This invention relates to tweezers, and especially to tweezers of a power-driven nature and which functions both to grip and to pull hairs or the like, and has for its object to generally improve power-driven tweezers as the same have been heretofore known.

It is a particular object of the invention to provide an instrument of this character in which the tweezers' gripping fingers incorporate an improved form of spring-closing action effectuating a substantially instantaneous grasp as the suppressed load of the spring is permitted to assert itself.

The invention has the further and important object of providing plural sets of gripping fingers in a single instrument and thus enabling the instrument to be effectively used in the removal of beards, the instrument being one which will rapidly remove the hairs from comparatively large skin areas and as distinguished from prior instruments which, employing only a single set of tweezers fingers, are capable of plucking only a very few hairs in each cycle of operation of the instrument.

It is a further object to devise a power-driven tweezers which can be freely moved over the skin surface being treated and with no liability whatever of pinching the skin.

It is a still further object to devise a power-driven tweezers which is relatively self-cleaning.

As a further object still, the invention aims to incorporate a pressure-air means of ridging the instrument of free hairs, and to develop the energy for the source of this pressure-air from the motor which drives the tweezers.

The foregoing, and still other particular objects and advantages, will appear and be understood in the course of the following description and claims, the invention consisting in the novel construction and in the adaptation and combination of parts hereinafter described and claimed.

In the drawings:

Figure 1 is a fragmentary elevational view illustrating a tweezers constructed in accordance with the now preferred embodiment of the present invention and shown in association with the drive motor therefor.

Figure 2 is a longitudinal sectional view to an enlarged scale illustrating the tweezers proper, and which is to say divorced from the flexible drive cable which is removable associated therewith, the section being taken on the axial line of the socket into which the drive cable fits.

Fig. 3 is a longitudinal sectional view modified from Fig. 2 as to the position of the tweezer fingers, and with the section taken on line 3—3 of Fig. 4.

Fig. 4 is a longitudinal sectional view on line 4—4 of Fig. 3.

Figs. 5 and 6 are transverse sections on lines 5—5 of Fig. 4 and 6—6 of Fig. 2, respectively.

Fig. 7 is a detail view to illustrate the crank shaft and the three eccentrics formed thereon which operate to drive respective sets of tweezers.

Fig. 8 is an underside view of the guard structure which is applied to the operating head of the machine, and which illustrates a form of guard modified from the showing of Figs. 2, 3 and 4, the departure lying in the fact that Fig. 8 illustrates a shim applied as a facing plate to the guard.

Figs. 9 and 10 are side and end elevational views, respectively, of the guard structure shown in Fig. 8; and Figs. 11 to 16, inclusive, are schematic illustrations showing the tweezers of the present invention at six stages of their cycle operation.

The device of the present invention provides a casing or housing member 20 arranged to be held within the hand of an operator, and there is provided within this casing a crank chamber 21 and a gear chamber 22. The two chambers connect and have a bearing 33 for members therein. Received within these two chambers is a shaft 24, to which is fixedly applied, at a point more or less central to the length, a collar 25 arranged to seat within the bearing 23, and acting in conjunction with this bearing for centering the shaft is a bore 29 formed in the outer-end-wall of the crank chamber. There are produced as an integral part of the shaft and placed to lie within the crank chamber a set of eccentrics 27—28—29 turned 120 degrees from each other, and functional to these eccentricities are respective traverse or pitman heads 35—31—32 having their connecting rods 33—34—35 working on set parallel axes. An arm, denoted 36, is formed integral with the casing and projects from the crank end of the latter to lie at right angles to the axis of the shaft, and this arm has formed in its outer portion a set of three exposed slideways, as 31, two of which are located in one face and lie at opposite sides of the arm's longitudinal medium length and the third of which is located in the other face and is placed central to the width.

Between the inner ends of these slideways and the crank chamber the arm's root end is bored, and extending through these bores into the slideways are the pitman rods 33—34—35. Plates 40 and 41 are removably secured to the arm to serve as covers for the slideways.

There is received in the slideways and detachably secured by means of pin fasteners 42 to the related pitman rod a respective slide block 43, and riveted or otherwise fixedly secured to and projecting forwardly from such block are a pair of tweezers 44—45 which serve as the operating elements for gripping and plucking hairs. Each said tweezers is formed upon its outer free end with a jaw, as 46, and provided upon the underside of each tweezers in rearwardly removed relation to the jaw is a cam-forming prominence 47.
produced much in the nature of a ratchet tooth with the inclined face lying toward the rear. The meeting faces of the jaws are grooved, knurled, or otherwise treated to assure a secure grip upon the hairs. There is associated with each set of tweezers and arranged to occupy a position between the spring-fingers a spreader member, and this member is comprised of a pair of parallel and longitudinally extending rods 48, joined at the rear by a cross-arm 50 and at the front by a spreader head 49. The spreader head terminates in a radial extension 51 and on each lateral face presents concavities 52. The over-all length of the spreader member is slightly less than the span between the jaws and the forward wall of the slide block 43, and namely such as will permit minor play of the spreader member. As a slide journal for the spreader member, rods 48 thereof are received through a stationary block 53, and this block, which extends transverse to the slide-way, is held in position by the engagement of its two ends (see Figs. 2, 3 and 5) in side notches formed in the arm 36, and also in the cover plate 40 or 41 as the case may be. The frontal part of the mounting block 53 has its lateral faces 53' sloped to a somewhat greater angularity than the slopes of the prominences 41 toward insuring that the first point of contact as between said lateral faces and the prominences will, in the retractive stroke of the tweezers, occur at the rear limit of these faces. This perforate serves to delay the opening of the tweezers or, otherwise stated, hold the tweezers in gripping engagement with the beard or hairs which are being plucked for a longer portion of the retractive stroke. Considering that it is desirable to hold the movement of the tweezers to a relatively short stroke, and being desirous of employing, in the manner hereinafter described, the terminating portion of the retractive stroke for cleaning adherent hairs from the faces of the tweezers, the described arrangement for initiating the opening of the tweezers at the last possible point commensurate with the permitted stroke is important as a means of proportionately prolonging the plucking travel.

The arrangement of the parts, and which will be clearly understood in the course of describing the operation, is such that the spreader member 49 moves in its advance or forward stroke in concert with the tweezers for a portion only of the latter's longitudinal travel, whereupon movement is interrupted in consequence of the cross-arm or the spreader head, as the case may be, coming into contact with the mounting block 53. The said movement of the tweezers brings the jaws forwardly beyond the extreme outer end of the arm 36, and carried by said arm to occupy a plane approximately coinciding with the outer anterior point of the tweezers' travel is a guard 54. This guard is or may be carried by rods 55 which fit in end sockets of said arm, and set screws 57 (Fig. 5) are provided to engage said rods for setting the guard in proper position. The guard has openings 58 cut through to accommodate the jaws of the tweezers. There may be platformed or otherwise treated in relation to the face of the guard a shim-like facing strip, as 60, presenting rows of comparatively small apertures 61 serving much the same function, and namely to admit the hairs of a beard, as the minute openings in the cutting heads of electric razors. While 61 represent these apertures as being square in form, it is apparent that the same could be round, oblong, rhombic, or as might be otherwise desired. Also, the guard might be convex or concave as well as flat.

Reverting now to the drive, a worm wheel 61 is secured by a pin 65 to the end of the shaft 24 which lies within the gear chamber, and meshing this worm wheel is a worm 68 driven through a flexible cable 67 from a motor 69, there being provided, by reference, a bracket 70 on which the motor is hung. The driving end of the flexible cable fits a key-hole socket 71 (see Fig. 6) of the worm shaft 72, and the flexible tube which carries the flexible cable is removably held to the casing by a bail-catch 73 spring-pressed by a split ring 74 into an annular groove (not shown) of the tube.

A feature of the present invention is the provision of a rotary fan the housing for which is denoted 75 and which is disposed at one end of the motor. From this fan, which is powered directly from the armature shaft of the motor, pressure air is forced through a hose 76 to a nozzle 77 suitably secured upon the end of the tweezers housing. This nozzle is so placed as to direct a fan-like jet of pressure air transversely over the three sets of tweezers and is controlled by a finger-operated valve 18.

The operation of the device is as follows, it being self-evident that a description of the cyclic action of a single set of tweezers will suffice, inasmuch as the cyclic action of the three sets of tweezers is identical, excepting only that the same are spaced 120 degrees apart. Assume now that the crank shaft has moved such as to locate one of the eccentrics at top dead center, the related tweezers will then perform be in fully retracted position, and the parts of the tweezers assembly will occupy the positions in which they are shown in Fig. 16. As the connecting rod 33, 34, or 35, as the case may be, now commences its outward travel (Fig. 11), the inherent spring of the tweezers fingers 4445 holds the jaws 46 against opposite faces of the concavities 52 of the spreader head 49. The spreader head thus is caused to move outwardly in concert with the tweezers fingers. As the outward travel proceeds and the connecting rod approaches the outer extreme of its forward stroke, cross arm 50 is brought into engagement with the stationary block 53 (Fig. 12) and the forward motion of the spreader head thus stops. The tweezers fingers continue to travel outwardly with the result that the jaws 46 slide forwardly until they leave the concavities and work over the crowned sides onto the sloping surfaces of the wedge nose 51, where upon the spring action snaps the jaws shut and "kicks" the spreader head rearwardly as indicated in Fig. 13, the connecting rods being now at the outer extreme of their forward stroke. The jaws are now perforce clamped upon any hairs or hairs which may have occupied the space between the closing jaws, and as the connecting rod now begins its retractive stroke, these hairs are plucked. In this retractive travel, the tweezers fingers contact the nose of the spreader head 43, and the spreader head and the tweezers fingers then move rearwardly in unison (Fig. 14). Conceived in this way, each of the apertures 47 of the tweezers fingers are brought into engagement with the rearward edges of the cam faces 53' of the stationary block 53. This forces the spring fingers almost fully open, but not to the maximum spread which is to occur during the stroke to rearward. When the point has been reached where the spread of the fingers is the
widest that the block 53 can effect, and which is to say when the peaks of the prominences 47 have passed rearwardly to and beyond the rearward edges of cam faces 53', the spacer head will then more or less simultaneously have been brought into contact with said block (Fig. 15). Such interpinn spreader head then responsively acts by its nose, and as the tweezers 44—45 continue rearwardly, to further spread said jaws. This serves a cleaning or wiping function to remove any adherent hairs. At this point, the peaks of the prominences 47 no longer ride on block 53, and the force 46 is applied upon the spacer 49 to cause the latter to move forwardly in unison with the tweezers after the advance stroke has started, the jaws having theretofore been brought up and over the wedge nose and lodged in the concavities 52 (Fig. 16). This completes a cycle of action. At periodic intervals the operator presses the valve button 78 and discharges a jet of pressure air to rid the head of loose hairs.

While I have here illustrated and described my invention in the form now preferred by me, it will be apparent that numerous variations will appear to those versed in the art, and it is therefore my intention that the heretofore annexed claims be given a scope in their interpretation commensurate with the state of the advance.

What I claim is:

1. A power-driven tweezers comprising a casing, a block mounted for reciprocatory sliding movement within the casing, means for powering the block in said reciprocatory movement, two relatively movable and spring-closing jaws carried by said block, a stationary cam for opening said jaws and engageable by the jaws at the rear extreme of the block's reciprocation, holding means arranged to move with the jaws during the following forward stroke of reciprocation for holding the jaws in said open position, and means releasing said holding means to permit the jaws to close.

2. A power-driven tweezers comprising a casing, a block mounted for reciprocatory sliding movement within the casing, means for powering the block in said reciprocatory movement, a pair of resilient fingers anchored by their rear ends to said block and providing gripping jaws upon the free ends, the inherent spring of said fingers being relied upon for snapping the jaws shut, and means working in opposition to the spring action of said fingers and activated intermittently in a timed sequence of movements co-ordinated with the reciprocal cycle of the jaws for opening the jaws and holding the same in separated relation during a predetermined stage of the block's reciprocation.

3. A power-driven tweezers comprising a casing, a block mounted for reciprocatory sliding movement within the casing, means for powering the block in said reciprocatory movement, a pair of spring-metal tweezer fingers firmly anchored by their rear ends to and projecting forwardly from said block and providing gripping jaws upon the free ends, the inherent resilience of said spring metal being relied upon for snapping the jaws shut, a guard carried by the casing and placed to occupy a position approximately coinciding with the outermost point of movement of the jaws, and means working in opposition to said resilience of the spring fingers and activated intermittently in a timed sequence of movements co-ordinated with the reciprocal cycle of the jaws for opening the jaws and holding the same in separated relation during the block's outward stroke of reciprocation so that the jaws will snap closed at said outermost point.

4. The structure of claim 3 in which said guard comprises a head slotted to accommodate the jaws, and having a shim-thickness foramous facing member applied to the head to cover said slot.

5. A power-driven tweezers comprising a casing, a plurality of blocks mounted for reciprocatory sliding movement within the casing on closely associated and paralleling slide axes, transverse rods for the respective blocks, means common to each of said rods for powering the same to reciprocate said blocks, a pair of relatively movable and spring-closing jaws carried by each of said blocks, and intermittently movable means acting counter to the spring which serves to close said jaws for opening the latter during a predetermined like stage of the reciprocation of each said block, and means for moving said intermittently movable means into and out of its jaw opening position at the beginning and end, respectively, of said stage.

6. A tweezers comprising a source of reciprocating power, a slidably mounted block driven from said source, a separator member disposed in forwardly spaced relation from the block and supported for free sliding movement on a coinciding axis, a pair of tweezer fingers secured to the sliding block and projecting by their free ends forwardly beyond the latter into overlying relation to said separator member, said fingers being yieldingly pressed together and providing complementary gripping jaws on their forward free ends, means acting upon said separator member as the sliding block reaches the rear extreme of its reciprocatory travel for locating the member between the jaws and such as to hold the jaws in open position, the member thereafter moving longitudinally with the jaws in the forward travel of the block, and means acting upon said separator member momentarily in advance of the point at which the sliding block reaches the forward extreme of its reciprocatory travel for interrupting the movement of the separator member to allow the jaws to snap shut.

7. A tweezers comprising a source of reciprocating power, a slidably mounted block driven from said source, a separator member disposed in forwardly spaced relation from the block and supported for free sliding movement on a coinciding axis, a pair of tweezer fingers secured to the sliding block and projecting by their free ends forwardly from the block into overlying relation to said separator member, said fingers being yieldingly pressed together and providing complementary gripping jaws on their forward free ends, means operating in the retractive stroke of reciprocation of the block and effective upon said separator member and the tweezer fingers as the block reaches the rear extreme of its reciprocatory travel for opening the jaws and positioning the separator member therebetween, the open jaws with the separator member therebetween thereupon travelling forwardly in unison as the sliding block works in the opposite stroke of reciprocation, and means operating on said forward stroke of reciprocation and effective upon said separator momentarily in advance of the point at which the sliding block reaches the forward extreme of its reciprocatory travel for interrupting the movement of the separator member to allow the jaws to snap shut.

8. The structure of claim 7 in which said sep-
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ator member is formed upon its front end with a wedge-shaped nose.

9. The structure of claim 7 in which opposite faces of said separator member are made moveable and act to engage the jaws in the forward stroke of the latter's reciprocation for establishing a grip causing the separation member to move with the jaws.

10. A power-driven tweezers comprising, in combination with the armature shaft of an electric motor and a blower having its fan direct-driven by said armature shaft, a casing separate from the housing of the motor and providing working jaws arranged both to grip and to pluck hairs, a rotary means in said casing for operating said jaws, a flexible drive shaft from the armature shaft of the motor to said rotary means of the casing for powering the rotary means, an air nozzle carried by the casing and placed to direct a pressure jet over the jaws to rid the jaws of free hairs, a flexible hose from the blower to said nozzle, and a finger-operated valve for controlling the discharge of pressure air from the nozzle.

11. A power-driven tweezers comprising, in combination with the armature shaft of an electric motor and a blower having its fan direct-driven by said armature shaft, a casing separate from the housing of the motor and providing working jaws arranged both to grip and to pluck hairs, a rotary means in said casing for operating said jaws, a flexible drive shaft from the armature shaft of the motor to said rotary means of the casing for powering the rotary means, an air nozzle carried by the casing and placed to direct a pressure jet over the jaws to rid the jaws of free hairs, and a flexible hose from the blower to said nozzle.

12. A power-driven tweezers comprising, in combination with an electric motor having a blower fan direct-driven by the armature shaft thereof, reciprocally movable jaws driven from the motor, means responsive to said reciprocation for opening and closing the jaws, an air nozzle fed from the blower and placed to direct its pressure jet over said jaws for ridding the latter of free hairs when they are open, and a valve for controlling the discharge of pressure air.

13. A power-driven tweezers comprising, in combination, a casing, a pair of spring-closing and reciprocally movable gripping jaws carried by the casing, means for powering the jaws in said reciprocatory movement, a separator member arranged by energy derived from the jaws to move in unison with the latter throughout a predetermined stage of the latter's reciprocation and, in such stage, occupying a position between the jaws, said separator member having concave seats upon the lateral faces thereof for the engagement of the jaws and means for bringing said separator member into and out of said position between the jaws at the beginning and end, respectively, of said stage.

14. A power-driven tweezers comprising multiple sets of complementary hair-plucking jaws, each having a comparatively wide plucking swath and so arranged in lapping relation as to collectively cover a working area very nearly corresponding to the aggregate swaths of the individual sets of jaws, means for imparting reciprocatory movement to said sets of jaws, and means made responsive to said reciprocation for imparting non-coinciding cyclic opening and closing movements to the jaws.

15. A power-driven tweezers comprising, in combination, a casing, a pair of spring-closing gripping jaws carried by the casing, means for reciprocally moving said jaws in concert in an endwise direction, an interruptedly activated member operative when activated to spread the jaws and arranged by energy derived from the jaws to move in unison with the latter only through a predetermined stage of the latter's movement in the forward stroke of the former and, in such stage, performing its jaw-spreading function, and means for interruptedly activating said member.

16. A power-driven tweezers comprising, in combination, a casing, a pair of spring-closing gripping jaws carried by the casing, means for reciprocally moving said jaws in concert in an endwise direction, a separator member arranged by energy derived from the jaws to move in unison with the jaws only through a predetermined stage of the latter's movement in the forward stroke of reciprocation and, in such stage, occupying a position between the jaws, means for bringing said separator member into and out of its jaw-spreading position at the beginning and end, respectively, of said predetermined stage, and means independent of said separator member for actuating its fan drive for accommodating the same to the separator member.

17. The structure of claim 16 in which the means last recited is held stationary.

18. A power-driven tweezers comprising, in combination, a casing, a pair of spring-closing gripping jaws carried by the casing, means for reciprocally moving said jaws in concert in an endwise direction, a stationary member actuating upon the jaws in the course of the latter's return stroke of reciprocation for putting the jaws in an open condition, and holding means interruptedly movable in concert with the jaws throughout the major part of the latter's forward stroke of reciprocation and acting to move said jaws in concert in an endwise direction and means for interrupting the movement of said holding means.

19. A power-driven tweezers comprising, in combination, a casing, a pair of spring-closing gripping jaws carried by the casing, means for reciprocally moving said jaws in concert in an endwise direction, a separator member arranged by energy derived from the jaws to move in unison with the jaws through predetermined stages of the latter's movement in both forward and return strokes of reciprocation and occupying an active position between the jaws in said forward-stroke unitary movement while being inactive to the jaws during said return-stroke unitary movement, and means for bringing said separator member into and out of said active position.

20. A power-driven tweezers comprising, in combination, a casing, a pair of spring-closing gripping jaws carried by the casing, means for reciprocally moving said jaws in concert in an endwise direction, and jaw-opening means interruptedly movable in unison with the jaws such that the concerted movement is interrupted at a predetermined point short of both the outer and inner extremities of the jaws' reciprocatory travel, said jaw-opening means actuating the jaws open during the forward-stroke concerted travel and means for making said jaw-opening means inactive to the jaws during the return-stroke concerted travel.

21. A power-driven tweezers comprising, in combination, a casing, a pair of gripping jaws
carried by the casing means for closing the jaws, means directly connected with the jaws for powering the jaws in said reciprocatory movement, means controlling the closing of the jaws and including structure interruptedly movable in unison with the latter through a predetermined stage of the latter's forward stroke of reciprocation, and means for interrupting the movement of the said interruptedly movable structure of the controlling means.

22. The structure of claim 21 in which the said interruptedly movable structure of the controlling means last recited derives from the jaws the energy responsible for its own movement.

23. The structure of claim 21 in which the said interruptedly movable structure of the controlling means last recited derives its motivating energy from the jaws and occupies a spreading position between the jaws in its said unitary forward movement therewith, the flanking faces of said jaw-controlling means being intended to provide seats for the jaws.

24. A tweezer comprising a casing, a pair of spring-closing jaws carried by the casing for reciprocatory movement inwardly and outwardly bodily in concert and in an endwise direction, means for imparting said movement to the jaws, and holding means activated interruptedly in a timed sequence of movements co-ordinated with the reciprocal cycle of the jaws for holding the said jaws open throughout the greater part of the latter's movement in said outward direction of travel.

25. A tweezer comprising a casing, a pair of spring-closing jaws carried by the casing for reciprocatory movement inwardly and outwardly bodily in concert and in an endwise direction, and jaw-controlling means activated in a timed sequence of interrupted movements co-ordinated with the reciprocal movement of the jaws such as to be inactive to said jaws through substantially their entire stroke travel in the inward direction of movement and arranged during outward movement to occupy a position between the jaws for spreading the latter outward against the spring force until the jaws approach their outward limit of travel.

26. A power-driven tweezers comprising a casing, a block mounted for reciprocatory sliding movement within the casing, means for powering the block in said reciprocatory movement, two relatively movable jaws caused to move in concert with the block and yieldingly urged together by spring means, a stationary cam for opening said jaws and engageable by the jaws as they approach the rear extreme of the block’s reciprocation, holding means brought into play only after the cam has opened the jaws and acting to hold the jaws open against the pressure of the spring means until the jaws reach a point approaching but yet short of the forward extreme of the block’s reciprocatory travel, and means for releasing said holding means so that the jaws may grip.

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