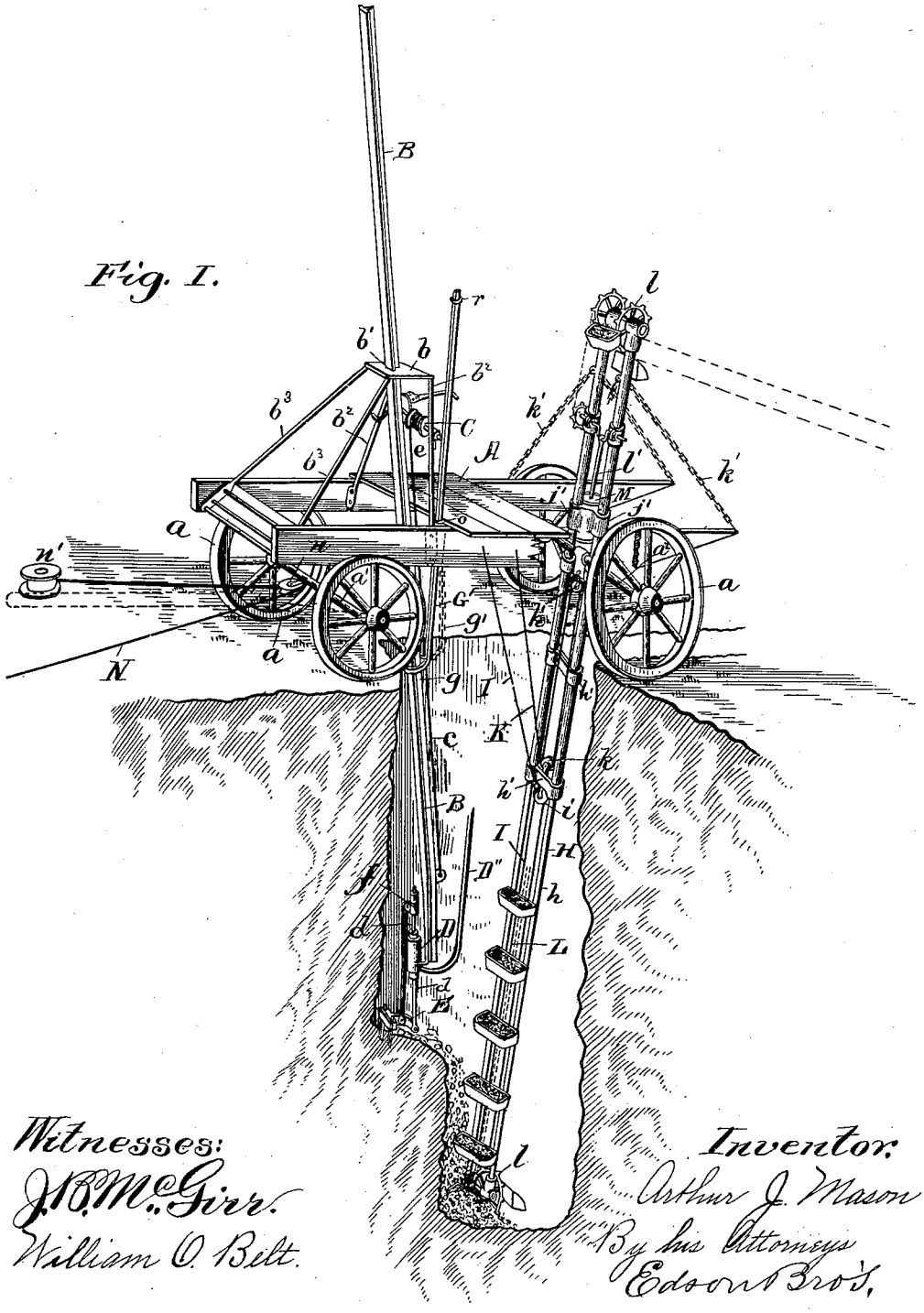
(No Model.) 3 Sheets—Sheet 1.

# A. J. MASON.

## TRENCH EXCAVATOR.

No. 482,260. Patented Sept. 6, 1892.

Fig. 1.




Witnesses:
J. B. McGirr.
William O. Belt.

Inventor:
Arthur J. Mason
By his Attorneys
Edson Bros.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 2.

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Fig. II.

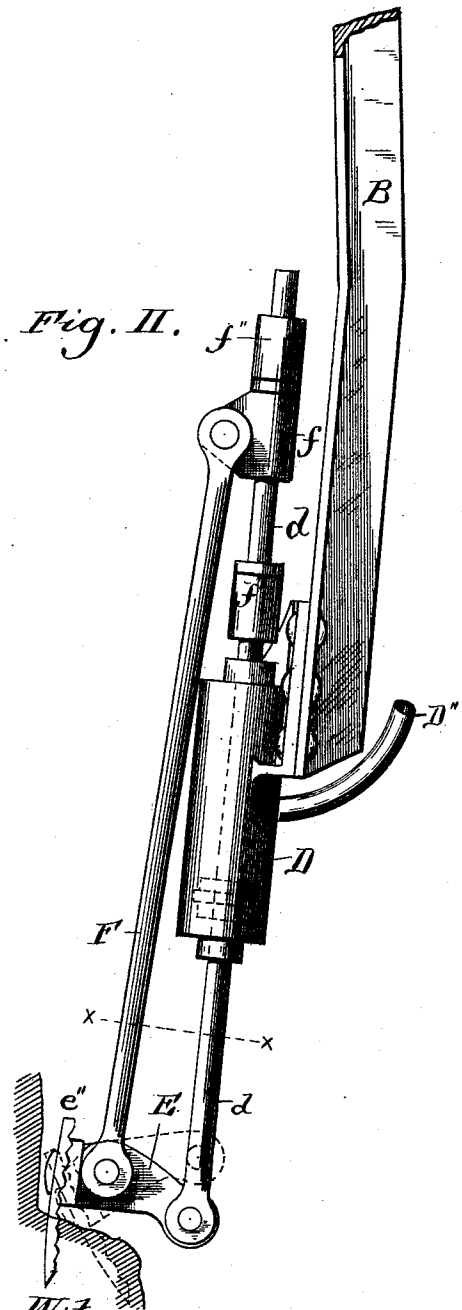



Fig. III.

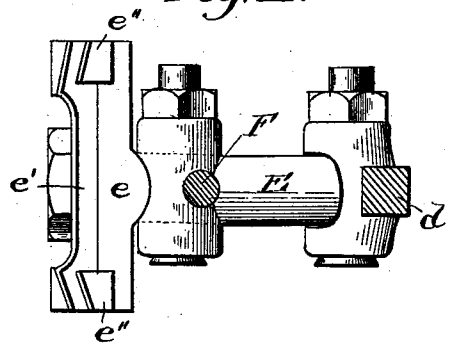



Fig. IV.

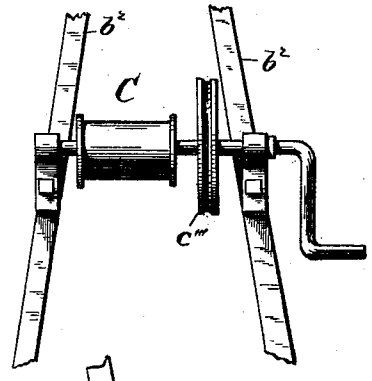
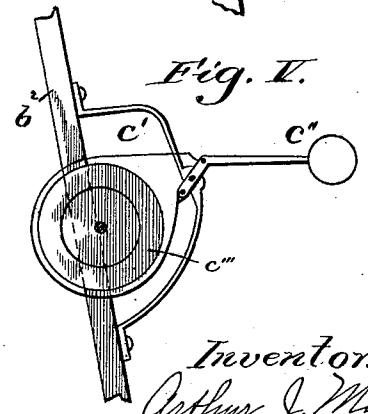



Fig. V.

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William O. Belt

Inventor:
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Edson Bros.

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## TRENCH EXCAVATOR.

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Fig. III.

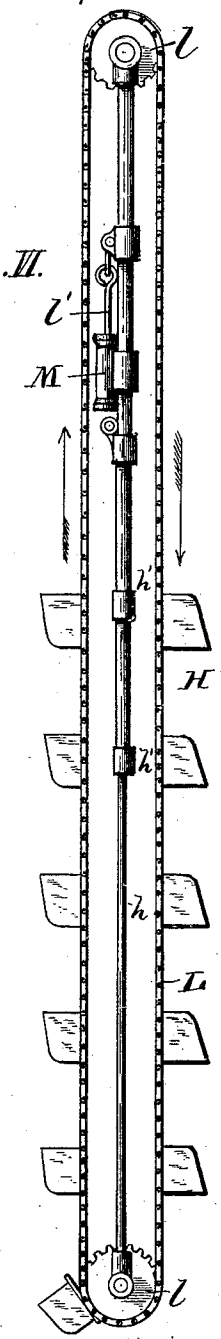



Fig. VII.

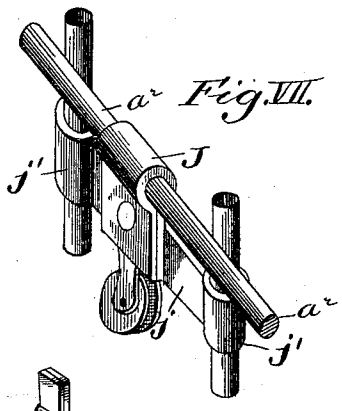
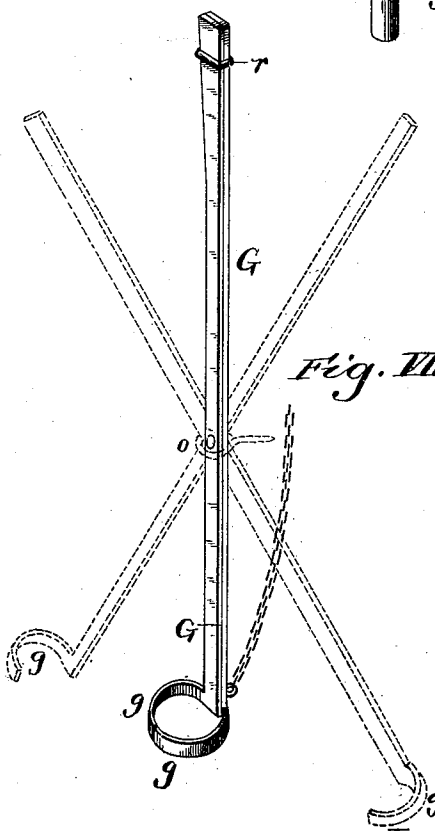



Fig. VIII.

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# UNITED STATES PATENT OFFICE.

ARTHUR JOHN MASON, OF KANSAS CITY, MISSOURI.

## TRENCH-EXCAVATOR.

SPECIFICATION forming part of Letters Patent No. 482,260, dated September 6, 1892.

Application filed July 24, 1891. Serial No. 400,606. (No model.)

*To all whom it may concern:*

Be it known that I, ARTHUR JOHN MASON, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Trench-Excavators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in steam picks and excavators especially adapted for use in digging trenches; and the object is to provide a simple and convenient machine capable of digging into the earth in any desired direction, which at the same time elevates the earth loosened by the pick to the level of the ground to be conveyed away in a suitable manner.

A further object of my invention is to provide suitable means for operating and adjusting the length and direction of the pick and elevator, and finally it relates to certain details of construction desirable for the effective operation of my machine.

With these and other ends in view my invention contemplates a suitable frame mounted on carrying-wheels, a beam loosely secured in the front portion of the frame, from which is suspended a pick arranged on the lower end of the frame with the cylinder, and suitable valve mechanism for operating the piston in said cylinder, which communicates motion to the pick. The pick is arranged to operate in the front part of the trench and the elevator is suspended in rear thereof and adapted to receive the earth thrown down by the pick. The elevator-frame is composed of two or more sections of parallel tubes adapted to telescope one within the other and connected together by means of a rope or ropes and pulleys. This elevator-frame is loosely suspended on the rear axle of the running-gear and an endless chain of buckets is arranged to run over it to collect the earth at the bottom of the trench and deposit it in a chute above the trench, whence it is conducted to a cart or other suitable vehicle. A steam-cylinder is secured in the upper end of the elevator and a piston operating in said cylinder is connected in a suitable manner with the driving-shaft for the endless chain of buckets to impart the proper motion thereto.

The beam carrying the pick mechanism can be elevated by means of a windlass and a rope secured to the lower end of the beam, and suitable brake mechanism is provided on the windlass to govern the descent of the pick, the position of the pick being governed or controlled by means of tongs which engage the beam and are fulcrumed in the frame.

My invention further consists of certain details of construction and arrangement of parts, as will more fully appear hereinafter.

To enable others to more readily understand my invention, I have illustrated the same in the accompanying drawings, in which—

Figure I is a perspective view of my improved machine arranged and adapted for operation in a trench, showing a portion of the side of the trench broken away. Fig. II is a side elevation of the pick with the mechanism for operating the same. Fig. III is a view taken on the line $x\ x$ of Fig. II, showing the manner of securing the pick in position. Figs. IV and V are detail views of the windlass and brake mechanism, respectively, on the pick-carrying beam. Fig. VI is a side elevation of the elevator. Fig. VII is a detail view of the device for suspending the elevator in place on the axle, and Fig. VIII is a view of the tongs.

Referring to the drawings, in which like letters of reference denote corresponding parts in all the figures, A designates the frame or platform of my improved excavator, which is mounted on the wheels $a$, fitted on the axles $a'\ a^2$ in a manner similar to the ordinary running-gear. The front of this frame is provided with an opening in which the beam B is arranged to operate. The beam B is made of angle-iron and it is mounted in a small plate $b$, which is supported in position over the opening in the frame by suitable rods $b^2$ $b^3$, and an angular opening or slot $b'$ is provided in the plate $b$ to receive the beam. By this construction of parts the beam B can be moved to assume any position within a circle of about eight feet in diameter directly beneath said plate $b$ at any depth below the same not greater than the beam itself, and at the same time the beam is effectively prevented from twisting or revolving. This also enables the

operator to direct the pick supported on the lower end of the beam to a point beneath the surrounding level ground at an angle to the vertical plane of the trench, so that the trench may be made larger at the bottom than at the top.

Secured on two of the supporting-rods $b^2$ of the plate $b$ below the same is a windlass C, and a rope or cable $c$ is connected to the lower end of the beam B and the windlass, by means of which the beam and pick mechanism may be elevated. In order to prevent a too rapid descent of the beam while the pick is in operation or when it is being lowered into position, I provide a brake-band $c'$ on a pulley $c'''$ on the windlass, and a weighted arm $c''$ is secured to this band and holds its normally in close frictional contact with the pulley to retain the beam in an elevated position. When the operator desires to lower the pick and beam, he simply raises the weighted arm, which releases the brake-band, and the beam will descend by gravity. This is an advantageous arrangement, as these machines have to be constantly changed and altered, and the means for retaining the pick in a particular position should necessarily be simple and capable of easy and quick operation.

The pick and the mechanism for operating the same are secured rigidly on the lower end of the beam B, and consists of a steam-cylinder D, provided with suitable valve mechanism for admitting and exhausting steam therein, the preferred form of which is similar to that used in steam rock-drills familiar to those skilled in the art, and a piston $d$ extends through both ends of the cylinder and projects some distance on either side thereof. The cylinder is itself bolted or otherwise rigidly secured to the lower end of the beam, and steam is conducted to the same through a flexible pipe D'', leading to an engine located either on the ground above the trench or on the machine in a convenient place.

Pivotally secured on the lower end of the piston-rod $d$ is a link E, which is provided on its free end with a broad plate $e$, and a corresponding plate $e'$ is screwed on the face of the rigid plate $e$ and clamps the points $e''$ of the pick firmly in place between them. These pick-points may be constructed of any size and shape; but they are preferably two in number arranged on either side of the center of the clamping-plates, and their rear surfaces are corrugated to insure a firm hold on the earth. By this arrangement the pick-points $e''$ may be readily removed to be sharpened and quickly clamped in their proper position.

A rod F is pivotally secured to the link E just in rear of the rigid plate $e$, and it extends upward close to the cylinder above the upper end thereof. The upper end of the rod is loosely secured to a movable sleeve $f$, which is fitted on the upper end of the piston-rod $d$. Adjustably secured on either side of this sleeve $f$ on the piston-rod $d$ are two abutments $f'$ $f''$, which are adapted to limit the upward and downward movement of the sleeve $f$, and the lower abutment $f'$ also limits the descent of the piston-rod. The operation of the pick is automatic and the pick-points adjust themselves at each stroke of the piston in their proper position for operation. In Fig. II the position of the pick-points and the mechanism is shown in dotted lines in the act of discharging the earth, and when they are in that position the steam is admitted by the valve mechanism into the lower part of the cylinder to elevate the piston quickly. When the piston-rod $d$ begins to rise it first turns the link E into the position shown in dotted lines in Fig. II, and as the piston-rod continues to rise the abutment $f'$ strikes the sleeve $f$ and lifts the pick bodily to the highest point of rise of the piston-rod. As the piston-rod begins its descent it first turns the link E back into the position shown in full lines in Fig. II, at which time the abutment $f'$ strikes the sleeve $f$, and the entire pick descends while in this position into the earth. The operation being repeated the earth is broken and pushed off and falls on the buckets of the elevator.

In order to quickly and easily adjust the course of the pick I provide a pair of tongs G, which are pivotally secured at or about the middle and fulcrumed at said pivotal point to a convenient place on the main frame close to the beam B. The lower end of each member of the tongs is provided with a jaw $g$, which jaws are adapted to inclose the beam, and as the operator stands on the platform he can readily adjust the tongs on the beam and direct the work of the pick to any position within a circle of limited diameter. This construction of the pick mechanism and supporting-beam enables the pick to be operated beneath the surface of the ground out of the vertical line of the sides of the trench, which is often very desirable in the practical operation of machines of this class, or it can be adjusted a long distance forward to work ahead of the machine proper, so that it will not be necessary to move the whole machine forward so often as the work of excavating the trench progresses. For this purpose the tongs are suspended from the platform by a chain $g'$, attached to the platform, and they pass loosely through an opening in the platform and are fulcrumed in an eyelet $o$ of a staple on the platform or by other desired means in such a manner that said tongs may assume any position within forty degrees of a vertical line, and thus adjust the beam and pick correspondingly. A small loop or ring $r$ may be slipped over the upper ends of the tongs to hold them together after they have been adjusted on the beam.

The elevator H consists of two or more sections, each section comprising two parallel tubular pieces $h$, adapted to telescope into the section next before it. These tubular sides $h$ are suitably secured together by transverse pieces $h'$, arranged at the bottom of each section, and the upper ends of the tubes of each

of the lower sections are fitted in the lower ends of the tubes of the section next above. In order to shorten or lengthen the elevator to adjust it to the depth of the trench, I connect the lower end of each section with the corresponding end of the section next above it by a rope I, which runs over pulleys *i*, attached to said ends, and the fall line of said rope is attached to the frame of the machine in a convenient place. This elevator-frame H is secured in place on the rear axle $a^2$ of the running-gear by means of a suitable suspension device, which works loosely on said axle. This suspension device may consist of the collar J, loosely secured on the rear axle of the machine, and the depending ends of this collar are swiveled to a plate *j*, which has the sleeves *j'* on either side of the collar J. The parallel tubes of the upper section of the elevator are adapted to slide vertically in these sleeves *j'* as the elevator is adjusted in a vertical direction. This vertical adjustment of the whole elevator is accomplished by means of a rope K, which runs over the pulleys *k k'*, attached to the suspending device and the lower end of the first section, and the fall line of this rope K is also fastened to a convenient place on the frame. By the arrangement of the elevator and the suspending device the lower end of the elevator may be easily and quickly swung in any direction, the collar J permitting the elevator to be slid to either side of the trench, and as the collar J has a swiveled connection with the plate *j*, which carries the elevator, it is obvious that said elevator may be swung in any direction. To regulate the position of the elevator, a number of guy-ropes *k'* are secured to the top of the elevator and to convenient places on the frame to steady the elevator and adjust the same in the desired position for work. It will thus be seen that I provide a vertical adjustment of the whole elevator and an independent adjustment of each section, which, in connection with the lateral adjustments of the elevator, provides an easy and advantageous means for placing the elevator in any position to receive the earth thrown down by the picks.

A chain of buckets L is adapted to run over the elevator-frame on suitable sprocket-wheels *l*, and these wheels are driven by a suitable connection with the piston-rod *l'*, which operates in a steam-cylinder M, mounted in the frame. The boiler for driving the bucket-chain as well as for operating the pick may be suitably placed on the frame of the machine, if desired, or on the ground.

When it is desired to shorten the elevator, the rope K or I is operated and the bucket-chain properly shortened, and when a longer elevator is wanted the bucket-chain is disengaged and the weight of the elevator will cause it to drop until arrested by the rope K or I.

The telescopical arrangement of the elevator is another important feature of this machine which enables the lower end of the ladder to move in a vertical direction whenever a bucket strikes an obstruction in its path. As the chain travels and a bucket passing around the lower end of the elevator strikes a stone or root too firmly embedded to be moved, the effect of the strain on the upside of the elevator-chain raises the foot of the elevator clear of the obstruction.

In operation the vehicle is adjusted to straddle the trench and the pick adjusted approximately in position for work. The elevator is then adjusted to collect the earth thrown down by the pick, and the machine set in motion. When all the trench has been excavated within reach of the pick and elevator, a line N is attached to a stake driven in the ground on the center line of the proposed trench at some distance ahead of the machine. This line is then led back to the machine and passed around a pulley *n*, attached to the forward axle, and thence back to the end of the tongue to a windlass *n'*, attached to said tongue. The machine is then moved forward by operating the windlass, and by manipulating the tongue the operator keeps the machine properly across the place where the trench is to be excavated.

I am aware that changes in the form and proportion of parts and details of construction can be made without departing from the spirit or sacrificing the advantages of my invention, and I therefore reserve the right to make such changes as fall within the scope of my invention.

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

1. In a trench-excavator, the combination of a main frame, a plate supported above said frame, an angular beam carrying the pick, arranged to move vertically in said plate, and the tongs adapted to grasp said beam and adjust it laterally, so that the pick will operate in the desired position, substantially as described.

2. In a trench-excavator, the combination of the main frame, an angularly-slotted plate supported over the front portion of said frame, an angular beam adapted to move vertically in said plate, the pick, and mechanism for operating the same on the lower end of said beam, a windlass arranged below the plate on the supports therefor and having a weighted arm, a rope attached to said windlass and the lower end of the beam to adjust the same vertically, and the tongs fulcrumed on the frame to move the beam laterally, substantially as described.

3. In a trench-excavator, the combination of a main frame, the rods in the front part of said frame, an angularly-slotted plate supported on the rods, and the pick-carrying beam adapted to move vertically in said plate and fitting loosely in the slot to permit the lower end of the beam to be adjusted laterally, substantially as described.

4. In a trench-excavator, the combination

of a main frame, the rods secured in the front portion of said frame and converging to their upper ends, the angularly-slotted plate mounted on said rods, the pick-carrying beam adapted to move vertically in said plate, and the tongs fulcrumed on the main frame, adapted to grasp the main beam and adjust it laterally, substantially as described.

5. In a trench-excavator, the main frame, the pick-beam loosely mounted thereon, and the tongs having their lower ends curved and extending at right angles to the handles thereof, said tongs being fulcrumed to the main beam at their pivotal point, substantially as described.

6. In a trench-excavator, the combination of a main frame, the pick-beam mounted on said main frame, the pick mechanism, the tongs fulcrumed in the frame, and the chain supporting said tongs, substantially as described.

7. In a trench-excavator, the combination of the main frame, the beam loosely supported on said frame, the cylinder secured to the lower end of the beam, the piston-rod, the pick, and connections intermediate of the pick and piston-rod to operate the former, substantially as described.

8. In a trench-excavator, the combination of the pick-beam, the cylinder, the piston-rod extending through said cylinder, and the link pivotally secured to the lower end of the piston-rod and carrying a pick-point, substantially as described, for the purpose set forth.

9. In a trench-excavator, the combination of the pick-beam, the cylinder, the piston-rod extending through the cylinder, the link pivotally secured to the lower end of said piston-rod and carrying the pick-points, the rod pivotally secured to said link between the pick-points and the piston-rod and having its upper end loosely connected to the upper end of the piston-rod, and the abutments on said piston-rod, as and for the purpose set forth.

10. In a trench-excavator, the combination of the pick-beam, the cylinder, the piston-rod extending through the cylinder, the link on the lower end of the piston-rod, the clamping-plates on said link, the pick-points, the rod pivotally secured to said link and connected to the upper end of the piston, and the abutments, substantially as described.

11. In a trench-excavator, the piston-rod, the link pivotally secured thereon at its lower end, the transverse plate on the front of said link, the movable plate adapted to be clamped tightly to the transverse plate, the recesses in said plates, and the picks, substantially as described.

12. In a trench-excavator, the piston-rod, the link pivotally secured thereon at its lower end and carrying the binding-plates, the picks, and a screw passing through said plates and securing the picks firmly between them, substantially as described.

13. In a trench-excavator, the elevator comprising the movable sections, each section consisting of two parallel tubes adapted to telescope into the tubes of the section next above, the transverse pieces connecting the lower ends of each pair of tubes, and means for suspending said elevator on the machine, substantially as described.

14. In a trench-excavator, the elevator composed of the sections adapted to telescope one within the other, the ropes connecting the lower end of one section with the main frame and with the lower end of the next adjacent section, whereby each section may be independently adjusted, and the bucket-chain, substantially as described.

15. In a trench-excavator, the elevator consisting of the sections of parallel tubes, each section being adapted to telescope in the one next above, the ropes connecting the lower ends of two adjacent sections, the bucket-chain, and the suspension device loosely secured on the rear axle of the machine, substantially as described.

16. In a trench-excavator, the frame, the elevator, and the suspension device consisting of the collar loosely secured on the rear axle of the machine and the plate swiveled to said collar and having the sleeves on the outer ends thereof, through which pass the tubes forming the elevator, substantially as described.

17. In a trench-excavator, the frame, the collar fitted loosely on the rear axle of the machine, the plate swiveled to said collar and having the sleeves in which the tubes of the elevator pass, the suspension devices, the elevator, and the rope connecting the suspension device with the lower end of the upper section of the elevator and adapted to elevate the same, substantially as described.

18. In a trench-excavator, the frame mounted on wheels and adapted to straddle the trench, the pick-beam loosely secured above the frame, the pick and mechanism for operating the same, carried by the beam, the elevator loosely secured on the rear axle of the machine, and the bucket-chain, both pick-beam and elevator being capable of a vertical and lateral adjustment to bring the latter in proper position beneath the pick, substantially as described.

19. In a trench-excavator, the frame, the pick-beam loosely secured in the forward part of the frame and capable of vertical adjustment, the pick and mechanism for operating the same, carried by the beam, the elevator composed of the telescopical sections, said elevator being loosely secured on the rear axle of the machine, the bucket-chain, and means for adjusting the pick-beam and elevator, substantially as described.

20. In a trench-excavator, the frame, a pick-beam loosely secured in the front portion of said frame and having a vertical and lateral adjustment, the pick and mechanism for operating the same, carried by said beam, the ele-

vator loosely secured on the rear axle and adapted to be adjusted laterally thereon, the bucket-chain operating on said elevator, and means for adjusting the pick and elevator, substantially as described.

21. In a trench-excavator, the pick-beam made of angle-iron loosely fitted in an angularly-slotted plate to enable the lower end of the pick-beam to be swung in any direction, substantially as described.

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

ARTHUR JOHN MASON.

Witnesses:
C. A. SIAS,
H. T. RIPLEY.