Jan. 26, 1926. 1,570,829

J. A. FORSYTH

LOADING MACHINE

Filed Jan. 13, 1922 2 Sheets-Sheet 1

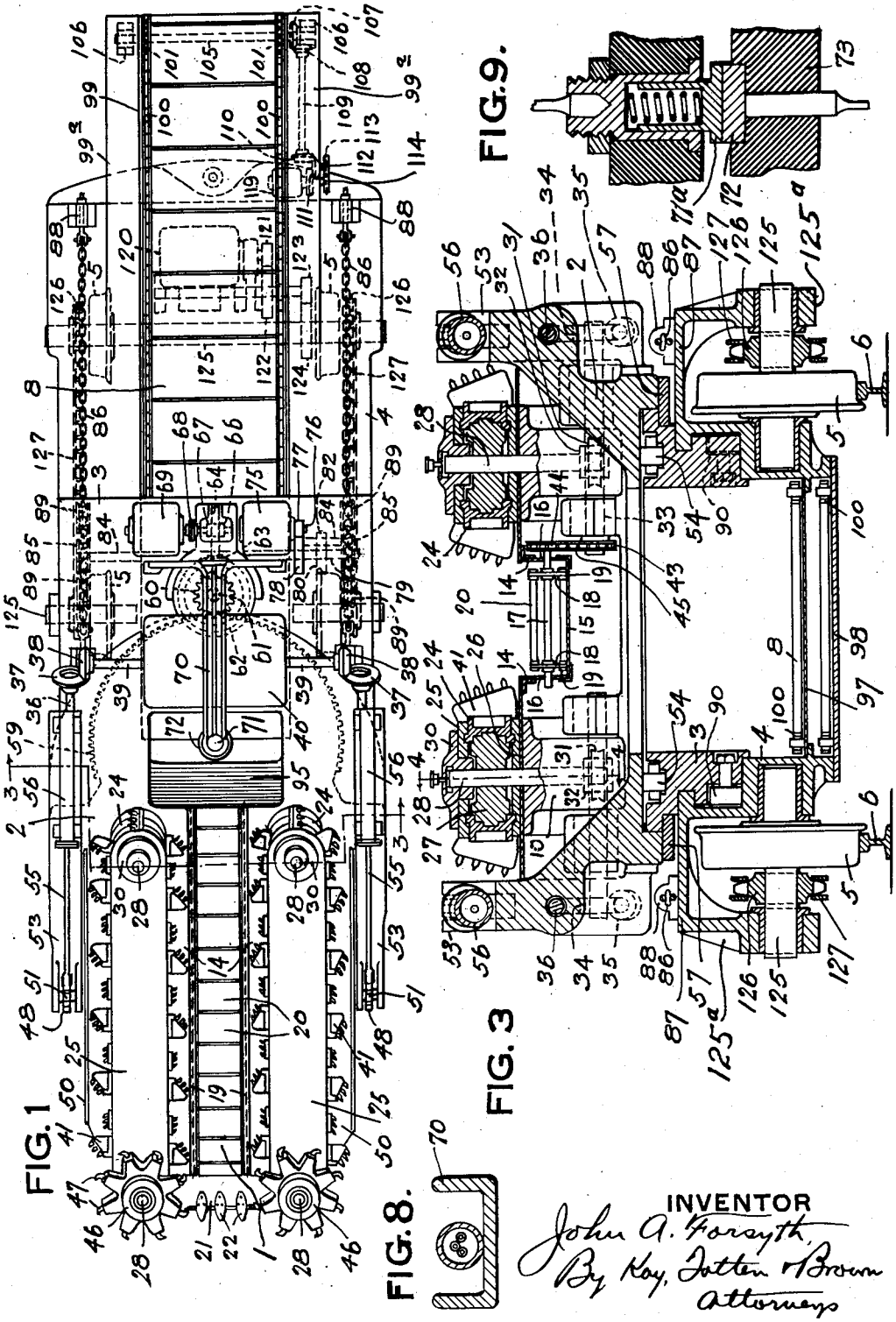


FIG. 1

FIG. 9.

FIG. 3

FIG. 8.

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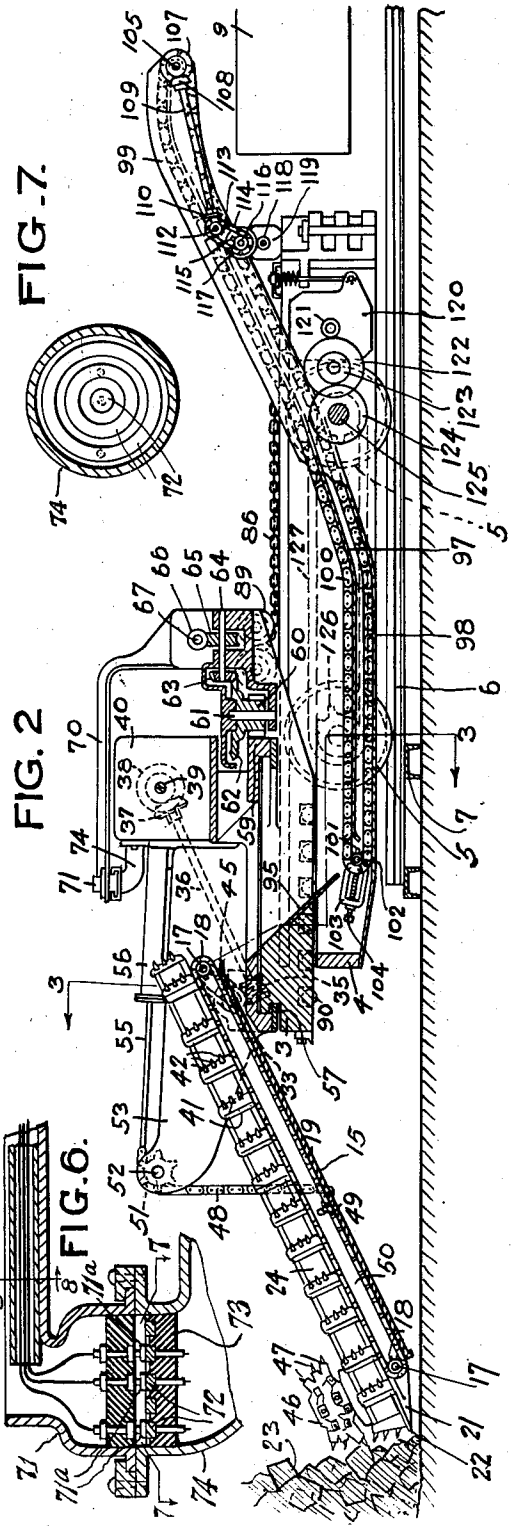


FIG. 7.

FIG. 2

FIG. 6.

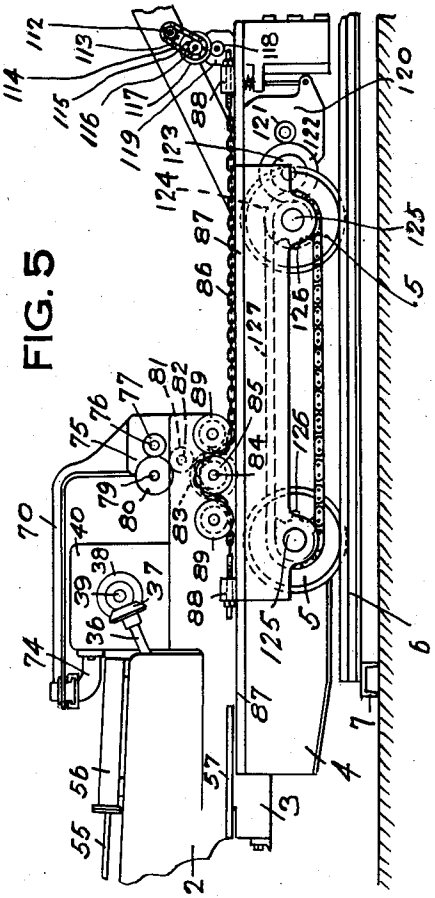


FIG. 5

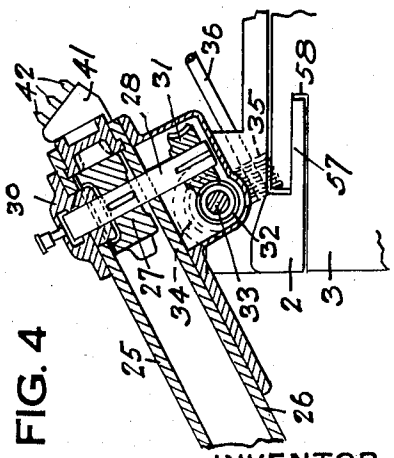


FIG. 4

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1,570,829

UNITED STATES PATENT OFFICE.

JOHN A. FORSYTH, OF NEMACOLIN, PENNSYLVANIA, ASSIGNOR OF ONE-FOURTH TO CLYDE J. SMITH, OF UNIONTOWN, PENNSYLVANIA.

LOADING MACHINE.

Application filed January 13, 1922. Serial No. 528,976.

To all whom it may concern:

Be it known that I, JOHN A. FORSYTH, a citizen of the United States, and resident of Nemacolin, in the county of Greene and State of Pennsylvania, have invented a new and useful Improvement in Loading Machines; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to machines for loading coal and like materials into mine cars.

One object of my invention is to provide improved means for gathering up coal that has been previously broken down by a short-wall machine, a long-wall machine or other suitable mining apparatus, and for conveying the coal to the mine cars in an improved manner.

Another object of my invention is to provide a loading machine that will trim the working place and will properly load coal after any usual type of cutting machine, even though the cutting machine may have been carelessly operated and may have left stumps of uncut coal or masses that have not been properly broken up.

The present application is related to my copending application for Letters Patent, Serial No. 508,712, filed October 19, 1921, wherein I have shown a complete system of loading apparatus including means for gathering up the coal, and a conveyer for conveying the coal away from the mine wall and loading it into a string of cars, the cars being run beneath the conveyor and being loaded from the end nearest the mine entrance, so that when the string of cars is completely loaded it is ready to be drawn out of the mine.

My said copending application is particularly concerned with the conveyer by means of which it is possible to load a string of cars in the manner stated. My present application relates particularly to the construction of the means for trimming and gathering up the coal and for delivering it to the conveyers claimed in the said copending application.

In mining coal by mechanical means the machines most commonly used are known as short-wall machines, and operate by undercutting the face of a working place, after which the coal is shot down with powder. The machine is transported from one working place to another on a truck, is unloaded at the working place to be undercut, and is set up adjacent to one side wall, the machine being set at an angle so that when the end of the cutter bar reaches the end of the cut the front end of the cutter bar will be on a line parallel with the side of the working place. After the machine is lined up, the rear of the machine is raised with a jack and is blocked so that the cut will pitch downward in order to keep the undercut near the bottom of the place.

The undercutting machine is then started and the cutter is forced under the coal, while cutting, by means of suitably anchored feed ropes or chains, and after the cutter bar enters to the full depth of the bar the machine is stopped and the feed rope or chain is moved across to the opposite side of the working place where it is made fast and the machine is again started up and moved bodily sidewise across the face, thereby undercutting the place for the full width to a depth which is usually about seven feet. On approaching the opposite side of the place the front end of the machine is swung forward and outward to complete the cut and bring the outer end of the cutter bar in line with the side wall of the place. The machine with its equipment is then loaded on its truck and is moved to the next place to be undercut.

Another type of machine for undercutting, overcutting or intermediate cutting is known as the arc-wall machine and is built as a unit with its truck. As at present designed, the arc-wall machine does not cut close to the bottom of the place.

In operating both types of machines mentioned above, much difficulty is experienced in getting the machine runners to cut close enough to the bottom of the place, and they will persistently leave several inches, or even several feet, of coal at the bottom. According to the present practice, these stumps of coal must later be taken up by hand picks, especially when a considerable thickness of coal has been left and when it is necessary to lay tracks through the working place.

Also, it is a difficult matter to get the machine runners to line up the machine properly when starting the cut, and it is

frequently found that the machine is either not started close enough to the rib, or is not set at the proper angle. At the end of the cut it is usually found that the cut is not continued far enough.

All of these errors in operation leave stumps of unbroken coal on the bottom and sides of the working place, and when the coal is shot down some of the coal remains in place and must be dug out by hand picks in order to maintain the width of the entry, and also to prepare the face for the next undercut.

My present invention aims to provide a loading machine which will not only gather up coal which has been broken down, but will also trim away the unbroken stumps of coal, thereby correcting any faults resulting from improper undercutting and shooting. To this end, the machine is provided with means for gathering up the broken coal and also with means for cutting any stumps of unbroken coal which remain on the floor or sides of the working place, the loading and trimming being thus done in an entirely automatic manner.

The machine of my present application consists, in general, of an inclined gathering device consisting of an endless flight-conveyer having a shovel device at its forward and lower end, and two endless-chain gathering devices arranged at the sides of the endless flight-conveyer and provided with scrapers which are similar in a general way to the lugs and bits employed in chain cutter-bars, but which are so arranged as to scrape or push the lumps of coal ahead of them rather than primarily to cut through the coal. These endless chain devices operate to bring the coal upon the lower end of the flight-conveyer, and assist the flight-conveyer to elevate the coal and deposit it upon a second conveyer which carries the coal to a suitable storage hopper. The inclined conveyer, with its endless-chain pushers, is mounted on a turret which is carried by a carriage that is slidably mounted on a wheeled truck. This truck supports the intermediate conveyer which transfers the coal to the storage hopper.

The accompanying drawing shows the form in which I now prefer to construct my machine, it being understood, however, that various changes may be made without departing from my invention. In the drawing, Fig. 1 is a plan view of the machine; Fig. 2 is a side elevational view with parts in vertical section; Fig. 3 is a transverse vertical section on the line 3—3, Fig. 1; Fig. 4 is a longitudinal vertical section on the line 4—4, Fig. 3; Fig. 5 is a side elevation of a portion of the carriage, showing the means for shifting the turret; Fig. 6 is an enlarged longitudinal vertical section taken centrally through the rotatable contact device shown in Fig. 2; Fig. 7 is a horizontal section taken substantially on the line 7—7, Fig. 6; Fig. 8 is a transverse section taken substantially on the line 8—8, Fig. 6; and Fig. 9 is an enlarged vertical sectional view taken centrally through one of the brushes shown in Fig. 6.

As shown in Figs. 1 and 2, the machine consists of a gathering conveyer 1 which is supported in an inclined position on a turret 2 that is mounted for swinging adjustment on a carriage 3 mounted slidably in guides on a truck 4 having wheels 5 which run upon tracks 6, which may be the ordinary mine tracks and may be carried by metal or wood ties 7. The track 4 also carries a conveyer 8 which transfers the coal to a storage hopper 9 indicated diagrammatically on Fig. 2. As shown in my above-mentioned copending application, another conveyer may transfer the coal from the storage hopper 9 to a series of unit conveyers which carry the coal to the rear end of a train of cars and which are specifically described and claimed in my said copending application. The present machine may, however, be employed for loading the coal into cars in other ways than by the use of my unit conveyers, and it is to be understood that this machine is not limited to use with such unit conveyers. Electric or compressed-air power for driving the several motors of the machine is brought to the machine by means of the usual cable or piping.

The gathering conveyer 1 is mounted in a trough consisting of side plates 14 and a bottom plate 15. The side plates 14 have bearings 16 at their upper and lower ends in which are journaled shafts 17 carrying sprocket wheels 18 around which extend endless chains 19 carrying flights 20. At the lower end of the conveyer is a shoe 21 having fingers 22 which engage beneath the pile of broken-down coal 23 as the machine advances.

At each side of the flight conveyer 1 is an endless chain 24 traveling in guideways formed in upper and lower guide plates 25 and 26 and around sprocket wheels 27 carried by shafts 28 at the upper and lower ends of the conveyer. As shown in Figs. 3 and 4, the upper shaft 28 extends through the lower guide plate 26 and into a bearing member 30 which extends through the upper guide plate 25. Near its lower end this shaft carries a worm wheel 31 meshing with a worm 32 on a drive shaft 33 which carries at its outer end a worm wheel 34 meshing with a worm 35 which is carried at the lower end of an inclined shaft 36 provided at its upper end with a bevel gear 37 meshing with a bevel gear 38 on the armature shaft 39 of an electric or air motor 40. This train of driving gear is duplicated on opposite sides of the machine for driving the two chains 24.

The chains 24 are provided with scraper lugs in which may be placed the bits 41 having teeth 42, these bits being so arranged as to break down coal from the sides or face of the working place and also to break coal loose from the bottom and assist in drawing the coal around upon the flight conveyer 1.

For the purpose of driving the flight conveyer 1, one of the shafts 33 carries a sprocket wheel 43 in line with a sprocket wheel 44 on the end of the upper shaft 17 of the flight conveyer. A chain 45 extends around the sprocket wheels 43 and 44 and drives the shaft 17, which, through the sprocket wheels 18, drives the flight conveyer.

The lower shaft 28 at each side of the flight conveyer carries a breaking wheel 46 provided with several rows of teeth 47. When the lower end of the conveyer is thrust beneath a pile of coal adjacent to the rib, the breaking wheels 46 assist in separating and breaking down any coal remaining up after being shot, and also assist the bits in delivering the coal properly to the flight conveyer.

The frame of the loader head, which supports the flight conveyer 1 and the bit chains 24, is supported pivotally on the shafts 33 by means of hinge-castings 10, and is suspended from above by means of chains 48, one of which is provided at each side of the loader head, as shown on Fig. 1. Each of these chains is attached at 49 to the side plate 50 of the frame and passes over a sprocket guide wheel 51 which is loosely mounted on a short shaft 52 near the outer end of a bracket 53 which extends forward from the turret 2 of the sliding turn-table 3. The upper ends of the supporting chains 48 are attached to the piston rods 55 of hydraulic cylinders 56 which are supplied with liquid through suitable pipe and pump connections, not shown, to raise or lower the flight conveyer and the bit chains to the desired angle.

The entire loader head, including the flight conveyer, the bit chains, the motor 40 and its driving connections, is so mounted on the carriage 3 as to be rotated as a unit to turn the flight conveyer and its attachments in any desired direction within an angle of about 90° to the right or left, making a total angle of 180°. For this purpose the turret 2 rests upon rollers 54 which are received in a runway in the carriage 3, as shown in Fig. 3. The turret 2 is provided with a circularly curved guide flange 57 which runs in a curved guide slot 58 formed in the forward end of the sliding carriage 3. The turret 2 also has a circularly curved toothed extension 59 meshing with a pinion 60 on a vertical stub shaft 61 which carries a bevel gear 62 driven by a bevel pinion 63 on a horizontal shaft 64 which carries a worm wheel 65 meshing with a worm 66 on a shaft 67 which is connected by means of a coupling 68 to the armature shaft of an electric motor 69. The motor 69 is employed only for swinging the loader head through the connections just described, and is provided with the usual starting switch, not shown.

In order to bring electric current to the motor 40 without interfering with the angular movement of the turret 2, a hollow bracket 70 is supported on the frame of the carriage 3 and extends horizontally forward to a point above the axis on which the turret 2 swings. At this point the bracket 70 carries a head 71 which carries electric brushes 71^a that engage contact rings 72 mounted in a support 73 carried by a hollow arm 74 which extends forward from the housing of the motor 40.

The conducting wires are brought in the usual conduit 70^a through the bracket 70 and are connected to the contact brushes 71^a carried by the head 71. From the contact rings 72 suitable wires 72^a are led through the hollow supporting arm 74 to the motor 40. The brush contactors 71^a carried by the head 71 are provided with the usual springs 71^a for holding them in close contact with the rings 72 and the brushes and rings are suitably insulated from each other and from their supports. An air motor may be used instead of the electric motor 40 for driving the conveyors.

The forward and backward sliding movement of the carriage 3 is produced by means of an electric or air motor 75 mounted on the carriage 3 adjacent to the motor 69 and carrying on its armature shaft 76 a pinion 77 meshing with an intermediate spur gear 78 on a stub shaft 79 which also carries a spur gear 80 meshing with a pinion 81 on a shaft 82. The pinion 81 drives a gear 83 on a shaft 84 which also carries a sprocket wheel 85 over which extends a chain 86 which rests upon the side sill 87 of the truck 4 and is adjustably fastened at its opposite ends by means of dead-eyes 88. Guide rollers 89 engage the chain 86 on opposite sides of the sprocket wheel 83 and insure proper engagement between the sprocket wheel and the chain. This chain and sprocket wheel construction is duplicated on both sides of the machine, the shaft 79 being extended across the shaft of the machine, as shown in Fig. 1, and operating a train of driving gears similar to that described above. When the motor 75 is started it drives the sprocket wheels 83 and, as the chain 86 is held against movement on the truck 4, the carriage 3 is caused to move forward or backward on the truck 4, depending on the direction in which the motor 75 is started. The weight of the carriage 3 is supported by rollers 90, as shown in Figs. 2 and 3.

An inclined apron 95 carried by the carriage 3 directs the coal from the upper end of the flight conveyer 1 upon the second flight conveyer 8, which is carried by the truck 4 with its upper run approximately on a level with the axles of the wheels 5, as shown in Figs. 2 and 3. The upper and lower runs of the conveyer 8 rest upon sheet metal plates 97 and 98, respectively, which direct the conveyer rearwardly and upwardly, as shown in Fig. 2, and extend beyond the rear of the truck so as to bring the rear end of the conveyer 8 above the storage hopper 9. Guards 99 are supported from the sides of the conveyer 8, to prevent the coal from falling from the sides of the conveyer. That portion of the conveyer and its attachments which extends above and beyond the truck 4 is supported by side plates 99[a] to which the sheet metal plates 97 and 98 are fastened.

The conveyer 8 is composed of flights carried by endless chains 100 which extend around sprocket wheels 101 at the opposite ends of the conveyer. The sprocket wheels 101 at the forward end of the conveyer adjacent to the apron 95 are carried by a shaft 102 which is adjustable in a support 103 by means of a screw 104. The sprocket wheels 101 at the rear or outer end of the conveyer 8 are carried by a shaft 105 which is mounted in bearings 106 in the side plates 99[a], and carries a bevel gear 107 driven by a bevel pinion 108 on an inclined shaft 109, the lower end of which carries a bevel gear 110 meshing with a bevel pinion 111 on a stub shaft 112 which also carries a sprocket wheel 113 around which extends a chain 114 that also extends around a sprocket wheel 115 on a shaft 116 carrying a spur gear 117 which is driven by a pinion 118 on the armature shaft of an electric or air motor 119. The motor 119 is mounted on the rear end of the truck 4 and drives the conveyer 8 continuously through the connections just described.

The truck 4 is provided with an electric or air motor 120 for moving the entire machine on the tracks 6. The armature shaft of the motor 120 carries a pinion 121 which, through a train of gears 122, 123 and 124, drives the axle 125 of one of the wheels 5. All four of the axles 125 are provided with sprocket wheels 126 and chains 127 extend around the sprocket wheels 126 for the purpose of driving all of the wheels of the truck simultaneously.

It will be noted that the axles 125 form trunnion mountings for the wheels 5, and that the space between the axles is free from obstruction which would be caused if the axles 125 consisted of shafts extending across the machine. The axles 125 are individually mounted in bearings carried by bearing frames 125[a] which bridge over the wheels, as shown in Fig. 3. The axles 125 are preferably provided with cushioning springs to take care of inequalities in the tracks 6.

This axle construction enables the conveyor 8 to be supported at a level at or below the level of the axles, and gives an unobstructed passage for the coal carried by this conveyor, with the result that the machine is low, which is desirable in machines which are to operate in coal mines, while at the same time, the machine may be provided with wheels of large size.

The machine described above is employed to gather up and load a cut of coal which has previously been partially or wholly broken down in the mine by any usual means. If a mining machine is employed it is removed, the coal is drilled and shot down, and then the loader, with its cars and conveyers, is brought up on the track 6. As the machine approaches the coal to be loaded, the loader head is swung around to bring the front end of the conveyer to one side of the working place, and the conveyer is lowered until its front end rests on the floor of the place.

These adjustments are effected by means of the motor 69 which swings the loader head, and by means of the motor 75 which slides the carriage lengthwise on the truck. The motors 40 and 119 are started and operate, through the gearing described, to drive the first conveyer 1, the bit chains, the breaker wheels and the rear conveyer 8. The scraper lugs, with the bits 41 as they pass around the lower sprocket wheels, break loose the bottom coal and side coal, and break up any large masses of coal that have not been broken when shot down. The lugs and bits also engage the lumps of coal and tend to scrape them around upon the flights of the conveyer 1, this action being assisted by the breaker wheels 46 which loosen the coal above and enable the bits to take hold of it. At the same time, the breaker wheels 46 break down any coal on the side which has not been undercut far enough or shot down. The conveyer 1, assisted by the scraper lugs and bits, elevates the coal brought to it by the scraper lugs and bits, and deposits the coal upon the apron 95 which guides it down upon the conveyer 8 which conveys the coal to the rear, elevates it above the storage hopper 9, and finally deposits it in the storage hopper. From the storage hopper the coal is loaded into cars by any suitable means, such as the unit conveyers described and claimed in my co-pending application for Letters Patent, Serial No. 508,712.

During the operation of gathering up and trimming the coal as described above, the sliding carriage 3 is moved forward by means of the motor 75. When the carriage

reaches the forward limit of its sliding movement the lower end of the conveyer, with its scrapers and cutter head, is raised a distance equal to its thickness measured from the bottom of the conveyer to the top of the scraper wheels. During this backward movement the breaker wheels break down any coal which has been left hanging above the conveyer, and the scrapers continue to deliver this coal to the elevating conveyer.

When the reverse movement of the carriage is completed the loader head is then swung to the opposite side of the working place and the operation is repeated. After this second operation is completed the lower end of the conveyer is again passed over the bottom of the working place and gathers up any coal that may have been broken down and may not have fallen on the conveyer. The loader head is then swung over again to the starting side of the working place, the machine is moved forward on its truck, and the whole operation is repeated in the same manner as above, except that on this second set of operations the front end of the conveyer with its breaker wheels will usually reach the end of the undercut and as it is raised it breaks down coal from the face, thereby trimming the face and increasing the amount of coal that is broken out for each undercutting and shooting operation.

The machine described above has the advantage that it trims the working place and loads the coal in an entirely automatic manner after any type of cutting machine, and irrespective of whether the cutting machine has been operated correctly or not. It also has the advantage that it will break down and load coal that has been incompletely shattered by light shooting. Hand pick work is thus eliminated entirely, not only in loading the main body of coal, but in taking up the bottom stumps and trimming the sides, roof and face.

On account of the fact that the machine trims the sides, roof, bottom and face of the working place and simultaneously loads the coal, a considerable saving in time is effected, and also a greater recovery of coal, by reason of the fact that this machine breaks up and loads coal down to the bottom of the seam. The smooth and even bottom produced by this machine also saves time and labor in laying track.

Further savings in time and labor are produced by reason of the fact that the undercutting need not extend to the bottom and therefore there is no delay such as now results when the cutting machine encounters rolls on the bottom of the seam which makes it necessary for the cutting machine to be backed out and blocked up.

By reason of the turret construction described above the machine is capable of loading on curves and in close places to an extent which is not possible with ordinary loading machines.

The novel construction of the frame of my machine, whereby the rear conveyer 8 is carried only a short distance above the floor, permits the entire machine to be made much lower than ordinary loading machines, so that this machine is suitable for use in workings where the roof is very low.

While I have described herein the manner in which I now prefer to construct my improved loader, it will be understood that various changes may be made without departing from my invention, the scope of which is indicated in the appended claims.

I claim as my invention:

1. A loading machine comprising an inclined movable endless conveyer, endless chains extending along the sides of said conveyer, and scraper lugs with bits carried by the said chains for pushing material upon said conveyer.

2. A loading machine comprising an inclined movable endless flight-conveyer, endless chains extending along the sides of said conveyer and parallel thereto, and scraper lugs with bits carried by the said chains for pushing material upon said conveyer.

3. A loading machine comprising an inclined endless flight-conveyer, endless chains disposed adjacent to the sides of said conveyer and parallel thereto, bits carried by the said chains for pushing material upon said conveyer, teeth carried by said bits, and breaker wheels disposed on opposite sides of the lower end of said conveyer and above the lower ends of said chains.

4. A loading machine comprising an inclined endless conveyer, endless belts extending along the sides of said conveyer and parallel thereto, bits carried by the said chains, and means for adjusting the inclination of the said conveyer and the said chains.

5. A loading machine comprising a loader head provided with an inclined endless conveyer, and also provided with endless chains extending along the sides of said conveyer and parallel thereto, the said chains carrying scraper lugs with bits for pushing material upon the said conveyer, a carriage supporting the said loader head, and means for adjusting the said loader head to vary the inclination of said conveyer and said chains.

6. A loading machine comprising a loader head provided with an inclined endless conveyer, and also provided with endless chains extending along the sides of said conveyer and parallel thereto, the said chains being provided with bits for pushing material upon the said conveyers, a carriage supporting the said loader head, and means for adjusting the said loader head to vary the inclination of said inclined conveyer and said

chains, and also for varying the angular position of said conveyer and chains with respect to the said carriage.

7. A loading machine comprising an inclined endless conveyer, endless chains extending along the sides of said conveyer, means carried by said chains for pushing material upon said conveyer, a carriage supporting said conveyer, a truck supporting said carriage, and means for sliding said carriage lengthwise upon said truck.

8. A loading machine comprising an inclined endless conveyer, means for pushing material upon said conveyer, a turret supporting said conveyer, a carriage supporting said turret, means on said carriage for angularly adjusting said turret, a truck carrying said carriage, and means for sliding said carriage lengthwise on said truck.

9. A loading machine comprising an inclined movable endless conveyer, shafts disposed perpendicular to said conveyer near the upper and lower ends thereof, sprocket wheels carried by said shafts, endless chains extending around said sprocket wheels, bits carried by said chains, and a motor connected to drive said endless conveyer and said sprocket wheels, whereby the bits carried by said sprocket wheels are caused to push material upon said conveyer, and the said conveyer is caused to elevate said material.

10. A loading machine comprising an endless movable conveyor, endless chains extending along the sides of said conveyor, means carried by said chains for pushing the material upon said conveyor and rotatable means at the outer ends of said endless chains for breaking the material and assisting in directing said material toward said conveyor.

11. A loading machine comprising an endless movable conveyor, shafts disposed at the outer ends of said conveyor and on opposite sides thereof, sprocket wheels carried by said shafts, endless chains extending around said sprocket wheels, means carried by said endless chains for pushing the material upon said conveyor and breaking-wheels carried by said shafts which are at the outer end of said conveyor, said breaking-wheels being adapted to break material and to assist in directing said material toward said conveyor.

12. A loading machine comprising a wheeled frame, axles for individually supporting the wheels of said frame, a bearing for bridging each of said axles and leaving substantially unobstructed the space between said wheels, an endless conveyor mounted on said frame and having its upper run not substantially higher than the level of said axles, and a bearing plate for each of the runs of said conveyor, disposed between said wheels and in a plane below the axial line of said axes, said plates being supported by said bearings.

13. A loading machine comprising a frame having a pair of wheels at its forward end, two axle-bearings carried by said frame and each bridging one of said wheels, axles mounted in said bearings for individually carrying said wheels while leaving unobstructed the space between said axles, and an endless conveyor arranged between said axles with its upper run not substantially above the level of said axles.

In testimony whereof, I the said JOHN A. FORSYTH have hereunto set my hand.

JNO. A. FORSYTH.