a work-feeder supported below said throat-plate, a presser-roller above said throat-plate, a lever extending rearwardly from said presser-roller in the direction of feed and in which said presser-roller is journeled, a fixed fulcrum for said lever carried by said bracket-arm, manually operated means for swinging said lever upwardly about its fulcrum to raise said presser-roller from the work, and means for positively driving said presser-roller in timed relation to said work-feeder.
4. A puller-feed mechanism for sewing machines having, in combination, a frame including a bed, a standard rising from said bed, an overhanging bracket-arm carried by said standard and terminating at its free end in a head, a throat-plate, lower and upper puller-feed rollers and driving shafts thereto carried, respectively, by said bed and bracket-arm head, a vertical shaft journeled on said standard in interconnected relation with said driving shafts, and means for driving said interconnected shafts.
5. A sewing machine having stitch-forming mechanism including a reciprocatory needle, a throat-plate, a presser-foot, a four-motion feed dog disposed below and in cooperative relation with said presser-foot, a puller-feed roller disposed above said throat-plate closely in rear of said presser-foot, a lever carrying said puller-feed roller, a fixed fulcrum for said lever, manually operated means for lifting said lever, and means for driving said puller-feed roller.
6. A sewing machine having stitch-forming mechanism including a reciprocatory needle, a throat-plate, a presser-foot, a four-motion feed dog disposed below and in cooperative relation with said presser-foot, a puller-feed roller disposed above said throat-plate closely in rear of said presser-foot, a lever carrying said puller-feed roller, a fixed fulcrum for said lever in rear of said puller-feeder, and manually operated means connected to said lever between said fixed fulcrum and puller-feed roller for lifting the latter.
7. In a sewing machine, a cloth-plate, a feed-roller above said cloth-plate, a shaft parallel to said cloth-plate and carrying said feed-roller, manually controlled means for raising and lowering said shaft relative to said cloth-plate, a drive-shaft parallel to said cloth-plate and spaced both endwise and sidewise from said feed-roller carrying shaft, a two-sectioned endwise extendible inclined shaft having ball-and-socket universal joint connections at its opposite ends with said horizontal shafts, means for imparting step-by-step rotary motion to said drive shaft, and a spring carried by said inclined shaft for yieldingly expanding the latter endwise.

ANDREW B. CLAYTON.