SPECIFICATION

Terraced dwellings

This invention relates to building structures, and more particularly, to residential housing in a terraced arrangement.

It has been common practice to construct multi-storey apartment buildings in order to obtain maximum utilization of land, particularly at locations where the view of the surrounding terrain enhances the value of the property. The disadvantage of multi-storey apartment buildings is that the occupants of the upper floors are far removed from the surface of the ground, and access to the outside is provided only by narrow balconies at the level of the occupant's apartment. Because the occupants of such a building share many common areas, such as hallways, elevators, parking lots and a common entrance and exit, there is very little sense of privacy and individually among the occupants of the building.

In other areas, the terrain is relatively flat. Multy-storey apartment buildings which are commonly built in such areas tend to project upward from the ground, so that many of such buildings give an impression of congestion and crowded living conditions which are unpleasant for the inhabitants. Prior attempts to blend the housing into the flat terrain have had the disadvantage of reducing the density of population so that each dwelling unit becomes excessively expensive, or greatly expands the area required so that the buildings are spread apart and create traffic congestion with many dwellings located far from the most desirable location.

There are also many sites that are suitable, and highly desirable for housing, but unacceptable because of poor soils, or becaue the terrain is too steep for the construction of economical housing.

I have previously developed a system for constructing retaining walls and other structures, as described in my French Patents 1 393 988 and 2 055 983 (US 3,421,326 and 3,686,873). Furthermore, I have suggested that my technique can be utilized to construct terraces on several levels, and to build dwelling units on the horizontal surface of each terrace. This concept is disclosed, for example, in my French Patent No. 2 168 639 and in Annales de l'Institut Technique du Bâtiment et des Traveaux Publics Supp. No 299 November 1972. Neither my prior patents nor my publications, however, have disclosed a practical arrangement for a multi-dwelling structure in a hill formed at least partially of non-cohesive earth.

Viewed from one aspect the invention provides a housing structure comprising a mass of substantially particulate material superimposed on the surface of the earth, said material being arranged to provide tiered terrace levels each having a front edge portion and a rear edge portion, a plurality of dwellings being arranged separately on said terrace levels, said dwelling on one of said levels including a retaining wall extending along said rear edge portion and including a roof resting directly on and supported by said wall, the dwelling of the next higher terrace level including a floor and a front wall, said floor being spaced above the roof of the dwelling on the next lower level and said front wall being spaced rearwardly of said rear wall of said next lower level, said particulate material substantially filling space between said roof and said floor of the next higher level, the separate dwellings lying at sufficiently different vertical heights to accommodate the particulate material deposited on the roof of the lower dwelling up to the height of the floor of the upper dwelling, and said rear wall being positioned to retain said material.

Viewed from a further aspect the invention provides a multi-level building structure comprising a mass of a substantially particulate material having draining and load supporting properties superimposed on the natural ground and having a generally sloping surface, a plurality of dwellings, each of said dwellings having an exterior wall and a roof and a floor; a first one of said dwellings having a floor superimposed on said particulate mass and a second one of said dwellings being adjacent to said first dwelling and at a higher level, said second dwelling having a floor superimposed on said particulate mass; said first and second dwellings each having a portion of said exterior wall at the rear of said dwelling, said rear wall portions being substantially rigid and extending from adjacent the floor to adjacent the roof of the respective first and second dwellings; said floor of said second dwelling being at an elevation above the roof of said first dwelling and being spaced rearwardly of said wall portion of said first dwelling, said particulate mass substantially filling the space between said first dwelling and said second dwelling, the separate dwellings lying at sufficiently different vertical heights to accommodate the particulate material deposited on the roof of the lower dwelling up to the height of the floor of the upper dwelling, whereby said first and second dwellings are arranged in a tiered terraced relation.

Viewed from yet a further aspect the invention provides a method for constructing on a natural ground a residential community having separate dwellings of the type having a floor, exterior walls and a roof, said method comprising the following steps:

(a) depositing on the natural ground surface a mass of substantially particulate material having draining and load supporting properties, said mass having a generally sloping upper surface;

(b) shaping and compacting the upper surface of said mass so as to delineate a plurality of substantially horizontal areas, said areas being vertically and horizontally spaced from each other and each having a front edge portion and a rear edge portion;

(c) building a generally vertical wall adjacent to said rear edge portion of each area, the upper edge of said wall being lower than the level of the next higher horizontal area;

(d) applying a floor directly on the compacted material of each area, said floor extending from said wall toward said front edge portion;

(e) erecting a front structure on the floor;

(f) connecting between said wall and said front structure a roof member of generally flat shape; and

(g) depositing said substantially particulate material on said roof member up to the level of the next higher horizonal area, whereby in front of each dwelling can be provided a terrace extending over the roof of the dwelling on the next lower horizontal area.

Viewed from a yet a further aspect the invention provides a residential community having separate dwellings of the type having a floor, exterior walls and a roof, said community comprising:

a mass of a substantially particulate material having draining and load supporting properties superimposed on the natural ground and having a generally sloping surface, the surface of said mass being shaped to provide a plurality of horizontal areas vertically and horizontally spaced from each other and each having a front edge portion and a rear edge portion;

a generally vertical wall adjacent to said rear edge portion in each of said areas, the top of said wall being lower than the level of the next higher horizontal area;

a floor superimposed on said material of said horizontal areas and extending from adjacent said wall toward but spaced from said front edge portion;

a front structure; and

a roof member superimposed on said wall and said front structure of each of said areas, said roof member being substantially flat and being covered by a layer of said particulate material, whereby the roof of the next lower horizontal area forms a terrace in front of the front structure of the upper area.

The retaining walls may be constructed with panels, as described below, or the walls may be formed of concrete cast in situ. The terraces may be constructed with earth fill on existing sloping terrain, including steep hillsides, or the terraces may be constructed on relatively flat terrain by using earth fill to build a large mound.

A preferred embodiment of this invention is illustrated in the accompanying drawing in which :

Figure 1 is a top plan view, partially schematic, of a housing community incorporating the building structures of this invention;

Figure 2 is a cross-sectional view of the community along the line 2-2 in Figure 1;

Figure 3 is an enlarged cross-sectional view of the building structure along the line 3-3 in Figure 1;

Figure 4 is a front elevational view, partially in cross-section, along the line 4-4 in Figure 3;

Figure 5 is a cross-sectional view of the structure in an enlarged scale along the line 5-5 in Figure 3;

Figure 6 is a cross-sectional view of the rear wall of the dwelling along the line 6-6 in Figure 3;

Figure 7 is a cross-sectional horizontal view of the rear wall along the line 7-7 in Figure 6;

Figure 8 is a cross-sectional vertical view of the wall of Figure 6;

Figure 9 is a perspective view of a panel supporting block of Figure 6;

Figure 10 is a cross-sectional view of the community as in Figure 3, but showing a modified form of the invention.

A typical community constructed in accordance with this invention is shown in Figures 1 and 2. The dwelling units 2 are arranged on terraces as shown in Figure 2. The dwellings 2 may be arranged in a single row as shown at the right and left ends in Figure 1, or may be arranged side-by-side on the various levels of the terraces as shown in the middle of Figure 1. The community arrangement in Figure 1 is designed to allow the dwellings to overlook the terrain on two sides of the community. The other two sides, at the top of Figure 1 do not contain dwelling units, but provide roadways 4 for access to the dwellings. Of course, the community can be designed to permit dwellings to be positioned on all sides of the community, if desired.

An important feature of this method of construction is that the community can be constructed economically on relatively level terrain. For example, the natural surface of the ground prior to construction is shown schematically at 5 in Figure 2. Earth fill 38 is brought to the site and deposited on the ground to form an earth mass which serves as a base for the elevated community, including dwellings 2, roadways 4 and terraces 6. The earth fill 38 is a substantially particulate material having good drainage and load supporting properties. If the natural ground surface is sloping, it is nevertheless preferable to superimpose earth fill 38 on the surface of the ground to construct the dwellings without requiring excavating.

As shown in Figures 2 and 3, the dwellings 2 are arranged on the horizontal areas which form the terraces 6. Each dwelling 2 includes a rear wall 8, a floor 10 and a roof 12. The rear wall 8 may extend around the interior of the dwelling along the sides and join with the front wall structure 14. A typical front wall 14 is shown in Figure 4, and may include doors 16 and windows 18 with louvers or blinds 20.

The rear wall 8, according to one embodiment, includes a plurality of rigid concrete panels 22, as shown in Figure 6. The rear wall 8 and the front wall 14 preferably are arcuate, and the side walls 9 are straight. The panels 22 are supported at the base by concrete precast blocks 24 or by a footing, has a longitudinal slot 48 to receive the lower edge of the panels. The rear side 50 of the slot 48 slopes rearwardly (Figures 8 and 9) to provide a groove in which a moisture sealing material 52 may be applied. When blocks 24 are used, each panel 22 rests on a single precast block 24, and extends slightly beyond the end of the block to abut against the adjacent panel 22. As shown in Figures 5 and 7, the panels 22 are preferably arranged in angular relation to each other to provide a curvature to the wall 8. Similarly, the blocks 24 are set at an angle to each other to accommodate the curvature.

The joint between the panels may be sealed with suitable filler materials such as tar or polystyrene, and preferably a wide tape 32 is applied over the joint at the rear side of the wall. The arrangement for the straight walls 9 is essentially the same as that of the curved wall 8, except that the panels 22 and blocks 24 are aligned.

As shown in Figures 3 and 7, a plurality of reinforc-

ing members 34 are secured to the rear side of the panels 22 by means of brackets 36 which are cast in the panels. These reinforcing members 34 are in the form of thin, flexible strips capable of sustaining tension, as defined in greater detail in my French Patent 1 393 988 (US 3,421,326). Earth particles 38 fill the space between the reinforcing members throughout substantially the entire height of the panels 22, as described in my patent. As a result of the frictional engagement between the earth particles and the reinforcing members, the earth behind the rear wall 8 is stabilized and provides support for the next higher terrace 6. The rear wall 8 serves as a cladding for retaining the earth particles adjacent the rear face of the wall.

The floor of the dwelling is preferably formed of a concrete slab which is poured after the wall 8 is constructed so that the edge of the slab abuts against the curved wall surface formed by the panels 22. A conventional joint seal is preferably provided between the face of the panel and the floor slab 10. The earth 38 under the slab 10 preferably is of a particulate nature and extends continuously under the floor 10 and throughout the area surrounding the reinforcing members 34 behind the wall 8. The depth of the particulate earth 38 placed under the slab is preferably one meter. Also, the earth 38 under the slab 10 and between the reinforcing members 34 should be uniformly compacted to avoid settling.

The roof 12 preferably is formed by a concrete slab which rests directly on the top edge of the panels 22. The roof 12 may also be partially supported by a front wall 14. The weight of the roof is supported directly by the panels 22 and by the blocks 24. The earth under the blocks 24 is sufficiently compacted to avoid vertical movement of the panels 22. In accordance with conventional practice, the roof 12 may be precast in a thin slab with the remainder of the slab being poured at the site after the roof is in position.

At the front of the dwelling 2, directly over the wall 14, a plurality of precast blocks are superimposed on the roof 12. These blocks cooperate with an upright wall 42 to form a planter 44. The blocks 40 also extend over the wall 14 to deflect rain away from the wall. The planter 44 screens the upper terrace level 6 from the terrace of the next lower level.

The shape of the dwellings 2 may be varied by changing the curvature of the wall 8 and the orientation of the front wall 14 relative to the ground. As shown in Figure 1, a variety of arrangements of the dwellings 2 may be provided according to the requirements of the community.

The community is quickly and efficiently constructed by depositing a mass of the particulate material 38 on the natural ground surface 5 (Figure 2) The mass is contoured by conventional grading techniques to provide a plurality of substantially horizontal areas 6 which are spaced apart both vertically and horizontally from each other. The wall 8 is constructed by placing the footing block 24 on the material 38 after compacting the material. The panels 22 are then installed as shown in Figures 6 and 7, with the material 38 being filled and compacted in layers alternating with the reinforcing mambers 34. The floor 10 is applied over the material, and is preferable in the form of a slab of concrete, The front wall structure 14 is installed at the front of the slab. The roof 12 is then placed on the top of the wall 8, as previously explained, and covered by the material 38 to form a terrace above the roof 12 and in front of the front wall structure of the next higher area 6.

Another alternative is illustrated in Figure 10. In this form of the invention, the wall 8' is concrete that is cast in situ. The natural ground surface 5' is shown to slope, although it may also be more level, as in Figure 2. The mass of particulate material 38' is superimposed on the surface 5', as previously described, and contoured to form horizontal areas 6'. The dwellings 2' include the wall 8' at the rear edge portion of the areas 6'. A footing 54 is placed on the compacted material 38' and may be precast, or cast in situ. The floor slab 10' is also applied over the compacted material 38'. Preferably, the rear edge of the slab 10' is also supported on the footing. The roof 12' rests on the wall 8' and on the front wall structure 14' of the dwelling, and is covered with material 38' to form a terrace in front of the front structure 14' of the next higher area 6'.

In accordance with conventional practice, the concrete in the wall 8' should be reinforced adequately to withstand the loads bearing on the wall. Of course, the wall 8' may be formed of any other suitable wall construction, provided that the wall is sufficiently rigid to support the roof without substantial deflection.

While this invention has been illustrated and described in relation to a preferred embodiment, it is recognized that variations and changes may be made therein without departing from the invention as set forth in the claims.

CLAIMS

1. A housing structure comprising a mass of substantially particulate material superimposed on the surface of the earth, said material being arranged to provide tiered terrace levels each having a front edge portion and a rear edge portion, a plurality of dwellings being arranged separately on said terrace levels, said dwelling on one of said levels including a retaining wall extending along said rear edge portion and including a roof resting directly on and supported by said wall, the dwelling of the next higher terrace level including a floor and a front wall, said floor being spaced above the roof of the dwelling on the next lower level and said front wall being spaced rearwardly of said wall of said next lower level, said particulate material substantially filling the space between said roof and said floor of the next higher level, the separate dwellings lying at sufficiently different vertical heights to accommodate the particulate material deposited on the roof of the lower dwelling up to the height of the floor of the upper dwelling, and said rear wall being positioned to retain said material.

2. A housing structure according to claim 1 wherein said rear wall includes a plurality of rigid panels extending substantially upright and arranged

ing members 34 are secured to the rear side of the panels 22 by means of brackets 36 which are cast in the panels. These reinforcing members 34 are in the form of thin, flexible strips capable of sustaining tension, as defined in greater detail in my French Patent 1 393 988 (US 3,421,326). Earth particles 38 fill the space between the reinforcing members throughout substantially the entire height of the panels 22, as described in my patent. As a result of the frictional engagement between the earth particles and the reinforcing members, the earth behind the rear wall 8 is stabilized and provides support for the next higher terrace 6. The rear wall 8 serves as a cladding for retaining the earth particles adjacent the rear face of the wall.

The floor of the dwelling is preferably formed of a concrete slab which is poured after the wall 8 is constructed so that the edge of the slab abuts against the curved wall surface formed by the panels 22. A conventional joint seal is preferably provided between the face of the panel and the floor slab 10. The earth 38 under the slab 10 preferably is of a particulate nature and extends continuously under the floor 10 and throughout the area surrounding the reinforcing members 34 behind the wall 8. The depth of the particulate earth 38 placed under the slab is preferably one meter. Also, the earth 38 under the slab 10 and between the reinforcing members 34 should be uniformly compacted to avoid settling.

The roof 12 preferably is formed by a concrete slab which rests directly on the top edge of the panels 22. The roof 12 may also be partially supported by a front wall 14. The weight of the roof is supported directly by the panels 22 and by the blocks 24. The earth under the blocks 24 is sufficiently compacted to avoid vertical movement of the panels 22. In accordance with conventional practice, the roof 12 may be precast in a thin slab with the remainder of the slab being poured at the site after the roof is in position.

At the front of the dwelling 2, directly over the wall 14, a plurality of precast blocks are superimposed on the roof 12. These blocks cooperate with an upright wall 42 to form a planter 44. The blocks 40 also extend over the wall 14 to deflect rain away from the wall. The planter 44 screens the upper terrace level 6 from the terrace of the next lower level.

The shape of the dwellings 2 may be varied by changing the curvature of the wall 8 and the orientation of the front wall 14 relative to the ground. As shown in Figure 1, a variety of arrangements of the dwellings 2 may be provided according to the requirements of the community.

The community is quickly and efficiently constructed by depositing a mass of the particulate material 38 on the natural ground surface 5 (Figure 2) The mass is contoured by conventional grading techniques to provide a plurality of substantially horizontal areas 6 which are spaced apart both vertically and horizontally from each other. The wall 8 is constructed by placing the footing block 24 on the material 38 after compacting the material. The panels 22 are then installed as shown in Figures 6 and 7, with the material 38 being filled and compacted in layers alternating with the reinforcing mambers 34. The floor 10 is applied over the material, and is preferable in the form of a slab of concrete. The front wall structure 14 is installed at the front of the slab. The roof 12 is then placed on the top of the wall 8, as previously explained, and covered by the material 38 to form a terrace above the roof 12 and in front of the front wall structure of the next higher area 6.

Another alternative is illustrated in Figure 10. In this form of the invention, the wall 8' is concrete that is cast in situ. The natural ground surface 5' is shown to slope, although it may also be more level, as in Figure 2. The mass of particulate material 38' is superimposed on the surface 5', as previously described, and contoured to form horizontal areas 6'. The dwellings 2' include the wall 8' at the rear edge portion of the areas 6'. A footing 54 is placed on the compacted material 38' and may be precast, or cast in situ. The floor slab 10' is also applied over the compacted material 38'. Preferably, the rear edge of the slab 10' is also supported on the footing. The roof 12' rests on the wall 8' and on the front wall structure 14' of the dwelling, and is covered with material 38' to form a terrace in front of the front structure 14' of the next higher area 6'.

In accordance with conventional practice, the concrete in the wall 8' should be reinforced adequately to withstand the loads bearing on the wall. Of course, the wall 8' may be formed of any other suitable wall construction, provided that the wall is sufficiently rigid to support the roof without substantial deflection.

While this invention has been illustrated and described in relation to a preferred embodiment, it is recognized that variations and changes may be made therein without departing from the invention as set forth in the claims.

CLAIMS

1. A housing structure comprising a mass of substantially particulate material superimposed on the surface of the earth, said material being arranged to provide tiered terrace levels each having a front edge portion and a rear edge portion, a plurality of dwellings being arranged separately on said terrace levels, said dwelling on one of said levels including a retaining wall extending along said rear edge portion and including a roof resting directly on and supported by said wall, the dwelling of the next higher terrace level including a floor and a front wall, said floor being spaced above the roof of the dwelling on the next lower level and said front wall being spaced rearwardly of said wall of said next lower level, said particulate material substantially filling the space between said roof and said floor of the next higher level, the separate dwellings lying at sufficiently different vertical heights to accommodate the particulate material deposited on the roof of the lower dwelling up to the height of the floor of the upper dwelling, and said rear wall being positioned to retain said material.

2. A housing structure according to claim 1 wherein said rear wall includes a plurality of rigid panels extending substantially upright and arranged

side by side, said panels extending continuously from adjacent the floor of said dwelling to said roof.

3. A housing structure according to claim 2 wherein said rear wall includes a plurality of elongated reinforcing members extending outwardly from the exterior side of said panels at vertically spaced intervals, and wherein said mass of particulate material is interspersed and compacted between and around said reinforcing members throughout substantially the entire height of said panels.

4. A multi-level building structure comprising:

a mass of a substantially particulate material having draining and load supporting properties superimposed on the natural ground and having a generally sloping surface;

a plurality of dwellings, each of said dwellings having an exterior wall and a roof and a floor;

a first one of said dwellings having a floor superimposed on said particulate mass and a second one of said dwellings being adjacent to said first dwelling and at a higher level said second dwelling having a floor superimposed on said particulate mass;

said first and second dwellings each having a portion of said exterior wall at the rear of said dwelling, said rear wall portions being substantially rigid and extending from adjacent the floor to adjacent the roof of the respective first and second dwellings;

said floor of said second dwelling being at an elevation above the roof of said first dwelling and being spaced rearwardly of said rear wall portion of said first dwelling, said particulate mass substantially filling the space between said first dwelling and said second dwelling, the separate dwellings lying at sufficiently different vertical heights to accommodate the particulate material deposited on the roof of the lower dwelling up to the height of the floor of the upper dwelling, whereby said first and second dwellings are arranged in a tiered terraced relation.

5. A multi-level building structure according to claim 4 wherein said dwellings include a front wall and a terrace extending outwardly from said front wall, said terrace of one dwelling overlying at least a portion of the roof of the dwelling at the next lower dwelling.

6. A multi-level building structure according to claim 4 or 5 wherein said rear wall portion of at least one of the dwellings includes a plurality of rigid panels, said rear wall portion also having a plurality of elongated pliable reinforcing members extending rearwardly from said panels in said mass, said reinforcing members being connected with said panels, and being spaced apart vertically throughout substantially the entire height of said panels.

7. A multi-level building structure according to claim 6 wherein said rigid panels are formed of precast concrete and said structure includes footing means supporting said panels.

8. A multi-level building structure according to claim 6 or 7 wherein said roof of said dwellings is in direct engagement with said panels and supported thereby.

9. A multi-level building structure according to claim 7 wherein said footing means includes a plurality of footing blocks underlying said panels, said blocks including means cooperating with panels to prevent displacement of said panels relative to said blocks, and including means for maintaining alignment between said panels.

10. A multi-level building structure according to claim 9 wherein said footing blocks have a longitudinal slot receiving the bottom edge of said panels, and including sealant material interposed between said panel and said block along said slot.

11. A method for constructing on a natural ground a residential community having separate dwellings of the type having a floor, exterior walls and a roof, said method comprising the following steps:

(a) depositing on the natural ground surface a mass of substantially particulate material having draining and load supporting properties, said mass having a generally sloping upper surface;

(b) shaping and compacting the upper surface of said mass so as to delineate a plurality of substantially horizontal areas, said areas being vertically and horizontally spaced from each other and each having a front edge portion and a rear edge portion;

(c) building a generally vertical wall adjacent to said rear edge portion of each area, the upper edge of said wall being lower than the level of the next higher horizontal area;

(d) applying a floor directly on the compacted material of each area, said floor extending from said wall toward said front portion;

(e) erecting a front structure on the floor;

(f) connecting between said wall and said front structure a roof member of generally flat shape; and

(g) depositing said substantially particulate material on said roof member up to the level of the next higher horizontal area, whereby in front of each dwelling can be provided a terrace extending over the roof of the dwelling on the next lower horizontal area.

12. A method according to claim 11 wherein said wall building step includes placing prefabricated blocks along the base of said wall, and supporting a plurality of rigid wall panels on said blocks to form said wall.

13. A method according to claim 12 wherein said wall building step includes securing a plurality of elongated reinforcing members capable of sustaining tension on the rear side of said panels, said members being arranged in a series of horizontal layers with members in each layer extending side by side from the panels, said layers being spaced apart vertically, and includes placing layers of said particulate material in alternating relation with said layers of reinforcing members.

14. A method according to claim 11 wherein said wall building step includes casting said wall of concrete in situ.

15. A method according to any of claims 11 to 14 wherein said floor applying step includes casting said floor of concrete to form a slab bearing on said blocks.

16. A residential community having separate dwellings of the type having a floor, exterior walls

and a roof, said community comprising:

(a) a mass of a substantially particulate material having draining and load supporting properties superimposed on the natural ground and having a generally sloping surface, the surface of said mass being shaped to provide a plurality of horizontal areas vertically and horizontally spaced from each other and each having a front edge portion and a rear edge portion;

(b) a generally vertical wall adjacent said rear edge portion in each of said areas, the top of said wall being lower than the level of the next higher horizontal area;

(c) a floor superimposed on said material of said horizontal areas and extending from adjacent said wall toward but spaced from said front edge portion;

(d) a front structure; and

(e) a roof member superimposed on said wall and said front structure of each of said areas, said room member being substantially flat and being covered by a layer of said particulate material, whereby the roof of the next lower horizontal area forms a terrace in front of the front structure of the upper area.

17. A residential community according to claim 16 wherein said wall includes a footing and an assembly of panels arranged side by side and supported on said footing, a plurality of elongated reinforcing members secured to said panels and extending rearwardly into said mass to consolidate said mass.

18. A residential community according to claim 17 or 18 wherein said level of said next higher horizontal area includes a floor superimposed on said material, said floor of said next higher level being separated from said roof member by said particulate material.

19. A residential community according to claim to claim 18 wherein said level of said next higher level includes a front structure spaced rearwardly from said front edge portion, and said front structure of said next higher horizontal area being spaced rearwardly from the wall of said next lower horizontal area.

20. Housing structures substantially as hereinbefore described with reference to the accompanying drawings.

21. Methods of constructing a housing structure substantially as hereinbefore described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office, by Croydon Printing Company Limited, Croydon, Surrey, 1982.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.