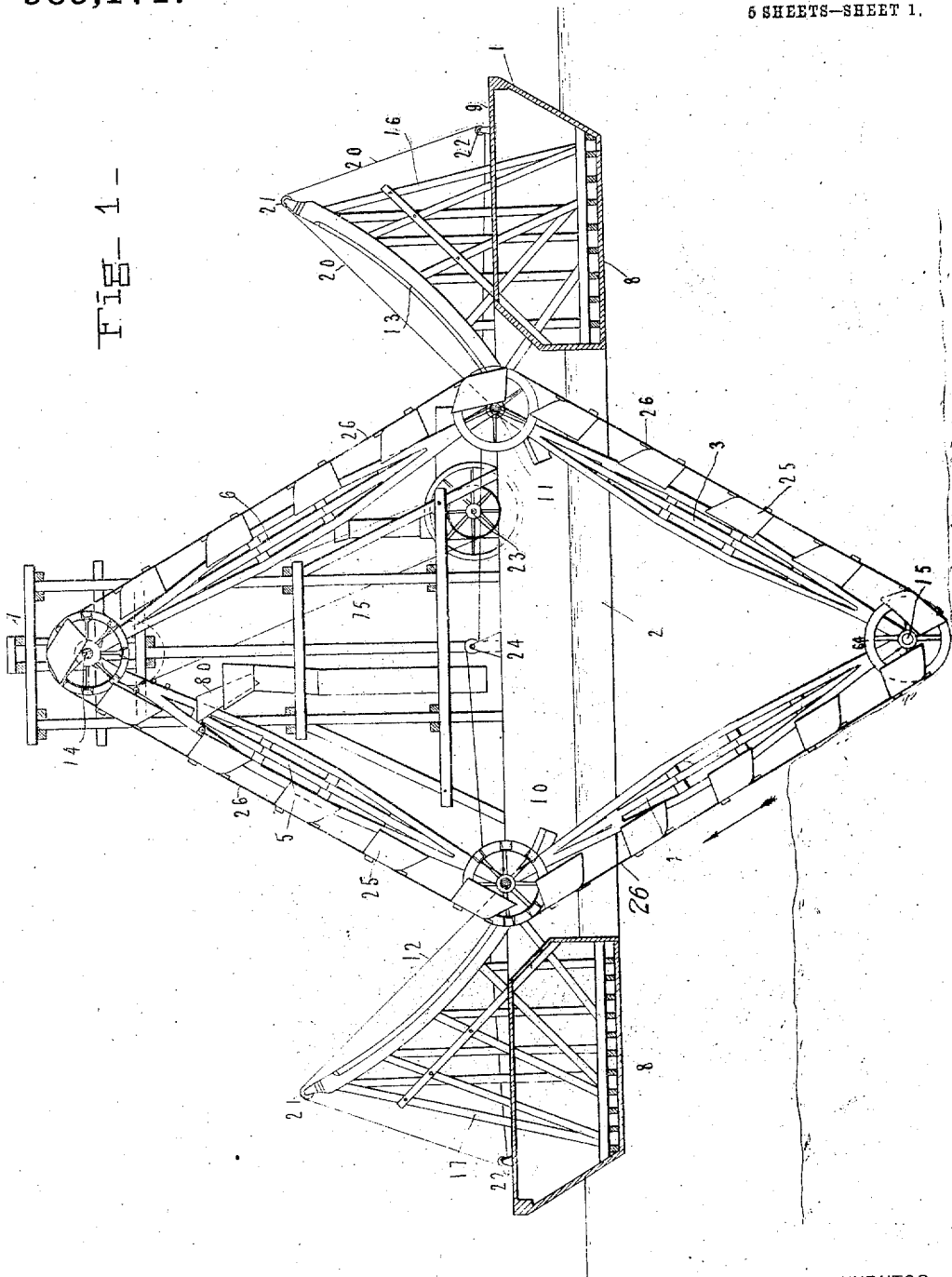


T. F. LONNEY.
 UNIVERSAL DREDGING MACHINE.
 APPLICATION FILED NOV. 16, 1906. RENEWED APR. 10, 1909.

969,171.

Patented Sept. 6, 1910.

5 SHEETS—SHEET 1.



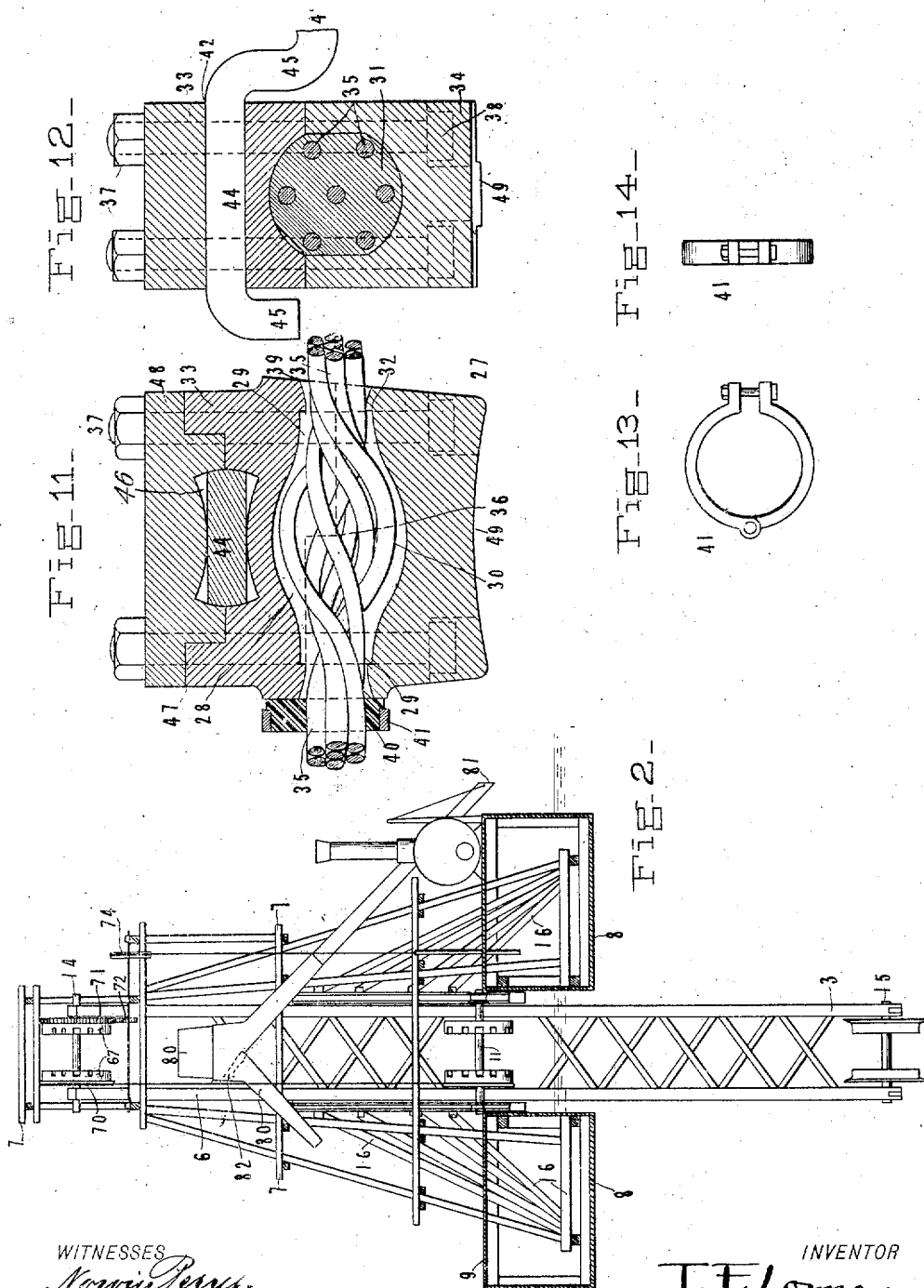
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5 SHEETS—SHEET 2.



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5 SHEETS—SHEET 3.

Fig-3-

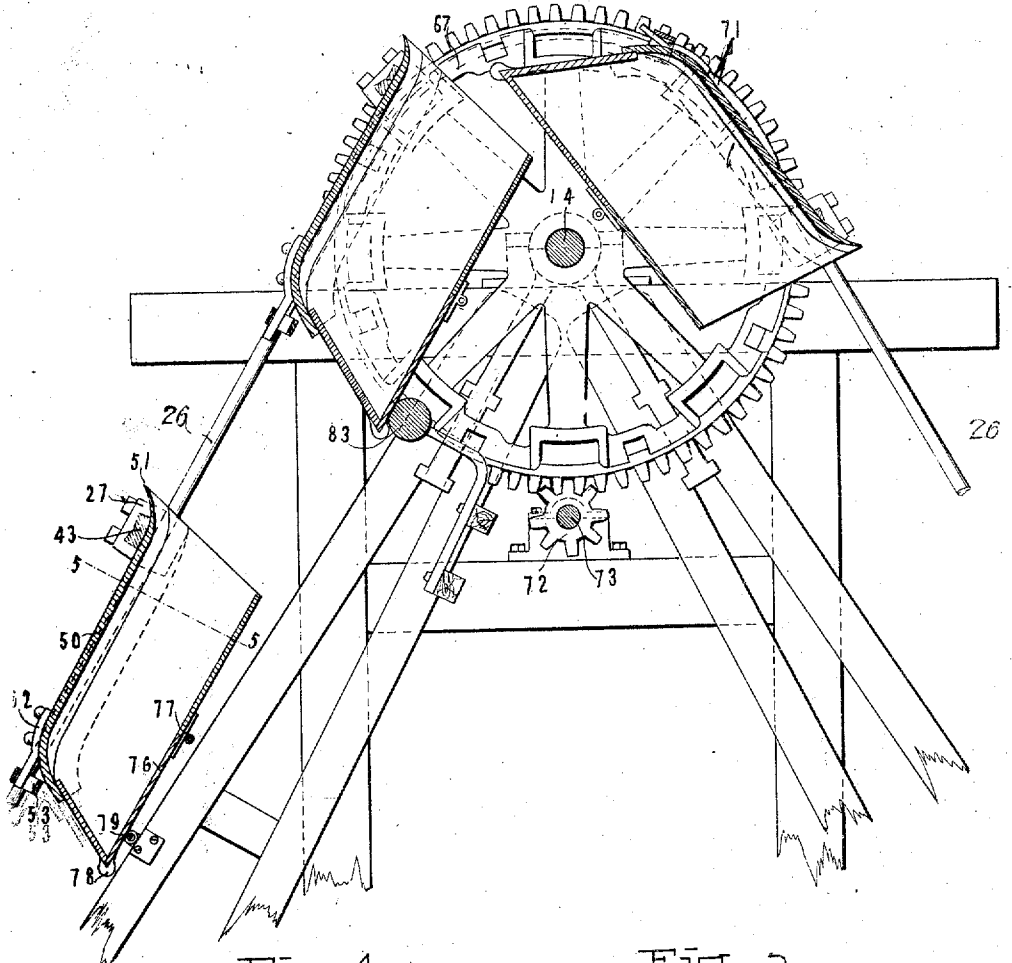


Fig-4-

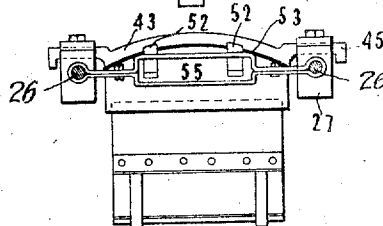
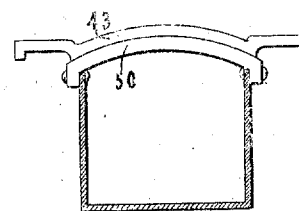


Fig-5-



WITNESSES

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 APPLICATION FILED NOV. 10, 1906. RENEWED APR. 10, 1909.

Patented Sept. 6, 1910.
 5 SHEETS—SHEET 4

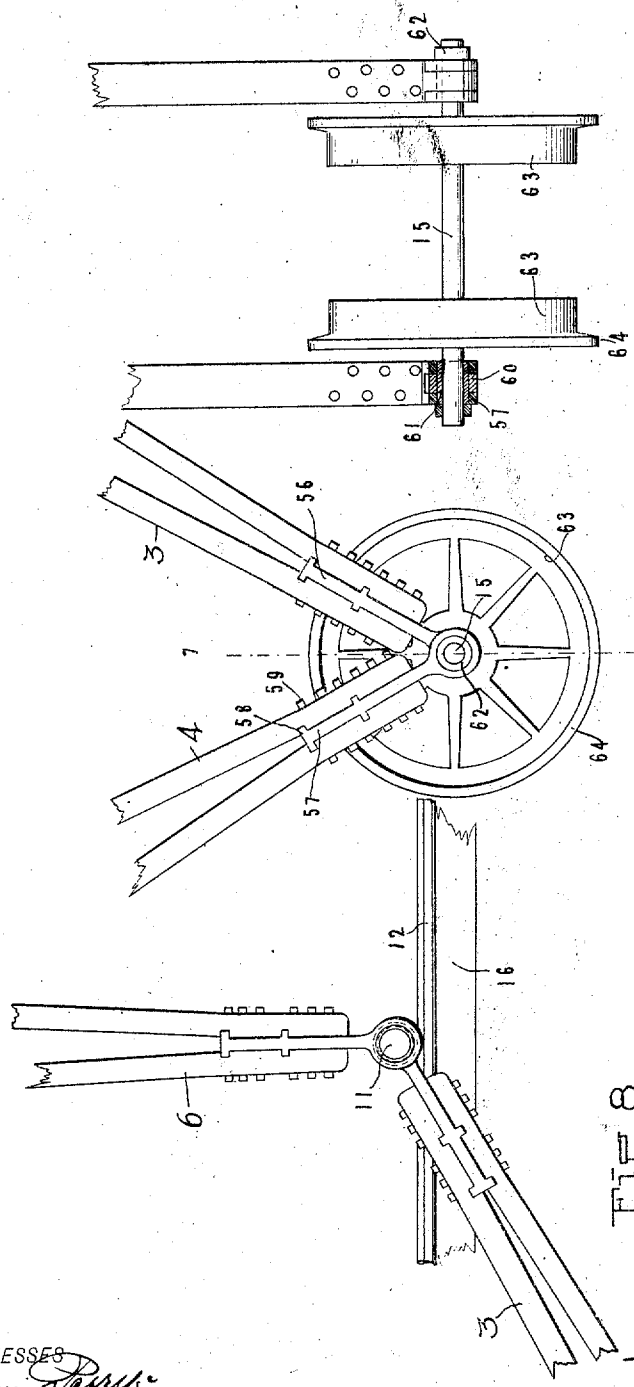


FIG-7-

FIG-6-

FIG-8-

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5 SHEETS—SHEET 5.

Fig-9-

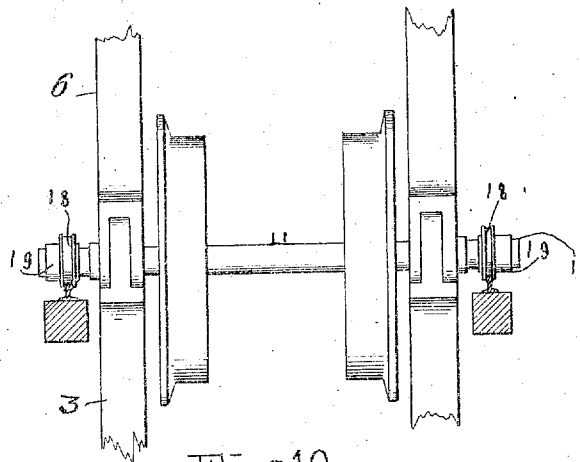
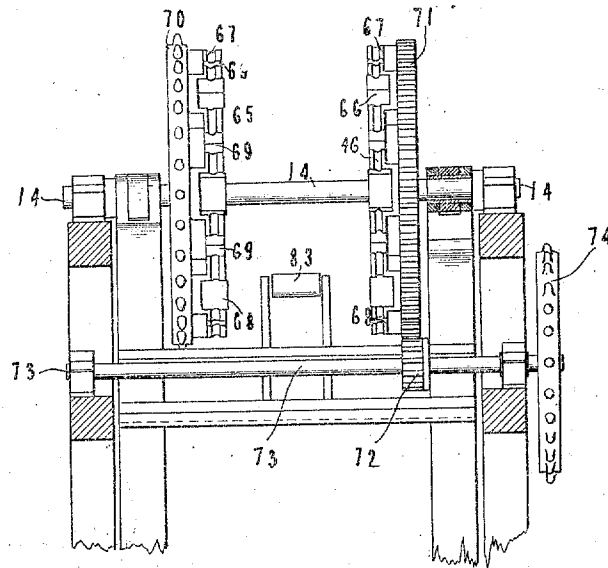


Fig-10-

WITNESSES

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UNITED STATES PATENT OFFICE.

THOMAS F. LONNEY, OF BROOKLYN, NEW YORK, ASSIGNOR TO GEORGE UPINGTON, OF BROOKLYN, NEW YORK.

UNIVERSAL DREDGING-MACHINE.

969,171.

Specification of Letters Patent.

Patented Sept. 6, 1910.

Application filed November 10, 1906; Serial No. 342,781. Renewed April 10, 1909. Serial No. 489,183.

To all whom it may concern:

Be it known that I, THOMAS F. LONNEY, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Universal Dredging-Machines, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention broadly relates to improvements in excavating apparatus, but more specifically it concerns apparatus of this character in which an endless excavating belt is mounted to travel around a runway, capable of being adjusted into diverse positions.

One object of this invention is to devise an excavating apparatus which, without effecting any variation in the length of the endless excavating chain, will permit of raising or lowering the cutting toe thereof to meet the requirements of various conditions.

Another object is to provide an excavating apparatus of the class described in which the strain imposed on the excavating bucket will be brought directly upon the cutting portion thereof, in contra-distinction from being transmitted thereto through the body portion of said bucket, in order that the excavating may take place more effectively and that the body portion may be made of as light material as is possible commensurate with the nature of the work performed by the bucket.

Another object of this invention is to provide excavating means which, while being capable of being diversely adjusted so as to cut or gather debris at various depths and places, will discharge such debris at a point fixed relatively to the vehicle or float upon which the excavating apparatus is mounted.

Another object is to provide an apparatus of the character described which is especially adapted for the excavating or dredging of canals, harbors and other water-ways, and which, as a whole, is well suited for being transported from place to place.

Another object is to provide a dredging apparatus which, taken as an entirety, will be self-contained, not being necessarily dependent upon auxiliary apparatus for assisting it in performing its work.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the application of which will be indicated in the following claims.

Referring now to the drawings, wherein is shown various possible embodiments of my invention, and wherein like numerals refer to like parts throughout all the views, of which,—

Figure 1 is a longitudinal elevation of my apparatus, illustrating the same as employed for dredging a water-way, and showing how the gathered debris may be discharged from a relatively fixed point into a suitable chute leading to an adjacent scow or appropriate point of accumulation. Fig. 2 is a transverse elevation taken midway of the ends of the float or vehicle, showing the latter in cross section. This view shows the arrangement of certain of the several parts not fully illustrated in Fig. 1, such as the chute, which as positioned discharges the debris to one side of the float, such debris being accumulated either upon the banks of the water-way or in suitable scows, by means of which it may be easily transported to more distant places. Fig. 3 is a vertical longitudinal section on an enlarged scale of the summit or apex of the apparatus, showing more particularly details of the means for automatically effecting a discharge of the buckets and also the means for driving and carrying said buckets around said apex. Fig. 4 is a bottom view of a bucket, as seen by looking upwardly along the rising side of the traveling excavating train, showing the arrangement and relationship of certain component parts of the bucket and also the means for flexibly connecting the same to the carrying ropes. Fig. 5 is a transverse section of a bucket taken along line 5—5 of Fig. 3 and showing the manner in which the ends of the cross bar or link are engaged with the traveling rope, the body portion of said cross bar being secured directly to the cutting face of the bucket in order that the strains may be brought directly upon the cutting edge thereof. Fig. 6 is a side elevation of the toe of the collapsible frame work

or runway, showing certain details as to the manner of hinging together the lower meeting ends of the converging depending truss members, and at the same time providing suitable turning means for the buckets. Fig. 7 is a vertical section taken along line 7-7 of Fig. 6, showing certain arrangements not clearly apparent from Fig. 6. Fig. 8 is a transverse sectional elevation of one of the intermediate hinges of the collapsible runway, showing a segmental track for supporting such part and permitting the same to have a lateral or swinging movement to effect a raising, lowering, advancing or retreating of the cutting toe of the apparatus. Fig. 9 is a sectional elevation taken along a median vertical plane transversely intersecting Fig. 3, and showing certain details not clearly apparent from said latter figure, such as the relationship between the collapsible frame work or runway and the stationary derrick, and also the specific arrangement of the driving means. Fig. 10 is an elevation of Fig. 8 looking at the same from the left toward the right and showing more particularly the rollers for facilitating the spreading or lateral movement of the intermediate joint of the apparatus, and, in cross section, the track supporting the same. Fig. 11 is a sectional view showing in detail one of the blocks, by means of which the buckets are secured against displacement to the traveling rope, and showing the manner in which the said blocks are positively attached to said rope, together with means for providing a slight pivotal movement of the buckets with respect to said blocks. Fig. 12 is a vertical section taken transversely through Fig. 11, showing more clearly the arrangement of the block and its associated parts. Fig. 13 is a front elevation of the clamping ring employed in connection with the aforesaid blocks. Fig. 14 is an end elevation of Fig. 13 looking from right to left.

At the outset it is to be clearly understood that the herein described excavating apparatus may be carried upon any suitable vehicle according to the use of the same. In the herein described embodiment, however, I have shown the excavating apparatus as being carried by a boat or float, this arrangement being especially adapted for the dredging of water-ways. The excavating apparatus may in some cases be positioned transversely of the float at or between the ends thereof, or otherwise, as may be warranted by special conditions. This excavating apparatus comprises, in the shown embodiment, a collapsible frame work or runway around which travels an endless excavating belt. Inasmuch as it is desirable from an essentially practical standpoint to enable the cutting toe of said runway to be raised or lowered without affecting the point

of discharge and without compelling an adjustment in the length of the excavating chain, I propose to construct said runway of a plurality of inextensible trusses having hinged joints permitting the said runway to be collapsed or expanded to raise or lower the toe. It will be understood that, owing to the peculiar construction of such a runway, the periphery thereof will not undergo variations in length during the changes in its configuration, and consequently the traveling chain of buckets may be of a constant length, irrespective of variations in the general outline of the runway. I have shown a frame work comprising four members connected together to form a diamond-shaped structure, but it will be understood that it lies within the scope of this invention to employ a greater number of trusses and to arrange them in various ways within the scope of the appended claims. As shown, however, I propose to so arrange the parts that the summit or apex of the diamond-shaped frame work will be constant in position.

Turning now to the annexed drawings, it will be seen that the excavating apparatus is mounted upon a suitable boat or float 1, which as shown provides a central opening or well 2 through which descends the lower part of the excavating apparatus. As it is desirable that the depth of the endless belt may be varied to correspond with different requirements either of depth of tide or depth of desired cut, as the case may be, the bottom portion of the polygon which carries the endless series of buckets will be formed of two depending truss members 3 and 4, each pivoted to associated upper truss members 5 and 6 and hinged together at their lower ends to form the toe of the apparatus. It will be observed that the collapsible runway thus formed may be supported solely from the intermediate joints or other parts, but to insure rigidity and to relieve such runway from undue strains, this invention proposes an auxiliary stationary supporting frame work or derrick 7 which rises from the boat on each side of the collapsible runway and braces the apex of the latter as shown more clearly by Fig. 2. Preferably this derrick rises from the bottom 8 of the boat and passes through the deck 9 thereof, so that the latter will not directly receive the weight of the derrick. The latter will comprise various cross pieces suitably disposed to stiffen the whole. The upper trusses are pivoted to form an apex which is partly braced and supported by the stationary frame, and travel at their lower ends, 10 and 11, along, and are supported by, arc-shaped tracks 12 and 13 whose center of radius is the upper pivot 14 of the swinging frame. These tracks are braced to the boat by a suitable scaffolding. It will now be understood that the foot of each up-

per swinging truss may be moved into any desired station upon the circular track, and that its upper end will always be in a fixed position, which is unaffected by the swinging of such frame. The lower end or toe 15, however, acts like the free end of a toggle, and it will be raised or lowered, depending upon the degree of separation of the intermediate joints 10 and 11 of the runway.

The intermediate joints of the collapsible frame work are in the main constructed substantially like the aforesaid toe, whose specific construction is hereinafter described in detail, but inasmuch as such joints are designed to be freely spread apart to raise the dredging toe and at the same time ride upon the aforesaid tracks to assist in carrying the weight of the collapsible frame work and prevent undue thrust from being imposed upon the other supporting parts thereof, I will now describe a preferred mechanism for freely affording such movement. To this end I have mounted upon suitable scaffoldings 16 and 17, carried by the vehicle as it is shown by Figs. 1, 2, 8 and 10, the segmental tracks which have been heretofore referred to in general terms. The shaft 11 constituting the pinion of the rear intermediate joint, protrudes a short distance beyond each side of the runway, as shown more clearly in Fig. 10, to form journals for small rollers 18, which are provided with side flanges interfitting with said track. The said rollers, while being free to rotate about said shaft, are positioned against lateral play through the instrumentality of suitable means, such as the shown collars 19. The intermediate joints may be moved along the tracks by any suitable mechanism, which may involve the principles of a ratchet or may comprise a rope 20, see Fig. 1, which passes over a pulley 21 at the upper end of the track and from thence over a second pulley 22 to the motor or engine 23, or to a winding capstan 24. The latter may conveniently be positioned to simultaneously operate each of the intermediate joints or it may be arranged to operate them independently or both, as may be desired.

The train of buckets is carried by a suitable endless chain or rope which in turn is mounted to travel around the periphery of the collapsible polygonal frame work. In this connection it may be observed that various equivalents may take the place of the shown excavating features, but the latter will for many purposes be the preferable construction, and comprises a series of buckets 25 each secured to and between a pair of endless wire ropes 26. I will now proceed to describe the preferred means whereby the said buckets are secured to the traveling ropes to allow for sufficient flexing therewith to readily pass around the pulleys at the turning points, and yet at the same time

to prevent said buckets from slipping along said rope and becoming displaced into unsuitable positions. At suitable intervals the rope, which will ordinarily consist of wire and be composed of a plurality of strands 35, will be spread, that is to say, the component strands of said rope will be partially untwisted so as to take the form illustrated more clearly by Figs. 11 and 12, in which a considerable space lies between each strand and the latter are so spread as to very considerably increase the diameter of the rope at predetermined stations thereof. This invention proposes a suitable block 27 having an aperture 28 corresponding in shape to the spread portions of said rope. This aperture is at its ends 29 of a size approximately corresponding with the normal diameter of the rope, and between the ends such aperture enlarges or bulges out, as at 30, to enable it to conform to the enlarged or spread portions of the rope.

It will be noted that, with the parts assembled as shown in Fig. 11, a very considerable amount of unfilled space is provided, and that the structure is not well adapted, as shown, to prevent longitudinal slipping of said block, inasmuch as such movement would tend to compress the spread strands into their normal position. To prevent this action this invention proposes to fill all of said recesses with a suitable unyielding material 31. This material will preferably consist of a readily fusible metal, such as lead, which is well adapted for being easily melted and then caused to fill all open spaces. Preferably small shoulders 32 will be provided within the normal sized portion of said aperture, the purpose being to prevent the block and rope from having any initial slipping movement, which might in time tend to work the parts loose on the rope. Inasmuch as the spreading of the rope may be more conveniently done before it is inserted in the bulged aperture, the block will ordinarily be composed of two parts 33 and 34, which are separable along such flaring aperture, as illustrated by Figs. 11 and 12, and preferably the joint may be broken at 36 so as to provide a satisfactory interlocking of the parts. The lead filling may be inserted either by pouring after the separable parts are arranged around the spread strands, or may be set previously and the separable parts subsequently brought around such bulged portion. The separable parts may be maintained together in any desired way, as for example by means of bolts 37, which are provided with countersunk heads 38.

It will be observed that as the block and rope pass around the turning points of the runway, the rope will flex relatively to said block, and inasmuch as it is desirable to provide a little play I give the exits 39 of the

apertures a slightly flaring or funnel-shaped form, within which the rope may flex when it is turned as described. Since this permits of some little play between the rope and the block 27 at this point, and inasmuch as sand when accumulated in this part tends to abrade the rubbing surfaces and thus wear away the parts, I provide means for permitting a slight yield without, however, allowing the foreign matter to enter said parts. This means consists of a packing 40 of rubber or other suitable resilient material, which surrounds the wire rope and bears against the corresponding end of said block. This packing is then distorted to form a tight and impervious joint between its contacting parts through pressure caused by a closure of the clamping rings 41 shown in Figs. 13 and 14. These rings may be variously constructed, but as shown, present a very satisfactory arrangement and comprise two portions hinged at one end and bolted together at the other end, so that such portions may be brought together to squeeze the rubber as described. In lieu of these rings I may provide any other obvious arrangements for the same purpose; for example, I may provide an ordinary stuffing box or the like, but the shown arrangement is simple and inexpensive and well adapted to meet the exigencies of the case. It will be noted that these blocks will be secured to the rope at suitable intervals and to such blocks will be affixed the excavating buckets, in any manner desired. Inasmuch as it is desirable to allow a slight pivotal or swinging movement of the buckets with respect to said blocks, in order that they may have some little freedom of movement in excavating and in passing around the turning points provided by the various turning pulleys carried by the runway, this invention proposes a connecting means which will provide for such play. In the embodiment shown by Figs. 11 and 12, each block is provided with a second aperture 42 to one side of the bulged or gripping aperture. A link or cross bar 43 provides extended ends 44, each of which passes through this aperture, and has portions 45 exterior thereof intumed, so as to prevent longitudinal displacement of said ends within said aperture. It will be understood, in this connection, that the shown formation of the link may be departed from within proper limits, and said link may be otherwise shaped, according to the dictates of special circumstances. However, the shown form will in general be found to be satisfactory and well adapted for carrying out the ends of this invention. The aperture through which said link passes will be of a double convex shape, as illustrated more clearly by 46 in Fig. 11, in which case the link is of a rectangular cross section as

shown. This form of aperture, as will be perceived, will allow of a slight swinging movement of the link and yet will securely retain the same in place. To provide for the replacement or removal of said link this invention proposes to form a joint 47 in said block through said aperture, and said joint will preferably be so formed that the two separable portions 48 and 33 of the block will interlock against lateral displacement. These and other parts of the block will be removably secured in place through the instrumentality of the bolts which have already been referred to. The under surface 49 of the block, that is to say, the portion of the block which is intended to ride around the turning pulleys, will preferably be slightly curved as shown by Figs. 11 and 12, to provide a smooth action during the travel of the same.

The arrangement of the link or cross bar 43, as it may be termed, on the excavating buckets is shown more clearly in Figs. 4 and 5, to which reference should now be made. Such link extends transversely of the bucket and is secured thereto so as to allow of protruding ends, which are in engagement with the corresponding blocks in the manner heretofore described. In the shown embodiment the link is affixed to the bottom 50 or cutting face of the excavating bucket, the purpose being to bring the strain or pull in a direct line with the cutting edge 51 of the bucket, see Fig. 3. This feature possesses certain fundamental advantages, inasmuch as not only does it provide a directness of action and tend to keep the bucket in suitable alinement for gathering material, but it also enables the rear or body portion of the bucket to be constructed of relatively light and inexpensive material, this owing to the fact that no strains other than the weight of material need be carried by the body portion of the bucket, whereas all of the strain due to forcing it into the material to be excavated is transmitted through the cross bar to the bottom. This invention proposes to make such bottom of relatively heavy proportions, and preferably such bottom will be made interchangeable, so as to be capable of being readily replaced after the cutting edge of the same has become unduly worn. From this it will be seen that in this arrangement a maximum lightness of bucket is provided, without the sacrifice of any of its strength or other advantages.

It is desirable to provide means for securing the rear end of the bucket also to the traveling chain or rope, so that the buckets, while admitting of a little yield, may be retained against an undue swinging about the traveling rope during their travel. To this end the rear of each bucket is provided with one or more steady arms 52 which are secured at one end to the bucket and pro-

trude therefrom short distances, as will be more clearly understood by referring to Figs. 3 and 4. An open cross bar 53 extends from rope to rope at the rear of the bucket, being fixed at its ends to said rope 26 but not being attached directly to the bucket. Such cross bar will ordinarily be composed of a pair of straps which are bolted together near their ends, which are suitably secured to the traveling rope, and at its intermediate portion is spread apart to provide an opening 55, as shown more clearly by Fig. 4. Through this opening or frame extend the protruding ends of the steady arms, it being intended to allow the ends to oscillate within the said opening so as to permit of some little movement of the buckets, without affording any undue movement. Of course many mechanical equivalents of this arrangement will occur to those skilled in the art, and therefore I do not desire to be limited to this precise construction, but have shown this so that the invention may be more clearly understood, and so that these advantages may be carried out in various ways by those skilled in the art.

To insure a smoothness of action of the excavating train, each joint of the runway is provided with a suitable turning means so that the train may properly ride over such joints. Thus the lower joint of the collapsible frame, which portion I have termed the toe, is constructed after the manner shown in Figs. 6 and 7, in which the depending trusses are provided at their lower converging extremities with companion bearing pieces 56 and 57, somewhat after the fashion of a rule joint. These bearing pieces have at appropriate places small lugs or projections 58 which are countersunk in the contacting portions of the truss, which portions may be brought together to clamp such piece therebetween through the instrumentality of a suitable number of bolts 59. The one bearing piece 57 has its lower end bifurcated, and the other is provided with an extension 60 adapted to fit between the legs thus provided. These ends of the bearing pieces are apertured, and within such aperture is placed a suitable sleeve 61 which serves as a replaceable collar adapted to receive the wear of the shaft 15 which passes therethrough. This shaft is maintained against end movement by any suitable thrust means, as for example the shown nuts 62 at the ends thereof. It will of course be understood that some latitude in the arrangement of these details is permissible within the scope of this invention, and in this particular variations will be made to adapt the device to best meet the requirements of particular circumstances. The shaft, as will be perceived, serves as a pinion about which

the depending trusses may swing in raising or lowering the toe, and spaced apart upon such shaft are suitable wheels 63 which as shown are provided with flanges 64 whose purpose is to guide the traveling excavating train and prevent the lateral displacement thereof. The ropes, or chains, as the case may be, which connect the excavating buckets together, pass over the periphery of these wheels and the excavating buckets lie intermediate the wheels, as will be more clearly understood by referring to Fig. 12 and also Fig. 1. The intermediate joints are similarly provided with hinged joints and turning wheels, as will be seen by referring to Fig. 10.

The train of buckets may be driven from any desirable point, and by any suitable means, and in the shown embodiment of my invention such means is located at the apex of the collapsible frame work and serves also as a means for riding the chain about said apex. Thus properly spaced apart upon the upper pinion shaft 14 are two sprocket or chain wheels 65 and 66 having their peripheries configured to interfit with the protruding features carried by the traveling ropes, as will now be described. Thus the periphery of each sprocket wheel has a groove 67, which in the case of ropes will be semicircular and in the case of chains will be correspondingly shaped in conformity with such chains. At suitable intervals about this periphery are also provided seats or recesses 68 into which the blocks 27 successively engage as the said sprocket wheels are rotated. Intermediate these seats I also provide seats 69, which are adapted to receive the rope clamping portions 54 of the open cross bars 53. From this it will be understood that the train of buckets will be caused to positively travel upon a rotation of these top wheels, the interfitting with said wheels of said ropes insuring against a slipping, and at the same time the action will be very smooth and of an essentially practical character. To drive the wheels, one or both of them may be provided with a spurred periphery 70 which is adapted to engage a chain or belt running from a suitable engine carried by the float, or more preferably one or both of these wheels are provided with a toothed periphery 71 which is in engagement with a small pinion 72 carried by a shaft 73 preferably supported by the stationary frame work 7. A large sprocket wheel 74 is also fixed to said shaft, and is driven by a driving belt or chain 75 from the aforesaid engine.

While the uppermost shaft carrying the turning wheels at the apex may be supported solely by the collapsible frame work, for the sake of steadiness and good mechanical construction it is best that it be mounted within

bearings carried by the stationary derrick. This serves to reinforce the rigidity of the whole.

The automatic discharging means is exceedingly simple, although very effective in operation. Turning to Figs. 3 and 4, it will be noted that each bucket has a hinged door 76 on its inner face, the hinge 77 being shown intermediate the top and bottom of the bucket, so that the lower edge of the door may swing outwardly. This door is normally retained closed by means of one or more spring latches 78, which engage the lower end of said door. The buckets descend in a closed condition, the cutting edge takes into the matter which is to be excavated and scoops up an appropriate amount of debris, which is then carried upwardly along the forward periphery of the collapsible frame work until it reaches a point adjacent the apex of the same. At such point is located a stop 79 which engages each latch 78 and throws the same downward, thereby releasing the swinging door 76, which through the weight of the material contained in the bucket swings outwardly and allows the debris therein to discharge. A chute 80, see Figs. 1 and 2, is provided to receive this debris and carry the same to a suitable conveyor 81 leading to the discharging point, which may be either over a collecting scow or may lead to the bank of the canal or other place, as may be preferred. The chute 80 may lead to each side, as shown by Fig. 2, and may have a shuttle door 82 for directing the debris into the appropriate side. As each discharged bucket, with its swinging door, continues to rise it rides over a roller 83 carried by the stationary scaffold, and this roller closes the swinging door, which is then automatically engaged by the said latches and maintained in closed condition. The bucket then continues to ride over the apex, down the other side, and in due time is again filled with debris, the operation being continuous. One marked advantage of this construction resides in the fact that the point of discharge of the debris collected by the excavating chain remains constant, that is to say, the discharge takes place near the apex of the collapsible frame work, which point, as has been already seen, is fixed in position. Owing to this peculiarity, the adjustment of the collecting toe may be made irrespective of adjustment of the location of the discharge point, and consequently the dredging may be carried on rapidly and continuously.

The parts of the boat or vehicle not occupied by the features directly incidental to the dredging apparatus may be used for quarters, coal bunkers and the like.

While I have throughout this specification and in the following claims referred to the word "rope" I desire it to be under-

stood that I have employed this term in its representative sense as denoting any means having functions similar to that of the shown wire rope; that is, for example, a chain would in certain cases be regarded as an equivalent for said rope, except in so far as certain parts of this invention peculiarly relate to a rope composed of a plurality of strands. I have also herein employed the term "truss" in a representative sense as denoting the arms or elements of the collapsible frame work, inasmuch as such arms will preferably be built up of tension and compression pieces in order that a maximum strength may be associated with a minimum weight, but it is to be clearly understood that such term is used in a generic sense and comprehends all the various equivalent elements whether designated as beams, links or otherwise.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention, which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. A stationary derrick, a pair of depending trusses pivoted to the upper end of said derrick, an inextensible link system hinged to and connecting the free ends of said trusses, and an endless excavating chain mounted to travel around the periphery of the aforesaid parts.

2. A float, a derrick carried thereby, a pair of trusses pivoted to said derrick, each being adapted to be moved with or independently of its companion, trusses hinged to the lower portions of said swinging trusses and converging to form a toe, and an endless chain of buckets mounted to travel around the aforesaid frame work, whereby upon swinging one or both of said swinging trusses the toe of said frame work may be raised or lowered to excavate at different depths.

3. An excavating apparatus comprising, in combination, a vehicle, a plurality of trusses carried thereby and converging upwardly therefrom to form an apex, said apex being fixed in position relative to said vehicle, each of said trusses being arranged to independently swing about said apex as a center, a segmental track carried by said

vehicle and supporting the lower end of each swinging truss, and an endless excavating chain mounted to travel around the periphery of said trusses.

5 4. An excavating apparatus comprising, in combination, a vehicle, a pair of trusses converging upwardly to form an apex, said trusses being hinged at said apex and adapted to swing thereabout, a track carried by
10 said vehicle upon which the lower ends of said trusses are supported, and an excavating means adapted to be guided in its travel around said trusses and arranged to discharge material in proximity with the apex.

15 5. An excavating apparatus comprising, in combination, a vehicle, a pair of trusses carried thereby and converging to form an upper hinged joint about which each of said trusses may swing, a segmental track arranged to support the lower end of each
20 truss, said track having a curvature described by the bearing end of the swinging truss, and an excavating means mounted to travel around said trusses and discharge material adjacent the upper hinged joint
25 thereof.

6. An excavating apparatus comprising, in combination, a vehicle, a stationary frame work carried thereby, a collapsible frame
30 work comprising a truss pivotally swung from an upper pivot fixed to said stationary frame work, and an endless excavating chain mounted to travel around the periphery of said frame work and discharge material adjacent said upper pivot.

7. An excavating apparatus comprising, in combination, a vehicle, a stationary frame work rising therefrom, a pair of swinging
40 said stationary frame work and pivoted thereto, the lower swinging ends of said trusses being connected by a plurality of hinged trusses and providing a lower toe, whereby, upon spreading the lower ends of
45 said swinging trusses, said toe may be raised, and a train of excavating buckets mounted to travel around said frame work.

8. An excavating apparatus comprising, in combination, a vehicle provided with a
50 central well, a segmental track rising from each end of said well, the radii of said tracks intersecting at a point overlying said well and intermediate the ends of said vehicle, a pair of swinging trusses each having a lower
55 end arranged to travel upon an associated track, said trusses being hinged at said point, a truss hinged to and depending from the lower end of each of said upper trusses, said depending trusses converging to form a
60 hinged toe which may be raised by spreading the lower ends of said swinging trusses, and an endless train of excavating buckets mounted to travel around the periphery of said trusses.

65 9. An excavating apparatus comprising,

in combination, a vehicle, a collapsible diamond-shaped framework carried thereby, the intermediate joints of said framework being adjustably carried by said vehicle, whereby they may be moved relative to the
70 latter to raise or lower the toe of said framework, and an endless excavating chain mounted to travel around the periphery of said framework.

10. An excavating apparatus comprising, 75 in combination, a vehicle, a plurality of trusses hinged to form a collapsible diamond-shaped frame work, a curvilinear track carried by said vehicle and arranged to support the intermediate hinges of said collapsible frame work, whereby the latter may be
80 expanded to raise its toe, and an endless excavating chain mounted to travel around said frame work.

11. An excavating apparatus comprising, 85 in combination, a vehicle, a plurality of trusses hinged at meeting ends to form a diamond-shaped collapsible frame work, a segmental track whose center of curvature is the apex of said frame work, the intermediate joints of the latter being arranged to
90 travel along said track to raise or lower the toe of said frame work, and a train of excavating buckets mounted to travel around the periphery of said frame work.

12. An excavating apparatus comprising, in combination, a traveling rope, a block affixed thereto against relative movement
95 therewith, said block providing a double convex aperture, a link extending into said aperture and adapted to rock therein, and a bucket secured to said link.

13. An excavating apparatus comprising, in combination, a sectional block having a
105 bulged aperture, a traveling rope passing through said aperture and spread into the bulge thereof to fix the relative positions of said block and rope, said block having a double convex aperture, a link passing into
110 said aperture and adapted to rock therein, and an excavating bucket having its cutting edge directly secured to said link.

14. An excavating apparatus comprising, in combination, a three-part block each section thereof being enlarged to form an
115 aperture, one of said apertures being bulged, a traveling rope passing through said bulged aperture and having its strands spread therein, a filling of yielding material within the interstices within said bulged
120 aperture to prevent a contraction of said spread strands, a link pivotally arranged within said other aperture, a bucket carried by said link, and means for holding the
125 parts of said block together.

15. An excavating apparatus comprising, in combination, a traveling rope, a block providing an aperture through which said rope
130 passes, said rope and block being secured against relative movement, a resilient pack-

ing adjacent the point of egress of said rope from said aperture, and means compressing said packing into a close fit with said rope and block to prevent the admission of

5 foreign matter.

16. An excavating apparatus comprising, in combination, a block having a bulging aperture, a traveling rope passing through said aperture and interfitting with the bulge thereof to prevent relative movement between said block and rope, a resilient washer surrounding said rope and bearing against the outer periphery of said aperture, and a clamping ring arranged to compress said washer into close contact with said rope and

15 said block to prevent the admission of foreign matter into said aperture.

17. An excavating apparatus comprising, in combination, a pair of traveling ropes, a bucket pivotally secured at its front end and directly in line with its cutting edge thereto, a cross-bar secured at each end to the corresponding rope, and one or more steady arms projecting from the rear of said bucket and adapted to engage said cross-bar whereby a limited movement of said bucket may be permitted and an undue movement prevented.

18. An excavating apparatus comprising, in combination, a pair of traveling ropes, an excavating bucket pivotally secured to said ropes in direct line with its cutting edge and lying therebetween, a cross-bar secured at its end to and extending between said ropes at the rear of said bucket, and one or more steady arms protruding from the rear of said bucket into the path of movement of said cross-bar whereby a limited movement of the rear of said bucket relatively to said cross-bar will be afforded.

19. An excavating apparatus comprising, in combination, a pair of traveling ropes, an excavating bucket having each of its forward sides pivotally secured in line with its cutting edge to the corresponding rope, a cross-bar extending between said ropes and secured at each end to the corresponding rope, said cross-bar providing an inclosed opening between its ends, and one or more steady arms protruding from the rear of said bucket into said opening and adapted to reciprocate from side to side thereof, and thereby allow a limited movement of said bucket.

20. An excavating apparatus comprising, in combination, a collapsible polygonal runway, having turning wheels at the joints thereof, an endless rope mounted to travel around said wheels at a distance from the periphery of said runway, a series of buckets suspended from the side of said rope adjacent said runway, each bucket being provided with a hinged door adapted to discharge the contents thereof.

21. An excavating apparatus comprising, in combination, a runway, a carrier mounted to travel therearound, a bucket carried by said carrier, said bucket being provided with a hinged door and a catch for holding the same closed, a stop adapted to coact with said catch to open said door at a predetermined station of its travel, and means for closing said door at a succeeding station of said bucket's travel.

22. An excavating apparatus comprising, in combination, a runway, a carrier adapted to travel therearound, a series of excavating buckets suspended from said carrier, each bucket having a hinged door and a catch for holding the same closed, a discharge stop mounted on said runway and adapted to co-act with the catch of each bucket to open said door and discharge the contents thereof as it passes said stop, and a closing device carried by said runway to automatically effect a closure of said door after the discharge of the contents of said bucket.

23. The combination with an excavating bucket, of a cross bar attached to its front, belts, joint blocks for connecting the buckets to the belts, and open cross bars upon the belts, and arms upon the buckets for steadying the same substantially as set forth.

24. The combination with an excavating bucket, wire ropes and a cross bar of joint blocks for clamping the rope, said joint blocks being composed of the three portions bolted together, there being a cavity between the portions for the enlarged portion of the wire rope and its binding metal, and a slot between two of the portions for the cross bar, which slot is widest at its ends to allow for the movement of said bar, substantially as specified.

25. In a dredging apparatus, a float and a frame thereon, in combination with four radius bars arranged in pairs of equal length, hinges at the ends of the radius bars, shafts passing through the hinges and forming pivots, one of such shafts being supported in an elevated position, wheels upon said shafts, and a chain or belt of buckets passing around the respective wheels substantially as set forth.

26. An excavating apparatus comprising, in combination, a traveling rope, a block affixed thereto against relative movement therewith, said block providing a double convex aperture, a link extending into said aperture and adapted to rock therein, and a bucket secured substantially near its cutting edge to said link.

27. An excavating apparatus comprising, in combination, a traveling rope, an excavating bucket, and means securing said bucket directly in line with its cutting edge to said rope, whereby said bucket will be compelled to travel with said rope and re-

ceive the propelling force directly on its cutting edge, but may be rocked relatively therewith.

28. An excavating apparatus comprising, in combination, an endless traveling rope, a series of blocks affixed thereto against relative movement therewith, a corresponding number of excavating buckets, each bucket being pivotally secured in line with its cutting edge to one of said blocks whereby the pull of the rope will be transmitted directly to said cutting edge and said bucket will be compelled to travel with said rope but may rock slightly therewith.

29. An excavating apparatus comprising, in combination, a sectional block having a bulged aperture, a traveling rope passing through said aperture and spread into the bulge thereof to fix the relative positions of said block and rope, said block having a double convex aperture, a link passing into said aperture and adapted to rock therein, and an excavating bucket having its cutting edge directly secured to said link.

30. An excavating apparatus comprising, in combination, a traveling rope, an excavating bucket pivotally secured at its cutting edge to said rope whereby the pull of the rope may act directly on said cutting edge, and means connecting the opposite end of said bucket to said rope to provide a limited swinging movement of said bucket about said pivot.

31. An excavating apparatus comprising, in combination, a traveling rope, an excavating bucket pivotally secured at its cutting edge to said rope whereby the pull of the rope may act directly on said cutting edge, and means securing the other end of said bucket to said rope and adapted to permit a limited movement of said end relatively to said rope.

32. An excavating apparatus comprising, in combination, a traveling rope, a bucket pivotally secured at its cutting edge thereto whereby the pull of the rope may act directly on said cutting edge, an abutment secured to the opposite end of said bucket,

and a stop carried by said rope and adapted to limit the movement of said abutment. 50

33. An excavating apparatus comprising, in combination, a pair of traveling ropes, a bucket pivotally secured at its front end and directly in line with its cutting edge thereto whereby the pull of the rope may act directly on said cutting edge, a cross bar secured at each end to the corresponding rope, and one or more steady arms projecting from the rear of said bucket and adapted to engage said cross bar whereby a limited movement of said bucket may be permitted and an undue movement prevented. 55 60

34. An excavating apparatus comprising, in combination, a pair of traveling ropes, an excavating bucket pivotally secured to said ropes in direct line with its cutting edge and lying therebetween whereby the pull of the rope may act directly on said cutting edge, a cross bar secured at its end to and extending between said ropes at the rear of said bucket, and one or more steady arms protruding from the rear of said bucket into the path of movement of said cross bar whereby a limited movement of the rear of said bucket relatively to said cross bar will be afforded. 65 70 75

35. An excavating apparatus comprising, in combination, a pair of traveling ropes, an excavating bucket having each of its forward sides pivotally secured in line with its cutting edge to the corresponding rope, a cross bar extending between said ropes and secured at each end to the corresponding rope, said cross bar providing an inclosed opening between its ends, and one or more steady arms protruding from the rear of said bucket into said opening and adapted to reciprocate from side to side thereof, and thereby allow a limited movement of said bucket. 80 85 90

In testimony whereof I affix my signature, in the presence of two witnesses.

THOMAS F. LONNEY.

Witnesses:

ARTHUR S. PREVIN,
H. M. SEAMANS.